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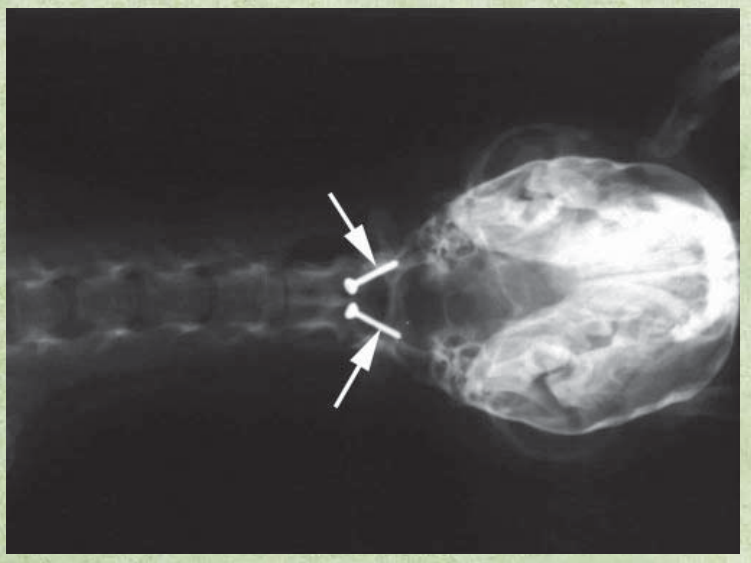

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The European Journal of Companion Animal Practice (EJCAP)

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APMVEAC *Associação Portuguesa de Médicos Veterinários Especialistas em Animais de Companhia*
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Editorial

Harmonisation and Mobility in Veterinary Education

We all know that within the European Union (EU) there is reciprocal recognition of veterinary degrees. But what about Continuing Education(CE)? Can we here also achieve sufficient harmonisation and reciprocal recognition so that we can all enjoy the diversity of Europe and spend CE time in different countries adding an additional professional and cultural flavour to our life long learning?

One step in this direction is to strive for a pan European accreditation of Veterinary CE with appropriate recognition of sub specialist achievement of accredited CE modules. This will encourage a structured approach to CE for the non specialist and will improve the standard of veterinary medicine and surgery available within a practice at the same time increasing awareness of the benefits of referral when more specialist assistance is needed. FECAVA has initiated discussion in this area with our colleagues in other veterinary organisations, which has culminated in the formation of a group to promote european veterinary accreditation of continuing education. This group will become known as EVACE and will begin its work in spring 2009. This is of course just the beginning and it will take a little time to put structures and procedures in place. Members will be kept updated on progress.
In many countries CE is mandatory for continued registration and most countries award 'points' for attendance at CE events. Many FECAVA members have suggested that we should look at harmonising such 'points' so that veterinarians who attend CE in other member FECAVA countries can easily submit these as valid credits.

In addition to exploring how we can improve harmonisation of education which benefits our patients from a Veterinarian point of view, FECAVA is honoured to have been asked to participate in the Veterinary Nursing practical examination project (PEPAS) which aims to develop a pan European objective standardised clinical examinations system, helping to promote practical clinical skills for Veterinary Nurse students by developing a standardised system of assessment.

Finally, and most importantly, we have our own FECAVA Eurocongress, an ideal way to improve our CE. What better way to sample the fruits of European diversity than to ensure that one of your practice attends the FECAVA Eurocongress every year. The congress protocols have been extensively reviewed to re invent and future proof our annual FECAVA Eurocongress. This year it will be a joint event held in Lille on November 27th to 29th and hosted by three FECAVA member Associations -AFVAC(France), SAVAB (Belgium) and LAK (Luxembourg) - don't miss it. Also watch out for "FECAVA Days" at national congresses.

We are fortunate to live in Europe where harmonisation is a common goal in many walks of life yet where the diversity of many differing points of view and cultures is cherished and preserved. Let's bring this into our education by mutually approved systems of accreditation and recognition- and most of all by you, the reader, packing your bags and travelling for your CE this year - Bon Voyage!

Andrew Byrne, President of the FECAVA

FECAVA NEWS

New continuing education system for practitioners

Striving to improve the quality of the practice of companion animal veterinary medicine and surgery is one of FECAVA's key aims, and education is the fuel that helps to achieve this objective.

But how can we encourage and facilitate structured continuing education for practitioners that is achievable and which gains appropriate recognition? Veterinarians in practice need to be able to advance their knowledge and skills. This is most easily facilitated in large group practices. Here individuals may select personnel areas of clinical interest, enabling the practice as a whole to advance in several fields. This is not specialisation - practices who advance their knowledge push their frontiers further forward and so recognise the importance of doing the best for their patients which in turn means referring to a specialist when this is appropriate.

To be a specialist one must follow a particularly rigorous path of professional development within an appropriate clinical environment, leading to the undertaking of diplomate qualifications. It is usually not possible for veterinarians in practice to follow this route while remaining in full time practice, and yet there is a professional desire and a need for continuing education that is focused on specific areas of interest.

In order to explore ways of facilitating and encouraging veterinarians in practice who wish to follow a structured path of continuing education, FECAVA has convened a postgraduate education working group, which reports to the FECAVA Council. One of the first decisions of this group was the proposal to collaborate with our colleagues in FVE and UEVP to form a continuing education accreditation committee.

This committee will have three members from FECAVA, three from statutory bodies and three from FVE/ UEVP/ ECCVT. This accreditation committee will be called the "European veterinary accreditation (committee) of Continuing Education (EVACE). The object is to develop and test, through a pilot scheme, an accreditation system that will facilitate quality assured structured continuing education for practitioners. We are in the early stages of this project and there is still much work to be done.
This is a part of FECAVA's strong commitment to continually advance the quality of the practice of veterinary care through education.

Andrew Byrne

If you have any comments or suggestions, please contact your association's FECAVA Director or any FECAVA Board member. Visit www.fecava.org for contact e-mail addresses. Your ideas and comments are what will keep FECAVA active and relevant.

Andrew Byrne
President of FECAVA

National Congress 'FECAVA day' proposed

The FECAVA Eurocongress is held once a year. It is held together with the WSAVA World Congress when this is held in Europe. (Generally every second year).

The FECAVA Eurocongress concept is essentially a means to make national congresses better known to other associations and their members. In doing this, national congresses will increase their size and delegate numbers, but keep their own style.

In addition to the FECAVA Eurocongress, FECAVA now encourages national congresses to consider organising a 'FECAVA Day' as part of their annual congress. The purpose of the FECAVA Day is to promote FECAVA to national members and all delegates at national congresses and hopefully to increase and encourage delegates from other countries to attend. This concept was first tried very successfully by AFVAC (F) in December 2007 and repeated by them in November 2008.
Guidelines to help other Associations hold a FECAVA Day at their Congress were introduced at the FECAVA Council meeting last August and hopefully will be approved and adopted at council this spring in Baden Baden.

Astrid Bjerkås
Executive Assistant to FECAVA

FECAVA supports continuing education in member countries

The FECAVA Continuing Education Project has been operating for more than 6 years and mainly concerns Eastern European countries, who can apply for support from FECAVA for CE meetings. For any event supported by the FECAVA CE project, the FECAVA logo should be printed on the programme cover page and shown in the introductory visual presentation. Many of the events are visited by FECAVA officers and Directors. Some offer an opportunity to host FECAVA Council meetings (e.g. Krakow 2005, Istanbul 2007).

Jerzy Gawor

In 2008, the following 9 countries applied for a FECAVA CE grant: Bulgaria, Estonia, Lithuania, Latvia, FYROM, Montenegro,

Poland, Serbia and Slovenia. Ten educational events were organized with the participation of 1147 delegates.

Multi-disciplinary and more specific conferences and workshops were organised covering most of the clinical disciplines: physiotherapy and rehabilitation, imaging, cardiology, dermatology, marketing, veterinary nurse education, exotic animal medicine, oncology, paediatrics and neonatology, endocrinology, ophthalmology, surgery and orthopaedics.

32 European speakers presented contemporary veterinary medicine under the FECAVA banner.

Jerzy Gawor
FECAVA Treasurer

EJCAP Special issue on zoonotic diseases in companion animals

In December last year EJCAP published its second yearly special issue **EJCAP 18(3)**. The topic is zoonotic diseases in companion animals. All the articles can be downloaded free of charge from the FECAVA Website.
Veterinarians need to be able to recognise zoonotic diseases and the effects they have on animals. Companion animal veterinarians also need knowledge on the effect of these diseases on human beings, thus enabling them to cooperate with human doctors in disease control.

The EJCAP special issue on zoonotic diseases in companion animals is available on www.fecava.org.
The issue comprises a collection of articles dealing with important zoonoses all written by outstanding European experts

Photo: Pixelio.de

in their field. The aim is that the information gained from these articles will help veterinary practitioners identify and handle zoonoses in the best way possible.

If you have any comments or questions to the special issue on zoonoses, do not hesitate to contact the Sub Editor of EJCAP Astrid Bjerkås at astrid.bjerkas@gmail.com

Astrid Bjerkås
Sub Editor of EJCAP

50 years of service to Companion Animal Vets in France – A triumph for AFVAC

This was a special year for AFVAC, celebrating 50 years of service to French Companion Animal Vets. What better place to celebrate this than Strasbourg, seat of the European Parliament, and central in Europe.

The concept of European unity has always been championed by AFVAC. Didier Carlotti, the present AFVAC President, was instrumental in founding FECAVA some 19 years ago. AFVAC, then called CNVSPA, was one of the 13 founder members of what is now our 34 member Federation.

The roofs of old Strasbourg with the European parliament in the distance.

Didier Carlotti (left) talks to David Wadsworth (WSAVA President). Andrew Byrne (FECAVA President) is on the right.

Past AFVAC Presidents Roger Guerre (left) and Richard Lecomte with Madame Guerre.

The celebrations started with a special dinner in the historic Chambre de Commerce, in the heart of old Strasbourg. All except two of the Past Presidents of AFVAC together with the current and some past Presidents of FECAVA and WSAVA were present. Indeed, the over 100 guests all had given especial service to AFVAC, FECAVA and WSAVA.

The evening started with a walk through the streets of old Strasbourg which was festive mood as the Christmas market was starting, the streets being decorated in a spectacular and sophisticated manner. The clear skies and frosty air provided an excellent a pre aperitif for the evening.
As this was France, we were eagerly awaiting a gourmet evening, but what was to come exceeded everyone's expectations. The meal was prepared and the service supervised personally by Emile Jung, the celebrated Michelin starred Strasbourg chef.

Emile Jung, the celebrated Michelin starred Strasbourg chef.

We ate at a leisurely pace, interspersed by President Didier Carlotti introducing, and inviting different guests to speak. Our President, Andrew Byrne, impressed everyone by speaking in French, albeit with an Irish accent! Many FECAVA Associations were represented by their past Presidents who had been instrumental in FECAVA's foundation.

This dinner was of course only the start of a fantastic Congress. It was a privileged few who attended the special Dinner, but on the Saturday night 1600,in

In FECAVA from the beginning Keith Davies (Editor of EJCAP), Dr. Villamor (AVEPA), Christian Dumon (Past President AFVAC), Francesc Florit (Past President AVEPA).

Strasbourg - Petit France.

fact most delegates, were able to join in a Fiesta celebration. In addition to the Past Presidents already mentioned founder CNVSPA member Doctor André Triau attended the celebration. The important imput of Past Presidents Paul Groulade and Jean Fournier, sadly no longer with us, was mentioned.
The Strasbourg Palais de Congrès is impressive, providing ample room for the commercial exhibition of 93 exhibitors. Many of them had sponsored the Congress. Hills, Royal Canin and Virbac were prime sponsors, Merial and Pfizer also providing a key sponsorship role.

The scientific programme, as one has grown to expect from AFVAC, was excellent, supporting 8 simultaneous streams. There were 685 Veterinary Surgeons, 150 Veterinary students and 144 Veterinary nurses attending lectures. The Congress was Francophone, but this year was of course a particularly 'home members' celebration of AFVAC's first 50 years. The history of the Association was graphically described in a presentation in the entrance to the commercial exhibition.

Next year AFVAC will start its second 50 years by hosting the FECAVA Eurocongress in Lille. Here there will be many lectures given in English, and also simultaneous translation into other languages. This will enable hundreds of FECAVA members from other countries to enjoy a congress in France with the legendary French hospitality. An exciting programme, backed by the ambience of a French location and French cuisine is planned. FECAVA members should straightway make plans to celebrate with AFVAC the first congress of its next 50 years. Mark it in your Calendar now. National Associations, and regions within those Associations should aim to bring a group to Lille. Let's see which Association or regional group can bring the biggest delegation to Lille to join in the big FECAVA party. Be there ! Attend a Eurocongress for 'Life long Learning' and 'social' intermixing.
www.fecavalille2009.com

Keith Davies,
Editor EJCAP

Belgian researcher Hannah Dewerchin wins the ABCD & Merial Young Scientist Award 2008

The first ABCD and Merial Young Scientist Award 2008 was presented to Dr Hannah Dewerchin, from the State University of Ghent (Belgium) on 25 September in Edinburgh, on the occasion of the congress of the European Society of Feline Medicine.

Dr Dewerchin (29) received the award for her work on Feline infectious peritonitis (FIP), and in particular its interaction between the infecting coronavirus and the host cell, and its ability to evade the humoral immune response.

"The immune mechanisms involved might explain why a cat cannot overcome the infection and why vaccination attempts usually fail", she said. Her research contributes important insights for a better understanding of FIP pathogenesis.
The award was presented by Professor Marian C. Horzinek, Chair of the Advisory Board on Cat Diseases (ABCD) and of the award jury, who congratulated the laureate. *"The standard of the applications we received was very high, but the entire jury agreed on the quality of the work of Dr Dewerchin. She is a very promising young scientist!"*

Dr Jean-Christophe Thibault, Merial's Technical director for biologicals (Europe, Middle East and Africa), added, *"True to Merial's mission statement of being an innovation-driven leader in animal health, we are very proud to have made this European award possible. Initiatives such as these, in association with renowned scientific bodies like the ABCD, highlight promising young researchers and the teams to which they belong."*

Both Professor Horzinek and Dr Thibault agreed that Dr Hannah Dewerchin, under the tutorship of Professor Hans Nauwynck (University of Ghent), has contributed lasting insights into an enigmatic feline infectious disease.

The ABCD and Merial Young Scientist Award, created in 2008 and worth 1000 €, is funded by Merial and is presented to a young scientist in veterinary or biomedical science, who has made an original contribution in the field of feline infectious diseases and/or immunology. Applicants should have published their findings in a journal listed in *PubMed* or *Web of Science* or had them accepted by another recognised assessing body.

Candidates should be based in Europe (EU or EFTA country), have completed a veterinary or biomedical curriculum, but should not yet have achieved a PhD or Diplomate status at the time of application. Applications for the 2009 award are now being considered The next award will be presented by the ABCD at the **congress of the European Society of Feline Medicine (ESFM)** to be held in Dubrovnik (Croatia) from **18 to 21 June 2009**.

Hannah Dewerchin, laureate of the 2008 ABCD and Merial Young Scientist Award, flanked by Jean-Christophe Thibault from Merial (left) and Marian Horzinek, chair of the ABCD (right).

Application forms and detailed rules for future Awards can be downloaded from the ABCD web site (www.abcd-vets.org) For further information, please contact Karin de Lange, ABCD secretary, karin.delange@abcd-vets.org

Karin de Lange, ABCD Secretary

UEVP NEWS

A busy year has ended, but an even busier one lies ahead in 2009

2008 was another year of intensive contributions by the UEVP to the EU legislative process and it seems that 2009 will be yet another exciting year of lobbying on behalf our profession -- in spite the world crisis.
Most of the work in 2008 centered round the debates that followed the presentation of the New Animal Health Strategy for the EU in September 2007. Following this initiative, the UEVP decided to promote many different issues of major importance for veterinary practitioners, including the implementation of a farm and animal rearing visitation system, the European accreditation of veterinary schools and the recognition of the importance of maintaining a veterinary web throughout the EU. Following various lobbying meetings we had with Members of the European Parliament (MEPs), some of them tabled amendments suggested by us, on the points mentioned above. It was gratifying that most of our suggestions were actually adopted by the Parliament. We pursued our actions at the European Commission level, a having a meeting with the cabinet of Health Commissioner Androulla Vassiliou .This all turned out to be very successful, given the fact that the Action Plan published by the Commission to implement the New Animal Health Strategy actually refers to the farm visitation system and the European accreditation system. Now that Animal Health Laws are being written ,both the UEVP and the FVE will again strongly involved in this process ,writing discussion papers and holding discussions with stakeholders and the Commission. Both organisations were very active in promoting the veterinary profession during the EU "Veterinary Week" event which was launched in Brussels. Follow up activities are planned to continue for a whole year with various events throughout the different EU Member States. This is a real opportunity to show the public the scope of our activities, our expertise and our professionalism.
The second main action led by the UEVP focused on a written declaration initiated by five MEPs, on the importance of the liberal professions. The UEVP drafted a position paper supporting the text, met MEPs and released a press release which was published in many major media outlets specialising in European affairs. The declaration was unfortunately not backed by the majority of MEPs, but the UEVP action made a significant impact by bringing knowledge regarding the aims and values of the liberal professions to the notice of the public.
Besides these actions, the UEVP kept up its usual monitoring work on the many issues that are of interest to veterinary practitioners, for example, animal transportation rules, animal welfare and legislation related to slaughterhouses. The UEVP also presented two FECAVA delegation projects to the Directorate General for Research, - a Greek research proposal on canine leishmaniasis and a Norwegian surveillance programme of zoonotic diseases involving companion animals -, seeking financial support for both. These projects are still on going as is the pilot project looking into mutual acknowledgement of continuous education throughout the EU.
Last but not least, the UEVP and the FVE inititated a survey on 'puppy trading', circulating a questionnaire with which the FECAVA was deeply involved bringing in both its experience and support. The results will ,in due course be published in a future issue of EJCAP. Also In 2009 we must not forget questions regarding animal identification and antibiotic resistance problems. These are two very important problems on which we have collected a lot of information important and which will requiring our continued skills and attention .
As you can read, 2009 is definitely going to be a very busy year, but it will also be a time of important changes with the EU elections and a new Parliament.

Christophe Buhot President UEVP

WSAVA Vision: WSAVA is dedicated to the continuing development of global companion animal care.

WSAVA Mission: To foster the exchange of scientific information between individual veterinarians and veterinary organizations.

At the WSAVA 2008 Assembly meeting in Dublin, Ireland, in addition to the passing of the Presidential Chain of Office and the retirements of Drs. Anne Sorensen as Honorary Secretary, Larry Dee as Immediate Past-President, and Anjop Venker-van Haagen as Scientific Advisory Committee Chair, an election of Officers was held that saw the new WSAVA Executive Board affirmed. These are (pictured from left to right) Dr. Brian Romberg (Immediate Past-President; South Africa), Dr. Luis Tello (Vice President; Chile), Dr. David Wadsworth (President; UK), Dr. Jolle Kirpensteijn (President Elect; Netherlands), Dr. Di Sheehan (Honorary Treasurer; Australia), and Dr. Walt Ingwersen (Honorary Secretary; Canada).
The assembly members voted in favour of accepting 2 new full member associations, namely the Montenegro Association of Small Animal Practitioners (MASAP) and the Federation of Indian Small Animal Veterinary Associations (FISAVA). The Veterinary Emergency and Critical Care Society was also voted in as an affiliate member.

WSAVA President's Award

Past WSAVA President Dr. Hans Klaus Dreier was presented with the inaugural President's Award for his past and ongoing significant contributions to the WSAVA and international veterinary medicine.

Additional 2008 WSAVA Award winners

WSAVA WALTHAM International Award for Scientific Achievement
Dr. Peter Moore, Professor, Department of Pathology, Microbiology, and Immunology, School of Veterinary Medicine, University of California, USA.

WSAVA INTERVET/SCHERING PLOUGH International Award for Service to the Profession
Dr. Marion Horzinek, Professor, Department of Infectious Diseases and Immunology, Faculty of Veterinary Medicine, Utrecht University, the Netherlands.

WSAVA HILL'S Mobility Award
Professor David Bennett, Institute of Comparative Medicine, University of Glasgow Veterinary Faculty, Bearsden, Scotland, UK.

WSAVA Hills Excellence in Veterinary Healthcare Award
Dr. Carl Osborne, Professor, University of Minnesota and Co-Director of the Minnesota Urolith Centre, Minnesota, USA.

The Vaccination Guidelines Group (VGG) enters its second phase (VGGII)

The VGG has published 'standard of care' Guidelines for the vaccination of dogs and cats. These guidelines are available through the Scientific Advisory Committee pages of the WSAVA website (http://www.wsava.org/SAC.htm), establishing the WSAVA as the global leader in companion animal vaccinology. For VGGII, didactic initiatives aimed at both academia and the general, pet-owning public are on the agenda.
The WSAVA and VGG appreciate the support of Intervet/Schering Plough as their generous sponsorship has allowed this project to proceed.

WSAVA World Congress Sao Paulo 2009 July 21-24, 2009

Approximately 250 lectures by 75 world-renowned speakers covering over 20 disciplines complemented by an exciting social programme in culturally diverse Sao Paulo with all that Brazil and South America has to offer are just a click away. Please visit www.wsava2009.com for additional details and online registration and hotel accommodation.

Future Congresses

Geneva, Switzerland – June 2-5, 2010
Jeju, South Korea – 2011
Birmingham, UK – 2012

COMMISSIONED PAPER

Blood Pressure in Small Animals - Part 2*: Hypertension - Target organ damage, Heart and Kidney

A.P. Carr[(1)], *B. Egner*[(2)]

*INTRODUCTION

In the last issue of EJCAP [18 (2)] we published the first paper of the series on Blood Pressure in Small Animals. This first paper largely dealt with the assessment of Blood Pressure. Part 2 deals with Target organ damage(TOD). Heart and Kidneys. Part 3 will be featured in the October 2009 issue of EJCAP and will deal with Target organ damage Eyes and CNS

What is hypertension?

Hypertension is a sustained elevation of blood pressure that is higher than "normal" for that patient. As routine measurements are not done in all clinics, we cannot always refer to the individual's normal blood pressure but have to compare it to either breed specific values or normal ranges established by the Veterinary Blood Pressure Society and ACVIM Hypertension Consensus Group.[1] Rather than speak of mild, moderate or severe hypertension it is better to refer to the risk of endorgan/ target organ damage (TOD). Hypertension is not only a symptom of a disease but also a disease in itself as it causes damage, mainly to the eyes, the heart, the kidney and the brain.

Risk categories	Systolic Pressure	Diastolic Pressure	Risk for target organ damage
I	<150	<95	minimal
II	150-159	95-99	mild
III	160-179	100-119	moderate
IV	≥180	≥120	severe

It is important to judge systolic and diastolic pressure individually as we can differentiate between:

- isolated systolic hypertension: only systolic blood pressure is high, diastolic is normal
- isolated diastolic hypertension: only diastolic blood pressure is high, systolic is normal
- mixed hypertension: both, systolic and diastolic blood pressure are elevated

Each type of hypertension occurs in dogs and cats and each type can cause TOD.

What type of hypertension can be found in dogs and cats?

Dogs and cats, unlike human beings, suffer predominantly from secondary hypertension. That means that there is an underlying disease causing blood pressure to rise. In some individuals it is not possible to diagnose an underlying problem; these cases are best referred to as "Idiopathic Hypertension". [1]

The Kidney and Hypertension

Chronic renal disease (CRD) is a relatively common problem in small animal patients, especially older cats. Renal disease is also the most common cause of hypertension in small animals. The prevalence of hypertension with renal disease is difficult to

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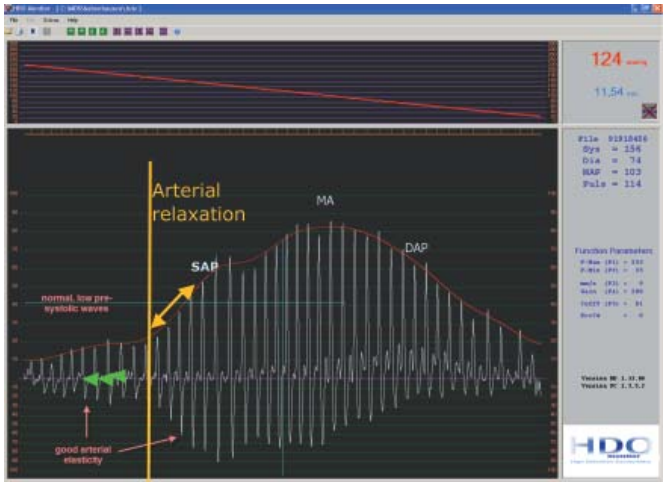
establish; some studies have suggested prevalences as high as 60%.[2] A recent study in a first opinion practice determined that approximately 18% of cats were hypertensive when initially diagnosed with chronic renal disease.[3] This study only looked at systolic pressures however so that any diastolic hypertensives would have been missed. How many animals with renal disease go on to develop hypertension is unknown. Data in dogs with spontaneous CRD is conflicting with some studies finding few hypertensives whereas others suggest it is common. [4,5] In dogs it has been shown that the presence of hypertension with CRD is associated with a more rapid decline in renal function and shorter lifespan than dogs with normal blood pressure.[5] In experimental renal injury in dogs relatively minor differences in blood pressure between groups (approximately 20 mmHg systolic, 15 mmHg diastolic) were associated with significantly worse outcomes.[6] In cats the effect of hypertension on outcome is less clear with research suggesting that initial systolic blood pressure and response to antihypertensive therapy are not indicative of survival.[7,8] These studies in cats have however a major limitation in that only systolic blood pressures were measured. By having only systolic values a significant amount of blood pressure information is not available. Not only can diastolic blood pressure be an important factor affecting outcomes, but pulse pressures at presentation have been associated with renal function decline in humans with essential hypertension.[9] Before the degree of hypertension, renal function, and control of hypertension can be definitively related to outcome it is important to gather data on systolic as well as diastolic blood pressure to get a more complete picture of blood pressure status.

The genesis of hypertension in CRD is most likely multifactorial. Most of the data regarding the pathophysiology of hypertension is gleaned from studies on lab animals or humans. In humans both chronic renal failure and glomerulonephritis is associated with hypertension. Possible mechanisms for hypertension include volume overload, renin-angiotensin-aldosterone system (RAAS) activation (systemically as well as locally in the kidney), sympathetic overactivity, increased intracellular calcium, elevated parathyroid hormone levels, and endothelial dysfunction.[10]

Angiotensin II and aldosterone contribute to impaired arterial elasticity, as shown in High Definition Oscillometry Fig. 1.

Fig. 1a: Oscillometric pattern in a normotensive patient.



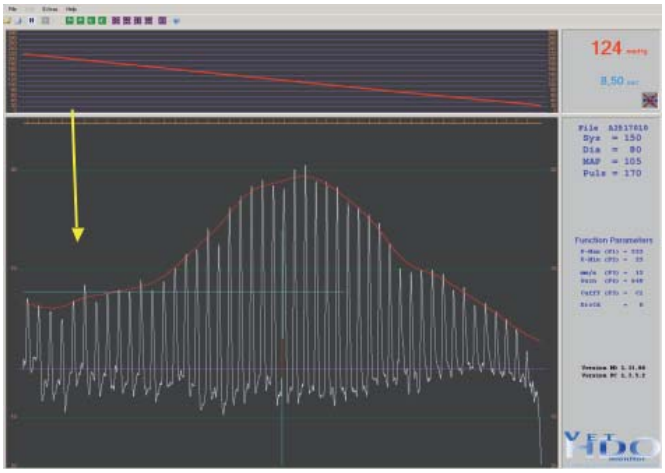


Fig. 1b Increased amplitude of presystolic waves indicates of impaired arterial elasticity

Potential reasons:

Angiotensin II mediated vasoconstriction (will disappear with ACEi treatment) or arterial remodelling (Angiotensin II and/or aldosterone related)

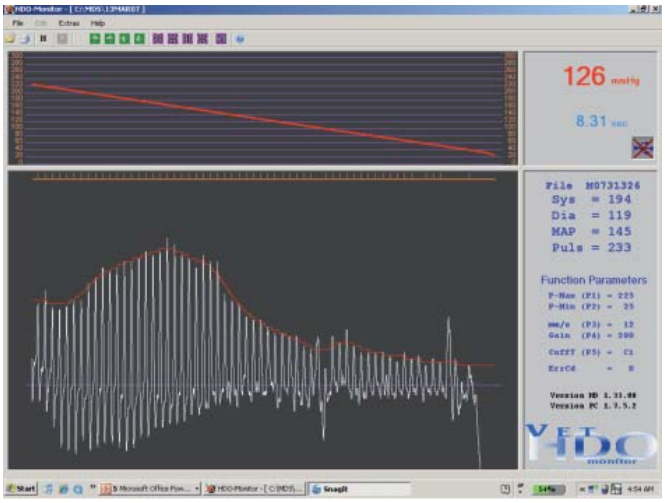


Figure 1c. Note the markedly increased amplitude of the presystolic waves indicative of decreased arterial elasticity in a dog with severe hypertension secondary to renal disease.

Chronic renal disease has been associated with a loss of renal autoregulation. Renal autoregulation refers to the ability of the kidney to maintain relatively constant intraglomerular pressures over a wide range of systemic blood pressures. This allows glomerular filtration rate and renal blood flow to remain relatively constant. Loss of autoregulation in renal disease has two major clinically important effects. First it means that remaining glomeruli are subjected to higher pressures when the patient is hypertensive (hyperfiltration) leading to more rapid deterioration of renal function. Secondly it means that the kidney is less able to deal with lower blood pressures resulting in loss of GFR and RBF at pressures that would not cause such an effect in animals with normal kidney function. Loss of autoregulation has been documented in dogs undergoing ¾ or 7/8 nephrectomy.[11] Loss of autoregulation has been found in humans and various

lab animal models of hypertension, however autoregulation can be restored through the use of angiotensin converting enzyme inhibitors (ACEi).[12] Alternatively, aggressive lowering of systemic blood pressure will also minimize glomerular hyperfiltration.

The Heart and Hypertension

Hypertension affects the heart in a variety of ways; however cardiac changes in hypertensives can at times be caused by the diseases that are the underlying etiology of the hypertension. As an example hyperthyroidism can cause hypertension, however the metabolic changes that occur with this disease also have a direct effect on the heart.

In hypertension, the most common cardiac change is the development of left ventricular hypertrophy (LVH) and abnormal valvular motion and loading sequences.

This is an adaptive response to the increased pressure load on the heart. This increased pressure load leads to increased left ventricular wall stress. The Law of LaPlace can be used to understand wall stress(Fig 2);

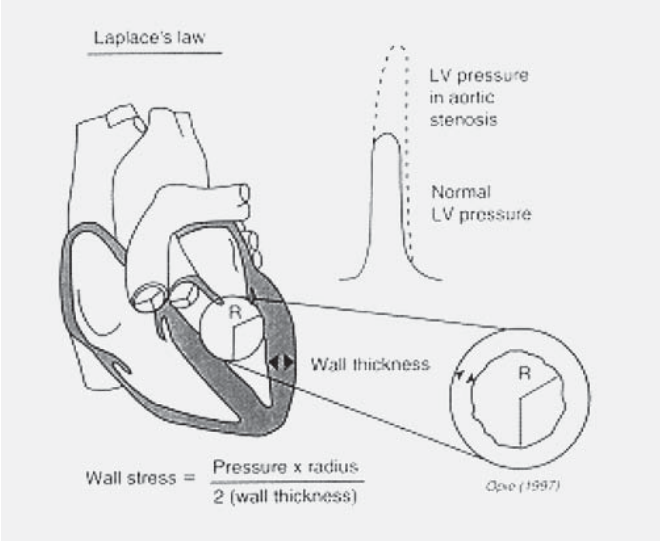


Fig 2

$$\text{Wall stress} = \frac{\text{end diastolic pressure x radius}}{\text{Wall thickness}}$$

Wall stress can be increased by increased intracavitary pressures (more severe hypertension) and by increases in the radius of the internal diameter of the left ventricle (for example with dilated cardiomyopathy). If wall stress is increased, an increase in wall thickness (compensatory hypertrophy) will minimize this. The increased wall stress with hypertension is sensed by cardiomyocytes and nonmyocytes which then initiate the processes by which a variety of signals such as growth factors, intermediate peptides (e.g. endothelin and angiotensin II), interleukin 6 related cytokines (cardiotrophin I), and insulin like growth factor I are generated that lead to changes in the myocardium.[13] Both myocardial hypertrophy and myocardial hyperplasia occurs. The result of both is more or less marked wall thickening (concentric left ventricular hypertrophy) and increase in heart muscle mass and abnormal diastolic function.

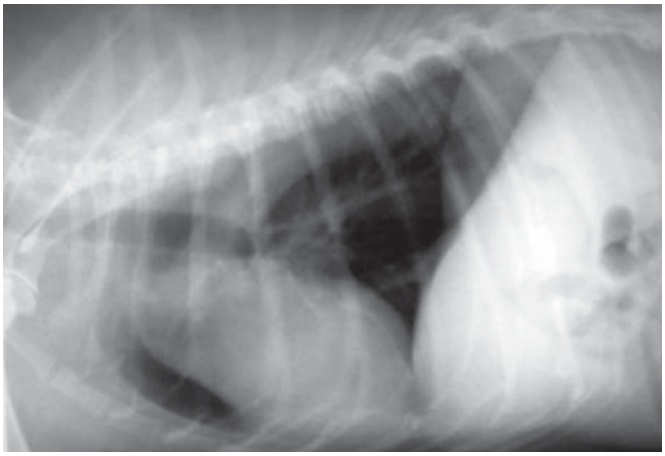
In the patient with hypertension, LVH can have significant negative effects. One such negative effect is the tendency toward a variety of arrhythmias that has been documented in humans.[14] With LVH there is often a mismatch between myocardial oxygen demand and supply, potentially resulting in ischemia. Collagen synthesis leading to fibrosis is commonly seen resulting from growth factors (angiotensin II, increased sympathetic drive) often together with tissue hypoxia. The hypertrophied heart is also more prone to being electrically unstable which can predispose to arrhythmias as can ischemia and fibrosis. Hypertrophied cardiac muscle is also more sensitive to adrenergic stimulation and increased sympathetic activity is common to hypertension.

The presence of LVH negatively affects cardiac function. The predominant reason for this is myocardial fibrosis.[15] Reduced diastolic function is found early in hypertension. As fibrosis advances there is also an inability to generate myocardial force, in other words systolic function also begins to be compromised. In some cases prolonged hypertension can lead to heart failure.

Auscultation: Abnormal auscultatory findings are frequent in dogs and cats with hypertension. In one study 70% of hypertensive cats had abnormalities, with 40% having murmurs.[16] The presence of a murmur may not however necessarily relate to the presence of hypertension as a study in cats showed that hypertensive and normotensive cats had a similar prevalence of heart murmurs (62 vs. 72%). [17] On the other hand in this study only hypertensive cats had gallop rhythms which were present in 16% of the hypertensive cats. Gallop rhythms generally develop because of decreased left ventricular compliance secondary to ventricular hypertrophy. A new murmur or gallop rhythm should always lead to a blood pressure measurement. Other findings include tachycardia and arrhythmias.

ECG: Findings are not specific for hypertension and can be seen in older cats and especially in cats with heart disease or hyperthyroidism. Common findings are tall R waves (high voltage), increased heart rate and less frequently taller P-waves and dysrhythmias. Conduction abnormalities such as bundle branch blocks or left anterior fascicular block are also seen.

Fig. 3. Hypertensive dog with a prominent aorta.



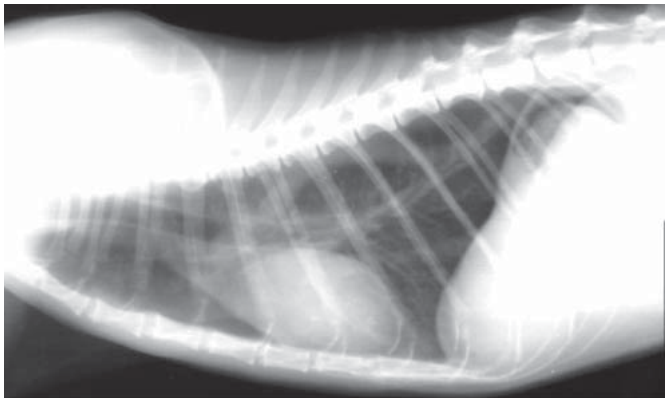
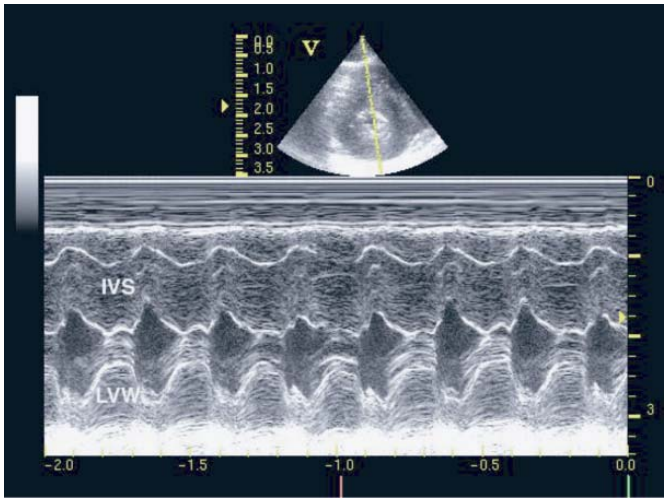


Fig. 4: Hypertensive cat with an undulating aorta.

Thoracic radiographs: There have been limited studies addressing the radiographic findings in hypertensive patients. Some of the changes attributed to hypertension can also be seen in older patients without hypertension. In one study where normotensive older cats were compared to hypertensive cats, the only significantly different parameter was aortic undulation which was present more commonly in hypertensives.[18] Indicators of cardiomegaly were equally common in hypertensives and non-hypertensives.

Echocardiography:
Abnormal motion of the mitral valve may be seen. The diastolic pattern of mitral inflow velocity recorded by pulsed wave Doppler change from normal to impaired relaxation.
In hypertensive cats left ventricular enlargement is found, often with asymmetric or symmetric thickening of the intraventricular septum and the left ventricular free wall.[17] Left ventricular internal diameter is reduced in diastole. This study shows that survival is not affected by the presence of echocardiographic changes. Other studies have shown similar cardiac hypertrophy, however decreases in left ventricular internal diameter were rarely found.[19], Overall the hypertrophy in most cases is relatively mild. Dilation of the proximal ascending aorta has been documented in hypertensive cats.[18] With treatment, some of the echocardiographic changes can normalize in hypertensive cats.[20]

Figure 5. Echocardiogram showing marked thickening of the septum and left ventricular freewall in hypertension (Illustration above from Stepien R. Hypertension and the heart in Egner B, Carr A, Brown S: Essential Facts of Blood Pressure in Dogs and Cats. ISBN 978-3-938274-15-6, VBS GmbH 2007)



Treatment of Hypertension

Although a variety of medications have been suggested for treatment of hypertension in pets, Angiotensin Coverting Enzyme Inhibitors (ACEi) and amlodipine are the predominant ones used.

ACE inhibitors
ACEi are of special interest in association with cardiac or renal disease based on the pharmacologic effects of these agents. ACEi lower intraglomerular pressure by dilating the efferent arteriole, thereby minimizing hyperfiltration. ACEi also reduce endothelial dysfunction, including of the renal vascular bed.[12] ACEi reduce proteinuria and production of cytokines that lead to fibrosis, inflammatory cell recruitment and compensatory hypertrophy.[21] When using ACEi, it is important to monitor for azotemia as this can occur secondary to the vasodilator effect. Blood pressure reduction achieved with an ACEi is usually relatively minor. ACEi as sole agents resulted in initial control of hypertension in only 6 of 16 hypertensives, after 6 months only 2 of 16 were still controlled.[22] Ramipril is an ACEi that may be more effective at controlling hypertension. A research abstract showed that in 12 hypertensive cats 0.125 mg/kg of ramipril daily resulted in good blood pressure control in all cats for up to 6 months, with an average blood pressure decline of approximately 40 mmHg.[23]

Medication	Cat Dosage	Dog Dosage
Enalapril[1]	0.25 to 0.5 mg/kg Orally twice daily	same
Benazapril[2]	0.25 to 0.5 mg/kg Orally daily	same
Ramipril	0.125 mg/kg Orally daily	0.125 to 0.25 mg/kg Orally daily
Amlodipine	0.625-1.25 mg/cat/day by mouth (0.13 to 0.3 mg/kg Orally daily)	0.1 to 0.4 mg/kg Orally daily

***A Guide to common dosages used** – Please check with manufacturer or cardiology specialist*
1 Some suggest higher doses in dogs – up to 3.00 mg/kg twice a day, and favour the lower dose only in cats
2 some suggest a higher dose in cats of up to 1.0 mg/kg

There is evidence that suggests that ACEi should be used whenever calcium channel blockers (CCBs) such as amlodipine are used to control blood pressure. CCBs dilate the afferent arteriole, resulting in increased intraglomerular pressure if systemic blood pressure is not normalized. CCBs as a sole agent were associated with increased proteinuria in humans with protein losing kidney disease unless mean arterial pressure was dramatically lowered. This was not seen if an ACEi was given

concurrently.[24] A blunting of RAAS activation by amlodipine in healthy dogs was seen when enalapril was given concurrently. [25] Other ACEi's used in Europe are Benazepril and Enalapril.

Calcium Channel Blockers

Amlodipine has been the medication that has allowed successful management of hypertension, especially in cats. Amlodipine decreases calcium influx into both cardiac and vascular smooth muscle leading to vasodilation. Adverse side effects from a rapid drop in blood pressure (weakness, syncope, organ failure) are rarely reported. Amlodipine (at a dose of 0.625 to 1.25 mg/cat/day) reduces systolic blood pressure by approximately 40 mmHg. The higher dose is usually needed in heavier cats. Transdermal amlodipine may also be efficacious in cats though higher dosages may be needed and titration to effect may be more challenging. In dogs an ideal dosage has not been determined to date. Initially 0.1 mg/kg can be given daily, this can be increased up to 0.4 mg/kg/day if needed.

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COMMISSIONED PAPER

Clinical Cytology of Companion Animals: Part 2. Cytology of subcutaneous swellings, skin tumours and skin lesions

E. Teske[1]

INTRODUCTION

Subcutaneous swellings, skin tumours, and skin lesions are extremely well suited for cytological examination via FNAB (Fine needle aspiration biopsy). Aspiration can be performed without difficulty, and causes little or no pain except with processes on the feet or the nose, and even in these cases, anaesthesia is seldom required. An impression smear or scraping can easily be made of open lesions, but it is advisable to perform FNAB from the edges of the wound as well. Cytological examination can in many cases lead quickly to the correct diagnosis and be of decisive importance to the choice of therapy and to the prognosis.

The cytological examination of FNAB of skin tumours and subcutaneous swellings often makes histological examination unnecessary. Histological examination costs more time, is more invasive, and more expensive. However, it should be emphasized that follow-up histological examination almost always offers a solution in the event that cytological examination is insufficient, and some processes can only be determined by histological examination.

Cytological examination of skin tumours and to a lesser extent also skin lesions and subcutaneous swellings forms a good start for veterinarians who wish to become familiar with cytology. Many diagnoses are rather easy to make and to verify subsequently via a second opinion by an experienced cytologist or by histological examination.

This paper is organized in a way to help the inexperienced cytologist quickly on the way to the first diagnosis but also to help recognize as such the preparations that are difficult to interpret. The evaluation of the latter can be left to an experienced cytologist. The reader is further advised to consult one of the many cytology books that are available, as in this article only condensed information can be given due to publication limits.

The following advice is offered to the inexperienced cytologist in order to avoid erroneous diagnoses:

1. Examine only cell-rich, well streaked-out preparations.
2. Interpret the cytology as far as possible in relation to the clinical information such as age of the patient, past history, and the macroscopic appearance, rate of growth, and location of the tumour.
3. For the time being have all diagnoses, including those made without difficulty, verified by an experienced cytologist or by histological examination.

It can be difficult to differentiate skin tumours and subcutaneous swellings. Skin tumours can spread subcutaneously and subcutaneous processes can infiltrate the dermis, and both can cause skin lesions. Usually it is possible by inspection and palpation to correctly localize a process. This is important in obtaining a FNAB because the origin can give specific indications of the nature of the process (Table 1).

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Causes of subcutaneous swellings
- Haematoma
- Fat
- Cysts
- Inflammation, abscess
- Mesenchymal tumours
  - lipoma, fibroma, haemangioma, haemangiopericytoma, haemangiosarcoma, (injection-site) fibrosarcoma, liposarcoma, leiomyosarcoma, chondrosarcoma, osteosarcoma
- Malignant lymphoma
- Glandular-epithelial tumours
  - adenomas and adenocarcinomas of sebaceous gland, sweat gland, thyroid, salivary gland, perianal gland, mammary gland, and anal sac

Skin tumours
- Round cell tumours
  - mast cell tumour, melanoma, malignant lymphoma, plasmacytoma, histiocytoma, condyloma
- Epithelial tumours
  - basal cell tumour, squamous cell carcinoma, adenoma and adenocarcinoma

Table 1

Subcutaneous swellings

Subcutaneous swellings can arise from structures of the subcutis as well as from other tissues located under the skin, such as salivary glands, lymph nodes, thyroid, mammary glands, cartilage, bone, etc. Mammary tumours and inflammations of the mammary glands will not be dealt with in this chapter. Cytology of the mammary gland of the cat and especially of the dog is one of the most difficult areas of clinical cytology in companion animals.

Haematoma

Preparations that contain many erythrocytes are searched carefully for the presence of other cells. If only a few epithelial cells and/or mesenchymal cells are found and by examination under the 100x objective these are seen to have no malignancy criteria, then i) a blood vessel may have been penetrated, or ii) there may be a tumour of cells of vessel walls (e.g. haemangioma/haemangiosarcoma), or iii) the blood is from a haematoma. The latter can usually be confirmed by the fact that blood from a slightly older haematoma contains no thrombocytes but does contain brown bilirubin crystals and macrophages that show erythrophagocytosis and accumulation of iron pigment. A few inflammatory cells, like neutrophils and lymphocytes, may also be present (Fig. 1).

Fat/lipoma

Preparations that before fixing/staining contain a good amount of glassy, fatty material but after staining contain only a vague background with some empty round spots of different sizes probably contained only fat that has been dissolved by the alcohol. Sometimes there are few free pyknotic nuclei of the fat cells and/or intact three-dimensional clusters of empty fat cells. The presence of pure fat indicates an unsuccessful aspiration (subcutaneous fat) or an aspiration from a lipoma. The cells of a lipoma look the same as normal fat cells.

Cysts

Smears that contain large, blue, epithelial cells without nuclei are usually contaminated with flakes of keratin from the skin. If the smear contains almost exclusively large numbers of keratin flakes or amorphous blue or black material, then probably a *dermoid (epidermoid)* cyst has been aspirated (Fig. 2). Such cysts also often contain cholesterol crystals. These can cause secondary inflammation. If in addition to keratin flakes there are also immature nucleated epithelial cells, these should be examined carefully for malignancy criteria.

Preparations can also contain a homogenous pink layer of protein in which there are sporadic epithelial cells and/or mesenchymal cells or intermixed blood cells. This can indicate aspiration from 1) oedematous tissue, 2) a very poorly exfoliating tumour, or 3) a *serous cyst* (seroma, hygroma). Aspiration from a cyst is usually recognized during aspiration. By microscopic examination one

Fig. 1 Haematoma in a dog. Several erythrocytes are in the background, but also phagocytized by macrophages and broken down to dark granular material.

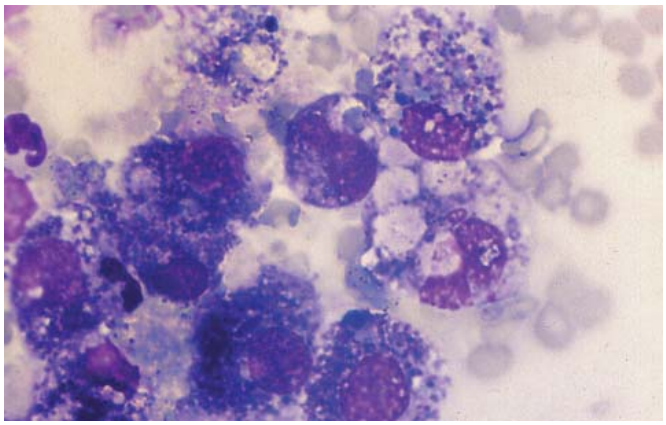
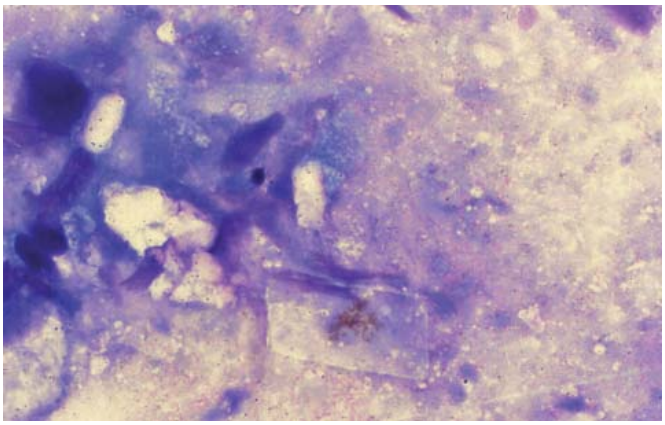


Fig. 2 Content of an epidermoid cyst. Several keratin flakes are present with their characteristic sky blue colour. A large cholesterol crystal is also present.



also usually finds a few mononuclear cells (macrophages, cyst wall cells) and cholesterol crystals.

Salivary cysts are equally easy to recognize (Fig. 3). The characteristic findings, apart from the location of the cyst and the mucoid consistency of the contents, are the presence of clumps and strings of amorphous blue material (mucus) and many foamy macrophages, which develop very strong phagocytic activity and can contain erythrocytes, bilirubin crystals, and haemosiderin, because there is always some blood in salivary cysts. Because of the high viscosity of the saliva the erythrocytes are often stretched out in rows. Preparations from salivary cysts also often contain a few groups of cells from the salivary gland. These are easy to recognize. The clumps of cells, which have a clearly acinar structure and a great amount of cytoplasm, are often enclosed in dark blue strings of mucus.

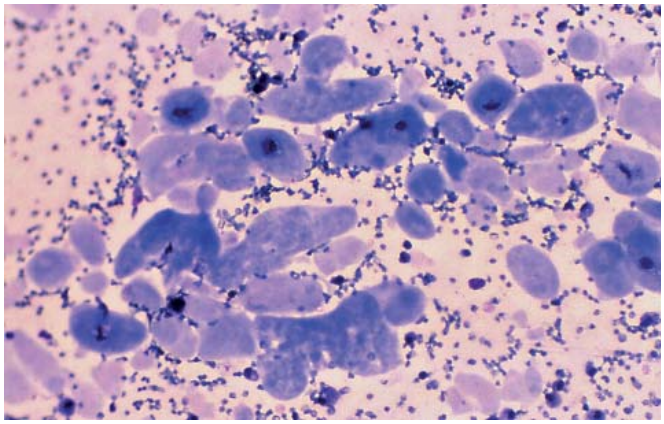
Smears from *abscesses* have large numbers of neutrophils. A single lymphocyte, plasma cell, or macrophage may also be found. Dependent upon the cause of the abscess the neutrophils may show many degenerative signs. One should always carefully look for intracellular bacteria.

Inflammation

General inflammatory processes have been described in Part I. Some special types of inflammatory processes can be recognized on cytological evaluation:

- *Plasmacytic pododermatitis*
  Plasmacytic pododermatitis starts as a soft swelling of one or more footpads. Aspirates demonstrate large numbers of plasma cells. Some lymphocytes and neutrophils may also be present. Most plasma cells are well differentiated.
- *Nodular panniculitis*
  In nodular panniculitis sterile subcutaneous inflammation of fat tissue results in the formation of one or more subcutaneous nodules, which may ulcerate. A pyogranulomatous inflammation with non-degenerated neutrophils, foamy macrophages and multinucleated giant cells is characteristic of the disease. A fatty background and lipocytes are present. No microorganisms can be found.
- *Eosinophilic inflammations*
  Biopsy samples contain large numbers of eosinophilic granulocytes. This type of inflammation occurs in the eosinophilic granuloma in the cat, the lick granuloma in the dog, and also in parasitic infections and allergic reactions. Eosinophilic granulocytic infiltrates are also a characteristic finding in many mast cell tumours.

Fig. 3 A salivary cyst with some secondary haemorrhage. Many large clumps of amorphous blue mucus are to be seen, with macrophages on the background and sometimes on top of these clumps.



Mesenchymal cells in FNABs

Mesenchymal cells occur in all organs, as connective and supporting tissue and as a component of the blood vessels. They are also the elementary building blocks of many different tissues (connective tissue, cartilage, bone, muscle, vascular wall, adipose tissue). Mesenchymal cells are also almost always involved in repair of damaged organs, in which they can partly replace the original tissues (mesenchymal hyperplasia, scar tissue). During inflammatory processes mesenchymal cells are stimulated to cell division and proliferation to aid in tissue repair. FNABs from inflammatory processes thus also usually contain fibroblasts. These can be so strongly stimulated that they give the impression of being malignant. Hence the cytoplasm can be strongly basophilic staining and there can be remarkable large or multiple nucleoli. Giant cells with more than one nucleus, sometimes varying in size, can also be present. The presence or absence of inflammatory cells is thus of great importance in the interpretation of mesenchymal proliferations.

Sporadic, well-differentiated mesenchymal cells such as fibrocytes are usually from the normal connective tissues that are also aspirated in the FNAB. If fibrocytes are found in large numbers, they can be an indication of a **fibroma**. In this case, there are few inflammatory cells. Malignant mesenchymal tumours can have histological characteristics of the tissue of origin (e.g. **fibrosarcomas, osteosarcomas, liposarcomas, chondrosarcomas, haemangiosarcomas, leiomyosarcomas**). It is not always possible to differentiate the different types of mesenchymal tumours cytologically and it can even be difficult to recognize that a malignant tumour is of mesenchymal origin. It is essential that the diagnosis of malignant tumour is only made if sufficient criteria of malignancy are confirmed (see Part I) and that, if the cells are of uncertain mesenchymal origin, that the proliferation of the "tumour" cannot be attributed to inflammation.

A few special types of mesenchymal tumours will be discussed: Biopsies of **osteosarcomas** are usually reasonable cellular and often show cellular necrosis. Mild to moderate amounts of an eosinophilic, osteoid-like, extracellular substance surrounding the osteoblasts can be seen. Depending on the histological subtype few to moderate amounts of fibroblasts can be found as well. Less frequent osteoclasts are present. The osteoblasts have a pale blue to blue cytoplasm with eccentric nuclei, often with a Golgi like elucidation in the cytoplasm. Slight to moderate eosinophilic granulation of the cytoplasm is a distinct characteristic of malignant osteoblasts (Fig. 4). The tumorous osteoblasts frequently have poor to moderately distinct cell borders. Distinct nucleoli, often more than 2 per nucleus, are present. Chromatin pattern is reticular to clumped. Additional malignancy criteria can be found, like angular nucleoli, anisonucleoliosis, macronucleolisation, nuclear moulding and

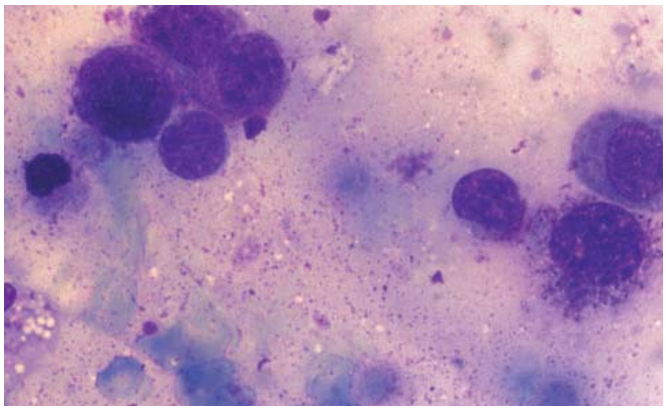


Fig. 4 Aspirate of an osteosarcoma in a dog. Some poorly differentiated osteoblasts are present with in some cells moderate eosinophilic granulation.

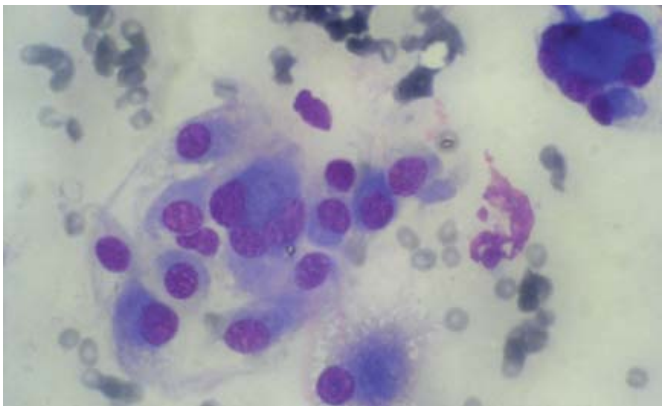


Fig. 5 Hemangiopericytoma. Several individual mesenchymal cells can be seen with whirling like protrusions, round nuclei and sometimes multinucleated cells. On the right top a typical crown-form is present.

aberrant mitoses. Additional staining with alkaline-phosphatase may differentiate between osteosarcoma and other types of sarcomas.

Haemangiopericytomas are vascular neoplasms thought to be derived from pericytes. They are classified within the group of peripheral nerve sheath tumours. Cytologically, they have very distinct characteristics. The cellularity can vary from moderate to abundant. The cells are individual, spindle shape formed and have whirling-like protrusions of the cytoplasm. The nucleus is round and the cells can be binuclear or even multinucleated, forming so-called insect-head or crown like cells, respectively (Fig. 5).

Injection-site sarcomas in the cat are located in the hypodermis and have great cellular pleomorphism and high mitotic rates. Many of these sarcomas are associated with inflammation. The inflammatory reaction is characterized by frequent aggregates of lymphocytes and smaller numbers of plasma cells. Large round macrophages with blue-grey cytoplasm, presumably associated with phagocytised adjuvant material, are commonly found within, around, or adjacent to these sarcomas. Tumours are often contiguous with granulation tissue that surrounds areas of necrosis at the vaccine site. Multinucleated giant cells are a common finding in feline vaccine-associated fibrosarcoma.

Adenomas and adenocarcinomas

Various glandular structures in and under the skin can give rise to benign tumours (adenomas) or malignant tumours (adenocarcinomas). The endocrine or exocrine gland of origin of many adenomas and adenocarcinomas is difficult to determine but a few tumours carry characteristic features, which reveal their origin.

A general diagnostic feature of a glandular epithelial tumour is of course the occurrence of tumour cells in clusters, as is true of all epithelial tumours. More specifically in cell clusters of glandular origin, an acinar structure can still be recognized. In very malignant carcinomas, however, this is lost.

Adenomas scarcely differ cytologically from normal gland tissue. The round to cuboid cells show little variation in cell size, nuclear size, and N/C ratio. The macroscopic appearance of tumour formation in combination with the cytological finding of clusters

Fig. 6 Clusters of epithelial cells from a sweat gland adenocarcinoma. Several malignancy criteria like anisokaryosis, coarse chromatin pattern, abnormal nuclear forms and multiple nucleoli are present.

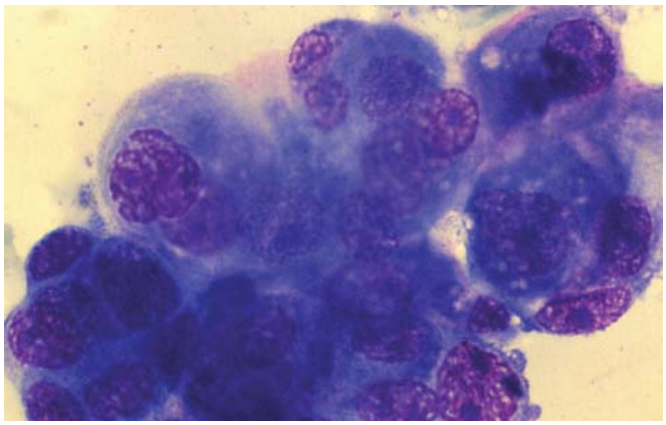
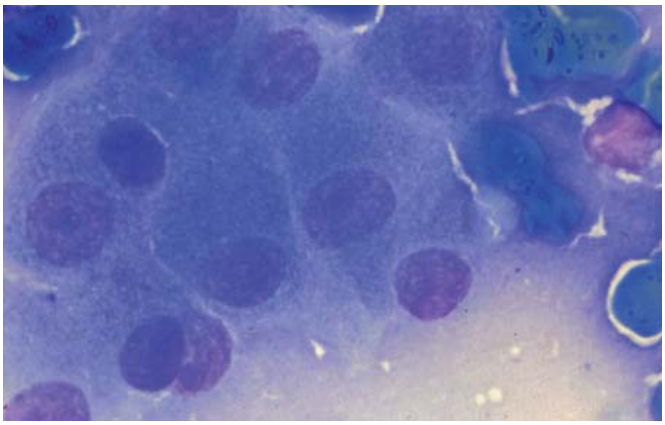


Fig. 7 Cluster epithelial cells of a perianal gland tumour. Typical hepatoid cells with abundant somewhat granular/foamy cytoplasm and round nuclei, which sometimes have a large nucleolus.



of uniform epithelial cells which may have a slightly high cell density and slightly chaotic arrangement is consistent with the diagnosis of adenoma.

Adenocarcinomas can still show some acinar formation here and there but also have a number of criteria of malignancy (see Part I). In general at least four such criteria should be found for the diagnosis of "malignant" to be made (Fig. 6). In well-differentiated adenocarcinomas, that can sometimes be difficult.

Perianal gland adenoma/carcinoma are tumours of the perianal glands that occur usually in male dogs and less frequent in bitches. They are located in the immediate surroundings of the anus, occasionally on the tail, on the prepuce, in the flank, and on the back. They are usually benign but can become malignant. The tumour is sometimes called a hepatoid tumour because the tumour cells resemble hepatic parenchymal cells. The cells lie mainly in three-dimensional clusters, but on the edge of the clusters the cells can be examined more closely. They are large cells, often egg-shaped, with an eccentric nucleus that contains one or two obvious nucleoli. The cytoplasm is usually somewhat granular/foamy (Fig. 7). Often remnants of vascular structures can be found in the smear. Perianal tumours often ulcerate and can then be infiltrated with inflammatory cells. Sometimes there are malignancy criteria.

Anal sac adenocarcinoma is a malignant tumour that, like the thyroid carcinoma in the dog, does not always show obvious characteristics of being malignant. Very often the biopsy reveals large numbers of monomorphous cells, frequently without any apparent cytoplasm. On careful examination, however, acinic structures can be recognized. Also some anisokaryosis, as one of the few malignancy criteria, is usually present. Morphologically the tumour cells resemble the thyroid adenocarcinomas in the dog.

Mammary tumours are not always recognizable as such without cytological or histological examination. The cytology of mammary tumours, however, is one of the most difficult in veterinary cytology and will not be described in this paper.

Thyroid tumours are composed of epithelial cells that are very rich in cytoplasm. The cells exfoliate easily and also rupture quickly. The preparations are often very bloody. If, however, little blood is aspirated, the obvious acinar clusters as well as primarily loose nuclei will be found in an homogenous protein-rich background. The nuclei are about the size of lymphocytes and must not be confused with them. A FNAB from a thyroid contains in any case no lymphoglandular bodies. Here and there is usually an intact cluster of cells with an acinar structure. The nuclei show usually only sporadic malignancy characteristics such as mild anisokaryosis and multiple nucleoli (Fig. 8). In dogs these tumours are nevertheless always considered to be malignant. In cats they are usually benign hyperplasia (adenoma).

Skin tumours and skin lesions

Skin tumours are usually recognizable as such. Sometimes the subcutis is included in the process or an inflammation or tumour from the underlying tissues is infiltrated in the skin. The differential diagnosis then becomes more extensive and more difficult. Usually cytological examination can still arrive at the diagnosis, provided that there are enough characteristic cells present.

Tumours of individualized round cells

Several skin tumours are characterized cytologically by a uniform population of round tumour cells that have little or no apparent connection with each other. The FNAB from such tumours is usually cell rich because they, in contrast to mesenchymal tumours, release cells easily during aspiration. To this group of so-called "discrete cell neoplasms" belong the mast cell tumours, malignant lymphomas, cutaneous plasmacytomas, histiocytomas, melanomas, and the transmissible venereal tumours (TVT).

Mast cell tumours are usually immediately recognizable because of the presence of many purple cytoplasmic granules. The cells are large and round. The nucleus of the cell is often difficult to see because it is poorly stained and covered by granules that absorb so much stain (Fig. 9). Sometimes large

Fig. 8 Aspirate of a thyroid gland carcinoma. Groups of, often naked nuclei, in acinic structures are present. The nuclei are round, very uniform, and lacking obvious malignancy criteria.

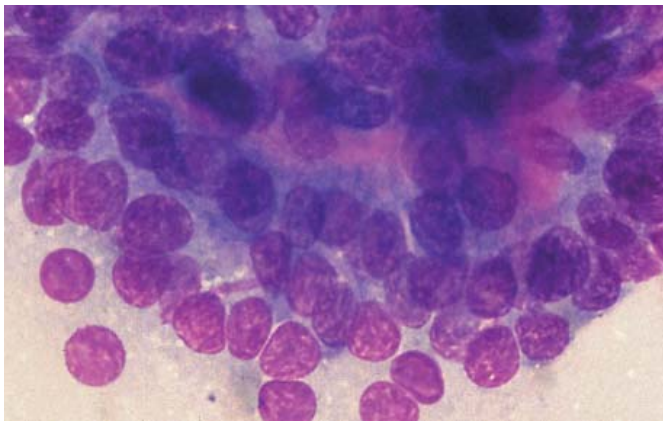
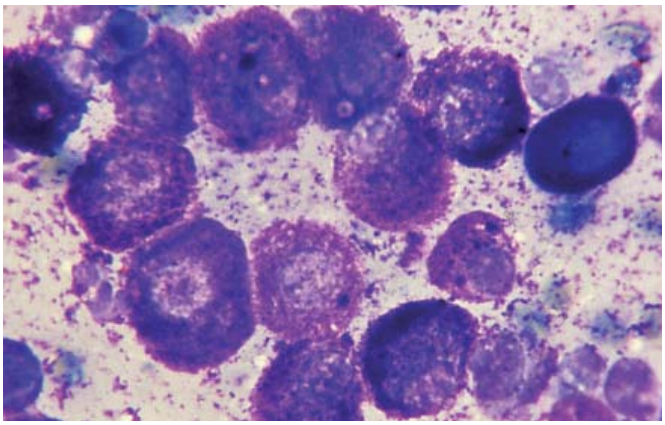


Fig. 9 Several large discrete cells are present in this aspirate of a mast cell tumour. The cells have many purple granules in their cytoplasm.



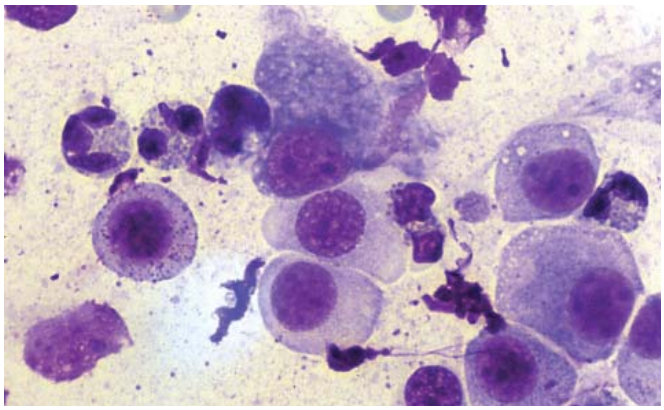


Fig. 10 The tumour cells of this mast cell tumour lack the characteristic purple granules. Only in one cell on the left some granules are present. Among the cells several eosinophils can be seen.

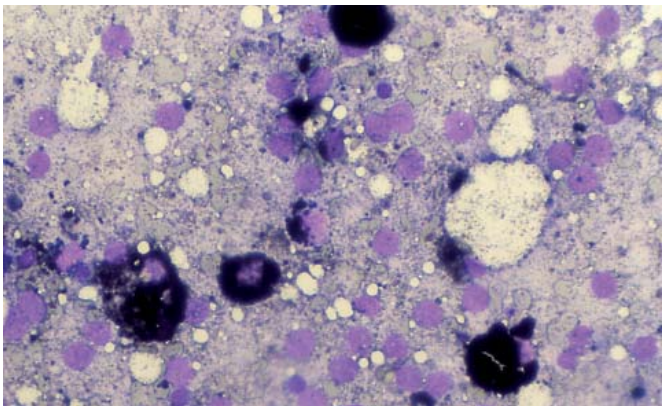


Fig. 11 Aspirate of a melanoma tumour in a dog. Apart from several naked nuclei some large melanoma cells filled with black melanine granules are seen.

numbers of eosinophils and/or fibroblasts can be seen. In poorly differentiated mast cell tumours the purple granules are often less frequently present or even lacking. Cytology cannot, however, be used for grading the tumours.

Differential diagnosis: There are mast cell tumours that contain very few granules (Fig. 10). These can be difficult to diagnose. The presence of many eosinophils can give support to the presumptive diagnosis of mast cell tumour. Inflammatory processes can give differential diagnostic problems because they can also contain mast cells and eosinophils. In an inflammation, however, the number of other inflammatory cells is considerably greater than the number of mast cells. Melanomas could also be mistaken for mast cell tumours. Melanoma cells can, like mast cells, be round to oval and contain pigment granules. However, most melanomas also contain spindle-shaped tumour cells. In addition, the pigment granules in melanomas are variable in size and irregular in shape and they stain, depending on the thickness of the pigment layer, greyish-blue to greenish-black.

Melanomas are tumours composed of cells that produce melanin. The melanomas belong to the group of "round cell tumours without cell interconnections" because they largely meet the characteristic cytological features of these tumours. In addition to round-oval cells, however, there are usually some spindle-shaped cells and sometimes these dominate the picture. Very bizarre cell forms and giant cells can also occur. The amount of pigment in melanoma cells can vary markedly. The nucleus of the melanoma cell is sometimes barely visible because it is covered by melanin granules (Fig. 11). These granules are blue to greenish-black, irregular in shape and variable in size. Melanomas can be malignant or benign. If the nucleus is visible it also may show definite malignancy criteria. The melanomas that hardly contain any pigment are almost always malignant. Such amelanotic melanomas are difficult as such to diagnose but a careful search of the preparation will often still reveal a few melanin-containing cells. Macrophages with phagocytized melanin granules may give an indication to the origin of the tumour.

Cutaneous malignant melanomas in cats can also be melanotic or amelanotic. Five types of melanomas can be distinguished: epithelioid, spindle, mixed, signet-ring, and balloon cell. Whereas all epithelioid, spindle, and mixed epithelioid/spindle cell types

Fig. 12 Signet-ring cell type melanoma in the cat. Many amelanotic cells, often with multiple nuclei are present.

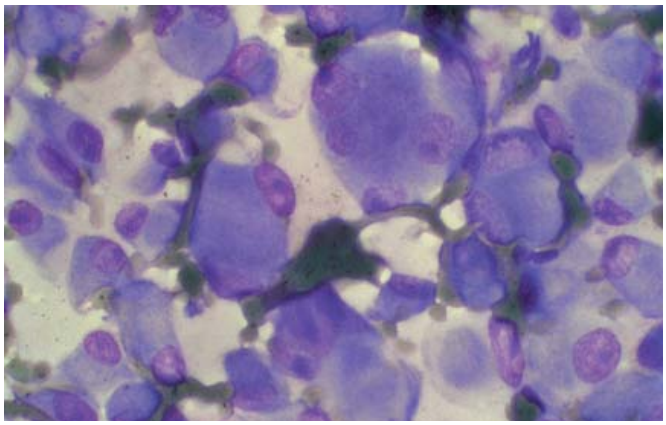
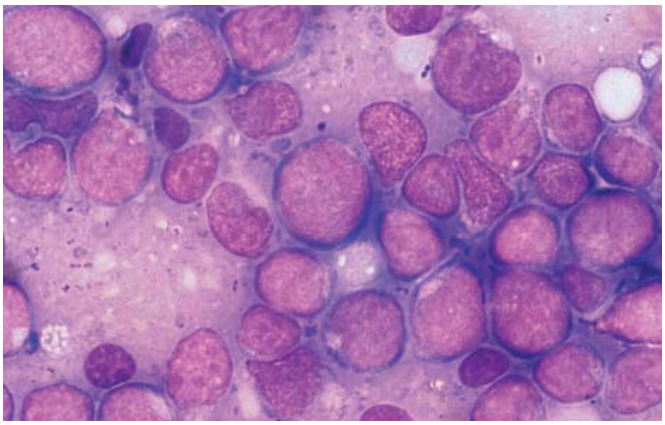


Fig. 13 Cutaneous malignant lymphoma in a cat. There are several large, immature lymphoid tumour cells, and a few mature reactive lymphocytes.



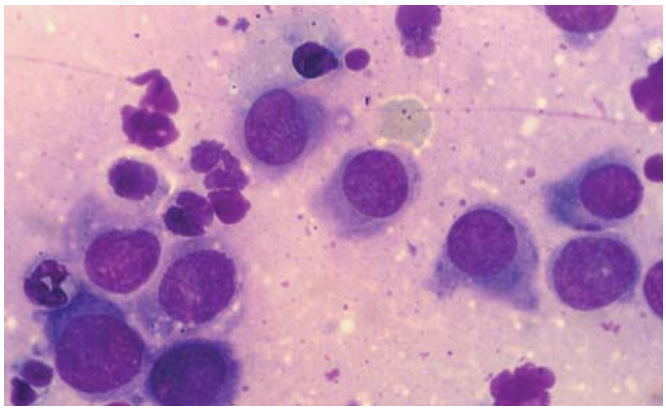


Fig. 14 Mixture of several histiocytoma tumour cells with some neutrophils and lymphocytes. The histiocytes are the large cells with pale grey-blue cytoplasm.

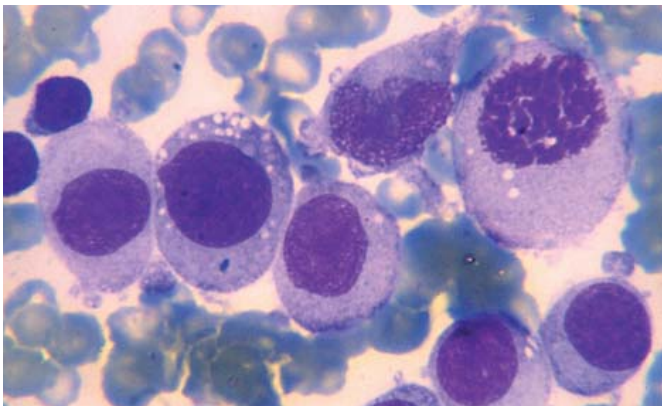


Fig. 15 The transmissible venereal tumour cells are big cells, with distinct cytoplasmic borders, sometimes with fine vacuoles. On the right a mitosis can be seen and on the left some reactive lymphocytes are present.

show pigmentation, signet-ring and balloon cell types are often amelanotic (Fig. 12).
The pigmented pathological cells of melanomas are easy to differentiate from normal pigmented epithelial cells. Melanocytes and pigmented squamous cells have very uniform, rod-shaped granules. The nucleus may be degenerated or may have disappeared, but will certainly have no malignancy criteria. The difference between melanomas and mast cells has been discussed in the section on mast cell tumours. Melanocytes must also be differentiated from macrophages that have phagocytized melanin (melanophages) or contain haemosiderin. Melanophages usually contain coarse conglomerates of melanin as well as vacuoles. They are encountered especially in melanomas but also in inflamed lymph nodes and in some disorders of the skin. Haemosiderophages are found in old haematomas. These are macrophages having vacuoles in which iron pigment is stored. Like the pigment of melanoma cells, the color of this hemosiderin is blue to greenish-black. The presence of cells that contain bilirubin crystals and show erythrophagocytosis helps in the differentiation.

Malignant lymphomas can be primary or secondary tumours in the skin. The primary, often epitheliotrophic lymphomas are usually characterized by the presence of large number of T-lymphoid tumour cells. These cells may look more differentiated, with some nuclear indentations, and with pale cytoplasm. This in contrast to the B-lymphoid tumours, which are more often characterized by the presence of large, blastic cells, with dark blue cytoplasm and round nuclei with prominent nucleoli (Fig. 13).

(Muco)cutaneous plasmacytomas are in principle benign tumours. In contrast to their malignant counterpart, the multiple myeloma, they are not combined with paraneoplastic syndromes. Aspirates normally yield large amount of tumour cells. The cells sometimes look like typically plasma cells, while in other cases they are less well differentiated. Most often there are discrete cells with distinct cytoplasma borders and a blue cytoplasm. The nucleus can be eccentric, a Golgi apparatus can sometimes be seen, and there can be several cells with two or more nuclei.

Histiocytomas are usually benign. They occur primarily in young dogs and can disappear spontaneously. A population of cells with somewhat variable shapes characterizes them cytologically. Small histiocytes resemble lymphocytes but have finer nuclear chromatin and more cytoplasm (Fig. 14). The larger histiocytes resemble epithelial cells but have no tissue organization. The cytoplasm is grey to light blue; a few cells are clear. The nuclei are mainly round but may be indented. The nuclei contain a few small, not very obvious nucleoli.

Differential diagnosis: The FNABs of histiocytomas usually contain few tumour cells, in contrast to the FNABs of other "discrete round-cell tumours". Because histiocytomas often ulcerate and become secondarily inflamed, it can be difficult to recognize the tumour cells, which resemble lymphocytes and epithelioid cells, among the inflammatory cells. Histiocytomas can also slightly resemble a transmissible venereal tumour (see below).

Transmissible venereal tumours (TVT) in the dog occur in the genital area, but on the head as well. They are seldom seen in the northern parts of Europe. The cells resemble histiocytes but the tumour exfoliates more easily and thus the preparations are richer in cells. The cytoplasm is also more sharply outlined and sometimes contains readily visible vacuoles (Fig. 15). The round to oval nucleus is eccentric, seldom indented, and can have large, noticeable nucleoli. The cell size, nuclear size, and the N/C ratio vary much more than in histiocytomas. Usually many mitotic figures are seen. TVTs can contain remarkably many plasma cells and macrophages in addition to tumour cells.
Differential diagnosis: apart from histiocytomas, basal cell tumours in particular must be considered (see below).

Epithelial tumours

Different types of epithelial cells can be encountered in cytological preparations from skin tumours, skin lesions, and subcutaneous swellings. They may be squamous cells but they can also be of glandular origin.

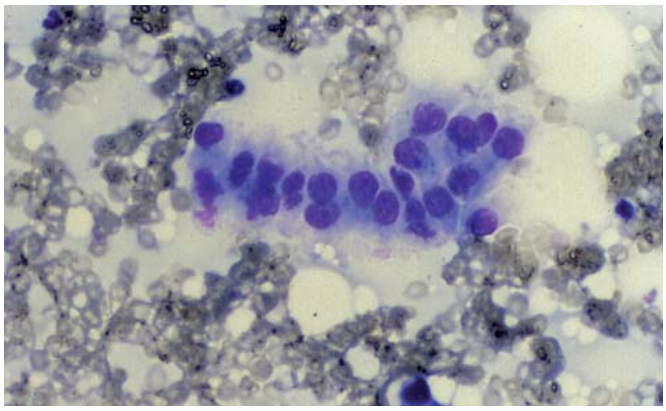


Fig. 16 A typical linear cell aggregate in an aspirate of a basal cell tumour. The basal cells are very monomorphic, with small round nuclei and few or no malignancy criteria.

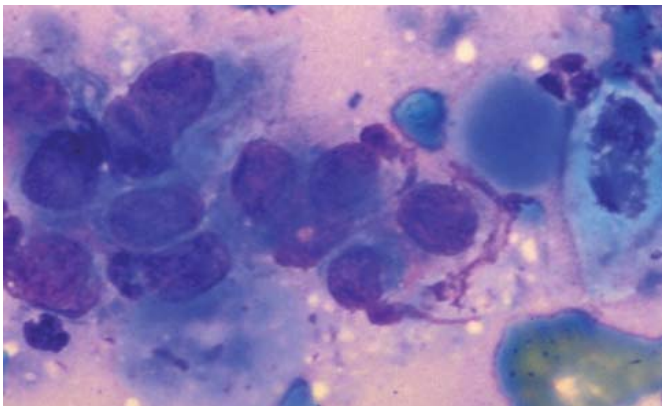


Fig. 17 Fully cornified, but round squamous cells without a nucleus as well as a cornified cell with a nucleus are present. In addition, a group of poorly differentiated cells with anisokaryosis, abnormal nuclei forms and multiple and abnormal nucleoli can be seen.

FNABs of lesions in the skin and the mucosa contain squamous cells in all stages of development, in addition to inflammatory cells. A cell-rich preparation can contain many individualized epithelial cells, but what is characteristic of normal epithelial cells is their appearance in groups or clusters that are often composed of a single layer of cells (so-called "monolayers"). Depending on the depth of the lesion, more of less immature epithelial cells will be seen. These basal cells and parabasal cells are round, deep blue, small in relation to mature epithelial cells, and have a higher N/C ratio. The mature squamous cells, which are usually much more numerous, appear in different stages of keratinization. The largest cells have often already lost the nucleus (keratin flakes or dandruff) or still contain a shrunken, pyknotic nucleus. The N/C ratio is very low and the cells are rectangular and often folded double. As the cell becomes more keratinized the cytoplasm staining changes from dark blue to sky blue. The cells can also contain vacuoles as signs of keratinization. Mature but not yet keratinized epithelial cells are lightly basophilic, round or oval, and have a centrally located nucleus with a well-defined chromatin structure that resembles a fine network.

Just as for normal epithelial cells, the arrangement of the cells in clusters is characteristic of epithelial tumours. Although in FNAB preparations from epithelial tumours many loose tumour cells can be seen, usually several definite clusters can be found. If the epithelial tumour is of glandular origin, the cell clusters also have an acinar structure (arrangement in a group or in a circle around a usually invisible duct). In some preparations there are predominantly clusters or monolayers of normal epithelial cells but careful searching also reveals definitely malignant cells.

Basal cell tumours are infrequent epithelial tumours that arise from the basal cell layer of the epidermis. Histologically, they can be divided into different varieties. The cytological diagnosis can be difficult due to the variable cytological features. Basal cells are round or elongated cells with one nucleus in a central or basal position and fine granular chromatin with a single and, in most cases, poorly detectable nucleolus. The N/C ratio is 1:1, with a uniform size of cells within cell aggregates. The basal cells can be organized in fragments of tissue, often with a typical linear or palisade-like arrangement (Fig. 16). In some cases well-differentiated fibrocytes and fibroblasts can be found, as well as pigmented basal cells or melanocytes. In addition, the

Fig. 18 An aspirate of a vesicle in a dog with pemphigus foliaceus. Among the large number of neutrophils several acantholytic cells are situated. These cells are round, have a nucleus and sometimes a perinuclear halo.

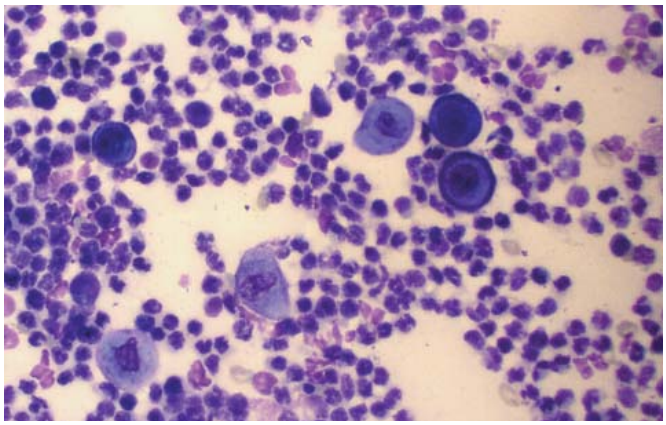
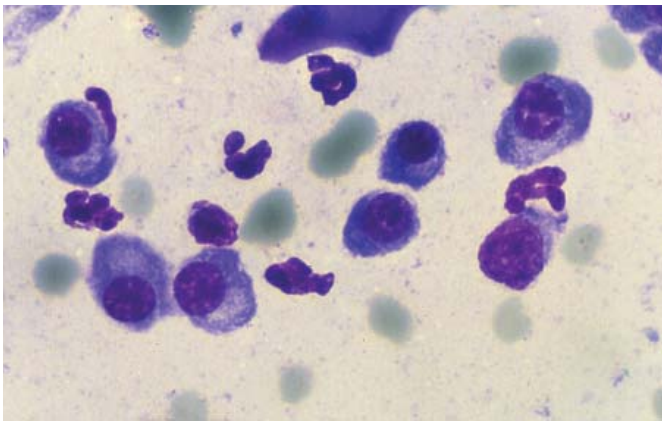


Fig. 19 Mature looking plasma cells in a brush smear of a cat with plasmacytic gingivitis.



presence of some squamous cells in some basal cell tumours with basosquamous areas can confuse the examiner even further. In most tumours also some inflammatory cells, such as neutrophils, can be detected. Despite the fact that in several tumours a significant proportion of the basal cells might reveal a few malignancy criteria, such as anisokaryosis, anisonucleoliosis and clumped chromatin pattern, giving the tumour a less differentiated appearance, basal cell tumours are considered benign.

Squamous cell carcinomas are quite common tumours, both in the cat and the dog. Preparations from squamous cell carcinomas are usually cell rich and contain loose tumour cells as well as clusters. The characteristics of malignancy can be very pronounced or not very obvious.

Squamous cell carcinomas easily become ulcerated and then contain many inflammatory cells. Because aspirates from squamous cell carcinomas usually contain neoplastic as well as normal, non-neoplastic squamous cells in all stages of development, the malignancy criteria of well-differentiated squamous cell carcinomas can be less obvious, the diagnosis of these tumours is sometimes difficult. One of the characteristic features of the squamous cell carcinoma is the discrepancy between maturation of the nucleus and the cytoplasm (Fig. 17). The tumour cells can contain a large amount of vacuolated cytoplasm and at the same time a completely intact, non-pyknotic nucleus having a detailed structure that sometimes also has malignancy criteria. Sometimes the vacuoles have become confluent into one large vacuole that causes a noticeable clear space around the nucleus, so that the cell resembles a bull's-eye. This is a strong indication of malignancy. Also, the occurrence side by side in a single cluster of mature and immature cells, or cells of markedly different basophilia, is very suspicious.

Skin lesions

It must be emphasized that skin lesions can become secondarily infected and inflamed. The confirmation of septic inflammation is thus not very informative in case of a skin lesion and certainly not if this is demonstrated by an impression smear, unless a very specific infective agent is demonstrated. The microorganisms that can play a role in inflammatory processes will be discussed in a later chapter. Inflammation and necrosis can make it very difficult to determine the primary cause of a process. Hence it is advisable not to rely on an impression smear but also to obtain a FNAB from a peripheral, not yet inflamed, part of the swelling. If the cytology of a skin lesion does not lead to a diagnosis, a dermatologist should be consulted and/or histological examination should be performed.

Pemphigus foliaceus is an autoimmune process that is directed against keratinocyte desmosomal cadherins, and in which interference occurs with the adhesive function of these molecules. When the epidermal cells lose their cohesion due to degeneration of the intercellular bridges, intra-epidermal clefts, vesicles, and bullae are formed. The isolated epidermal cells are called *acantholytic cells*. They are characterized by a basophilic cytoplasm and have well defined, round borders (Fig. 18). Several cells have a perinuclear halo. The nucleus is somewhat enlarged and has a coarse, irregular chromatin pattern. Often a clear nucleolus can be seen. Acantholysis is most often associated with the pemphigus complex. The acantholytic cells are usually surrounded by many neutrophils and/or eosinophils. No bacteria are present, unless the lesion has been ulcerated.

(Lympho)plasmacytic gingivitis/stomatitis, a disease with an unclear aetiology can present itself in many different ways in cats of all ages. Cytologic specimens can be obtained by brush methods and might reveal a combination of plasma cells, lymphocytes and sometimes also neutrophils (Fig. 19). The morphology of the cells is normal. The ratios between the different cell types can vary greatly among cases.

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ORIGINAL WORK (UK)

Disseminated *Mycobacterium avium* in a young Basset Hound located in a suburban area in the United Kingdom

K. Gerber[(1)] *J. Hargreaves*[(2)] *A. Iveson*[(3)] *D. Worth*[(4)]

SUMMARY

The prevalence of generalized *Mycobacterium avium* infection in dogs is believed to be low, as this species is innately resistant to infection. Publications in peer reviewed journals of *M. avium* in dogs are scarse. The majority of published cases in recent literature originated in the United States. This represents the first published case of *M. avium* in the UK and speculates that there may be an increased incidence of this sub species of Mycobacteria. A ten month old, female, neutered, Basset Hound was presented for lethargy, later accompanied by diarrhoea and anorexia. Clinical examination identified pyrexia and multicentric lymphadenopathy. Fine needle aspiration and biopsy of a lymph node was performed. The aspirate identified evidence of pyogranulomatous inflammation with a myriad of intracytoplasmic non- staining slender rod-like structures in the macrophages on Wright's stain. These proved to be acid fast on Ziehl-Nielsen stain. Histology results on the initial biopsy were consistent with cellulitis. Elective euthanasia was performed on the bases of a potential zoonosis and the poor response of mycobacteria to therapy in dogs. Histological lesions on all post mortem tissue samples demonstrated diffuse pyogranulomatous inflammation with acid-fast bacterial rods within the macrophages. Bacterial culture confirmed the presence of *M. avium*. A Polymerase chain reaction assay that targets the mycobacterium genus sequence within the 16S rRNA gene with specific primers for *M. avium* was positive and primers for the *M. tuberculosis* complex were negative. This was confirmed using the Genotype® CM kit (Hain Lifescience). Cytology using Wright's stain followed by confirmation with Ziehl – Nielsen stain is a valuable tool in the preliminary diagnosis of mycobacteriosis in dogs as clinical signs are often vague and non-specific. The incidence of *Mycobacterium avium* in humans and dogs particularly in immunocompromised individuals may be increasing and veterinary practitioners should be aware of this trend.

KEY WORDS: *Mycobacterium avium*, Basset Hound, United Kingdom, lymphadenopathy, cytology, PCR, culture

Introduction

In the early 20th century tuberculosis (TB) was a relatively common disease in canines, probably as a result of the higher challenge level from infectious cattle and people compared to today. Most cases of TB in that time period were associated with *M. tuberculosis* complex, to which dogs are more susceptible compared to *M. avium*. [1, 2, 3] Mycobacteriosis (tuberculous and non tuberculous) in domestic dogs was believed to be rare in Great Britain. The Veterinary Laboratories Agency (VLA) used to process fewer than five tissue samples from dogs in an average

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DATE	"suspect" mycobacteria cases submitted to Weighbridge.	Culture M bovis	Culture M avium
2002	3 canine submissions	1 positive isolate	None
2003	no canine submissions	no positive isolate VLA in Weybridge, see###	None
2004	3 canine submissions	1 positive isolate	1 positive isolate
2005	11 canine submissions	no positive isolates	1 positive isolate
2006	20 canine submissions	no positive isolates	2 positive isolates Weybridge, see***
2007	19 in first 6 months		3 positive isolates

Data retrieved from DEFRA library and Government Veterinary journal of CVO yearly reports.
- 1 positive from HPA documented in DEFRA report.
*** - 3 recorded in Government Veterinary journal. 2 from Weybridge and 1 from HPA who occasionally receive samples.

Table 1 Mycobacteria case submissions and isolate results in dogs in the UK

year. [4] This position has changed dramatically in the last three years with an upward trend to 19 suspect cases submitted in the first 6 months of 2007.
The increased trend is displayed in Table 1. This report documents a rare case of *Mycobacterium avium*, in a dog that lived in a suburban environment in Cheshire in the United Kingdom.

Case Presentation

A 10 month old, female, neutered, Bassett Hound was presented with a 3-day history of lethargy. Clinical examination was unremarkable except for pyrexia (39.8^{0}C) and submandibular lymphadenopathy. Haematology and biochemistry revealed a mild inflammatory leukogram and marginally reduced urea (2.2 mmol/l, reference range 2.5-9.6). The most likely cause of low urea was presumed to be secondary to anorexia. Mild (1+) protein was present on urine dipstick examination. Initial treatment was aimed at an uncomplicated infection with antibiotics to which she responded with an uneventful recovery.[a] She was presented 3 weeks later with symptoms of lethargy, vomiting and diarrhoea. The dog had experienced several mild episodes of depression in the intervening period.
Further investigation in an attempt to localize disease included thoracic and abdominal radiographs that identified a mild bronchial pattern (Figure 1) but those of the abdomen were unremarkable. An alternative group of antibiotics [b] in addition to anti – inflammatories [c] were prescribed to which there was no response. On the third presentation the patient was pyrexic (T= 40.2 ^{0}C), had developed pruritic erythematous skin with a greasy discharge and generalized peripheral lymphadenopathy. An initial consideration of lymphoma was deemed unlikely in such a young dog, but fine needle aspiration was performed to eliminate this differential. Aspiration of the right popliteal and submandibular lymph nodes yielded a turbid, light brown coloured fluid. This fluid along with further fine needle aspirates and biopsy specimens of the lymph nodes were taken and sent for cytological and histopathological analysis respectively.

Figure 1: Thoracic radiograph with a mild perihilar bronchial pattern.

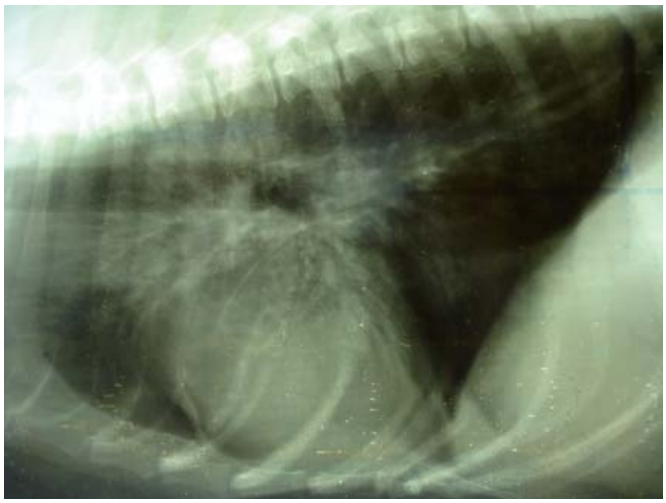
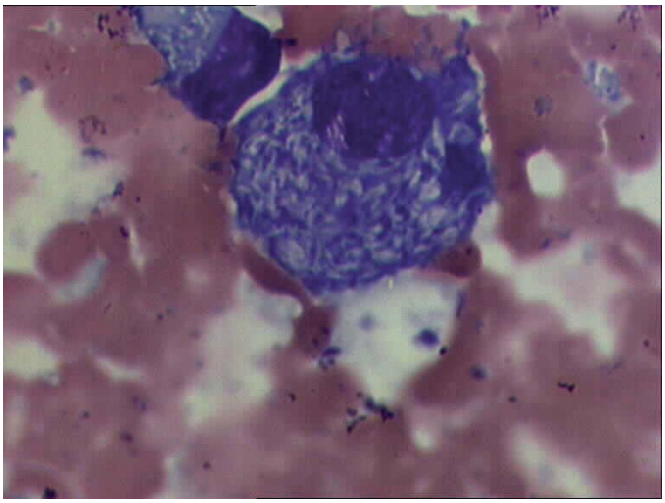


Figure 2: Cytology. Lymph node aspirate. A single large macrophage with numerous intracytoplasmic slender non-staining bacterial rods. Wright's stain X 1000



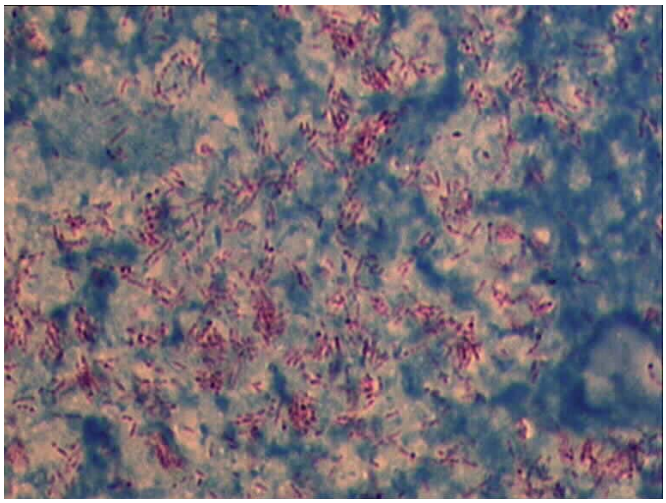


Figure 3: Cytology. Lymph node aspirate. Very high numbers of bright pink (acid-fast) slender slightly beaded bacilli. Acid-fast (Ziehl-Nielsen) X 200

Parameter	automated result
Protein g/l	41.1
Albumin g/l	16.6
Globulin g/l	24.5
WBC x10^9/l	2.95
RBC x^12/l	0.12

Table 2 Fluid aspirated from popliteal lymph node

Clinical Outcome

A presumptive diagnosis of mycobacterial infection was established on cytology results. The patient was euthanased based on her deteriorating clinical condition, and the poor prognosis [5, 6] as the disease was predicted to be generalised based on results of physical examination and symptoms and posed a potential zoonotic risk.

Cytological Interpretation

Automated analysis of fluid aspirated from the popliteal lymph node can be seen in Table 2. Chemistry was performed on the Olympus AU640 and cell counts were done on the Sysmex XT 2000i.

Microscopic examination

Direct and cytocentrifuge slide preparations using Romanowsky's method (Wright's stain) were made from the fluid aspirated from the popliteal lymph node. Cellularity was moderate and consisted of neutrophils and macrophages. Many of the macrophages contained a myriad of intracytoplasmic non-staining slender rod-like structures. (Figure 2) Similar structures were also present in the background. These proved to be acid fast on Ziehl-Nielsen (ZN) staining. (Figure 3) Cytological findings were compatible with pyogranulomatous inflammation, potentially accompanied by liquifactive necrosis. A presumptive aetiological diagnosis of mycobacterial infection was established based on the morphology and staining characteristics of the intracytoplasmic structures.

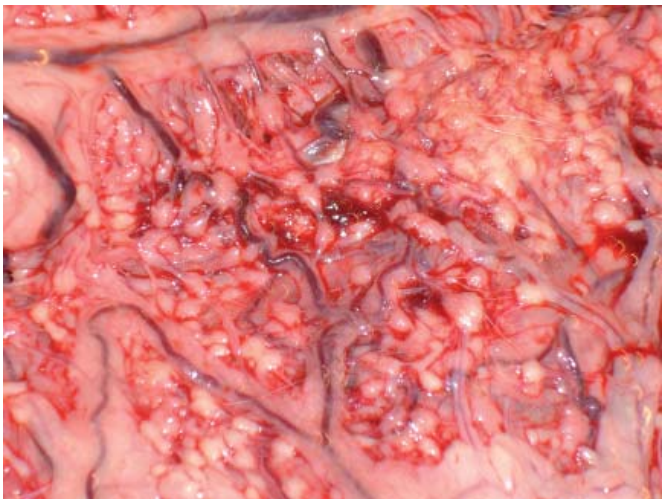


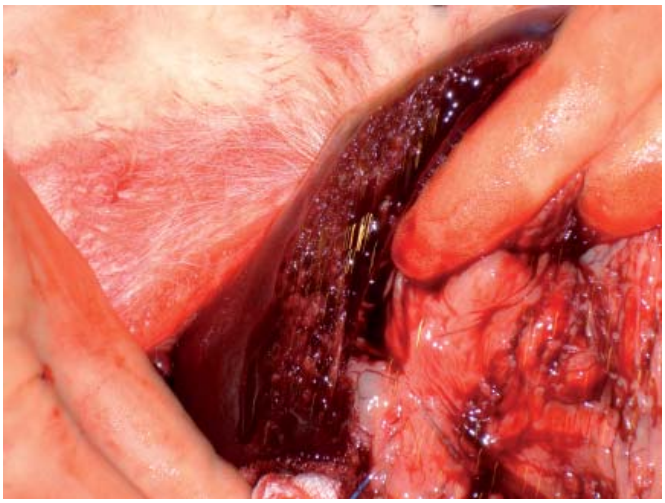
Figure 4: Postmortem, Abdomen. Severe focally disseminated granulomatous peritonitis. There is congestion of the mesenteric/ omental vessels and numerous disseminated white raised nodules (2mm to 2cm) scattered throughout.

Gross and histopathological findings

Histopathological examination of the initial biopsy specimen taken from the popliteal lymph node at the same time as the fine needle aspirate did not contain any lymphoid tissue. A diagnoses of cellulitis was reported but no infectious agents were seen in the tissue sample.

A post mortem examination was performed immediately after euthanasia. Mild generalized lymphadenopathy was present. The mesentery and serosal surface of the intestines were inflamed. (Figure 4) Small 1-2 mm white nodules were present in the mesentery and on the cut surface of the spleen. (Figure 5) Multiple specimens including mesentery, mesenteric fluid, spleen, mesenteric lymph node pool, right popliteal,

Figure 5: Postmortem, Abdomen. Cut surface of spleen – diffuse raised nodular appearance.



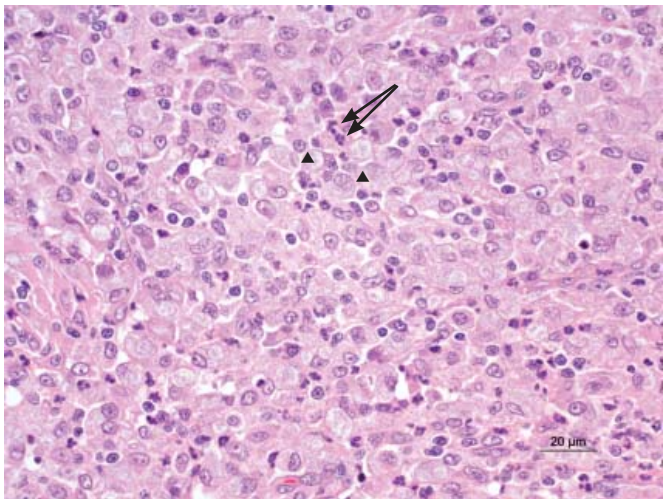


Figure 6: Histology. Tracheobronchial lymph node showing sheets of macrophages and neutrophils H&E X 400. Large distended macrophages (arrow heads), Neutrophils (long arrow)

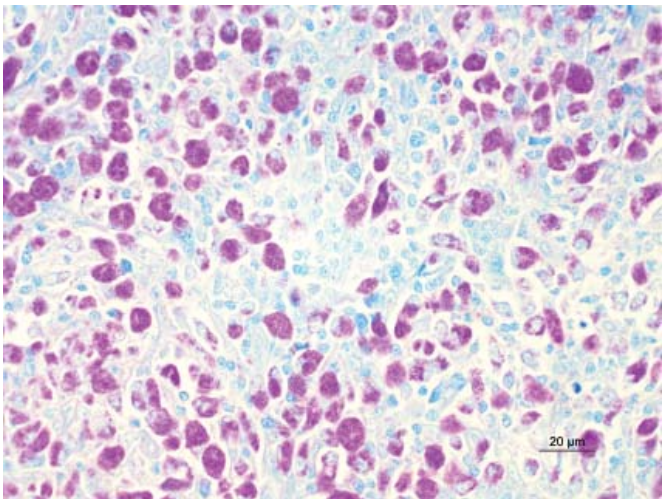


Figure 7: Histology. Tracheobronchial lymph node with numerous acid fast bacteria in macrophages ZN X 400

tracheobronchial and prescapular lymph nodes were submitted for cytology, histology and bacterial culture.

Samples of the lymph nodes, collected at post mortem, revealed almost complete effacement of normal architecture by pyogranulomatous inflammation that transected out through the capsule into the surrounding tissue. Epithelioid macrophages were arranged in diffuse sheets or rarely formed granulomata, interspersed with numerous neutrophils and fewer lymphocytes and plasma cells separated by fibrous stroma. (Figure 6) The spleen and the mesentery contained similar inflammatory infiltrates. The mesenteric lymph node also had confluent areas of liquefactive necrosis and microabscesses. ZN staining revealed large numbers of acid-fast bacterial rods within the macrophages. (Figure 7)

Microbiological evidence

Fresh and formalin-fixed tissue are required by the VLA in Weybridge to confirm a diagnosis and establish the specific mycobacterium involved. All the tissues collected at post mortem in this patient were processed and cultured separately by the VLA. [4] Mycobacteria were isolated and identified by colony growth and phenotypic characteristics. Bacterial growth on Lowenstein – Jensen base with glycerol and Dubos media, eliminated *M. bovis* and indicated that environmental mycobacteria were probably responsible for the infection. Molecular genetics techniques that included a multiplex PCR that targets a Mycobacterium genus sequence within the 16S rRNA gene, with primers specific for *M. avium* and *M. tuberculosis* complex, were applied for further characterization. The product was then run on agarose gel and images taken with a UV transilluminator and GeneGenius system (Syngene). Amplification products were found at 1030bp, indicating mycobacterium species and at 180bp indicating that the isolate was *M. avium*. This identity was confirmed using the Genotype® CM kit (Hain Lifescience)[d], that utilizes PCR followed by nucleic acid hybridization that can identify 14 common species of mycobacterium including *M. avium*. [7]

Discussion

Disseminated spontaneous *Mycobacterium avium* infection in dogs is thought to be rare, despite the organism's ubiquity in soil and water. Previous reported cases involved dogs living in America [2, 5, 8, 9, 10, 11, 12, 13], fewer in Australia [14] and South Africa [15], one case in New Zealand [15] and one in Germany [16].

This is the first reported case of *Mycobacterium avium* infection in a dog in the UK. By publishing this case the author's hope to increase the awareness of potential mycobacterial infection, in addition to focusing on the systematic steps involved in establishing and confirming a case of mycobacterial infection.

The increased incidence of M. avium in dogs (refer Table 1) may be due to the new Order introduced in March 2006 under which TB control in England was extended to include reporting of any tuberculous lesions in any farmed mammal or a mammal kept as a pet, to the VLA. [17,18]

Mycobacterial infections tend to remain sub-clinical for a long time, signs of infection are vague [13] and clinical cases in companion animals may be under-reported or mis-diagnosed. Lymphoma is sometimes mentioned as a differential in published case studies [11] based on multicentric lymphadenopathy or hepatosplenomegaly. Previous reports indicated the similarities in the clinical and macroscopic appearance of lymphoma and tuberculosis. [19] Fine needle aspiration cytology will help establish preliminary distinction between infection and neoplasia. Initiating immunotherapy for potential lymphoma would aggravate mycobacterial infection given the established link with acquired or innate immunosuppression.

Reports as early as 1966 postulated the role of immunodeficiency in malignant generalization of BCG (Tuberculosis) in children. [20]

A later publication noted the remarkably similar histopathological pattern and massive growth of *M. avium* in tissues isolated from dogs compared to the children. [9]

The increasing incidence of disseminated *M. avium* in

immunosuppressed humans suggests that inherent or acquired immunodeficiency may also play a role in predisposing these individuals to mycobacterial infection. [16, 21] Dogs are usually innately resistant to infection. [3, 6, 22, 15] In many cases, immunosuppressive drugs [5, 8] or innate immune deficiencies [9, 10, 11, 12, 13] are suggested to play a role. A defect in T cell function and cell mediated immunity may exist in Miniature Schnauzers [5, 11, 16] and Basset Hounds [10, 23] respectively, the two breeds most commonly affected. In a report of *M. avium* in five Basset hounds, pedigree analysis revealed that three of the dogs were related [10], which supports the possibility of an inherited predisposition in this breed. Immunodeficiencies may also be secondary as illustrated in a dog that had concurrent mycobacteriosis and hyperadrenocorticism.[14] The immune status of this Basset Hound was not evaluated.

Mycobacteria can enter the body through the respiratory or digestive system. The source of *M. avium* is presumably from environments contaminated from faeces or carcasses of infected birds. [6, 15] Another possible route of infection is ingestion of M avium infected chicken or porcine livers. [3, 5, 10] This dog lived in a suburban environment in Cheshire. The source and portal of entry was not clearly identified, but was probably by ingestion of contaminated fomites. The owner did not keep any pet birds, but did have several bird baths in her garden that were frequented by wild birds. The dog had also been to a National Trust property with wildlife and to a Community Farm.

Clinical signs in most reported cases are vague and can include lethargy, gastrointestinal signs, generalized lymphadenopathy, weight loss or pain. Young dogs are most susceptible. [6, 15, 8, 10, 11, 16, 23] The *M. avium* complex and consists of saprophytic and opportunistic pathogens, unique in their ability to not only cause cutaneous but also disseminated disease. [2, 6,15, 10, 11, 13, 16, 23]

General haematological and biochemical findings are non-specific. Fine needle aspirate cytology of lesions such as enlarged lymph nodes and organs is a valuable diagnostic tool to detect mycobacterial infection. It is worth highlighting that in a high percentage of cases referenced in this publication cytological examination provided the initial identification of potential mycobacterium infection. The organisms show negative staining because Romanowsky stains cannot penetrate the mycobacterial lipid wall. [6] The diagnostic accuracy of fine needle aspirate cytology is increased further if Ziehl-Nielsen stain, which identifies acid-fast bacilli, is used as an adjunct. [24] They are acid-fast because of the ability of the cell wall to retain arylmethane in an acid fast stain (ZN). [6]

Histological lesions caused by *M. avium* are distinct from the other mycobacteria in that they are generally not caseous and tend to be characterised by a monomorphic epitheloid macrophage response [3, 8, 9,10] rather than the more pleocellular granulomatous pattern with giant cells, that is seen in *M. tuberculosis* and *M. bovis* infection. [2, 15, 8] The organisms in *M. avium* are smaller and more numerous in macrophages compared to M. tuberculosis and *M. bovis*. [6, 22] Granulomas in dogs differ from other species in that they have central areas of liquefactive necrosis. [10, 23]. This liquefactive necrosis might explain why the initial biopsy specimen failed to contain any lymphoid tissue.

Neither cytology nor histopathology can differentiate between zoonotic and nonzonotic species of mycobacteria. [13] Definitive identification is only obtained with bacterial culture of fresh tissue and/or the use of PCR on grown culture, formalin fixed tissue [15] or buffy coat. [13]

Rapid identification of the species of the infecting mycobacterial organism is desired and possible with molecular genetic techniques, compared to bacterial culture that may take 2-12 weeks. [13] However, PCR has its limitation's in that there is considerable phenotypic and genotypic diversity within the MAC group. [25] Biologically distinct subtypes of *Mycobacterium avium* differ in possession of insertion sequence IS901. [26]

A negative PCR result for the IS901 gene of *M. avium* does not eliminate *M. avium* because not all strains have this insertion sequence. [13] No unique species biomarkers have been identified, and any two genotypic assays may yield conflicting results. [25]

Distinction between the *M. avium* complex and *M. tuberculosis* complex is important because of the public health concerns associated with the *M. tuberculosis* complex. The degree of zoonotic potential of M. avium is minor compared to the *M. tuberculosis* complex. Only immunocompromised individuals such as patients with AIDS or those with Crohn's disease are at risk. [6, 21] Additional studies indicate that human infection with *M. avium* complex occurs in individuals whose occupations involve prolonged soil exposure and is not secondary to infection in pets. [27] However, given the rise in predisposing conditions for potential *M. avium* infection in humans, including AIDS, old age, immunosuppressive treatment for cancer or organ transplantation, [21] resistance of *M. avium* to common disinfectants, elevated temperature [6] and multi drug resistance of *M. tuberculosis*, vigilance for infection at large should perhaps be increased.

Treatment of *Mycobacterium avium* in dogs has not been very rewarding, possibly because most cases are advanced at the time of diagnosis and MAC organisms can show marked resistance to common antituberculosis drugs. [5, 6,12, 21] If therapy is attempted a multi drug regimen is advisable. Therapy often requires a prolonged course of antimicrobials some of which are inherently toxic. Treatment of *M. tuberculosis* or M. *bovis* in dogs and cats is not advisable. [6]

Good communication between professionals, including clinicians, pathologists and microbiologists, is essential to achieve diagnosis in a disease that presents with vague, non-specific signs. Cytology when used appropriately, with thorough microscopic examination, can have a distinct and important role in establishing a presumptive diagnosis of mycobacterial infection.

Acknowledgements

Jakob Hayes and Malcolm Silkstone for inspiration and critical review. Martin Wheeler for graphic assistance. The bacteriological and molecular diagnostic investigation carried out at the VLA in Weighbridge was funded by DEFRA (surveillance contract SB4510).

Sources and Manufacturers

a. Clavulanic acid potentiated Amoxicillin (Synulox, Pfizer) by subcutaneous injection and oral clavulanic acid potentiated amoxicillin (Clavaseptin, Vetoquinol)
b. Enrofloxacin (Baytril, Bayer) orally.
c. 125 mg Carprofen (Norocarp, Norbrook)
d. Hain Genotype Mycobacterium kit. Genotype® CM kit (Hain lifescience), Hain Lifescience GmbH
Hardwiesenstrabe 1 72147 Nehren Germany

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REPRINT PAPER (UK)

Perceptions of veterinarians and clients to expressions of clinical uncertainty

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SUMMARY

OBJECTIVES: The aim of this study was to explore the attitudes of veterinarians and clients towards expressions of clinical uncertainty.

METHODS: Questionnaires that assessed the respondent's attitudes towards expressions of clinical uncertainty were completed by clients at six small animal practices. In addition, questionnaires that evaluated what veterinarians thought their client's attitudes would be towards expressions of clinical uncertainty were completed by veterinarians. The responses from clients and veterinarians were statistically compared.

RESULTS: Veterinarians significantly underestimated the desire of clients to be told about uncertainties in treatment and significantly overestimated how the expression of uncertainty would generally reduce client confidence. Veterinarians significantly overestimated the loss of client confidence resulting from saying "I am not sure about this" and from asking a nurse for advice. Both clients and veterinarians considered that verbal expressions of uncertainty would lead to a greater reduction in client confidence than behavioural expressions of uncertainty.

CLINICAL SIGNIFICANCE: This study suggests that most clients want to be told about their veterinarian's clinical uncertainties, and how this uncertainty is expressed can markedly influence client confidence.

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Introduction

It is widely accepted that uncertainty is inherent in human medical practice [Gawande 2002]. However, there is not a clear, objective consensus on how doctors should handle clinical uncertainty and whether they should always make their patients aware of their uncertainty. Some research has indicated that expression of uncertainty by doctors undermines client confidence, while other studies have suggested that communication of uncertainty empowers patients to be actively involved in decisions about their treatment and can enhance rather than reduce patient confidence and satisfaction [Gutheil and others 1984, Johnson and others 1988, Gordon and others 2000, Ogden and others 2002]. A recent study also suggests that the way a doctor expresses his or her uncertainty, alongside other contextual factors, can significantly influence patient confidence [Ogden and others 2002]. In particular, they found that while behavioural expressions of uncertainty (for example, referred patient to a hospital, asked another doctor for advice) may have a positive impact on patient confidence, verbal expressions of uncertainty (for example, "Let's see what happens" or "I don't know") have a consistently detrimental effect, which was underestimated by

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* Presented by BSAVA (UK)

doctors [Ogden and others 2002].

As with human medicine, uncertainty is likely to be a regular feature of clinical veterinary practice. Indeed, clinical uncertainty is, arguably, more common in veterinary practice because of the reduced number of diagnostic techniques and equipment available to veterinarians in contrast to our medical counterparts together with the constraints that may be applied to a diagnostic work up as a result of financial limitations.

Despite the fact that uncertainty is likely to be a ubiquitous feature of clinical veterinary medicine, little work has been done on the attitudes of either veterinarians or their clients towards expressions of uncertainty. In addition, there is an absence of objective data on how uncertainty can be expressed by a veterinarian while retaining client confidence. Furthermore, there is little information on how client confidence in veterinarians compares with the confidence they have for other health care professionals.

The aims of this study were threefold; first, we wanted to explore whether clients wanted to be aware of the clinical uncertainties of their veterinarian and also to investigate whether veterinarians expected their clients to want to know any clinical uncertainties they may have. In addition, we wanted to assess how clients considered uncertainty could be expressed without them losing confidence in their veterinarian and to contrast this with how veterinarians thought clinical uncertainty could be expressed to clients without losing their confidence. Finally, we wished to investigate whether clients had more confidence in their veterinarian than their general practitioner (GP) and to contrast this with responses from veterinarians who were asked to gauge whether clients had more, less or equal confidence in them compared with their GP.

Methods

Participants

Clients at six small animal veterinary practices in southern England between November 2004 and June 2005 who presented their healthy cat or dog for a routine vaccination were selected at random, and they were asked to complete a questionnaire in the practice following vaccination of their pet. The questionnaire was developed from a study of patient and doctor communication by Ogden and others [2002]. A total of 274 clients completed the questionnaire, and the response rate was more than 90 per cent of all clients approached. The number of responses per practice ranged from 21 to 84.

Questionnaires were also distributed to veterinarians at three small animal continuing education days held in southern England during November 2004. A total of 100 veterinarians completed the questionnaire, with an overall response rate of 35 per cent. A covering letter outlining the aims of the study and assuring anonymity was given to all respondents with a questionnaire.

Measures

The client questionnaire consisted of six questions (Fig 1); the first three questions gauged the general attitudes of clients towards the expression of uncertainty by veterinarians. The fourth question asked how six verbal expressions of uncertainty affected confidence in their veterinarian, with clients rating their responses on a five-point scale from "not at all confident" to "very confident". The fifth question assessed how six behavioural expressions of uncertainty affected client confidence, with clients again rating their responses on a five-point scale from not at all confident to very confident. The final question asked clients to compare ther level of confidence in their veterinarian with their GP.

The veterinarian questionnaire also consisted of six questions and was almost identical to the client questionnaire apart from that the questions were modified so that instead of asking what the client's attitude was towards expressions of uncertainty, the questions asked the veterinarian to predict their client's response (Fig 2). For example, the first question in the client questionnaire was "If your vet is unsure of the accuracy of their diagnosis do you want him/her to discuss their uncertainties with you?", whereas in the veterinarian questionnaire, this question was

A) If your vet is unsure of the accuracy of their diagnosis do you want him/her to discuss their uncertainties with you?

Yes (%)	No (%)
95·3	4·7

B) If your vet is unsure of the appropriateness of their treatment do you want him/her to discuss their uncertainties with you?

Yes (%)	No (%)
95·3	4·7

C) Generally, does the expression of uncertainty improve, not effect or reduce your confidence in your vet?

Improve (%)	No effect (%)	Reduce (%)
34·3	52·9	12·8

D) How confident would you feel in your vet if they said the following?

	Not at all confident (%)	Not confident (%)	Unsure (%)	Confident (%)	Very confident (%)
1) 'I am not sure about this'	3·3	17·5	36·1	38·0	5·1
2) 'I need to find out more'	1·5	3·6	13·5	62·0	19·3
3) 'Let's see what happens'	10·6	21·2	36·9	28·1	3·3
4) 'I don't know'	15·3	29·6	34·7	17·5	2·9
5) 'I haven't come across this before'	6·9	15·0	39·1	35·8	3·3
6) 'I think this might be….'	2·6	15·7	32·5	44·2	5·1

E) How confident would you feel in your vet if they did the following?

	Not at all confident (%)	Not confident (%)	Unsure (%)	Confident (%)	Very confident (%)
1) Used a book to find out about a condition	2·6	9·5	18·2	57·7	12·0
2) Asked another vet for advice	0·0	4·0	12·8	63·5	19·7
3) Asked a nurse for advice	10·6	22·2	36·5	24·8	5·8
4) Used a computer to find out information about a drug	0·7	5·5	15·3	63·2	15·3
5) Asked a specialist vet for advice	0·0	1·1	8·4	50·7	39·8
6) Referredyou to a specialist vet	0·0	2·6	8·0	48·5	40·9

F) Do you have more, equal or less confidence in your vet than your GP?

More (%)	Equal (%)	Less (%)
39	57	4

Fig 1. The six questions (A to F) which were asked to clients (n=274) together with their responses, shown as percentages of all responses

A) If you are unsure of the accuracy of your diagnosis do you think your clients want you to discuss your uncertainties with them?

Yes (%)	No (%)
96·0	4·0

B) If you are unsure of the appropriateness of your treatment do you think your clients want you to discuss your uncertainties with them?

Yes (%)	No (%)
76·0	24·0

C) Generally, do you think the expression of uncertainty improves, does not effect or reduces the confidence your clients have in you?

Improve (%)	No effect (%)	Reduce (%)
22·0	34·0	44·0

D) How confident in you do you think your clients would feel if you said the following?

	Not at all confident (%)	Not confident (%)	Unsure (%)	Confident (%)	Very confident (%)
1) 'I am not sure about this'	5·0	37·0	33·0	24·0	1·0
2) 'I need to find out more'	0·0	1·0	8·0	78·0	13·0
3) 'Let's see what happens'	9·0	18·0	48·0	24·0	1·0
4) 'I don't know'	21·0	30·0	29·0	18·0	2·0
5)'I haven't come across this before'	4·0	17·0	45·0	32·0	2·0
6) 'I think this might be….'	1·0	10·0	31·0	53·0	5·0

E) How confident in you do you think your clients would feel if you did the following?

	Not at all confident (%)	Not confident (%)	Unsure (%)	Confident (%)	Very confident (%)
1) Used a book to find out about a condition	1·0	8·0	22·0	61·0	8·0
2) Asked another vet for advice	0·0	4·0	14·0	73·0	9·0
3) Asked a nurse for advice	28·0	41·0	20·0	11·0	0·0
4) Used a computer to find out information about a drug	1·0	5·0	13·0	75·0	6·0
5) Asked a specialist vet for advice	0·0	0·0	0·0	57·0	43·0
6) Referred you to a specialist vet	0·0	0·0	2·0	52·0	46·0

F) Do you think your clients have more, equal or less confidence in you than their GP?

More (%)	Equal (%)	Less (%)
59	39	2

Fig 2. The six questions (A to F) which were asked to veterinarians (n=100) together with their responses, shown as percentages of all responses

changed to "If you are unsure of the accuracy of your diagnosis do you think your clients want you to discuss your uncertainties with them?".

Statistical analysis

The responses from veterinarians and clients were compared using a chi-squared test with Yates' correction. For the first two questions, this was based on analysis of the relative proportions of "yes" and "no" responses by clients and veterinarians. For analysis of question 3, the number of responses in the "improve" and "no effect" responses were pooled and compared with "reduce" responses also using a chi-squared test with Yates' correction.

A mean score for client and veterinarian responses to each verbal and behavioural expression of uncertainty was calculated by awarding a score of 1 to a response of "not at all confident", a score of 2 to a response of "not confident" and so on to a value of 5 for a very confident response and dividing the total scores for each response by the number of respondents. A client rank was based on the highest number (that is, most confidence) down to the lowest number (that is, lowest confidence).

The veterinarian and client responses to each verbal expression of uncertainty were compared using a five by two chi-squared test. To allow a chi-squared analysis to be performed as a comparison between veterinarian and client responses for each behavioural expression of uncertainty, not at all confident and not confident responses were pooled, and a four by two chi-squared test was performed.

To compare the scores between verbal and behavioural expressions of uncertainty for both veterinarians and clients, a total score was calculated for each respondent by adding the scores from the six verbal and six behavioual questions using the same 1 to 5 scoring system as described above. Therefore, the total scores could vary from 6 if the respondent had answered "not at all confident" to all six questions to a total score of 30 if the respondent had answered "very confident" to all six questions. The paired (verbal versus behavioural) total scores for veterinarians were compared using a Wilcoxon matched pairs test. This analysis was repeated for the paired client (verbal versus behavioural) total scores. The veterinarian and client total scores from the verbal and behavioural responses were compared using a Mann-Whitney U test. In all the cases, significance was taken to be below $P<0.05$.

Results

General attitude of veterinarians and clients towards expressions of uncertainty

The questionnaire distributed to clients and veterinarians is shown in Figs 1 and 2, respectively, together with the responses in percentages for each of the six questions (A to F). The vast majority of clients responded that they wanted to know if their veterinarians were unsure of their diagnosis, and a similarly high proportion of veterinarians replied that they thought that their clients would like to know of uncertainties they may have regarding their diagnosis (Figs 1 and 2, question A). Indeed, there was no statistical difference between the responses from veterinarians and clients ($P=0.98$). There was a reduced consensus on attitudes towards therapeutic uncertainty, as almost all clients replied that they would like to know of any therapeutic uncertainties felt by their veterinarian, whereas only 76 per cent of veterinarians thought that their clients would like them to discuss any therapeutic uncertainties (Figs 1 and 2, question B); this was a statistically significant difference ($P<0.0001$). When asked how the expression of uncertainty generally affects confidence in their veterinarian, 13 per cent of clients stated that it would lead to a reduction in confidence. Interestingly, when veterinarians were asked how they thought expression of uncertainty affected client confidence, 44 per cent replied that they thought it would reduce client confidence (Figs 1 and 2, question C). There was a statistical difference between the proportion of clients and veterinarians who responded "reduces" compared with the pooled number of "improves" and "no effect" responses ($P<0.0001$).

Responses to verbal expressions of uncertainty

Both clients and veterinarians responded that from the six potential verbal expressions of uncertainty, the statements "I need to find out more" and "I think this might be ..." were least likely to lead to a reduction in client confidence (Figs 1 and 2, question D; Table 1). In addition, both clients and veterinarians considered that the statement "I don't know" was the most likely of the six possible verbal expressions to lead to a loss of client confidence (Figs 1 and 2, question D; Table 1). The responses by veterinarians and clients to the various verbal expressions were not different for four of the six responses. However, the response "I am not sure about this" was highly signficantly overestimated by veterinarians to cause a loss of client confidence, and the response "I need to find out more" was significantly overestimated by veterinarians to enhance client confidence (Table 1).

Responses to behavioural expression of uncertainty

Both clients and veterinarians replied that from the six potential behavioural expressions of uncertainty, "asking a referral vet for advice" and "referring you to a specialist vet" were least likely to damage client confidence (Figs 1 and 2, question E; Table 2). In addition, both clients and veterinarians considered that asking a nurse for advice was most likely to cause a decrease in client confidence (Figs 1 and 2, question E; Table 2). The responses by veterinarians and clients to the various behavioural expressions were not different for four of the six responses. However, "asking a nurse for advice" was highly significantly overestimated by veterinarians to cause a loss of client confidence, where as the response "asked a referral vet for advice" was significantly overestimated by veterinarians to enhance client confidence (Table 2).

When the total paired scores for verbal and behavioural expressions of uncertainty were compared for veterinarians and clients, both groups of respondents considered that verbal expressions of uncertainty would lead to a greater reduction in client confidence than behavioural expressions (veterinarian P<0.0001, client P<0.0001). When the total scores for verbal expressions were compared between veterinarians and clients, there was no significant difference (P=0.13). There was a small statistical difference between the total scores for behavioural experessions of uncertainty of veterinarians and clients (P=0.02).

Table 1. Mean score and rank of veterinarian (n=100) and client (n=274) reponses to verbal expressions of uncertainty together with P value of a chi-squared test which compared scores between clients and veterinarians for each responses.

	Mean veterinarian score ± sd (rank)	Mean client score ± sd (rank)	P vaue
"I am not sure about this"	2.79 ± 0.91 (5)	3.24 ± 0.90 (3)	<0.0005*
"I need to find out more"	4.03 ± 0.78 (1)	3.94 ± 0.50 (1)	0.049*
"Let's see what happens"	2.90 ± 1.02 (4)	2.92 ± 0.90 (5)	0.32
"I don't know"	2.50 ± 1.03 (6)	2.63 ± 1.08 (6)	0.67
"I haven't come across this before"	3.11 ± 0.95 (3)	3.13 ± 0.85 (4)	0.63
"I think this might be..."	3.51 ± 0.89 (2)	3.34 ± 0.78 (2)	0.44

Sd Standard deviation
*Significant difference

Comparison of confidence in veterinarian compared with general practitioner

Nearly 40 per cent of clients had more confidence in their veterinarian than in their GP compared with nearly 60 per cent of veterinarians who thought that their clients had more confidence in them than in their GP (Figs 1 and 2, question F). There was a statistically higher proportion of veterinarians than clients responding "more" compared with the pooled number of "equal" and "less" responses (P<0.001).

Discussion

This study suggests that almost all clients wish to know about any uncertainties that their veterinarians may have on the accuracy of their diagnosis or appropriateness of their treatment. While most veterinarians responded that they thought clients would want to know of any of their diagnostic uncertainties, only three-quarters of veterinarians considered that their clients would want to be aware of their uncertainties of the appropriateness of any proposed therapy. In addition, more than 40 per cent of veterinarians thought that the discussion of uncertainty would lead to a decline in client confidence; in contrast, less than 20 per cent of clients considered that expression of uncertainty would reduce their confidence in their veterinarian.

These findings highlight the differences in attitudes about the expression of uncertainty between veterianrians and clients and suggest that expressing uncertainty is not as damaging to client confidence as predicted by veterinarians. This study also shows that the way in which clinical uncertainty is expressed can markedly affect client confidence. Both clients and veterinarians regarded verbal expressions of uncertainty such as "I need to find out more" and "I think this might be ..." and behavioural expressions such as "asking a referral vet for advice" and "referring you to a specialist vet" to be the least damaging to client confidence. Overall, both clients and veterianrians agreed that behavioural rather than verbal expressions of uncertainty were less damaging to client confidence.

While there was broad agreement in the expressions of uncertainty which would cause the most and least reduction in client confidence, veterinarians significantly overestimated the reduction in client confidence which would result from saying "I am not sure about this" and from asking a nurse for advice. Although nearly 40 per cent of clients had more trust in their veterinarian than their GP, it is noteworthy that a signficantly higher proportion of veterinarians predicted that their clients would have more confidence in them rather than that in their GP.

There is mixed evidence from human medicine on the relationship between the expression of uncertainty and patient satisfaction. A study which measured the frequency of physician expressions of uncertainty to patients together with patient satisfaction found that physician expressions of uncertainty were associated with greater patient satisfaction [Gordon and others 2000]. However, another study which randomised patients to view one of five videotapes that showed a doctor expressing various degrees of clinical certainty found that patient satisfaction was

highest where no uncertainty was disclosed [Johnson and others 1988].

While these two studies are difficult to compare because of methodological differences, they do highlight the complex communication decisions facing doctors who have clinical uncertainties and that it is difficult to predict how patients will respond to the expression of uncertainty. One possible explanation for the different findings is that the context of the expression of uncertainty is crucial for predicting the impact on patient confidence. One study that assessed the context of the uncertainty expression found that patients who indicated that both verbal and behavioural expressions of uncertainty would have the most detrimental impact on their confidence were younger, of lower social class and had known their GP for less time [Ogden and others 2002]. One of the weaknesses of the present study is that the relationship between the expression of clinical uncertainty and client confidence was assessed in a very general manner; further studies are required to tease apart how expressions of uncertainty will affect client confidence across a range of clinical scenarios as well as how the client's background and the pre-existing relationship between the client and veterinarian will affect the client's confidence following the expression of uncertainty.

It is widely accepted that communication skills are important to doctors, and inclusion of this topic is now commonplace in the undergraduate and postgraduate medical curriculum [Maguire and Pitceathly 2002]. Historically, little emphasis has been placed on the teaching of communication skills in the veterinary undergraduate curriculum. For example, a survey of the attitudes of recent UK veterinary graduates on the veterinary curriculum found that 17 per cent of respondents considered that more courses on client communication and business management were required [Fitzpatrick and Mellor 2003]. As the link between effective communication and client satisfaction is increasingly well recognised, the importance of communication skills in veterinary medicine is now becoming well established, and this topic is now included in the veterinary curricula [Radford and others 2003, Kogan and others 2004, Shaw and others 2004, Gray and others 2006].

However, there are still very few objective studies on what clients consider to be good communication by their veterinarian, and consequently, care must be taken not to base veterinary communication skills workshops on subjective assessments of what clients perceive to be effective communication. This study suggests that clients and veterinarians may have different perceptions on what constitutes effective communication and highlights that veterinarians cannot always predict what clinical information is desired by clients.

Table 2. Mean score and rank of veterinarian (n=100) and client (n=274) reponses to verbal expressions of uncertainty together with P value of chi-squared test. which compared scores between clients and veterinarians for each responses.

	Mean veterinarian score ± sd (rank)	Mean client score ± sd (rank)	P vaue
"Used a book to find out about a condition"	3.67 ± 0.78 (5)	3.67 ± 0.89 (5)	0.50
"Asked another vet for advice"	3.87 ± 0.61 (3)	3.99 ± 0.70 (3)	0.11
"Asked a nurse for advice"	2.14 ± 0.95 (6)	2.93 ± 1.06 (6)	<0.0001*
"Used a computer to find out information about a drug"	3.80 ± 0.67 (4)	3.86 ± 0.76 (4)	0.08
"Asked a referral vet for advice"	4.43 ± 0.50 (2)	4.29 ± 0.66 (1)	0.017*
"Referred you to a specialist vet"	4.44 ± 0.54 (1)	4.28 ± 0.72 (2)	0.06

Sd Standard deviation
*Significant difference

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FECAVA Policy statements

FECAVA Policy statement 7
The Availability of Medicines
(adopted by the FECAVA Council on 6th May 2006)

1. FECAVA recognizes the paramount importance of the role of veterinarians in the relief of suffering and the promotion of welfare of companion animals
2. To ensure this goal, FECAVA recommends that the authorisation of medicines to relieve suffering in companion animals should be facilitated to provide easy access throughout Europe to the medicines vital to animal welfare
3. FECAVA reconfirms that Companion Animal medication does not represent any risk to the human population through food contamination.
4. FECAVA is aware of the great responsibility vested in its members to protect and ensure the welfare of companion animals. In accepting that responsibility, FECAVA strongly recommends the introduction of legislation to allow for full availability of the medicines necessary to ensure good veterinary practice for these animals
5. FECAVA recognizes the desire of the EU Parliament and Council to achieve this goal when it stated clearly in the EU Directive 2004/28/EC on Veterinary Medicines in section 21 of the Introduction that 'the administrative procedures for supplying medicinal products for pets, on the other hand, should be simplified. FECAVA urges the governments of member states to reflect this aspiration in their relevant regulations

FECAVA Policy Statement 8
Organ Harvesting from Living Companion Animals
(adopted by the FECAVA Council on 14th October 2006)

1. FECAVA strongly feels that it is unethical to perform an operation on, or to kill, a healthy animal in order to harvest organs for the purposes of transplantation.
2. Currently there is no compelling evidence of the animal welfare benefits to animals receiving transplanted kidneys and other solid organs [1]
3. Future medical, surgical and technological advances might, in theory, enable successful transplants to be performed to the benefit of the recipient.
4. However, in veterinary medicine source animals cannot give informed consent for organ harvesting. This is unlike the situation in man. Therefore it is the view of FECAVA that the only ethical option is to harvest tissues for transplantation from animals that have died [2]

In the case of feline renal transplantation, there is no statistically significant difference in survival time between cats that have undergone renal transplantation compared with those that have been treated using medical and dietary management. There have been no published long-term studies of long-term adverse effects on uninephrectomised 'source' cats.

FECAVA Policy Statement 9
Veterinary Education Standards
(adopted by the FECAVA Council on 14th October 2006)

1. The Bologna declaration was formed with the objectives of harmonizing higher education in Europe. Within the scope of this declaration are definitions and guidelines that help define the various levels of higher education qualifications e.g. bachelors' degrees, masters, doctorates etc.
2. Each member state has regulatory bodies that define the educational requirements to become a registered veterinarian.
3. The quality of veterinary graduate education is monitored and promoted by a voluntary accreditation process run by FVE and EAEVE.
4. FECAVA is committed to supporting the above structures and following closely the evolution of veterinary education in order to ensure the high standard of training for veterinary undergraduates.
5. FECAVA believes that high quality veterinary undergraduate training and lifelong learning programs are essential to the continued provision of high quality companion animal healthcare and the support of animal welfare.
6. It is part of FECAVA's remit to play an active role in promotion of high standards of veterinary education.

All FECAVA Policy Statements can be found on www.fecava.org

[1] Recipient animals will need chronic oral immunosuppression in order to prevent organ rejection. This is a welfare cost, especially in cats. Furthermore, inability to administer such medication may lead to failure of the transplanted organ and unnecessary suffering.
[2] For example following a road traffic accident

COMMISSIONED PAPER

Professional Ethics and Business Ethics: a complex and necessary relationship in Veterinary Medicine

B. Roman[(1)]

SUMMARY

In this paper the importance of making clear the question of the moral values that are inherent in the practice of veterinary medicine is discussed. These ethical questions are important because the practice of veterinary medicine requires a difficult balance between professional and business ethics. In the case of former, it is inherently animal welfare that legitimises the profession. In the later case, business ethics has as its goal the obtaining of a fair profit. A Veterinary practice is in reality a private business which has to make profit and it is therefore not always easy to reconcile the professional and business aims.

Veterinarians need to consider several different factors when making decisions, each of which is important:

a) The satisfaction of the customer, that is the owner of the Companion Animal, or client, regarding service quality- namely the efficacy of treatments given, fair treatment costs and good personal attention.

b) Animal welfare, for example reducing pain, treating, and hopefully curing illnesses, etc.

c) Running a profitable business.

We also suggest in this paper that Veterinary Medical Associations fully support the veterinarians in the making in the making these decisions. Often it is not just a matter of personal morals, but also of the public's trust in our profession. Trust is the most important factor in the reputation and prestige of the professions that deal with life and healthcare. To promote such trust in veterinary medicine we propose several ethical commitments for professionals.

Why should we consider Ethics in Veterinary medicine?

Veterinary medicine has its social legitimacy, this is, its 'raison d'etre' in ensuring good animal healthcare. Every intervention in veterinary medicine aims to optimise the animal's welfare. The ability of the client to be able to afford the treatment charges which will need to be made in order to enable the Veterinary surgeon to return a profit, must be considered. It is not always easy to reconcile these aspects yet each of them is equally important in ensuring the quality of the veterinary services.

It is imperative that animals must be properly treated to ensure customer satisfaction. Veterinarians need to both constantly update their knowledge and to be prepared to pay staff to assist them in their business in order that they can earn a living.

They must also never forget the aims that legitimise the practice of veterinary medicine. When veterinarians are negligent they damage not only their personal standing but also that of the whole profession, because the client may well think that all veterinarians behave in a similar manner. The same happens when the charges for veterinary treatment become too expensive. Ultimately trust in the profession deteriorates and all concerned stand to lose.

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It is inherently animal welfare that legitimises the profession

In the last few years the veterinary profession has become more and more technical. Veterinarians need to have extensive knowledge of different techniques and be up to date with new pharmacological treatments; this technical or scientific side sometimes tends to hide the "human" side. Aspects relating such compassionate care of animals and clients can be neglected. Market competition, pressures from the pharmacological industry and financial problems in one's business can lead to veterinarians forgetting about good ethical practice.
At University veterinarians are trained in the technical and scientific aspects of the profession but often not matters of business management or client relations. Like other business people they can fail if they think *'business is business'* and what is important is merely a matter of making money.
It is therefore important that we consider ethics, and in doing so, we need to differentiate between four different ethical groups. These are Personal Ethics, Civil Ethics, Professional Ethics and Organisational or Business Ethics. Each employs different criteria for making decisions and we need to distinguish between these in order to give a quality service.

Some important questions in Ethics

Here we will talk about Ethics, not about morals. Ethics is moral philosophy, a critical and rational reflection about morals. Nowadays we need to engage in this reflection because we are living in a multicultural world, a morally plural world, where morals are changing depending on new technical challenges and newly evolving moral values. For example, our relation with animals depends on our vision of them. Now that we have started to realise that animals have rights, and this means that we, as human beings, have moral obligations towards them. It is our responsibility to guarantee that no animal suffers and it is our duty, where ever possible, to guarantee an animal's quality of life.

In some cultures however the relationship with animals is so utilitarian that the animal's treatment is often cruel. In these cases veterinarians have a responsibility to educate people in the meaning of *'a good relationship with animals'* . Some people have to be reminded that animals have a moral value; animals deserve moral consideration and should be well treated. Veterinarians should also remind owners that animals should be kept healthy. A very good diet for human beings, for example, is not necessarily appropriate for animals.
Veterinarians, as private individuals, have personal ethics, based upon which they make the day to day decisions in their private lives; pursuit of happiness being probably the main criterion. This concept *'happiness'* is too obscure and changing to be used as the criterion for civil ethics. Effectively, happiness is not the criterion we need to use to make decisions for the world, nor in professional or organizational situations.
We therefore must have minimal ethics for the global world that propose duties and rights for every person including responsibilities for other living creatures, and for planet Earth. This world ethics is civil ethics, for every citizen in the world. It is also a prime consideration and a *sine qua non* condition for personal ethics. Personal ethics has to result in happiness, but in a legitimate and fair manner, because cosmopolitanism must be a forerunner to individualism.
Civil ethics is world ethics, the ethics of justice, because it has to promote respect for human and animal rights (now and for future generations). The criterion for making decisions in this field is justice, which considers the primary values that everyone must have guaranteed; they are universal moral demands. This is a minimal ethics because it does not discuss how we should live our lives to the full, but is neutral regarding the world view. A. MacIntyre said that a good life is a life dedicated to the research of good life [1]. We need a good life for every citizen in the world , this is the object of civil ethics [2], and the choice for one way of life is the option for one's personal ethics. Veterinarians should separate their personal values from civil ones because the last word in decision making regarding the animal belongs to the owners, who will have their own private values.
In cases where the owner's private values are contrary to civil ethics, for example in the case of the mistreatment an animal by the owner, the veterinarian should have an overriding responsibility to the animal.(we are talking here about ethical responsibility above and beyond legal responsibility). This could happen for example in several instances regarding animals (e.g. ear cropping or tail docking, fights for entertainment, etc).
Service quality is the primary criterion in professional ethics. Quality implies satisfaction of the customer's expectations but in professional cases, where knowledge is fundamental, these expectations must be both well based and founded. For this reason veterinarians must explain to clients what they should expect from the veterinary treatment and from their practice. That is why the veterinarian's opinion is another important factor in the service quality. The third factor in the service quality is the sussess of the business. Here profitability is fundamental. We actually need business ethics and its executive arm, corporate social responsibility.
In practicing Veterinary Medicine one has commitments not only to animals and clients, but also to suppliers, employees,

landlords, etc. These stakeholders also demand quality in their relationship with the veterinarian. In this field the criterion for decision making is also service quality but since it is a business we use terms such as corporate social responsibility. Corporate social responsibility demands transparency in economic, ecological and social matters. It is not only a question of making money, but how money is made.

It is important to remember that professional ethics also involves the code of professional conduct. These are the rules that every veterinarian should follow to avoid accusations of negligence. If professionals limit their professional responsibility only to that which is legally necessary they will not accomplish the most important element in any profession ,that is the search of excellence. Excellence, *arête* in Greek, means virtue. Aristotle [3)]defined virtue (excellence) as a purposive disposition, lying in a mean that is relative to us and determinated by a rational principle. It is a mean between two kinds of vice, one of excess and the other of deficiency.

Real trust in the veterinarian as a person, and in the veterinary profession as a whole, depends on excellence. Progress in veterinary science depends on excellence. But excellence can only be aspired to – it cannot be demanded. It's a matter of vocation and self-fulfilment, both questions very close to the personal relationship of the veterinarian to the profession an all that this involves.

Veterinarians should engage in lifelong learning in order to keep their knowledge updated.
A Wet Lab at a recent AVEPA/SEVC Congress

To be aware of the ethics inherent to the profession implies several commitments.

A good practice would always refer a client to another colleague for a second opinion in cases where they felt they had insufficient expertise or knowledge to enable a client to receive the proper attention needed for their animal. This willingness to refer a case even though this may mean the temporary loss and potential profit from a case is a very important attribute in a professional person.

Many problems in professional practice are related to the pressure of work, the pressure from suppliers, the ability of owners to be able to afford treatment and the constant need keep up to date with the latest advances in knowledge and techniques. Sometimes the isolation of the professional is so great that the search of excellence and the maintenance of a high ethical code in the profession can be forgotten.

A matter of Trust

We propose that Veterinarians should make the following commitments to promote trust in their profession. They are also the main elements that audit service quality and corporate social responsibility.

1. Animal Welfare: Non-maleficence and beneficence

The main commitment in veterinary medicine is animal welfare. There are two intrinsic dimensions covered by this expression: *non maleficence and beneficence.*

Non maleficence implies palliating pain and suffering. This is the minimal intervention veterinarians should always guarantee to animals. It should be mandatory even if the owner cannot pay. Animal suffering or pain must always be avoided. There must be general agreement on this subject: nobody wishes pain or suffering, either for people or animals.

Beneficence means doing the best which is possible. But beneficence is complex to implement as it depends on the clients personal expectations (their world views, their personal ethics), and also on economic considerations and personal circumstances in general. An example would be when an owner makes the decision to put his dog to sleep [4] because he/she cannot afford to pay for the most efficient treatment. To refuse an efficient treatment because of the cost is a decision of the owner that is not beneficence from the veterinarian's perspective. In this type of case it is important to offer the client easier alternative methods of payment for treatment rather than agreeing immediately to end the animal's life. These decisions are difficult for both veterinarian and owner. The owner however must have the last word.

2. Autonomy of the owner

The owner is the ultimate responsible person for the animal. The owner also has moral questions, their own values and personal economic circumstances, etc; to consider. All these elements must be balanced when decisions are made regarding the pet.

Respecting the owners' autonomy not only means respecting their wishes, but also means giving them the right information of the whole process of treatment to which their animal will be subjected. Veterinarians and clients must mutually establish a moral contract. They must inform their clients of the cost,

Every intervention in veterinary medicine aims to optimise the animal's welfare.
Correction of congenital eyelid defects

the time frame, the treatment, the prognosis and the expected future quality of life of the animal or, if they feel it appropriate, recommend euthanasia. This information must be given appropriately, bearing in mind the clients' intelligence and ability to understand. The client must be prepared pay the costs and follow the veterinarian's recommendations.
Veterinarians should acquire a reasonable assessment of their clients. This should not only be with regard to the client's financial status but also as to whether or not they are likely to diligently follow the recommendations given by the veterinarian regarding their pet.
Uptake of information given and other aspects of communication often fail because the veterinarian is not aware of the different levels of knowledge clients have about animal welfare and responsible pet ownership. This can sometimes be due to different cultural backgrounds. The veterinarian must always take care of the animal's welfare and respectfully inform clients of best practice regarding the animal. Here veterinarians can be helped by using teaching aids and, of course, by employing an ethical approach.
The practice, of preparing a written document [5] will ensure that the owner has been informed of all risks, benefits, cost implications and the different steps that will be followed during treatment (for example during surgery) is thoroughly recommended. It helps build trust and can act as a moral contract between client and veterinarian. It not only provides a legal defence in cases where things go wrong or where things do not meet clients expectations but in some cases it can also help as a sort of 'moral contract' implying a commitment and a responsibility between client and Vet.
Veterinarians must help owners to make good decisions by giving full information about benefits, risks, costs and intended procedures and prognosis. It's not just a matter of what the owner prefers however. An animal is worthy of moral consideration, it is more than a simple inanimate object that can be used how and whenever one wishes. Autonomy is the capacity to make decisions and it requires responsibility not only for ones self but also for the vulnerable beings that depend on us.

3. Justice and solidarity

As Habermas says [6], justice implies a process of decision making involving all parties. It is a process where those affected by decisions take part in the decision making. Those concerned must be fully informed and have an equal say in the decision. In veterinary practice this means that the fair decision about the animal depends on the consensus between veterinarian and client.
Veterinarians should not discriminate against people for reasons of race, sex or culture. In cases where owners have financial problems, an animal must never be left without at least basic pain control. It's a matter of justice and fairness. The animal's welfare is a must in veterinary medicine and cost factors should not be the only ones considered when deciding what the correct treatment should be.
The relationship between veterinarians and owners is so important that it is recommended that veterinarians should learn communication skills as unfortunately these are not taught in University Veterinary schools.

4. Prudence

Veterinarians must balance benefits and risks inherent to surgical operations or treatments. This balance depends on the Veterinarians expertise and scientific evidence.
Veterinarians have a responsibility to take care of their continuing education (LLL – life long learning). It's difficult however to improve ones skills without practice ie 'learning from ones mistakes. This however can be dangerous as in the process of learning animal welfare could be endangered. In some cases the owner's financial situation will be the essential factor to consider before beginning a treatment.
Prudence means thinking about different alternatives and in this process the veterinarian must always consult the client.

5. Professional competence and improvement of the reputation of Veterinary medicine

Veterinarians should engage in lifelong learning in order to keep their knowledge updated. They must remember that Veterinary medicine is more than a mere job, it is a profession. This means that Veterinarians, in their daily practice, must develop the image that clients expect to see in a Veterinary practitioner. One's reputation, and that of the profession as a whole, is of paramount importance. The need to be profitable and earn a living must not compromise this.

6. Profitability with transparency

The practice of Veterinary medicine is a business and therefore it has to be properly managed. Business must be profitable. Good management involves having a good relationship with every person who is involved in the business. There should be transparency in employee relations, and staff should be well treated. The concept social in corporate social responsibility can mean many different things expected by stakeholders. They expect from the business: good competition among veterinarians, good information and fair prices for customers, good agreements and mutually beneficial arrangements with suppliers, good relationships with professional associations, etc.

Good business is more than earning a lot of money in the short term. To stay in the market in the medium and long term one needs a high level of professionalism, of course, but also high standards of management. Good management engenders customer trust.

Corporate social responsibility also involves respect of the environment. As professionals veterinarians must assume their share of this responsibility and always consider how to make their work more sustainable.

The more we use economical and ecological resources, the less we have. On the contrary, with moral resources (trust, justice, solidarity, transparency, respect, etc.) the more we use, the more we gain.

Acknowledgements

We are in debt to the Spanish Small Animal Veterinarian Association (AVEPA), especially to J. Aragonés and J. Capacés. During years we have shared our interest in promoting professional ethics among veterinarians and this has lead to the development of the Ethics Code of AVEPA (7).

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REPRINT PAPER(GR)

Surgical excision of skin folds from the head of a goldfish *Carassius auratus* (Linnaeus 1758)

P. Angelidis [1], *N.I. Vatsos* [1], *D. Karagiannis* [1]

SUMMARY

Goldfish Oranda very often exhibit overgrown skin folds in the dorsal head area. In many cases, these folds extend laterally towards the periocular area resulting in tunnel vision and thus stress of the fish. A goldfish, about four years old, with overgrown skin folds around its eyes underwent a surgical excision of these folds. For the three consecutive days prior to surgery the fish was treated with the wide spectrum antibiotic nifurpirinol (Aquafuran) by bath. After the fish was anaesthetised with phenoxyethanol, the excessive skin folds were excised with a scalpel. Histological examination of the excised skin revealed hyperplasia of the epidermis and excessive subcutaneous fat tissue. During first 24 hours after surgery the fish started to eat. In the next few days, its appetite and overall behaviour showed significant improvement compared to those prior to the operation, while almost 12 months post operation, no new skin folds appeared around the eyes, a fact that indicates that the operation improved the life of the fish.

Key words: goldfish, surgery, skin folds

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Introduction

The majority of surgical operations performed on fish, both for cosmetic and therapeutic reasons, are performed on valuable aquarium fishes. These therapeutic operations mainly involve the removal of tumors either from the skin [8] or the peritoneal cavity [6, 9, 11] while examples of cosmetic operations are the replacement of a destroyed eye with an artificial one [7] and the correction of scoliosis [3].

Most of the external characteristics of the goldfish (*Carassius auratus*, family *Cyprinidae*) that are maintained in aquaria nowdays are the results of genetic selection of random mutations [1]. Goldfish Oranda have a certain characteristic: skin folds grow on the top of their head, which enlarge as the fish grows. When the fish becomes 2 years old, these folds extended over a great area of the gill covers and the periocular area [4]. This extensive growth of the skin folds results in tunnel vision of the fish and therefore a reduced perception of the surrounding environment and difficulty in finding food. Furthermore, various microorganisms (e.g. opportunistic bacteria and parasites) find shelter within these folds causing serious skin lesions.

The aim of this paper was to describe the surgical excision of overgrown skin folds from an Oranda goldfish in order to improve its welfare.

Case Report

A goldfish about 4 years old was admitted to the Ichthyology Laboratory, Veterinary School, Aristotle University of Thessaloniki. According to its owner, during the last year the skin folds on the top of its head exhibited significant growth (Figure 1e) and expanded laterally, towards the periocular area, resulting in tunnel vision of the fish.

It seemed that this situation was quite stressful to the fish, as it presented inclination for isolation, loss of a few scales and loss of appetite.

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Figure 1. a) Oranda goldfish prior to surgery, b) administration of anesthetic using a tube, c) observing the excision of the skin using a magnifying glass, d) Oranda goldfish after the operation and before recovery e) excised skin tissues used for histological examination, f) goldfish Oranda 15 days after surgery. (Photos by S. Kiosseoglou, Oranda's owner)

Preoperative Treatment

Prior to surgery and for 1 hour per day for the previous three consecutive day period, the fish was immersed in a solution of the wide spectrum antibiotic nifurpirinol (Aquafuran, Aquarium Münster). The concentration of the antibiotic was 1 mg/l. These preventive baths killed any opportunistic pathogens which could cause some problems after the operation. In addition, the accumulation of the antibiotic in the tissues of the fish

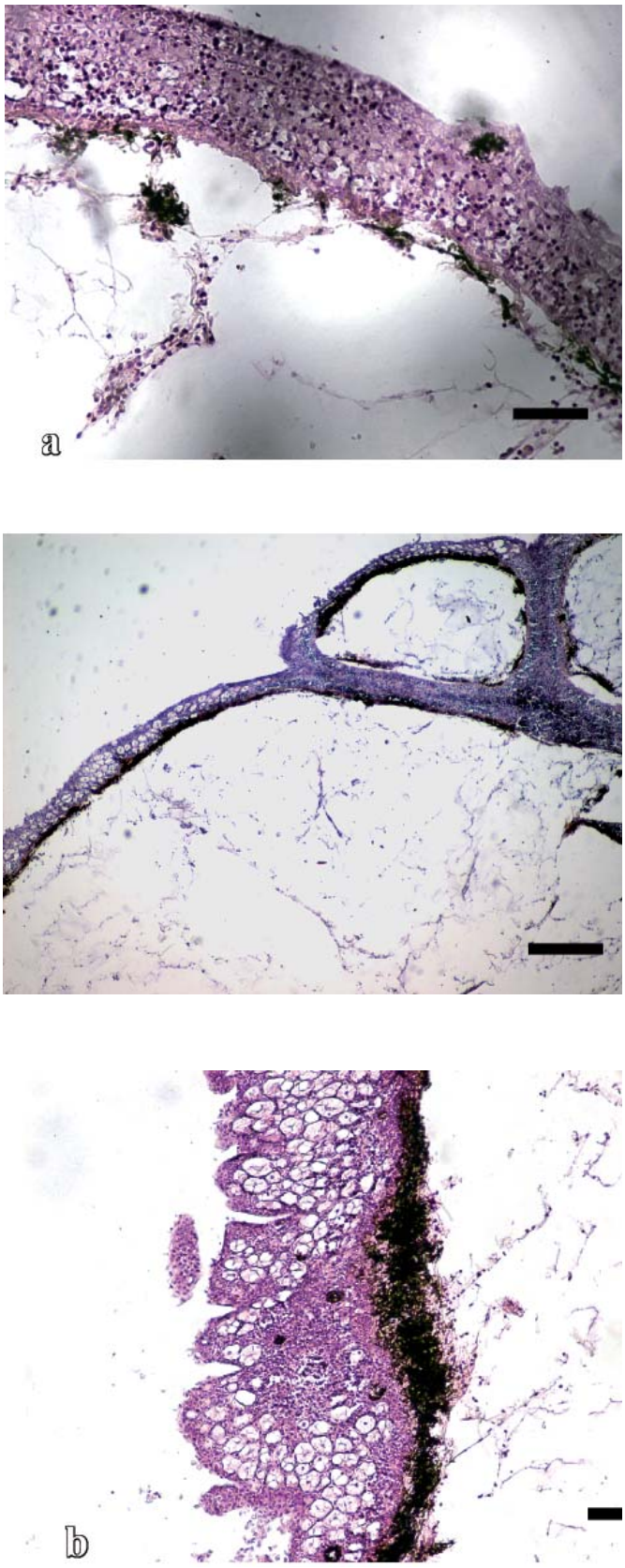

Figure 2. Section of overgrown skin folds of a goldfish Oranda. a) hyperplasia and spongiosis of epidermis, (HE, Bar = 200 μm) b) hyperplasia of epidermis and increased number of mucous cells, (HE, Bar = 200 μm) c) increased deposition of adipose tissue in the subcutaneous layer (HE, Bar = 400 μm)

would minimize the growth of any microbes that might enter the fish during the surgery. This was very important as very often fish exhibit anorexia after various operations and thus the administration of antibiotics per os is not possible.

Anaesthesia

The goldfish was transferred by its owner to the Laboratory, in a plastic bag containing approximately 2 l of aquarium water. Prior to surgery, the fish was placed in a plastic container containing 1 l of aquarium water in order to be anaesthetized with phenoxyethanol. The final concentration of the anaesthetic was approximately 0.6 ml/l [10]. The administration of the anaesthetic drug was gradual in order to monitor the behaviour of the fish and the induction of anaesthesia to be smooth.

Gradually the fish exhibited erratic swimming which finally ceased and as soon as it turned belly-up, it was removed from the anaesthetic solution and placed on the table, where the operation took place. In order to maintain the fish under constant anaesthesia and oxygenation, a plastic tube was placed inside its oral cavity (Figure 1b), which provided the gills of the fish with a constant flow of oxygenated water mixed with anaesthetic.

Operative surgery

The skin folds around the eyes were excised using a scalpel in a way that prevented any damage to the eyes. The scalpel blade was parallel to the head bones and excision was toward the periphery of the folds (Figure 1b). Due to the scales inside the folds, the force that was applied on the scalpel was not constant during the excision. Scales excision required more pressure than the excision of the soft tissues. The progress of the excision was observed using a magnifying glass (Figure 1c). When an adequate amount of skin tissue around the eyes was excised the flow of the anaesthetic ceased and the fish was transferred to a plastic container, which was filled with 5 l of aquarium water without anaesthetic, to recover (Figure 1d).

A faint opercular movement was noted during the first 5 minutes after the transfer, an indication of respiratory depression. In order to increase the water flow through the gills and therefore their oxygenation, an air-stone connected to an air-pump was placed inside the plastic container.

Gradually, the fish exhibited slow movement of the tail and the fins, so that after 7 minutes it started to swim normally.

The entire operation, from the induction of anaesthesia until the fish exhibited normal swimming behaviour, lasted about 25 minutes.

Samples from the excised skin tissues (Figure 1e) were collected, fixed in 10% buffered formalin and after 24 h were processed according to the methods described by Bullock [2]. Sections 7 μm thick were cut using a microtome, stained with haematoxyline – eosin (HE) and observed using light microscopy. Histologically hyperplasia and disorganization of the epidermis (Figure 2a,b) were noticed. Extensive sloughing of epidermal cells of the outermost layers was also observed. The number of the skin mucous cells was increased. In some areas, spongiosis of the epidermis and increased number of chromatophores in the dermis were observed. Finally, significant deposition of adipose tissue was observed subcutaneously. (Figure 2c).

Postoperative care and medication of the fish

After recovery from anaesthesia the fish was placed in a plastic bag containing approximately 2 litres of aquarium water in order to be transferred home. Initially, the fish was placed alone in a 25 litre aquarium tank for a few weeks, and then, with another goldfish.

For the first 5 days after surgery and for 1 h daily the fish was immersed in Aquafuran solution (1ml/l). It was decided that no antibiotics should be delivered to the fish by injection, because such a procedure would inflict more stress on the fish, something that could potentially have adverse results to the overall status of the fish.

To avoid any infection of the surgical field, baths with formalin (38% solution) at the dose of 0.1 ml / l for 10 minutes daily, for a total of 5 days, were also performed.

The fish started to eat during the first 24 h. During the next days (Figure 1f) its appetite improved, compared to its appetite before surgery and according to the owner, the fish did not exhibit any tendency for isolation.

Four days after surgery, white spots were noted in the surgical field and were probably the result of fungal infection. It was treated by immersing the fish in a 5% solution of NaCl, for 10 minutes daily, for 3 days. After the first day, regression of the white spots was observed.

Discussion

Very often, goldfish Oranda exhibit overgrown skin folds in the periocular area due to increased deposition of adipose tissue subcutaneously [4]. In the present case, the goldfish exhibited skin folds that extended to almost the whole head, especially in the periocular area, thus causing a problem in its vision. The aetiology of this condition is still not clear. According to Johnson and Hess [4] the overgrowth of these skin folds is genetically determined, or / and due to environmental factors. The factors that affect the accumulation of adipose tissue subcutaneously are: the temperature and the quality of the water, the diet of the fish and the degree of crowding. According to the owners of goldfish with overgrown skin folds, if the growth of the skin folds is extensive then the vision of the fish can be severely affected, as well as the feed uptake and the overall behaviour of the fish. Regarding the treatment of those skin folds there are no published reports. The owners either leave the fish untreated, which gradually become cachectic and eventually die due to inability to eat, or using various methods, which in most cases do not respect the welfare of the fish [5], remove these folds. The present case is the first surgical excision of these skin folds that has been published. The excised skin folds were also examined histologically and hyperplasia of the epidermal cells and increased deposition of adipose tissue subcutaneously were noted, as described by Johnson and Hess [4].

Regarding the postoperative status of the fish there are no published reports. There is only some unpublished information, mostly in internet sites, according to which new skin folds may appear after their excision. In the present case, the goldfish was monitored for about 12 months and in this period no re-growth of the skin folds was observed. Since the aetiology of this condition is still not clear it is believed that other factors apart from those suggested by Johnson and Hess [4] affect the growth of these skin folds on the head of Oranda goldfish. In the present case, there were no changes in the genetic material of the fish and no significant changes in its environment. It might also be of great importance the method by which the skin folds are excised.

The surgical excision of the overgrown skin folds described in this paper improved significantly the overall behaviour of the fish, which proves that the operation had a significantly positive effect on the quality of the fish's life.

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REPRINT PAPER (CH - FIN)

Stabilisation of atlantoaxial subluxation in the dog through ventral arthrodesis

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SUMMARY

Ten miniature breed dogs with atlantoaxial subluxation underwent ventral lag screw stabilisation. The procedure did not include bone graft packing into the atlantoaxial articulation. Four dogs showed continuous improvement after surgery. Three dogs developed complications due to external trauma and postoperative implant failure but improved with conservative therapy. Three patients died or euthanasia was performed in early perioperative or postoperative period. The long-term outcome was good or favourable in all surviving patients. Suspected fibrous tissue proliferation and stabilisation without permanent bone fusion was found to be clinically satisfactory when the atlantoaxial joint has been subjected to limited stress during a long-term monitoring period.

Keywords: Yorkshire terrier, atlantoaxial subluxation, ventral lag screw, bone graft

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Introduction

Atlantoaxial subluxation (AAS) is an inherited or acquired disease, mostly described in toy breed dogs [Lorenz and Kornegay, 2004]. Impairment of atlantoaxial articulation is caused by excessive flexion of the head resulting in injury to ligaments and/or dens axis fractures. Several inherited malformations of atlantoaxial articulations have been described in toy breeds [Johnson and Hulse, 1989; Wheeler, 1992; Lorenz and Kornegay, 2004]. Dens axis hypoplasia, aplasia or absence of ligamentous support predispose to failure with minimal trauma, resulting in pain and upper motor neuron tetraparesis. Pain during head flexion is the most common sign of the disease.

The treatment of AAS can be either conservative or surgical [Lorenz and Kornegay, 2004; Sharp and Wheeler, 2005; Havig *et al.*, 2005]. Conservative treatment is reserved for patients with mild clinical signs [Gilmore, 1984; Havig *et al.*, 2005]. The goal of surgery is to decompress the spinal cord and stabilise the atlantoaxial joint [Sorjonen and Shires, 1981; Lorenz and Kornegay, 2004; Sharp and Wheeler, 2005]. Dorsal and ventral surgical techniques have been described as effective in the stabilisation of AAS. Dorsal techniques include stabilisation of the atlas arch and dorsal process of the axis using orthopaedic wire, non-metallic surgical suture or nuchal ligament as well as cross pin fixation [Chambers *et al.*, 1977; LeCouteur *et al.*, 1980; Jeffery, 1996]. Ventral techniques include transarticular cortical screw placement [Denny *et al.*, 1988; Rochat and Shores, 1999; Wheeler, 1992], transarticular cortical screws and pins with polymethylmethacrylate reinforcement [Blass *et al.*, 1988; Schulz *et al.*, 1997; Platt *et al.*, 2004; Sanders *et al.*, 2004], transarticular pinning of atlantoaxial articulations [Beaver *et al.*, 2000; Johnson and Hulse, 1989; Thomas *et al.*, 1991] and bone plating [Stead *et al.*, 1993]. Veterinary surgeons tend to favour ventral stabilisation techniques recently, as they seem to

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* Presented by SVK/ASMPA (Switzerland), CZ (Czech Republic) and FAVP (Finland)

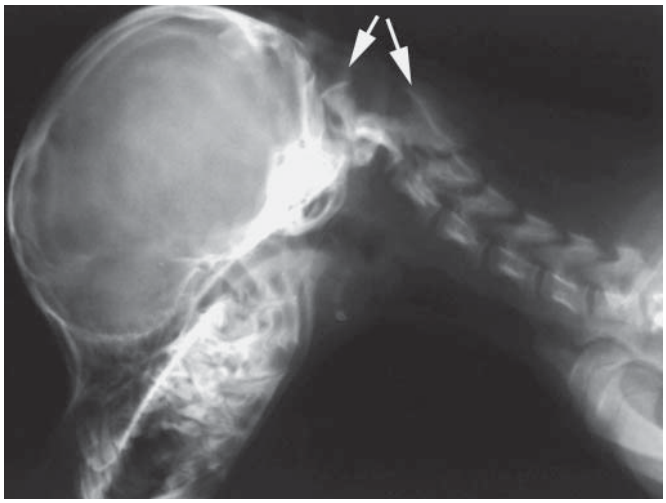


Figure 1: Preoperative lateral radiograph of a Yorkshire terrier with AAS. The distance between the dorsal arch of the atlas and the dorsal spine of the axis is enlarged (arrows). The cranial aspect of the body of the axis is dislocated to dorsal. Dens axis is hypoplastic.

provide easier anaesthetic monitoring, lower surgical risk and permanent fusion of atlas and axis. It has been proposed that bone grafting should be used to enhance fusion between two vertebral bodies [Lorenz and Kornegay, 2004]. All the above operating techniques produced good long-term results for patients [Denny *et al.*, 1988; Thomas *et al.*, 1991; Beaver *et al.*, 2000; Platt *et al.*, 2004; Sanders *et al.*, 2004]. The purpose of this study was to show long-term results and complications of ventral lag screws without cancellous bone graft packing in the joint in 10 cases of AAS stabilisation.

Animals, Material and Methods

The medical records of confirmed AAS cases from 2000 to 2005 were reviewed retrospectively. The inclusion criteria included complete results of physical and neurological examination, radiological conformation of AAS, surgical treatment with ventral lag screw stabilisation, postoperative radiographs and long-term follow-up data. Data collected included breed, sex, age, body weight and the course and duration of neurological dysfunction. The neurological status was graded before and after surgery according to the following scale: 1) without neurological deficits, 2) mild tetraparesis, mild generalised ataxia and episodic pain, 3) moderate to severe ambulatory tetraparesis, generalised ataxia and pain, 4) nonambulatory tetraparesis or tetraplegia and pain.

Diagnosis

The diagnosis was confirmed on plain lateral radiographs. Later, properly positioned plain lateral and ventrodorsal radiographs of the head and upper cervical region were taken under general anaesthesia before and after surgery, avoiding excessive head and neck flexion. The distance between the dorsal arch of the atlas and the spinal process of the axis were evaluated on lateral radiographs. Possible dens axis fracture, malformation or aplasia was checked on the ventrodorsal projection.

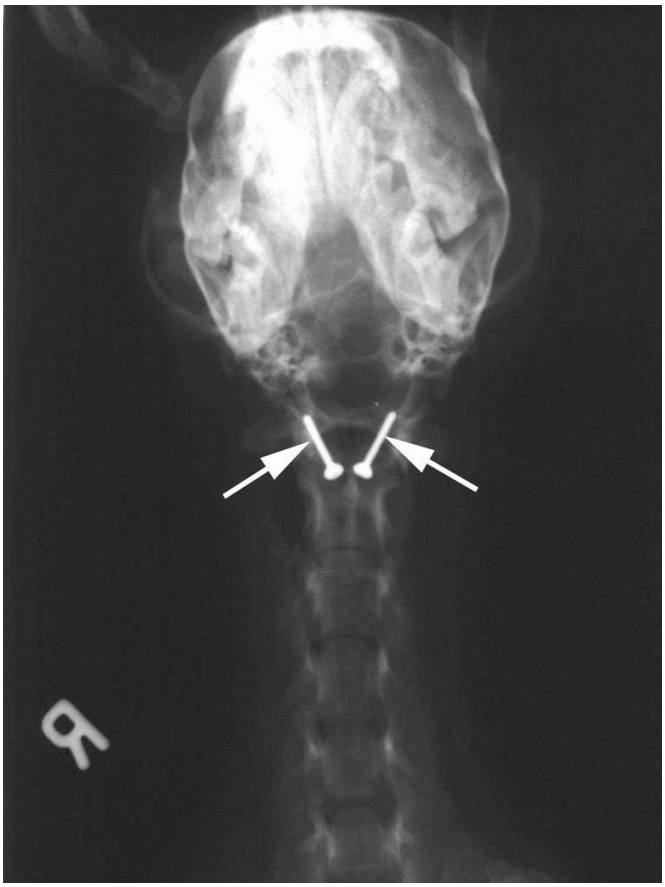
Anaesthesia

Anaesthesia protocol included premedication with i.v. diazepam [Apaurin, KRKA] and buprenorphine [Temgesic, Schering-Plough], induction of anaesthesia with i.v. bolus of propofol [Propofolum, Abbott Laboratories] and maintained by inhalation of a halothane [Narcotan, Slovakofarm], nitric oxide and oxygen mixture. Continuous fentanyl infusion was administered during surgery. Monitoring during anaesthesia included recording of pulse rate, SpO2, respiratory rate, and end tidal CO2. Manipulation during general anaesthesia was careful and patients were transported taped to firm cardboard.

Surgery

The surgical method in all cases was through a standard ventral approach to the atlantoaxial articulation [Sharp and Wheeler, 2005]. Patients where placed in dorsal recumbency with the neck slightly extended and the front legs pulled back. The patient was fixed into position with tapes over the mandible and cranial thorax. The skin incision extended from the larynx to C4–C6 vertebras. Care was taken to preserve the thyroid gland and its blood supply. The sternohyoid muscles were separated and retracted to expose the trachea. The sternothyroid muscle was mobilised and divided close to the larynx. The larynx and cranial section of the trachea were retracted laterally using Gelpi self-retaining retractors. The tendons of the longus colli muscles were elevated and separated from the ventral process of C2.

Figure 2a: Postoperative ventrodorsal radiograph of a Yorkshire terrier with AAS (case No. 6). 1.5 mm cortical screws are inserted through the atlantoaxial articulation (arrows).



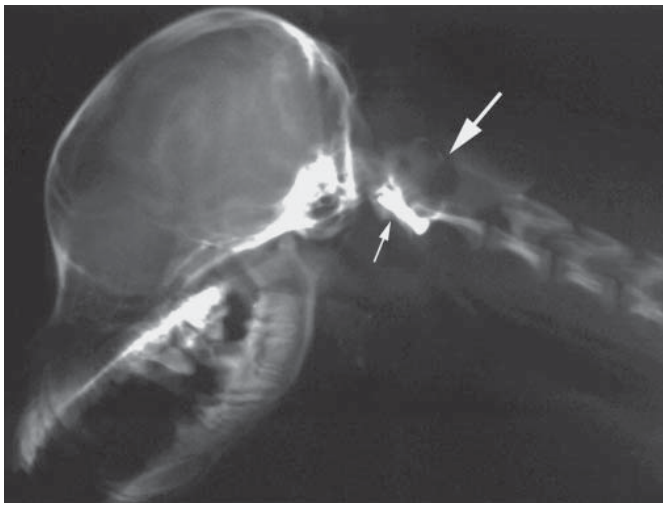


Figure 2b: Postoperative lateral radiograph of a Yorkshire terrier with AAS (case No. 6) showing normal distance between the dorsal arch of the atlas and the dorsal spine of the axis (big arrow). Transarticular implants are placed between C1 and C2 (small arrow).

Soft tissue remnants were removed from the ventral section of both vertebral bodies. The joint space was opened to identify the ventral border and position of each vertebra. Part of the joint capsule obscuring the view was removed. The vertebral body of the axis was grashed with micro Halsted forceps, positioned medially on the lateral section of the body. Forceps were used to establish and hold the optimal position of both vertebrae. 1.5 mm cortical screws were used to stabilise the atlantoaxial joints. A 1.5 mm hole for the lag screw was first drilled in the cranial section of C2 beginning on one side of the vertebral body just behind the bony cranial wall. Then, the opening to C1 was drilled using a 1.1 mm drill and tapped. The drill bit was covered with the sleeve to prevent soft tissue damage and ensure positioning as close as possible to the ventral musculature of C2/C3. The drill was directed craniolaterally approximately 30 degrees from the midline to reach the largest portion of the bony lateral part of the atlas. No bone graft was packed into the articulation. The screw was inserted in the predrilled and tapped hole, and tightened like a lag screw. Care was taken to ensure a firm grip into the bone. The procedure was repeated on the opposite side. The wound was closed in a routine manner. The position of the screws was evaluated on postoperative radiographs in lateral and ventrodorsal projections.

Postoperative care

Hospitalisation of patients was maintained until they were ambulatory and pain-free. Repeated injections of morphine (Morphin Biotica 1%, Hoechst-Biotica) every 6 hours were used for postoperative analgesia in all dogs during the first 24–48 hours. Soft padded neck bandages were applied postoperatively to young and small dogs with large heads in proportion to their bodies. Neck bandages were maintained during the first 4–6 weeks after surgery. The intensity and duration of postoperative physiotherapy was prescribed according to the postoperative neurological status of the patient. All owners were instructed to restrict their pet's physical activity for 6–8 weeks after surgery, allowing just short 5-minute walks three times daily.

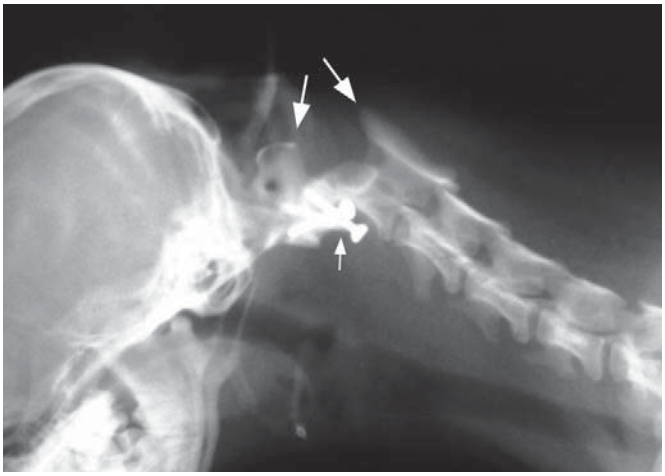
All dogs were evaluated daily during the postoperative hospitalisation period and at various intervals after discharge by the postgraduate or resident surgeon of the ECVN. Additionally, all owners were repeatedly interviewed by phone. Owners were asked to score their pet's condition using the following scheme: "good" – without any visible abnormalities, "favourable" – better than before surgery with only mild deficits in gait and/or rare episodes of rigidity/pain, and "poor" – status similar or worse than before surgery.

Results

From a total of 13 dogs, 10 met the inclusion criteria and 3 dogs were excluded because conservative treatment was applied. 8 dogs included in the study were Yorkshire Terriers, 1 was a Japanese Chin and 1 was a Chihuahua. 5 dogs were scored to have a neurological status grade 2, three dogs grade 3 and two dogs grade 4 before surgery. An increased distance between the dorsal arch of the atlas and the spinal process of the axis was noted in preoperative radiographs in all dogs (Fig. 1). The dens of the axis was fractured in 1 case, hypoplastic in 2 cases and normal in 7 dogs. The postoperative radiographs confirmed good implant positioning and the dorsal arch of the atlas was overlapped by the spinal process of the axis in all dogs (Fig. 2a and 2b). Neurological scoring after surgery was better in 4 patients, similar in 4 patients and worse in 2 patients than before surgery. Soft padded neck bandages were used for 3-6 weeks after surgery in 4 cases. The mean hospitalisation time was 7.2 days. Mean long-term results were collected after 28 months. Pertinent clinical data are summarised in Table 1.

4 dogs (40%) had no postoperative or long-term complications and a gradual improvement in their neurological condition was observed. The long-term results were rated as good (3 cases, 30%) or favourable (1 case, 10%). Perioperative complications occurred in one patient (10%), early postoperative in three (30%), and late postoperative complications in two cases (20%).

Figure 2c: Lateral radiograph of a Yorkshire terrier following an accident 5 days after surgery (case No. 6). Both implants are displaced caudally and dorsally (small arrow). The distance between the dorsal arch of the atlas and the dorsal spine of the axis is enlarged (big arrows).



	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10
Breed	Yorkshire terrier	Yorkshire terrier	Yorkshire terrier	Yorkshire terrier	Yorkshire terrier	Yorkshire terrier	Yorkshire terrier	Japanese Chin	Chihuahua	Yorkshire terrier
Sex	Male	Female	Male	Female	Male	Female	Male	Male	Male	Male
Weight (kg)	1.2	1.3	1.5	2.9	2.8	1.6	1.5	2	1.4	1.6
Age at presentation (months)	5	12	12	24	9	7	8	9	16	8
Neurological grade before surgery	2	2	2	2	3	3	3	4	4	2
Neurological grade 24 hours after surgery	CPA*	3	2	2	2	2	3	3	4	1
Neurological grade on discharge	-	2	1	1	1	2	5	2	2	1
Hospitalisation period (days)	-	3	6	6	8	2	3	17	12	8
Neck bandage after surgery	-	+	+	+	-	-	-	+	-	-
Follow-up period (months)	-	32	46	14	35	-	-	28	25	16
Perioperative complication (hours)	5	-	-	-	-	-	-	-	-	-
Early postoperative complication (days)	-	2	-	-	-	5	3	-	-	-
Late postoperative complication (days)	-	-	-	-	20	-	-	-	53	-
Neurological grade at the end of the study	dead	2	1	1	1	euthanasia performed	euthanasia performed	2	2	1
Final outcome, owners grading		Favorable	Good	Good	Good			Favorable	Favorable	Good

Table 1: Pertinent clinical data in 10 dogs with AAS. * cardiopulmonary arrest

One patient (case no.1) suffered a cardiopulmonary arrest and died 5 hours after surgery. Case no.6 improved from grade 3 to grade 2 during postoperative hospitalisation but three days after discharge the dog jumped off a sofa and became ataxic (grade 3). Radiological examination after the accident revealed fractures of the cranial articular surface of C2 and the caudal articular surface of C1 at the operation site (Fig. 2c and 2d). Both implants were displaced. The owners elected for euthanasia. The condition of case no. 7 did not improve during three days after the surgery. Repeated radiological examination revealed implant migration and fracture of the wing of the atlas. The owner elected euthanasia.

A worsening clinical status and ventrolateral migration of one of the implants was observed in one dog (case no. 2) within 36 hours after surgery. A soft padded neck bandage was applied for 3 weeks and the condition of the dog improved gradually. The long term outcome (32 months) was considered to be favourable in this patient after developing complications in the postoperative period. One patient (case no. 5) improved continuously during the first 20 days after surgery but became tetraparetic after running in a forest. Ventral migration of one of the screws was diagnosed on radiographs (Fig. 3). Strict cage rest in the hospital for 5 days improved the patient's condition. Another dog (case no. 9) had been discharged from the hospital after reaching grade 2, but 53 days after surgery he was attacked by a large dog and became ataxic (grade 3). The radiographs taken after the accident showed breaking of both implants but no significant dislocation in the atlantoaxial joint compared with postoperative radiographs. Patient status improved gradually after cage rest. Ultimately, long-term results were rated good or favourable in 7 cases.

Discussion

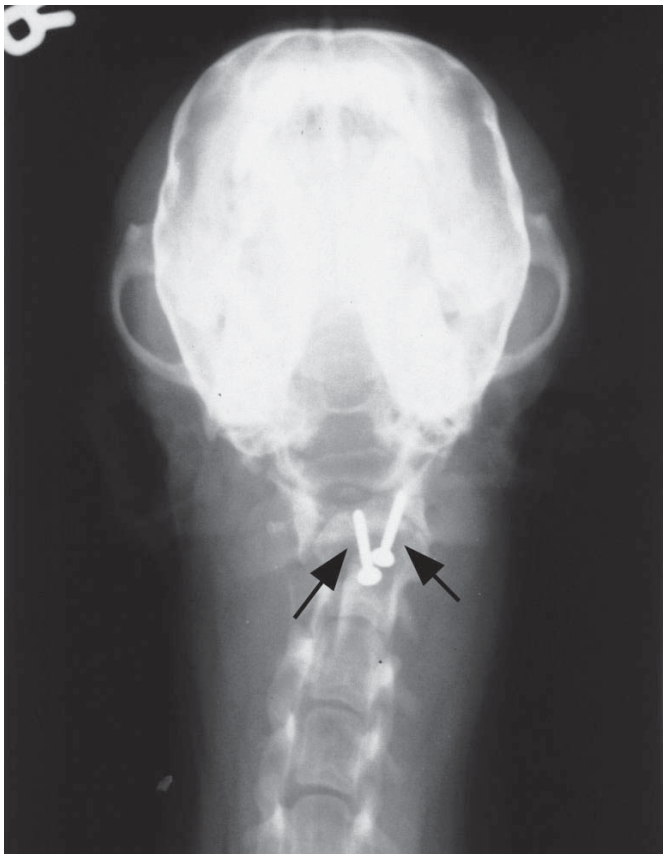
Ventral surgical techniques are widely used for stabilisation of AAS [Denny *et al.*, 1988; Thomas *et al.*, 1991; Schulz *et al.*, 1997; Beaver *et al.*, 2000; Platt *et al.*, 2004; Sanders *et al.*, 2004]. The general principle of stabilisation is to reach permanent stability of two unstable vertebrae. Bone graft harvested from the proximal humerus, together with surgical stabilisation achieves final bony union of the atlas and axis and implants provide the stabilisation until firm union occurs [Sorjonen and Shires, 1981]. In this study, the intervertebral space was not packed with bone graft. The joint space was opened just to confirm the correct position of the two vertebral bodies before implant introduction. Avoiding graft collection reduces surgical time and surgical trauma (humerus is not involved). Postoperative physiotherapy is thus easier. Fibrous connective tissue proliferates from the ventral part of the vertebral body, overlapping the joint space. Fibrous proliferation is independent of bone graft packed into the joint space and provides additional stability to surgical implants [Sorjonen and Shires, 1981]. According to the results of this study, lag screw stabilisation together with fibrous tissue formation connecting two vertebrae could be satisfactory for a

longer period of time. Seventy per cent of patients in this study showed good or favourable long-term outcomes after having been treated with ventral lag screw stabilisation without bone grafting.

A major perioperative complication in AAS surgery is cardiopulmonary arrest. The usual cause is suspected to be iatrogenic trauma to the medulla oblongata and/or the spinal cord during surgery due to excessive manipulation or improper implant placement [Thomas *et al.*, 1991; Beaver *et al.*, 2000]. Suboptimal implant placement, implant failure, and excessive patient movement are the common causes for such complications as did occur in dog no. 1. Other fatal complications (major implant failure, vertebra fracture, exacerbations of motability) in this study occurred postoperatively in 2 immature partients (age at presentation 7 and 8 months, Tab. 1). Lag screw failure was probably the consequence of improper implant positioning, vertebral immaturity or both. Immature patients might benefit from a different surgical stabilisation technique, using pins and/or screws reinforced with polymethylmethacrylate, or even from conservative treatment with a soft padded neck bandage or neck splint until the bone matures [Platt *et al.*, 2004; Sanders *et al.*, 2004; Havig *et al.*, 2005].

Late postoperative complications in 2 patients were associated with traumatic accidents during the convalescence period. Radiological examination revealed unilateral lag screw failure, but did not show exacerbation of AAS. These cases responded well to conservative treatment. Obviously, this study was limited by the small number of patients and the lack of objective histological findings to support the clinical results. Long-term results should therefore be collected in a larger group of patients.

Figure 2d: Ventrodorsal radiograph of a Yorkshire terrier following an accident 5 days after surgery. The left screw is still in the left caudal articular facet of the atlas but has moved out of the axis; the right screw is displaced from the atlas but still in the right cranial articular facet of the axis (arrows).



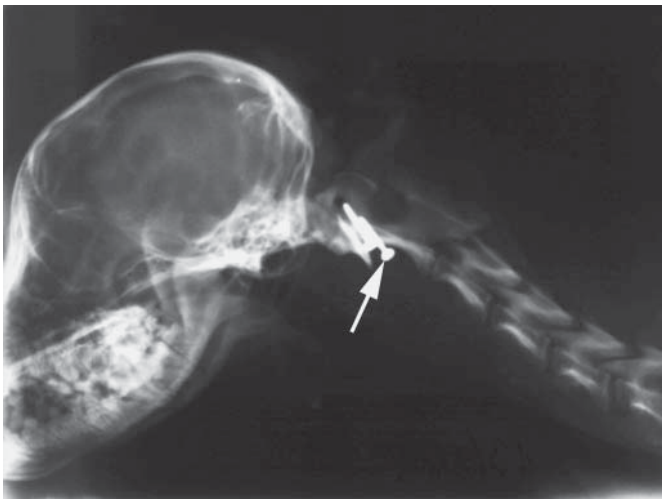


Figure 3: Lateral radiograph of a Yorkshire terrier (case No. 5) following an accident 20 days after surgery. One screw is displaced caudally (arrow). The distance between the dorsal arch of the atlas and the dorsal spine of the axis is normal.

There is probably no one single optimal procedure for the surgical stabilisation of AAS. The choice of treatment is dependent on many factors and is subjective. The ventral lag screw fixation technique seems to be effective in the cases in this study. Nevertheless, the surgical procedure might be complicated if vertebrae are too immature to withstand loads on implants. Stabilised patients can become healthy without permanent bone fusion associated with a bone graft applied to the joint space. Healing, after ventral stabilisation with fibrous tissue proliferation only, provides satisfactory long-term results in patients with AAS. Avoiding bone grafting shortens surgical time and makes postoperative physiotherapy easier.

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REPRINT PAPER (S)

Multiple cartilaginous exostoses in the dog#

A-C. Andersson(1)

SUMMARY

Multiple cartilaginous exostoses (MCE) is an uncommon disorder that typically occurs in growing dogs. It is characterized by multiple cartilage-capped exostoses in bones that develop by endochondral ossification. The condition has been reported in humans, horses, dogs and cats. MCE is considered hereditary in humans. A hereditary basis has also been suggested in the dog. The pathogenesis is unknown but two main theories have been proposed, a dyschondroplasia in the periphery of the growth plates or disturbances of the periosteum. Clinical signs depend on the location and size of the exostoses. The disorder can be clinically silent but can also cause neurological signs caused by compression of the spinal cord or altered limb function and pain. Diagnosis is based on radiography and histopathological examination. Treatment consists of surgical excision of exostoses causing clinical problems. The prognosis should be considered guarded to poor. Malignant transformation of MCE to chondrosarcoma and osteosarcoma has been reported.

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Introduction

Multiple cartilaginous exostoses (MCE) is a bone disease that has been described in man, the dog, the cat and the horse. The disease affects bone that develops via endochondral ossification and is characterized by multiple cartilage-covered exostoses on the surface of the bone. In the dog, the disease is almost always first seen in growing animals, although cases have been described in which it has been detected in older dogs. A hereditary aetiology has been confirmed in man and the horse, and there are indications of a genetic cause in the dog as well. The disease is in itself benign, but the exostoses can give rise to secondary problems such as compression of the spinal cord or growth disturbances in the bones of the extremities.

Definition and nomenclature

Osteochondroma is a cartilage-covered new exostosis that affects developing bones that grow via endochondral ossification. Osteochondroma can be solitary or multiple. The difference between solitary and Multiple Cartilaginous Exostoses (MCE) is only the number of exostoses, while the histological changes are identical [13]. Osteochondroma is not considered to be a true neoplasia but is a result of a developmental disturbance in bone growth. MCE has been described in man, the horse, the dog and the cat [2, 3, 5, 6, 8, 13, 15, 18, 21, 22, 24-32, 34].

At least 15 different terms have been used for the disorder in English [1, 3, 10, 12, 15, 18, 22, 25, 27]. This confusion of terms indicates that the pathogenesis has not been clarified.

Pathophysiology and development

Normal ossification

Insight into normal ossification is necessary for an understanding of the pathogenesis of multiple cartilaginous exostoses (MCE). Ossification can take place in two different ways [16]:

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The author describes the disease complex in the dog by means of a literature study. The article is an abbreviated version of the author's degree work for national specialist competence in diseases in the dog and cat. Supervisor: Lennart Sjöström

* Presented by SSAVA (Sweden)

DIFFERENT TERMS USED IN ENGLISH FOR MULTIPLE CARTILAGINOUS EXOSTOSES

Diaphyseal aclasia/aclasis
Exostoses
Exostosis disease
Hereditary deforming chondrodysplasia
Hereditary deforming dyschondroplasia
Hereditary multiple exostoses
Multiple benign exostoses
Multiple cartilaginous exostoses
Multiple exostoses
Multiple ossifying chondromata
Multiple osteochondromas
Multiple osteogenic exostoses
Multiple osteomatosis
Osteocartilaginous exostoses
Osteochondromatosis

intramembranous (direct) ossification, where bone is created directly from connective tissue without any cartilage stage, and endochondral (indirect) ossification, where a cartilage model is first created that is later replaced with bone.

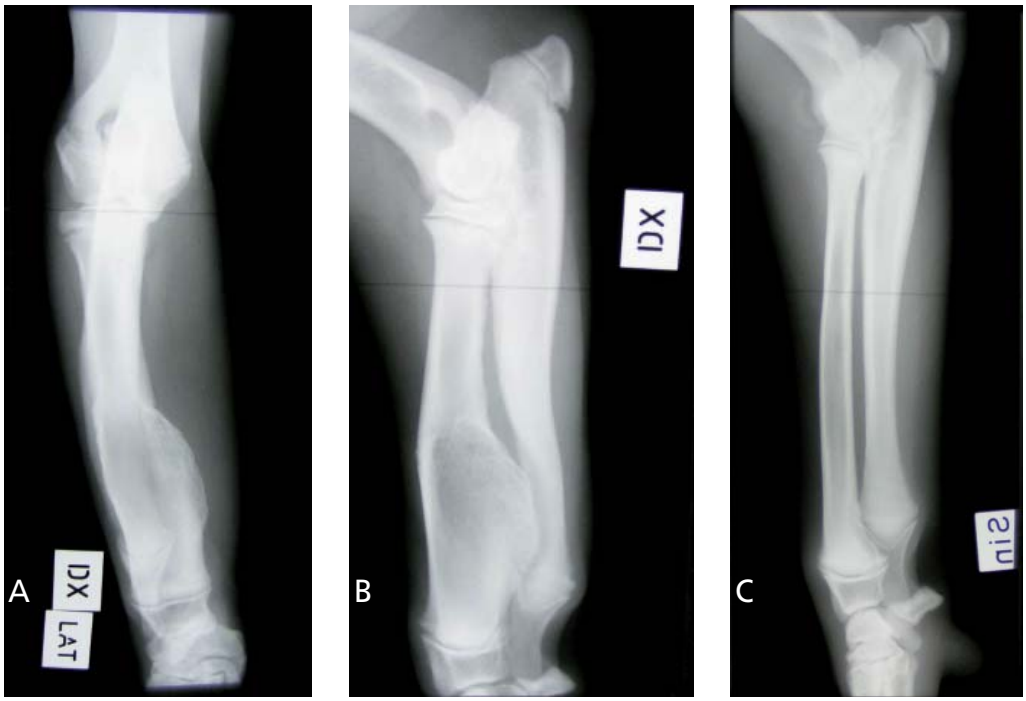
Most of the flat bones in the body, such as the bones of the skull, develop via intramembranous ossification. This type of ossification also contributes to the growth of the of short bones, e.g. vertebrae, and the thickening of long bones. The process takes place in the mesenchyme, where a group of cells are differentiated into osteoblasts. These build a bone matrix that then becomes calcified. Some of the osteoblasts are encapsulated and transformed into osteocytes, which leads to the building of islands of bone in the connective tissue. The process continues until ossification centers have become so large that they come into contact with each other and coalesce. Finally, all connective tissue is replaced by bone tissue [16].

Endochondral ossification is the source of the primary growth of all short and long bones in the body, such as vertebrae and long bones. A model is initially made up of hyaline cartilage that has a shape similar to that of the finished bone. Ossification begins in a primary ossification centre located in the diaphysis. In a later stage of development, ossification also takes place in secondary ossification centres in the epiphysis [16]. In the cartilage model, the first bone tissue is built intramembranously in the area around the diaphysis. Inside this layer of bone tissue, the chondrocytes that make up the cartilage model begin to degenerate. Calcium is deposited and the cartilage matrix becomes calcified. With time, as the chondrocytes disappear, cavities develop in the calcified cartilage. Capillaries grow through the periosteum and penetrate into the cavities. Stromal stem cells, so called osteogenic precursor cells, enter along with the capillaries. They proliferate to osteoblasts that cover the cartilage and begin to produce a bone matrix. The bone matrix gradually becomes calcified. Some of the osteoblasts transform into osteocytes. In this way, bone develops around the calcified cartilage residues, which will then successively be resorbed by cells that are similar to osteoblasts.

Cartilage will remain in the epiphysis on two levels, articular cartilage and cartilage in the growth zone. The longitudinal growth of long bones takes place by a proliferation of chondrocytes in the growth plate. Calcification takes place at the same time and, later, ossification of the part of the growth plate located closest to the diaphysis. As prolification and ossification take place at the same pace, there is no change in the thickness of the growth plate, but the bone becomes longer [16].

Pathophysiology of multiple cartilaginous exostoses

MCE in dogs arises only in bones that develop via endochondral ossification. The vertebrae, ribs, long bones, scapula and pelvis are areas of predilection [2, 13, 27, 32]. The bones of the skull and jawbones are not affected because they develop intramembranously [27]. Cartilaginous exostoses have also been described in the trachea [2]. These cases should however be



Figures 1A 1B 1C Radiological pictures of a five month old male Rottweiler diagnosed at the Referral Animal Hospital in Strömsholm with multiple cartilaginous exostoses. This is the first case of the disorder registered in Sweden. 1A shows the right radius and ulna, cranio-caudal projection. Cartilaginous exostosis are seen in the radius, with a shortening and deviation of the radius and ulna. 1B shows the right radius and ulna, lateral projection. For comparison, 1C shows the left radius and ulna, lateral projection, which is the healthy bone.

differentiated from MCE as a disease entity and instead be termed tracheal cartilaginous exostoses [32].

Two primary theories

The exact pathogenesis of MCE is not known, but two primary theories have been presented: the first describes the cause to be a dyschondroplasia in the periphery of the growth plates. Different concepts have been reported for the mechanism of the dyschondroplasia. Some authors believe that a defect in the perichondrium that surrounds the growth plate leads to the chondrocytes from the periphery being able to build a structure that resembles a growth plate [11, 15, 22, 27]. Other authors suggest that physical stress or a biochemical defect in the synthesis of the cartilage matrix can cause a proliferation in the outer parts of the growth plate, which results in the chondrocytes losing their ability to hold together here. [27].

The other primary theory rests on the concept that a disturbance in the periosteum leads to chondrocytes taking on a change in polarity, which results in an abnormal orientation of the growth of the bone. The mechanism behind this disturbance is not clear [15, 27]. Exostoses are covered by a membrane that is connected to the periosteum. Growth of exostoses takes place primarily via the development of chondrocytes from this membrane. There is also a growth of cartilage inside the exostoses. The cartilage gradually becomes ossified via endochondral ossification. The structure and function of an exostosis is similar to a growth plate [26, 27]. When the exostoses are located in the growth plates, they can disturb the normal growth, often resulting in an abnormal longitudinal bone axis.

In dogs, growth of the exostoses most often stops when skeletal growth is complete [27].

Hereditary factors

In humans, MCE is a disorder with an autosomal dominant hereditary cause [17]. The aetiology of MCE in the dog is not known, but there are indications of a hereditary factor in this case as well. However, there are different ideas as to how significant this factor is [2, 6, 8, 11, 15, 18, 21, 22, 23, 24, 25, 26, 27, 29, 31, 32, 34]. The disorder is considered to be virus-related in cats [18, 22, 26, 27, 32]. A disorder similar to MCE has been reported in experimental rats, but in these cases it was considered to be a true tumor disease since it affected older rats and the exostoses showed progressive growth. There were no signs of infection or hereditary predisposition [14].

Malignant transformation

A malignant transformation of MCE to osteosarcoma or chondrosarcoma has been described [30]. In humans, the risk of development to chondrosarcoma is considered to be 5 to 25 percent [13, 17]. In a case report of eight dogs with MCE, three developed chondrosarcomas [8]. Malignant development of MCE has been reported only in dogs older than seven years. Continued growth of the exostoses, despite a fully developed skeleton, is a sign of malignancy [15].

Incidence

The incidence of MCE in dogs has not been reported. The disorder is thought to be unusual, but there are probably more cases than have been diagnosed. Some dogs with MCE are without symptoms, and the disorder can thus remain undetected [6, 26, 27]. There is no evidence of gender predisposition. Terriers are over-represented among the cases reported [15, 23]. MCE, as mentioned, is primarily a disorder that is detected in growing dogs, up to about 18 months of age [27]. However, the disorder has been first diagnosed in older dogs [3, 15, 27, 30]. In a review of case reports of MCE, 30 percent of the dogs were between three and seven months, 39 percent were between four and 13 months and 30 percent were older than 13 months when the disorder was detected [15].

Symptoms

Dogs with MCE can sometimes be completely without symptoms, and the disorder can remain undetected during the dog's entire life or be detected as an incidental finding in examinations of other kinds. The symptoms are completely dependent on the location and size of the changes. Exostoses that start in the vertebrae can cause a compression of the spinal cord or nerve roots, which can cause neurological symptoms such as pain, weakness, ataxia, dysmetria, a decline of proprioception and paresis or paralysis. Exostoses located in the extremities tend to be located at the ends of the diaphyses or in the metaphyseal region, while epiphyses are never involved [27]. The exostoses can exert pressure on tendons, muscles, vessels and nerves and thereby cause pain and impaired function (Figure 2). Growth disturbances with abnormal longitudinal bone axes can cause impaired function in the extremity affected [6, 11, 26, 27, 32].

Most owners of dogs with the disorder seek veterinary advice because they have noticed one or more protuberances on their dog's skeleton. Contact with the veterinarian is in some cases first made when the dog has started to experience problems in terms of pain, limping or progressive paresis. Most MCE patients are otherwise completely healthy. In palpation of the skeleton, one or more protuberances can be palpated along the ribs and/or on the extremities. Changes in the vertebrae can sometimes also be palpated, even though these are usually more difficult to feel [27].

Diagnostics

A probability diagnosis can be made on the grounds of medical history together with clinical and radiological findings. A definite diagnosis requires histopathological examination of the exostosis [5, 6, 11].

Blood sample analyses

Dogs with MCE most often have normal values at blood sample analysis. Serum values for calcium, phosphorus and alkaline phosphatase are also usually within normal limits [11].

Radiological investigation

X-ray investigations of the entire skeleton, especially the vertebrae, ribs and long bones, are important to be able to visualize and establish the location and size of all changes [15]. An overall judgment of this kind is necessary for prognosis, and prior to any surgical intervention, so that no changes are neglected that can lead to future problems. In the case of

changes in the spine, it is important that myelography is done, as subclinical compressions can cause problems at a later stage if the exostosis grows [2].

Multiple cartilaginous exostoses can be seen radiologically as pedunculated or non-pedunculated growths of varying sizes from the surface of the bone.
The changes have a smooth, even contour and are dominated by bone density mixed with less radiopaque areas of hyaline cartilage which has approximately the same radio-opacity as soft tissue [11, 35]. Changes located in the ribs generally have more irregular edges and an unstructured mixture of bone-dense and less radio-opaque areas, while changes in long bones and vertebrae usually have a more organized appearance [33, 34]. Signs of neoplastic transformation are that the exostosis begins to lose its smooth contour, and at the same time bone destruction and/or bone production can be seen inside the exostosis [27].

MRI

MRI (magnetic resonance imaging) can be used to evaluate the degree of compression an exostosis has caused on the spinal cord or soft tissue before performing a surgical intervention. MRI can also be used to confirm a possible malignant transformation to chondrosarcoma or osteosarcoma. MRI can be used to measure the thickness of the cartilage cap. An increase in this is a sign of malignancy [13, 30].

Histopathological examination

Osteochondromas are covered by a perichondrium that is connected to the periosteum of the original bone. Under the perichondrium is an outer cap of hyaline cartilage. In osteochondromas in the process of growth, the cartilage resembles a growth plate and bone is produced by endochondral ossification, but islands of cartilage can often be seen in the bone tissue (Figure 3). Trabecular bone that constitutes the base of the change is completely connected to the tissue in the original bone [9, 32]. In active osteochondromas, in the process of growth, the cartilage cap is clear, while it can sometimes be very thin or lacking completely in mature changes [32]. Biopsies must be taken in a correct way to be able to make a correct diagnosis. The biopsy must contain both the cartilage shell, which can be recognized by its blue-white colour, and the underlying bone to be able to diagnose a cartilaginous exostosis [6]. If the biopsy is taken tangentially through the cartilage shell in an actively growing exostosis, an incorrect diagnosis can be made since the change then looks like a chondrosarcoma [26, 32].

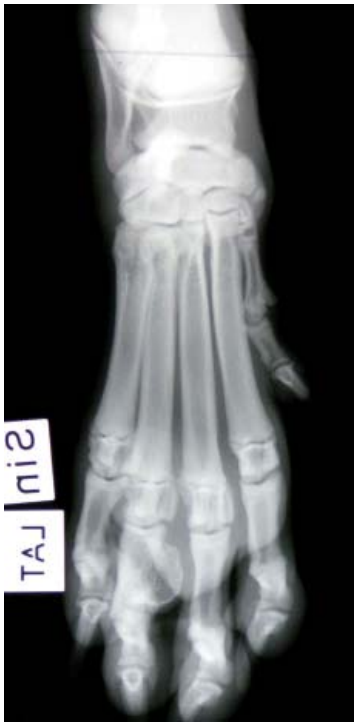


Figure 2. Left front paw, cranio-palmar projection, in the related Swedish case. The cartilaginous exostosis is seen medially in the first phalanx, fourth toe. The exostosis can exert pressure on tendons, muscles, vessels and nerves and cause pain and impaired function.

Differential Diagnoses

MCE can be differentiated from other skeletal changes by age at appearance, clinical symptoms, results of blood analyses, radiological appearance, location and histopathological appearance [15]. In the case of synovial osteochondromatosis, growth of new bone and cartilage occurs in synovial tissue, i.e. in joints, tendon sheaths and bursae [13]. However it is not difficult to differentiate these diseases clinically as MCE never involves the epiphyses. Furthermore, synovial osteochondromatosis occurs in dogs of middle age [15]. Osteomyelitis, osteosarcoma and giant cell tumors are bone changes that can sometimes be radiologically similar to multiple cartilaginous exostoses, but the histopathological appearance can confirm the diagnosis [1]. Disseminated idiopathic skeletal hyperostosis, fluorosis and hypervitaminosis A are other disorders that are characterized by benign exostoses. Hyperostosis occurs in middle aged to older dogs and has a different histopathological appearance than multiple cartilaginous exostoses. Fluorosis is caused by chronic fluorine poisoning and is very rare. Hypervitaminosis A causes exostoses only in cats [15]. Differential diagnoses in the case of neurological symptoms caused by spinal cord compression are congenital malformations and disturbances in the development of the vertebral column, trauma, inflammation, calcinosis circumscripta, disc prolapse and neoplasia [4, 23, 30]. Examples of other diseases that, like MCE, can cause delayed and/or incorrect growth are pituitary dwarfism, congenital hypothyroidism, juvenile diabetes mellitus, malnutrition, portosystemic shunt, congenital kidney impairment, congenital heart disease and skeletal dysplasia. These diseases can be excluded, primarily on the grounds of clinical, radiological and laboratory findings [22].

Treatment

Treatment of MCE is only necessary when the changes affect the animal's function, such as in the case of pain, impaired movement, growth disturbances or neurological symptoms [23]. Multiple cartilaginous exostoses should also be treated if there is a suspicion of malignant transformation [27]. Treatment is based on surgical removal of the changed tissue. Dogs with asymptomatic MCE are most often not treated surgically as the changes in themselves do not cause pain and as they most often cease to grow when the skeleton stops growing [23]. There are however advantages of early excision of exostoses. When the

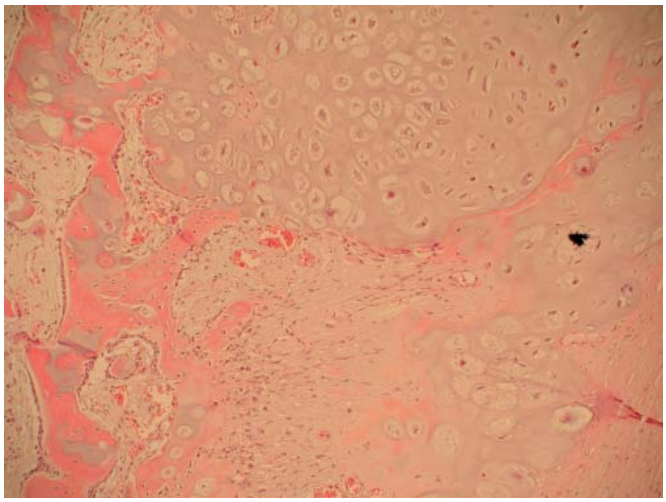


Figure 3. Histological section of the Swedish case. An inappropriate growth of cartilage and thus bone (subperiosteal cartilage dysplasia and endochondral ossification with islands of cartilage, focal fibrosis and medullary tissue between the trabecula). H&E, 34 x magnification.

changes are small, the intervention is less extensive, injuries in surrounding tissues are smaller and the risk of malignant transformation decreases [2].

In the treatment of multiple cartilaginous exostoses in vertebrae, decompression is performed by laminectomy. If larger areas must be removed, there is a risk of instability that for example can lead to fractures of the vertebra. To decrease the risk of complications after laminectomy, stabilization of the spinal column can be performed, particularly if the intervention is made in the cervical and lumbar area and if it is a large dog [23, 29]. Dogs with MCE should not be used for breeding because of the suspicion of hereditary factors [6, 11, 31].

Prognosis

Despite the fact that osteochondromas are benign changes, the prognosis is in most cases guarded to poor [15, 32]. In a review of published cases [32], eight of 21 cases were euthanasia was performed before the age of one year because of a progression of clinical signs. Malignant transformation occurred in five of the six cases that survived to the age of six [32]. In patients that have already developed signs, the prognosis depends of the number of exostoses, where the changes are located, how serious the signs are and the possibility of surgical excision of the exostoses. If the diagnosis is made in young dogs with many changes, the prognosis should be guarded. Even though surgical treatment can alleviate the discomfort the dog has at the time, the clinical course of remaining changes can never be predicted. A good prognosis is given in a dog that will soon have grown to its full size and whose signs come from an operable change [11, 27]. If the dog is fully grown at the time of the diagnosis and does not have clinical signs, the prognosis is good. There is however always a small risk that osteochondromas can become malignant at a later stage, and the owner should be informed of this.

Multiple Osteochondromatosis in Cats

The disorder that is called MCE in cats is very different from the disease in dogs, and it can be discussed whether it is in fact the same disorder. It occurs only in cats whose skeletal growth is complete, primarily at an age of two to four years, but there have been reports of cases from 16 months to eight years [19, 20, 25, 26, 27, 32]. It is considered to be acquired, and there is no evidence of it being hereditary [18, 22, 26, 27, 32] or of a predisposition of either sex or of any breed [18, 26, 27, 32]. Exostoses can be found on all types of bone, both that which is produced endochondrally and that produced intramembranously. The most common areas affected are the bones of the skull, scapula, vertebrae, ribs, sternum and pelvis [22, 26, 27]. However, long bones are seldom involved [25, 27]. MCE in cats, in contrast to MCE in dogs, has a progressive growth, which is a sign of "true tumours" [26, 27, 32]. The incidence of MCE in the cat is not known, but the disease is probably less common in cats than dogs.

The pathogenesis has not been established with certainty, but there is much that indicates that the disease is virus-related. Virus particles similar to the agents that cause feline leukaemia (FeLV) and feline sarcoma (FeSV) have been found in the cartilage cap on the exostoses. Hematogenous spreading of virus to the periosteum in random locations has been suggested as an explanation for the localization in cats being different from that in dogs with MCE [26, 27, 32]. Cats with the disorder should be considered FeLV-positive until proven otherwise [19]. Cats with MCE are initially free of signs. As the changes grow, they cause pain, muscle atrophy and functional disturbances [25, 32]. Diagnostic measures are the same as in dogs. The definite diagnosis is made by histopathology. The histopathological appearance occasionally differs somewhat from that seen in dogs [26, 32]. There is no treatment for MCE in cats because most are FeLV-positive. Surgical treatment most often gives only temporary alleviation owing to recurrences or occurrences of new changes [27]. The prognosis for cats with MCE is poor because the course of the disease is progressive [26, 27, 32]. From the time that the cat has begun to show symptoms, the survival time is usually a maximum of one year. A malignant transformation to osteosarcoma and perhaps chondrosarcoma occurs in some cats [27].

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REPRINT PAPER (D and CH)

Gastric emptying – physiology, pathology, diagnostic procedures and therapeutic approaches in the dog

S. Schmitz[(1)], *R. Neiger*[(1)]

SUMMARY

Gastric emptying disorders in the dog may be primary or secondary to various underlying diseases. Understanding the physiology of gastric motility and knowledge of the main influences and regulatory mechanisms as well as the main differential diagnoses of delayed gastric emptying are vital to finding the right diagnosis and providing adequate treatment.

This article therefore not only reviews physiological and pathological processes of the stomach, but gives an overview of diagnostic modalities and different treatment options in gastric emptying disorders.

Keywords: Gastric motility, gastric emptying time, scintigraphy, breath test, prokinetic agents

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Physiology of gastric motility

Gastric emptying is defined as the process by which food particles are transported from the antrum of the stomach into the proximal duodenum. It therefore allows optimal absorption of transported nutrients. [1] Gastric emptying of solid food particles is of greater interest to the veterinary clinician than liquid phase gastric emptying, as disorders of this phase are clinically more relevant and difficult to detect [1].

The canine stomach can be divided into three anatomically distinct regions (fig 1): gastric fundus, body and pyloric antrum. The Fundus and the body are a functional entity and are often named the "gastric store", whereas distal parts of the body and the whole antrum with its wave-like peristalsis represent the gastric pump that effectively transports food particles into the duodenum. [2]

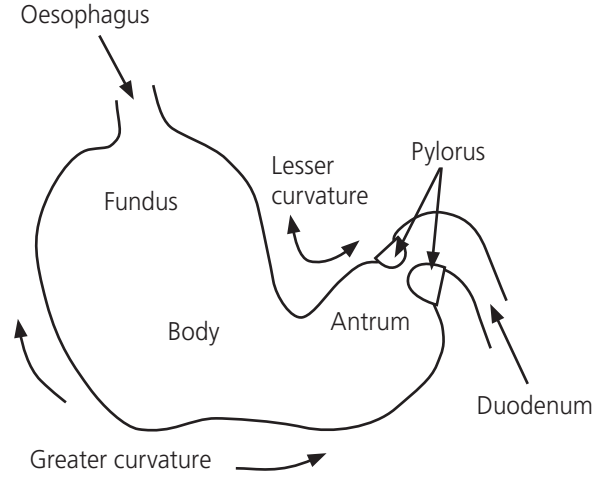

Fig 1. The canine stomach

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The gastric store:
The inner pressure of the stomach rises only a small amount during filling due to reflex relaxation of the smooth muscles and not only passive streching. [2]
There are 3 forms of *gastric relaxation:* a) the receptive relaxation, that occurs during chewing and swallowing and is mediated via mechanoreceptors in the oral cavity and pharynx; b) the *adaptive relaxation*, that ensures adaptation of the smooth muscle cells during the filling process via tension receptors; and c) the *feedback relaxation*, coordinated from the small intestine, which ensures that gastric emptying is adapted to the type and amount of food which empties into the duodenum.

The gastric pump:
The wall of the antrum consists of several layers of smooth muscle in circular and longitudinal bands The muscle cells in this area are able to cause regular cyclic basal depolarisations (so-called "pacemaker potentials") which, triggered by faster and deeper depolarisations called "electrical response activity", lead to contractile waves of the body, antrum and pylorus.
As the waves move aborally, the pressure and amplitude of the contractions increases. As a result, only the superficial semi-solid, acidic and partly digested portion of the food bolus is transported into the small intestine, while the more alkaline inner portion remains in the stomach for further digestion [2,3].

Gastric emptying and the Migrating Motor Complex (MMC):
There are three consecutive phases of gastric motility which lead to emptying of the stomach: a) the *phase of propulsion*, b) the *phase of emptying and mixing* and finally c) the *phase of retropulsion and "trituration"* [1]. While the proximal part of the antrum contracts, gastric content are transported into the relaxed distal part (phase of propulsion). When the peristaltic wave has reached the middle of the antrum the pylorus opens partially, and duodenal peristalsis is blocked so that the food can pass into the small intestine. In this phase of emptying and mixing the peristaltic wave is still some distance from the pylorus, so that the food is not pressed into the duodenum by force, but rather "flows" into it. Because liquids flow faster than viscous and solid contents, there is a sieving process at this stage, where small particles, suspended in liquid, pass through the pylorus, while the more solid food remains in the stomach (fig 2).
As the pylorus closes, particles too large to pass through the pylorus (> 2 mm in the dog) are propelled back into the body of the stomach. [1] This jet-like phenomenon causes a very strong mixture and trituration of food particles. By this mechanism, digestible food particles are reduced in size so that they can be emptied with the next peristaltic wave.

Larger particles which cannot be further reduced in size can still be emptied from the stomach. This does not occur during normal postprandial peristalsis, but during an interdigestive pattern of gastrointestinal motility. The so-called migrating motor complex (MMC) is found only in humans and dogs. It starts with a band of intense contractile activity (Phase III) which is followed by a period of relative quiescence (Phase I) and then a period of irregular activity (Phase II) [4].

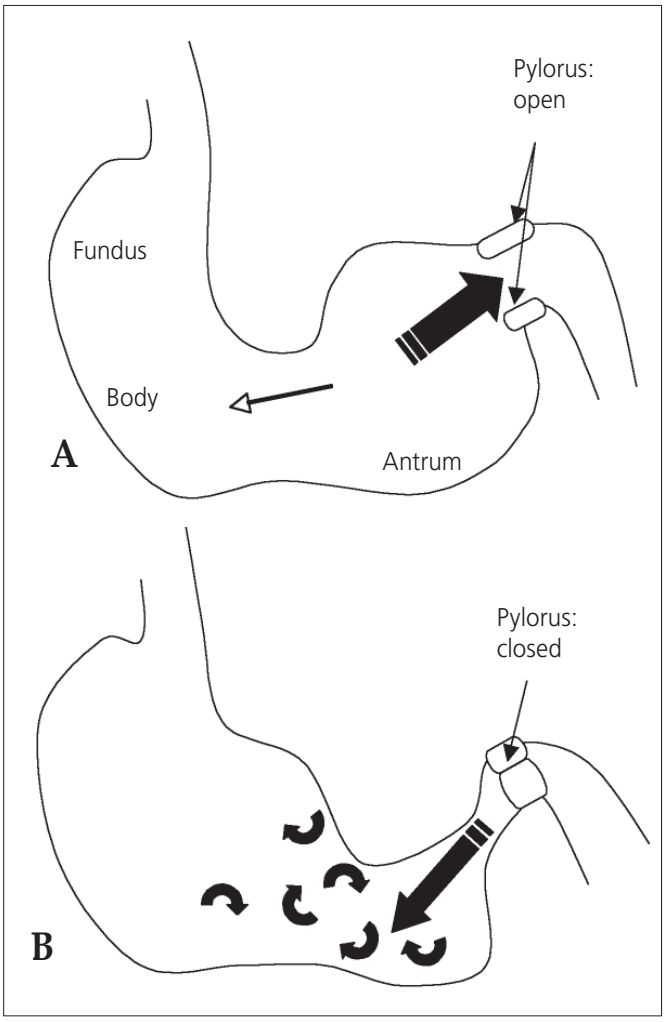


Fig 2: Phases of gastric emptying
A: phase of emptying and mixing
Bold arrow: transpyloric flow
Thin arrow: larger particles are propelled back
B: phase of trituration
Bold arrow: jet-like backflow leading to mixture (smaller arrows)

Influences on gastric emptying

Gastric emptying is associated with a number of exocrine and endocrine functions of the stomach and is influenced by a variety of physiological, pharmacological, dietary and pathological factors. Emptying of liquid contents differs sigificantly from highly viscous [5] or solid food and is highly dependent on calorie content of the ingested meal [6].
Liquids like water or isotonic saline are emptied in an exponential pattern without evidence of a lag phase. In contrast, solid food is emptied with a lag phase of varying length (depending on the need for "trituration" of the ingesta) and follows a more linear pattern afterwards [7]. The temperature of the meal plays a role; fluids at about 37° C are emptied faster than very cold (4° C) or warmer (50° C) ones [8].
Regulation by the autonomic nervous system plays a central role in gastric emptying and in coordination with intestinal motility. Parasympathetic effects enhance motility (via acetylcholine),

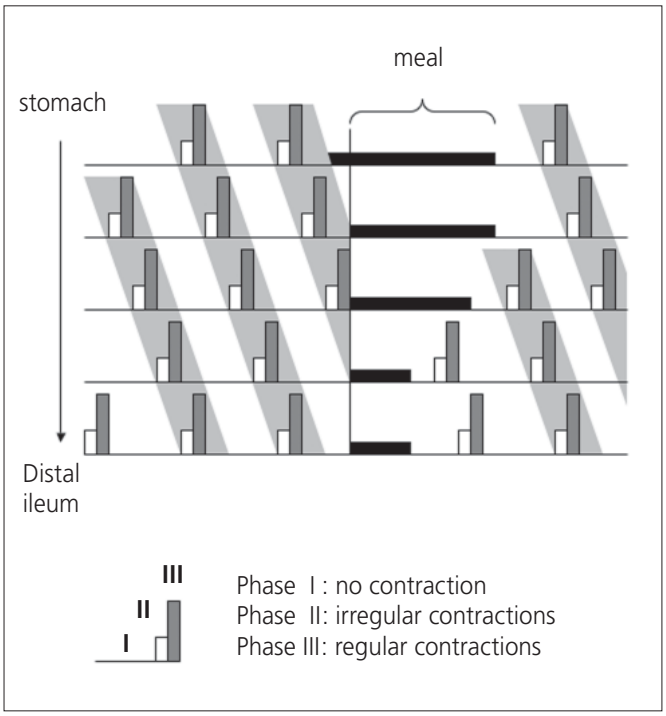


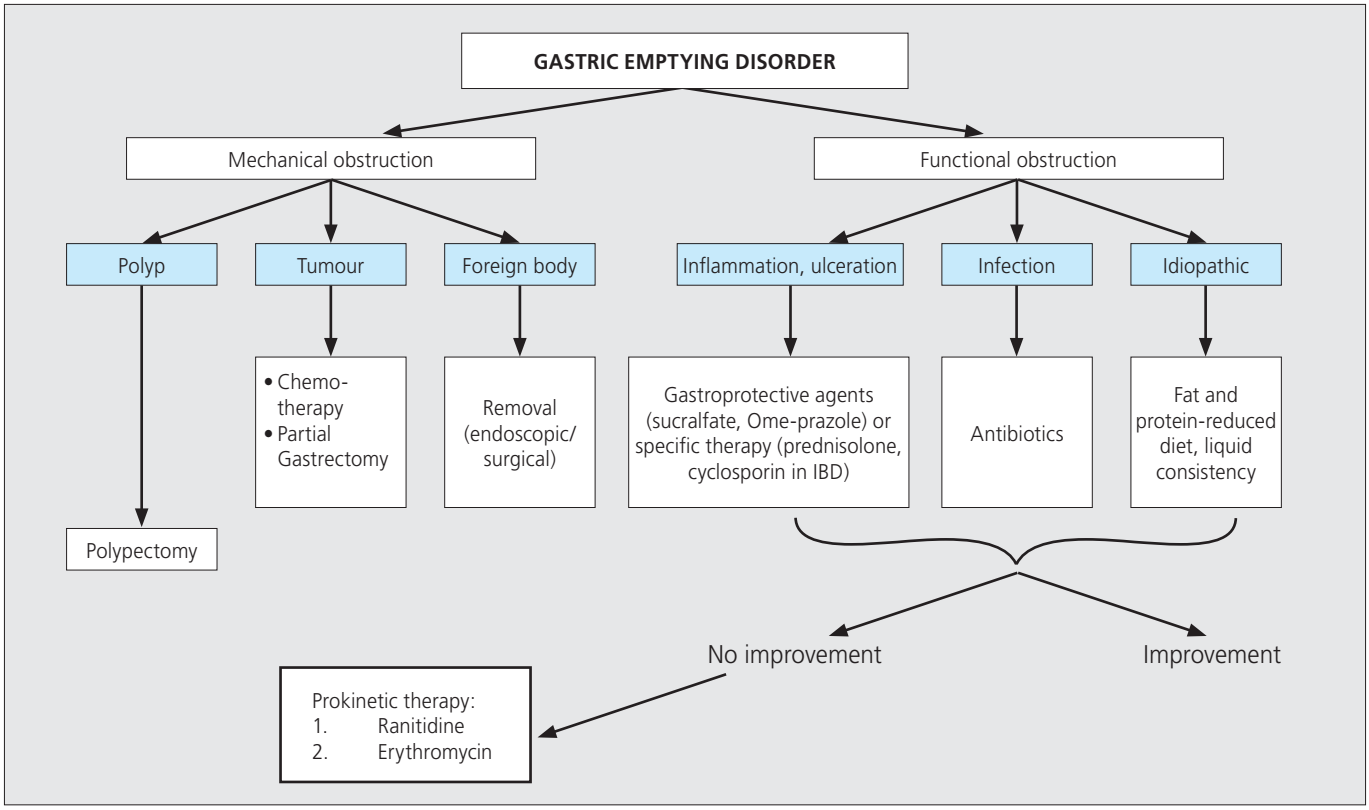
Fig 3. Migrating Motor Complex (MMC)
Contractions move aborally in regular intervals. Following ingestion of a meal, they are aborted completely and start again after postprandial motility has subsided (after Ganong, 2004).

whereas sympathetic stimuli block contraction (via adrenaline and noradrenaline).
Postsynaptic α1-receptors lead to contraction of the pylorus and ß-receptors induce relaxation of the gastric smooth muscle [2,9].
Besides classical neurotransmitters, there are a number of gastrointestinal peptides which are produced in the distal parts of the small intestine and have regulating effects on gastric emptying (feedback mechanism). Examples are peptide Y, enteroglucagon, galanin, gastric inhibitory polypeptide (GIP), gastrin, ghrelin, glucagon-like peptide 1 (GLP-1), vasoactive intestinal peptide (VIP), cholecystokinine (CCK), substance P, neurotensin and somatostatine [10,11]. The most important substance seems to be CCK. It is produced by the I-cells in the duodenal and jejunal epithelium and is transported haematogenously to the stomach, where it causes relaxation. CCK-receptors of afferent vagal fibres are stimulated [2,9].

Delayed gastric emptying

Disturbed gastric emptying is a relatively frequent finding in the dog [12]. It is the result of pathological processes which inhibit normal function of the stomach (storage, mixture, and emptying of food particles). Obstructions can be either mechanical or functional (fig 4). Morphological changes (eg. neoplasia, hyperplasia, foreign body) cause delayed gastric emptying via mechanical obstruction. Diagnosis of such a process is usually direct and uncomplicated (fig 4). By contrast, diagnosis and therapy of functional problems (ie. pathological processes in the myenteric plexus, the smooth muscles of the stomach or disturbances of antropyloroduodenal coordination) is much more difficult.
A number of primary causes of functional obstruction have

Fig 4.: Causes and therapy of gastric emptying disorders (modified from Washabau et al., 2003)
IBD = inflammatory bowel disease



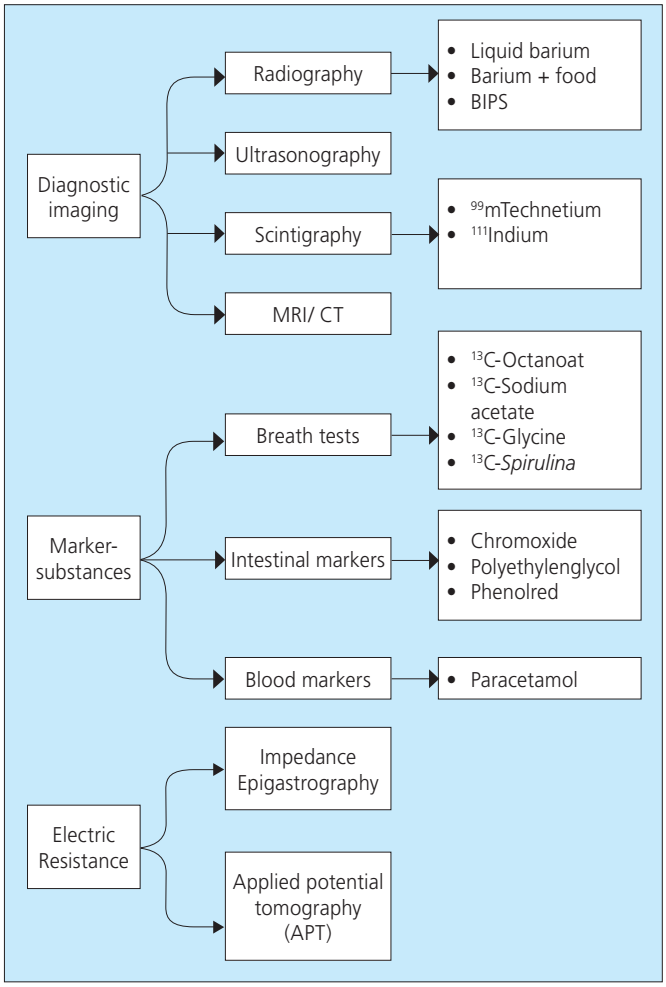
been described, for example infectious or inflammatory diseases (Washabau, 2003), peptic ulcers [13] or gastroparesis after pyloroplasty [14].

Secondary causes of gastric emptying disturbances include electrolyte disturbances with their multiple causes, metabolic diseases, drugs (anticholinergic drugs, adrenergic antagonists, opiod agonists), acute stress, septicaemia, pancreatitis, radiation-induced vomiting and acute intra-abdominal inflammatory processes [12]. Surgical correction of gastric dilation and volvolus is nearly always accompanied by significant delayed gastric emptying, induced by myoelectrical and motor abnormalities. Other studies suggest that delayed gastric emptying is also a significant factor in the pathogenesis of gastric dilation and volvulus [15]. Influence of body weight on gastric emptying has been studied intensively, but results are controversial: one study found a significant impact of body weight on gastric motility [16], another showed no difference in gastric emptying times between large and small breed dogs [17].

Diseases of the large intestine (eg. colitis and inflammatory bowel disease) can also influence gastric emptying negatively via reflex mechanisms [18].

Delayed gastric emptying has also been observed in dogs with experimentally-induced diabetes mellitus [19] and rare diseases such as chronic pyloric hypertrophy and dysautonomia [12].

Fig. 5: Methods of assessing gastric emptying in the dog
MRI: Magnetic resonance imaging
CT: Computed tomography



Methods of assessing gastric emptying times in the dog

The methods used to examine gastric emptying in the dog which have been used so far are summarised in figure 5.

1. Diagnostic imaging procedures

Radiography

Radiographic and fluoroscopic methods are used most frequently to assess the passage of a radio-opaque meal through the gastrointestinal tract (Wyse *et al.*, 2003). Different radio-opaque test meals have been used, eg. liquid barium with or without food [14,20] or BIPS© ("barium impregnated polyethylene spheres") [1]. BIPS© are available in different sizes (1-3 mm and 5 mm diameter). They can be given orally and are thought to simulate the liquid and solid phases of gastric emptying.

During contrast studies lateral and ventrodorsal images of the abdomen are usually obtained over a time period of 4-12 hours [1]. Gastric emptying can be estimated visually or by counting the BIPS© that remain in the stomach. Unfortunately, these contrast media are neither chemically nor physically identical to normal food, limiting interpretation of these contrast media studies in respect to functional gastric emptying. In addition, the poor palatability of the liquid barium or BIPS© may make force feeding necessary, which can itself influence gastric emptying.

Contrast studies are therefore acceptable to assess gross abnormalities for example defects in the gastrointestinal mucosa, obstructive processes or to visualise foreign bodies, but correct assessment of gastric emptying times is difficult [1].

Endoscopy

Gastroscopy is not useful in assessing gastric function and motility. Structural abnormalities, ulceration, foreign bodies and (via biopsies) inflammatory infiltration can be diagnosed, but functional assessment of gastric emptying or pyloric tonicity (as for example in pyloric stenosis) is not possible [1].

Ultrasonography

In human medicine, good correlation between ultrasonographic and scintigraphic measurements of gastric emptying of liquids has been shown [21]. These measurements are based on the assessment of antral volume, a technique that is not perfomed routinely in veterinary medicine and requires some experience with ultrasonographic interpretation. In addition, these measurements are influenced by retrograde flow of gastric contents during the process of mixing and sieving and can be difficult when gas is present in the stomach [1].

Recent studies in the dog have nonetheless shown that ultrasonography may still be a useful tool in assessing gastric emptying [22]. Ultrasonography is widely available in veterinary practice and is non-invasive. However standardised methods are still lacking and reference values are currently not available to make ultrasound a reliable tool in diagnosing gastric emptying disorders.

Magnetic resonance imaging/ computed tomography

Magnetic resonance imaging (MRI) to study gastric emptying is under intensive investigation in human medicine at the moment. Some recent studies show good results [23]. MRI has not been

described in the dog for this purpose, and because sedation or anaesthesia would be necessary in the veterinary field, it may be not ideal, because anaesthesia itself might influence gastric emptying.
In human medicine another technique is also used: single-photon emission computed tomography (SPECT). [24] This method is an alternative to conventional scintigraphy, as it also uses radio-isotopes (^{99m}technetium and/ or ^{111}indium). The authors are not aware of a study in veterinary medicine using this method.

Scintigraphy
Scintigraphy is considered the gold standard method to assess gastric emptying in the dog [1]. It was firstly described in 1966 [25] and has been used in a variety of species. A radio-active substance is given with normal food or a special test meal (eg. an omelette) is prepared individually for each test. Reduction of radio-activity in the stomach is assessed over time. ^{99m}Technetium is used most frequently because it has a relatively short half life (6 hours) and because it is not absorbed from the gastrointestinal tract. ^{111}Indium is used less frequently but may be useful to assess liquid and solid phase gastric emptying simultaneously since it emits gamma rays of different wave lengths (dual isotope technique) [1].
Availability of scintigraphy is limited by the need for specialised equipment (gamma camera, safety area) and personnel and is also regulated strictly by the law. Up to now it is therefore restricted to larger clinics and universities.
A study by one of the authors [26] shows a weak correlation between scintigraphic measurements of gastric emptying and breath test analysis in the dog. In addition, only a weak correlation could be found between serial scintigraphies in the same individual dogs. Definition of normal gastric emptying times in the dog seems difficult and multiple influences for example individual day-to-day variations in gastric emptying and technical difficulties have to be taken into account.
Due to these variations, scintigraphy has to be interpreted with caution and, although it may be a useful standard to compare other methods with, has its drawbacks.

2. Marker substances
In general different marker substances can be used to assess gastric emptying directly (by measuring the amount of an undigestible marker in gastric or duodenal contents) or indirectly (by measuring a substance that has previously been absorbed in the small intestine in blood serum or exhaled breath).

Breath tests
In the last decades breath tests have successfully been used in human medicine to measure gastric emptying times [27]. They have also been used quite frequently in the dog [1,16,17,22]. To perform a breath test, a stable carbon isotope (usually ^{13}C) bound to a carrier subtstance (octanoic acid or sodium acetate) is given mixed with a test meal. The ingested amount of ^{13}C is quickly absorbed in the duodenum after leaving the stomach. It is metabolized to $^{13}CO_2$ in the liver and is exhaled in the breath. Serial breath samples are obtained using a face mask or a tube and the amount of exhaled $^{13}CO_2$ in comparison to the normal $^{12}CO_2$ is measured and can indirectly give information about the duration of gastric emptying (fig. 6).

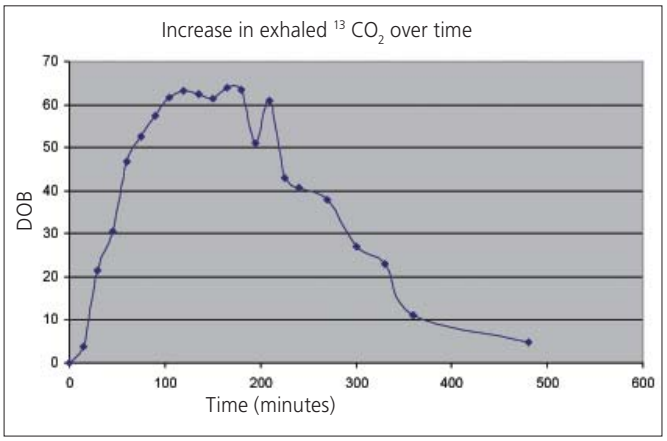


Fig 6.: Increase in the exhaled $^{13}CO_2$ in a dog during breath test analysis to assess gastric emtpying times (after ingestion of $^{13}CO_2$-sodium acetate at time point 0).
DOB = delta over baseline values, where delta is the difference between 12C and 13C measured in the exhaled breath samples. The first value measured is used to set the "baseline" and all following values are expressed as delta over baseline values.

To measure $^{13}CO_2$ in the breath, mass spectromety or infrared spectroscopy are used [1]. In the dog, ^{13}C breath tests have been compared to ultrasonographic measurements of gastric emptying and a good correlation was found [22].
A recent study [26] shows a weak correlation between ^{13}C-sodium acetate breath test and scintigraphy. Further studies are necessary to assess the value of these kinds of tests in routine diagnostics. Performing breath tests may be a good alternative for everyday veterinary practice in comparison to more invasive methods.

Plasma tracer
The paracetamol (acetaminophen) absorption test has been performed to assess gastric emptying of liquids and solids in the dog [19]. Acetaminophen is not absorbed in the stomach, but rapidly in the duodenum and does not influence gastric emptying. Serial blood samples are necessary to get an absorption pattern, so that indirect assessment of gastric emptying is possible. The paracetamol absorption test has been compared to scintigraphy in humans and has also been used to study several prokinetic drugs [19,28]. Advantages of this test include the simple test protocol; it is easily done in veterinary patients. Acetaminophen itself is stable and can be measured routinely in blood samples [29]. Disadvantages are the requirement of multiple blood samples over a certain period of time as well as the fact that abnormal intestinal and liver function (site of metabolism) can influence the results.

Non-absorbable marker substances ('intestinal marker')
After ingestion of non-digestible substances, serial samples of gastric and intestinal contents can be used to calculate gastric emptying times. This has been done frequently in dogs in experimental dogs. The samples have been obtained either via nasogastric tubes or permanent gastric or duodenal fistulas or catheters [30,31]. To assess solid phase gastric emptying, undigestible particles, freeze-dried food and chromoxide have been used. Emptying of liquid contents has been examined

with polyethylene glycol and phenolred. These studies have provided useful information about physiological processes in the gastrointestinal tract, but because of their invasive nature are not eligible for everyday use in the clinical patient [1].

3. Measurement of electrical impedance

Gastric emptying rate can be assessed via changes in the electrical impedance during contraction of the stomach. Similar to an electrocardiogram, surface impedance values change because ingestion of a meal causes a rise in impedance over the area of the stomach. The so-called "applied potential tomography" uses multiple electrodes in the region of the cranial abdomen; whereas impedance epigastrography techniques involve the use of two pairs of standard electrodes. Unfortunately, both these methods are very prone to movement artifacts [1]. The use of these techniques in the dog has not been described.

Treatment of delayed gastric emptying

Therapy of the underlying disease

Treatment of gastric emptying disturbances relies largely on treating the underlying cause (fig 4). Foreign bodies can be removed endoscopically or surgically; the same is done in cases of (rare) gastric polyps. Treatment of gastric neoplasia depends on tumour type and stage [32]. The therapy of choice for gastro-intestinal lymphoma is chemotherapy; a variety of different protocols are available (Madison-Wisconsin protocol or other doxorubicin-based protocols) [33,34]. The choice of chemotherapy depends on the individual patient and factors such as clinical appearance, cost and owner compliance have also to be taken into account. Solitary neoplasms (for example carcinomas, adenocarcinomas, leiomyosarcomas, gastrointestinal stromal tumours) are best treated surgically (Billroth I or gastrojejunostomy) [35]. Influence of chemotherapeutic agents on these types of tumours is currently not clear and large studies are necessary to evaluate this treatment modality. Prognosis of gastro-intestinal adenocarcinomas and leiomyosarcomas after surgical excision is poor, because in most cases metastases are evident at the time of diagnosis [35].

In the case of inflammatory processes which have been diagnosed using either diagnostic imaging procedures (ultrasonography, radiography, endoscopy) or histological examination of gastrointestinal biopsies, symptomatic treatment with gastroprotective agents (sucralfate, omeprazole, famotidin) can be effective [36,37].

Inflammatory bowel disease (IBD) is one of the most common infiltrative inflammatory diseases in the dog. Changes in gastric emptying due to this disease are strongly suspected but have never been proven in these patients. Treatment of IBD depends on clinical severity and consists of dietary management and immunosuppressive agents (prednisolone, azathioprine, cyclosporine) [38,39].

Infectious diseases of the gastro-intestinal tract are rare in the dog in Europe, but antibiotic-responsive gastroenteropathies are

Table 1: Mechanisms of action, location of action, indication and dosages of prokinetic agents
GOES = gastroesophageal sphincter; CRTZ = chemoreceptor trigger zone; GOER = Gastroesophageal reflux; CRI = continous rate infusion; p.o. = orally; i.v. = intravenously.

Drug group/ mechanism of action	Location of action	Indication	Dosage
Dopamine (D2) antagonists			
• Metoclopramide	GOES, stomach, intestine, CRTZ	vomiting, GOER, gastric emptying disturbance, obstipation	0.2-0.5 mg/kg p.o., i.v. q 8 h.; 0.01-0.02 mg/kg/h CRI
• Domperidone	GOES, CRTZ	Vomiting, GOER	0.05-0.1 mg/kg p.o. q 12 h
Serotonin (5-HT4) agonists			
• Cisapride	GOES, stomach, intestine, colon, CRTZ	GOER, gastric emptying disturbance,obstipation chemotherapy-induced vomiting	0.1-0.5 mg/kg p.o. q 8 h.
• Tegaserode	Small intestine, colon	constipation	0.05-0.1 mg/kg p.o., i.v. q 12 h.
• Prucalopride	Stomach, colon	gastric emptying disturbance, constipation	No information available
Motilin-like substances			
• Erythromycin	GOES, stomach, intestine, colon	GOER, gastric emptying disturbance, constipation	0.5-1 mg/kg p.o., i.v. q 8 h.
Acetylcholinesterase inhibitors + H2 antagonists			
• Ranitidine	stomach, colon	gastric emptying disturbance, constipation	1-2 mg/kg p.o., i.v. q 8 h.
• Nizatidine	stomach, colon	gastric emptying disturbance, constipation	2.5-5 mg/kg p.o. q 24 h.

recognised. It is not clear whether they induce clinically significant gastric emptying disorders. Infection with *Helicobacter* species is not associated with gastritis or clinical manifestation of disease.

Prokinetic therapy

Prokinetic drugs can be divided into 4 large groups (table 1) Their use should be restricted to cases where all other causes of delayed gastric emptying have been excluded or aetiological treatment has not been successful (fig 4) [12].

1. Dopamine antagonists

These drugs bind to peripheral (prokinetic) and central (anti-emetic) D2-receptors. The two most important representatives of this group are metoclopramide and domperidone. In the dog they cause dopamine-induced gastric relaxation and reverse apomorphine-induced vomiting [12]. The exact mechanism of action on gastric emptying is unknown and it is debatable whether metoclopramide has a prokinetic effect on the stomach at all [40]. Metoclopramide also has serotonin antagonistic (5-HT_3) and serotoninergic (5-HT_4) effects that may contribute to the prokinetic effect. It increases amplitude and frequency of antral contractions, blocks receptive relaxation of the stomach and coordinates motility of stomach, pylorus and duodenum. In addition, domperidon has not only dopaminergic but also $\alpha 2$ and β_2- antagonistic effects [40]. It is less effective in the dog compared to humans. It has been shown that it decreases frequency of gastric contractions and decreases antropyloroduodenal co-ordination in the dog [12].

2. Serotonin agonists

Drugs which act on gastrointestinal 5-hydroxytryptamine (5-HT) or serotonin receptors, have potent prokinetic effects. They bind to the 5-HT_4 receptors of cholinergic neurons in the gastrointestinal tract and induce depolarisation and thus contraction of the smooth muscles. They are not exclusively selective for 5-HT_4 receptors, but also have 5-HT_1 or 5-HT_3 agonistic effects [40]. Cisapride is the best example of this class, but has been removed from the market, after severe cardiac toxicity has been observed in human medicine (QT-interval prolongation, increase in cardiac repolarisation times by blockage of fast potassium channels in cardiac muscle cells, fatal ventricular tachyarrhythmias for example the "Torsades de pointes" arrhythmia). Similar effects have been noticed in canine Purkinje fibres, but no side effects in vivo have been documented in the dog so far [12].

The withdrawl of cisapride from the market has left a clear gap in the medical treatment of gastric emptying disorders in the dog, so that different prokinetic agents have been developed. Prucalopride (a selective 5-HT_4 receptor agonist) has been used in some experimental and clinical human studies [41], but is to the authors' knowledge not available on the market.

Tegaserode, another selective 5-HT_4 receptor agonist was released in 2002 as a human product on the American market, but has been removed again recently because of the occurance of massive ischaemic-haemorrhagic colitis and cardiac rhythm disturbances comparable to the ones seen with cisapride.

3. Motilin agonists

After the antibiotic properties of macrolid antibiotics had been discovered in the 1950s, it was found that their use also frequently caused gastrointestinal side effects (retrograde peristalsis, vomiting). In dosages below the antibiotic effect, however, stimulation of the MMC and anterograde peristalsis were noticed. This effect is comparable with the gastro-intestinal hormone motilin. In particular phase III of the MMC (strong phasic contractions) is stimulated [12]. The erythromycin derivatives EM 574 [42] and EM 523 [43] are even more potent prokinetics without the antimicrobial effect. In 2000 another erythromycin derivative (ABT-229) was compared to cisapride in the dog and showed excellent results [44]. A recent study from 2006 revealed good efficacy of a new acid-resistant formula of a motilin agonist (Mitemcinal = GM-661) in rabbits, but the effect in the dog seemed to be restricted to colonic motility [45]. These substances are not available for routine use so far.

4. Acetylcholinesterase inhibitors and cholinomimetic agents

The classical H_2-histamine receptor antagonists ranitidine and nizatidine stimulate gastro-intestinal motility by blocking acetylcholinesterase. This effect is most prominent in the stomach and the proximal small intestine. Other substances of the same class (cimetidine, famotidine) do not exert the same effect on gastric emptying [12].

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The Animal Hospital Postojna*

'Where Oncology and patient meet"

INTRODUCTION

There is no longer any doubt regarding the role of oncology in companion animal medicine. With the development of effective prophylaxis and/or therapy for many infectious and metabolic diseases, cancer is becoming the number one cause of death in our patients. For this reason oncology is now one of the most important specialities in the Veterinary field. Our profession has an enormous responsibility to adapt. The traditional attitude of animal doctors towards patients with cancer was entirely negative. Far too many treatable animals are still "put to sleep" as soon as neoplasia is diagnosed. In many cases these animals could continue to have an excellent quality of life for a significant period of time. Survival time is not so crucial to owners. What matters most to dedicated owners is the quality of the time they spend together with their pets. The deep gratitude for the happy period they can spend together with their pet following diagnosis, however long or short this is, is seen daily at AHP. This is attributed to the professional approach of the clinic, which includes psychological support for owners and a caring approach towards patients.

Oncology in Europe

Every veterinarian encounters patients with tumours in their daily practice. With appropriate diagnosis and treatment planning, many of these can be treated successfully, though this requires extensive knowledge of the subject and often the expertise of dedicated medical and surgical oncologists based at a specialist centre. One of the ways to gain the necessary knowledge to deal satisfactorily with cancer patients is through membership of relevant societies such as the European Society of Veterinary Oncology (ESVONC; www.esvonc.org). ESVONC was founded by a group of visionary veterinarians in Rome on September 24th 1992. Since then the society has organised regular scientific meetings in different locations all over the Europe, becoming the focus for more than 200 veterinary clinicians and scientists who are dedicated to developing knowledge and expertise in veterinary oncology. Veterinary oncology services in Europe have developed considerably since the foundation of ESVONC, paralleling advances in human medicine. It is no longer just academic institutions but also specialised private practices that can provide this expertise.

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Professor Dr. Janoš Butinar

Janoš Butinar has spent most of his working life in the Faculty of Veterinary Science at the University of Ljubljana working his way up to full professor in 2008. With a keen interest in surgical oncology, Dr. Butinar joined ESVONC some 7 years ago. He developed friendships with many eminent European oncologists.

He started visiting and collaborating with European oncology practices, later extending his travels beyond Europe so that he could observe the widest range of facilities and services. Contacts with dedicated clinicians such as Drs. Martin Kessler, Malcolm Brearley, Greg Ogilvie and Johan de Vos influenced him to continue extending his knowledge further.

The Postjona team. Dr. Butinar, technician Ana and anaesthetist Dr. Rejec preparing a patient for surgery.

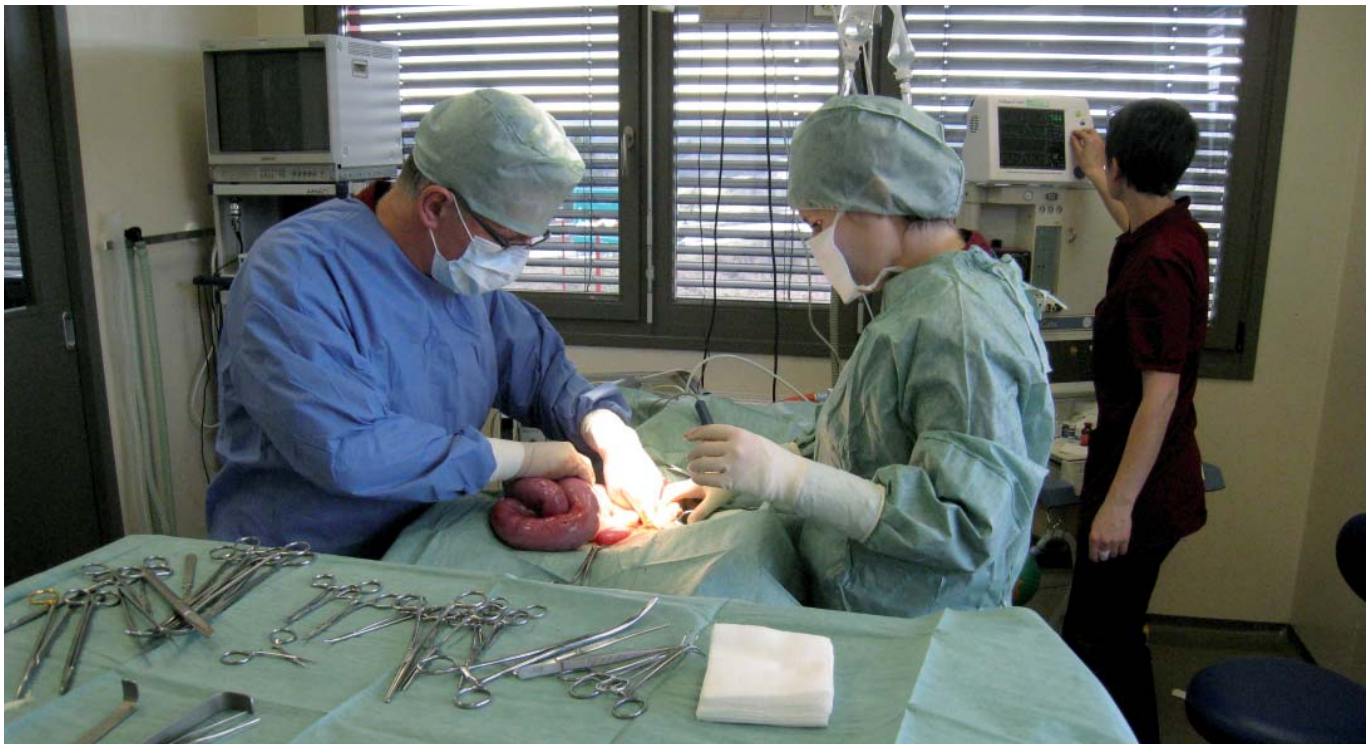
Animal Hospital Postojna

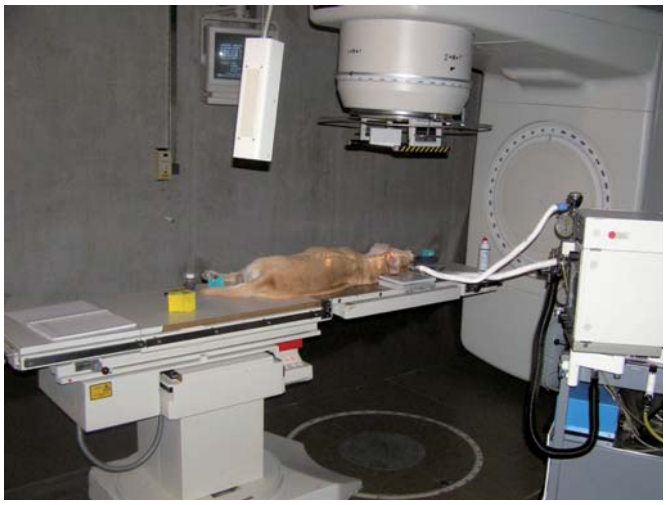
At 50 years of age Dr. Butinar was inspired to create his own specialist oncology centre. The idea developed from a combination of seeing what others had accomplished and his feeling a need to match the expectations of clients who increasingly demand a high quality of service and compassionate care for their animals. The plan was to set up everything necessary to provide an optimal service to cancer patients, including on-site cross sectional imaging and radiotherapy (availability of which is limited to only about 10 veterinary centres in Europe). With such facilities the centre would also provide for the needs of specialists in other medical fields as well as oncology.

Establishing AHP was a very ambitious project requiring a considerable investment of time and money. After much thought and planning, plus many meetings with architects and planners, builders and suppliers [1] whose experience and advice were invaluable, the project seemed feasible and the search for a suitable location was sought. Postojna, a town best known for the world famous cave system located nearby, is situated next to the main motorway route from Central Europe to Italy, and is only about a 30 minutes drive from the Slovenian capital, Ljubljana, and both the Italian and Croatian borders. This potential location was added to the already well thought out business plan, largely devised by System VVE [2] and young economist Miloš Sterle. This plan was presented to the bank manager at Banka Koper. The bank accepted the project and approved the necessary loans with a proposed payback period of 10 years.

As with any building project there were occasional setbacks and delays, but these were overcome and the Animal Hospital

Drs. Butinar and Mahne operating whilst Dr. Rejec maintains anaesthesia.





The 6MV Elekta Philips Linear accelerator.

Dr Butinor (left) discusses the management of a case and the prognosis with clients.

Postojna opened to patients on July 23rd 2007. Since then more than 1500 patients have passed through its doors, about 60% of these being oncology cases. The business plan appears to have been sensible and achievable as, after 15 months, AHP's income is within 90% of the projected figures. This is largely due to the whole team's extensive and meticulous advance planning, careful selection and ongoing motivation of clinical staff and the regular monitoring and advice from AHP's economist, Miloš Sterle and his company System VVE.

The philosophy of AHP

The goal of AHP is to provide the highest level of professional service to clients and patients in accordance with the latest scientifically based medical knowledge, whilst also providing owners with the psychological support they require. To fulfil this aim the best possible options are used to obtain an accurate diagnosis. The diagnostic process requires careful, thorough and complete history collection, clinical examination, imaging, lab testing and time for those involved to assimilate and correlate all the information gained. At all stages the best person for the job needs to be involved in order to ensure maximum benefit from investigations and treatments. For example, it is important for both cytopathology and histopathology to be performed in a highly specialised laboratory and reported on by professional veterinary pathologists. In-house cytopathology often provides a guide for initial treatment planning but with advances in immuno-histochemistry and tumour typing, AHP routinely submits samples to Gesonde Dieren (GD Institute) [3] clinical pathologists in the Netherlands who can generally provide results, including phenotyping when requested,within 5 days, minimising the delay before treatment can be started. Specific non-standard laboratory tests are performed by other specialist labs such as the Diagnostic Laboratory of the Veterinary Faculty in Ljubljana and Utrecht, Laboklin [4] in Germany and the University Clinical Centre in Ljubljana, Slovenia.

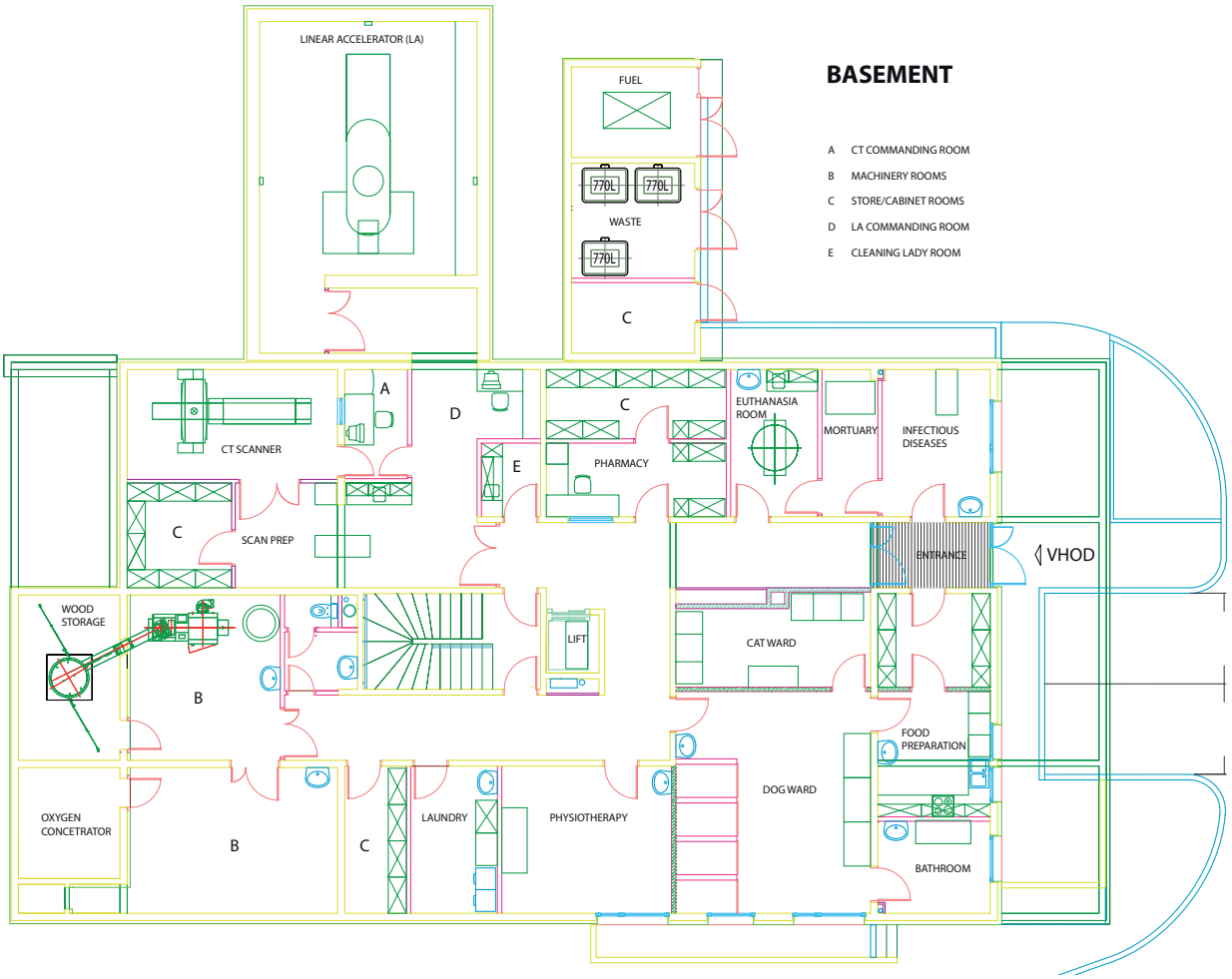
A combination of tumour staging procedures are needed for accuracy, most animals having a combination of ultrasound scans, conventional digital radiography and CT scanning.

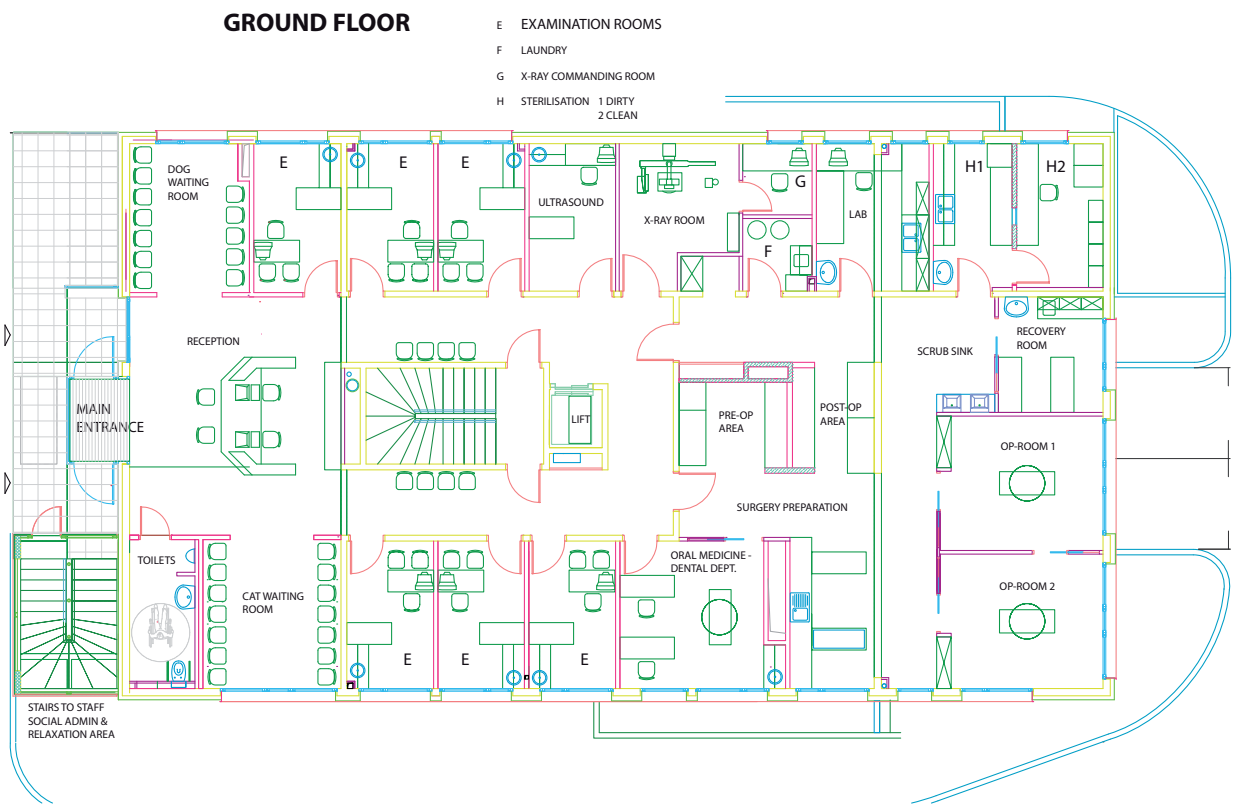
Assessments of prognosis and treatment planning are undertaken using a team approach.

An international panel of external advisers from the USA, The Netherlands, Great Britain and Germany are included along with the in-house clinicians for demanding cases. All current therapeutic options are available in-house at AHP. Surgical treatment is provided by Dr. Butinar and other experienced surgeons who have the necessary knowledge and expertise to reconstruct the large surgical defects created when sound surgical oncology principles are applied. Radiotherapy is available as either a primary modality or adjunctively in combination with surgery and/or chemotherapy. Use of the 6MV Elekta Philips Linear accelerator, provided by Elekta Europe Company [5] requires the most demanding and delicate procedure planning which is performed by a highly trained medical physicist from the Institute of Oncology in Ljubljana, whose main job is radiotherapy planning in human patients. The accelerator is operated by a human radiotherapist from the same Institute.

Chemotherapy is performed by AHP clinicians, with guidance from experienced external specialist advisors in critical and demanding cases.

To fulfil the goal of giving our clients appropriate psychological support, personnel are instructed to bear in mind the fact that most clients have had or will have experience of cancer themselves either personally or affecting their relatives and friends. By demonstrating a caring approach to their pets, by providing detailed explanations and by listening carefully to and answering both the asked and unasked questions honestly and completely, it is possible to exert a very positive and helpful influence on the pet owner. In general the AHP approach is optimistic. Provision of as much objective data as possible in a calm and relaxed atmosphere diverts owners from thinking of cancer as an immediate death sentence. Although *"How long will he live?"* is still a frequently asked question, it is more likely to be in the form of *"Can we keep him happy for his remaining time with us?"* once the emphasis on absolute cure has been removed and the modern concept of maintaining near normal life by controlling and living with disease has been accepted.


BASEMENT
A CT COMMANDING ROOM
B MACHINERY ROOMS
C STORE/CABINET ROOMS
D LA COMMANDING ROOM
E CLEANING LADY ROOM
LINEAR ACCELERATOR (LA)
FUEL
770L
770L
WASTE
770L
C
A
D
C
EUTHANASIA ROOM
MORTUARY
INFECTIOUS DISEASES
CT SCANNER
E
PHARMACY
C
SCAN PREP
ENTRANCE
VHOD
WOOD STORAGE
LIFT
CAT WARD
B
FOOD PREPARATION
DOG WARD
OXYGEN CONCETRATOR
B
C
LAUNDRY
PHYSIOTHERAPY
BATHROOM


GROUND FLOOR
E EXAMINATION ROOMS
F LAUNDRY
G X-RAY COMMANDING ROOM
H STERILISATION 1 DIRTY 2 CLEAN
DOG WAITING ROOM
E
E
E
ULTRASOUND
X-RAY ROOM
G
F
LAB
H1
H2
RECEPTION
SCRUB SINK
RECOVERY ROOM
MAIN ENTRANCE
LIFT
PRE-OP AREA
POST-OP AREA
OP-ROOM 1
SURGERY PREPARATION
TOILETS
CAT WAITING ROOM
ORAL MEDICINE - DENTAL DEPT.
OP-ROOM 2
E
E
E
STAIRS TO STAFF SOCIAL ADMIN & RELAXATION AREA

The large curved reception area enables the receptionist to communicate easily with incoming clients.

Discussions about the comparative value of life in animals compared to our own and comparisons with other diseases such as arthritis, kidney disease or diabetes mellitus are all helpful. Cancer is a chronic and sometimes devastating disease, but so is severe arthritis. Both may progress to the point where euthanasia is required but both can usually be controlled for a period of time before this is necessary, and a year for an adult dog is like 10 years for a person; even a fraction of this period is well worth living.

A secondary aim of AHP is to propagate knowledge to the veterinary profession and to the public. Veterinary education is provided by both organising and running seminars with international speakers which are open to veterinary students and practitioners, and by accepting visiting students who wish to learn more. It is hoped over the next year to develop AHP's web site (www.ahp.si) and start providing veterinary medical educational information for the public there.

Clinic plan and equipment

AHP was planned with a total floor area of 1400 m^2 distributed over three floors with an lift (elevator) as an essential feature enabling easy communication between floors. The ground floor consists of two waiting rooms with a big, curved divider in the middle so clients with dogs and cats can be accommodated separately yet enabling the receptionist to communicate easily with them and with incoming clients. Soothing music is played in the background, a computer is provided in an internet corner and wifi is available for those wishing to use their own laptops. The height of the reception desk was carefully selected; most veterinary practices have a reception desk either too high, so that it becomes an obstacle for communication, or too low making a seated receptionist appear impolite to the standing client. Business and clinical records are maintained using a computer system, Easy Vet from Vet Z Co. Germany, [6] which also accepts direct input of digital radiographic, CT and ultrasound images. A corridor extends back on either side of reception with three examination or consulting rooms on each side, each equipped with seating for clients and clinician, an unobtrusive desk, computer terminal and a high quality trolley mobile exam table [1]. An ultrasound room equipped with a Philips Envisor Doppler ultrasound machine [7] and the digital radiography room equipped with a Canon Digitalised, Philips Bucky Diagnostic x-ray machine [8] are also situated off the left corridor whilst the public entrance to the oral medicine and dental suite, equipped with a tub table, [1] scrub sink, an air driven dental machine, aspirator, ultrasonic scaler and a Schick digital dental x-ray system, [9] is on the end of other corridor. Both corridors lead to the clinical area which is not open to the public. Within this area are the pre-op preparation and post-op recovery areas, two sterile operating theatres fully equipped with Draeger Cato anaesthetic machines, [10] Vet Specs monitors, [11] an Arthrex Endoscopic Tower [12]. All surgical, dental and exam lights are from US Co. Medical Illumination. [13] Medical gasses are piped to all clinical areas, a Danish Oxymat oxygen generator [14] produces up to 30 litres/min making AHP completely independent of the need for a cylinder gas supply. The consumption of oxygen can be high as up to 4 anaesthetic machines may be running simultaneously.

There is access from the preparation area to the oral medicine room. Oral medicine and surgery is an important area of specialisation undertaken at AHP. Almost every patient sooner or later has a mouth problem requiring treatment. Bacteraemia from periodontal infection is a common cause of surgical wound infections or septicaemia in debilitated and immune-suppressed animals, as is aspiration pneumonia. Many cancer patients therefore require oral procedures prior to undertaking elective surgery, radiotherapy and chemotherapy. Dr. Crossley, PhD, Dipl EVDC acts as an external adviser providing frequent on-line advice and visits as mentor to staff member Dr Ana Rejec.

Within the preparation/post-op areas there are holding and recovery cages, instrument and equipment storage cupboards, scrub and general sinks and mobile trolley tables, provided by Shor-line [1].

There are dedicated instrument cleaning and sterilisation rooms situated off the preparation area, where all the necessary equipment and supplies are kept for instrument maintenance,

One of the 6 consulting/examination rooms.

A comfortable and quiet room is available when matters regarding euthanasia need to be discussed.

Hydro physiotherapy room with the water treadmill.

including an instrument washing machine (thermo-steriliser) that makes contaminated instruments safe for handling before they are packed and sealed prior to steam sterilisation in the professional hospital autoclave. The in-house laboratory, equipped for routine haematology, fluid chemistry and microscopy is located in an adjacent room directly off the prep area.

The basement houses the Shimadzu CT scanner [16], Elekta linear accelerator [5], pharmacy, euthanasia room, food and general storage rooms, separate dog, cat and exotics wards, an infectious diseases room, animal bathroom, Hydro physiotherapy room with the water treadmill, [15] the laundry and machinery rooms. As a combination of wood and solar energy are used for heating the building and providing hot water, and the building design incorporates numerous energy saving features. AHP was declared an ecology investment and supported with a loan from the Slovenian Ecology Fund.

The top floor of AHP houses a seminar room with digital projection and seating for 35 people, which is used for continuing education seminars, a small kitchen and staff dining space, vets offices, 2 fully equipped residential apartments used by personnel and visitors. In addition to Oncology other seminars organised to date have included neurology, and oral medicine.

Personnel

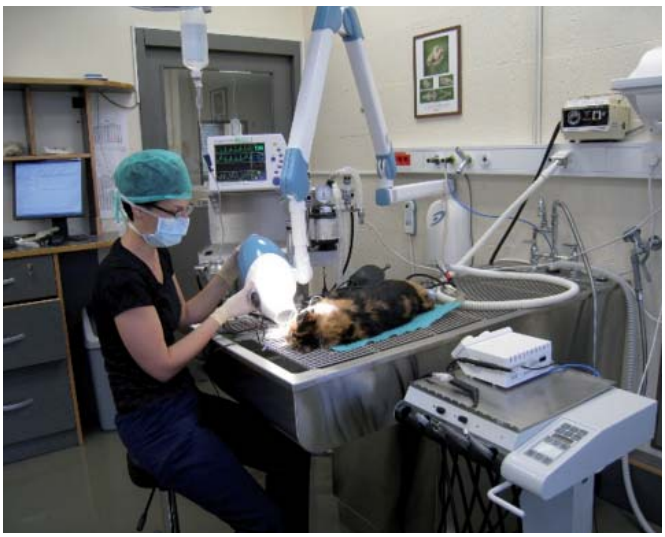
Dr. Janoš Butinar

The founder and principal surgical oncologist at AHP has 25 years experience in small animal medicine and surgery. He started to focus seriously on soft tissue surgery during a study year spent working with Dr. Dick White at the Queen's Veterinary School Hospital at Cambridge University in 1992, following which he concentrated on refining his skills and gaining as much surgical experience as possible, undertaking several visits to Utrecht University studying with Professors van Sluijs and Kirpensteijn. Additional inspiration came from time spent with human abdominal surgeons, especially the world renowned hepatic surgeon Professor Eldar M. Gadzijev. Dr. Butinar has always been involved in oncological surgery, but this interest increased during the last decade along with his deep involvement in ESVONC. He is constantly trying to understand the basic principles of tumour biology and how to apply this knowledge to clinical oncology, i.e. diagnostic procedures, staging and grading of tumours, to enhance selection of treatment regimes for his cancer patients. There is an old American definition of a surgeon which is especially applicable to the oncology surgeon: *"A good surgeon knows how to operate, a better surgeon knows when to operate, and the best surgeon knows when not to operate!"*. Dr. Butinar aspires to be within the latter category.
Dr. Butinar is assisted by two young enthusiastic veterinarians who are employed full time.

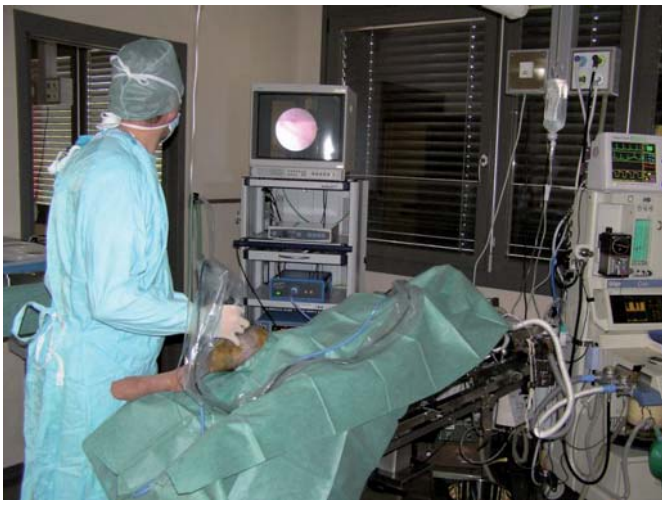
Dr Ana Rejec

Ana is responsible for anaesthesia and perioperative care. Her interest in anaesthesia started as a student and whilst an undergraduate at the Veterinary Faculty, University of Ljubljana

Ana Rejec performs a dental procedure.



Urška Mahne operating the CT scanner.



Bojan Frantar performs arthoscopy.

where she undertook a research project investigating intestinal permeability during NSAID and corticosteroid treatment under the mentorship of Prof. Butinar. She later gained additional experience in anaesthesia during an internship at the Veterinary Faculty. Since being employed at AHP Ana has developed an interest in oral medicine. To help develop her knowledge and skills she spent a month in Germany with Dr. Jan Schreyer, Dip. EVDC and a similar period in the UK with Dr. David Crossley, Dip. EVDC who now visits AHP on a regular basis to assist in her continuing education and acting as an advisor on maxillofacial surgery.

Dr Urška Mahne

Urška is responsible for clinical imaging and medical oncology. She spent 6 months at Turin University with Dr. Michelle Borgarelli, Dip ECVIM (cardiology) studying cardiology, followed by 3 months in the Netherlands with Dr. Monique Lecljuise improving her ultrasonic scanning skills. As she is responsible for CT scanning at AHP, Urška studied with Dr. Mihaljevic in Ravensburg to gain the necessary experience, this being reinforced by several weeks spent in the Diagnostic Imaging Department of The General Hospital Rijeka, in Croatia.

Dr. Bojan Frantar

The AHP's orthopaedic and neurosurgeon is Bojan Frantar, who works there on a part time basis. He is an experienced surgeon who has attended a number of international A-O courses. He spent 10 years working at the Clinic for Small Animal Medicine and Surgery of the Veterinary Faculty in Ljubljana. With improvements in diagnostic methodology he is recognising that a increasing number of orthopaedic and neurological cases are in fact oncology patients. AHP also has a panel of internationally recognised veterinary specialists who work on a visiting basis or as external advisers covering the fields of diagnostic imaging, clinical pathology, medical oncology, surgical oncology, cardiology, dermatology, ophthalmology, oral medicine, dentistry, maxillofacial surgery, orthopaedics, as well as human medicine specialists who participate in diagnostics and therapy of some patients.

Ideally AHP requires the services of at least 3 full time veterinary nurses/technicians, but these are hard to find in Slovenia because of this the posts are shortly to be advertised internationally. Currently their jobs are being undertaken by the veterinary staff with assistance from part time helpers. At AHP nurses would be expected to be involved in nursing and treatment of patients, and not just be glorified cleaners. From the outset a dedicated cleaner has been employed resulting in maintenance of a clean and hygienic working environment.

Acknowledgements

Companies supplying expertise and equipment at AHP

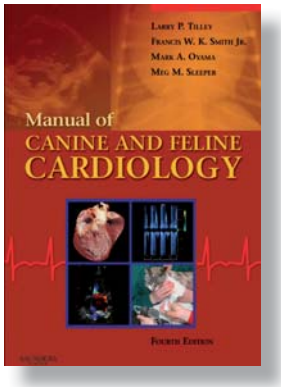
AHP would like to acknowledge the help it received from the companies listed below, when setting up and equipping the clinic. Readers may also find details of the companies useful. The Editor would like to point out, however, that often similar excellent equipment is available from other companies.

[1] Shor-line : quality@shor-line.co.uk
[2] System VVE : info@sistem-vve.si
[3] Gesonde Dieren (GD Institute) : info@gddeventer.com
[4] Laboklin : www.laboklin.de
[5] Elekta Europe Company : info@elekta.com
[6] Easy Vet from Vet Z Co. : info@myvetz.com
[7] Philips Envisor Doppler ultrasound machine : www.medical.philips.com
[8] Canon Digitalised, Philips Bucky Diagnostic : info@myvetz.com
[9] Schick digital dental x-ray system : InternationalSales@schicktech.com
[10] Draeger Cato anaesthetic machines : www.draeger.com
[11] Vet Specs monitors : info@veterinarytechnics.com
[12] Arthrex Endoscopic Tower : www.arthrex.de
[13] US Co. Medical Illumination : export@medillum.com
[14] Danish Oxymat oxygen generator : fg@oxymat.dk
[15] Technik Technology : websales@techniktechnology.co.uk
[16] Shimadzu Europa : www.shimadzu.eu

Manual of Canine and Feline Cardiology (4th Edition)

Tilley, Smith, Oyama, Sleeper

Published by Elsevier Saunders (www.elsevierhealth.com) Feb 2008
464 pages, 300 illustrations.
Paperback ISBN: 9781416023982
€ 79.99 / £52.99



This book of approximatly 450 pages is an excellent review of the current state of the field of small animal cardiology. It is comprehensive and very thorough, up to date, has a scientific approach as well as being clinically oriented and it is very enjoyable to read. This book is an amazing accomplishment in the reviewer's opinion!

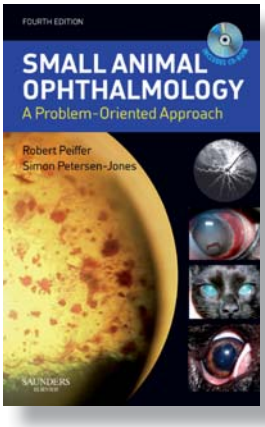
The book is divided into three sections:
I. Diagnosis of heart disease.
II. Cardiovascular disease.
III. Treatment of cardiovascular disease.
The first section presents a fully comprehesive review of clinical examination, radiology of the heart, ECG, echocardiography and doppler examinatio and special techniques such as provocative manoeuvres, Holter registrations and the use of biomarkers in heart disease.
Section II includes discussion of acquired valvular disease, canine and feline cardiomyopathy, cor pulmonale, pulmonary hypertension and pulmonary thromboembolism, heartworm disease, pericardial disorders and cardiac tumours, congenital heart disease, cardiovascular effects of systemic disease including effect of different poisonous substances and systemic hypertension. The discussions concerning treatment of asymptomatic chronic valvular disease, and the diagnosis of restrictive and unclassified cardiomyopathy in cats are particularly interesting and valuable.
Section III begins with a thorough discussion of the pathophysiology and definitions of heart failure, as well as a comprehensive review of the therapy of heart failure. The following chapters in this section include treatment of cardiac arrhythmias and conduction disturbances, cardiopulmonary resuscitation, emergency management and critical care of the cardiac patient, as well as anaesthesia of the cardiac patient, cardiac surgery and pacemaker therapy. The relatively new classification of heart failure into stages A to D with successively increasing severity of heart diesease is introduced. Boxes with frequently asked questions and key points help the reader to focus on the main issues, and complete this very valuable addition to small animal cardiology. Read it!

Anna Tidholm, DVM, PhD,
Dipl.ECVIM (Sweden)

Small Animal Ophthalmology - A Problem-Orientated Approach 4th Edition

Robert Peiffer
Simon M. Petersen-Jones

Published by Elsevier Saunders (www.elsevierhealth.com) 344 pages, 250 illustrations Paperback - plus CD Rom
ISBN: 978-0-7020-2861-8 € 58.99 / £ 39.99



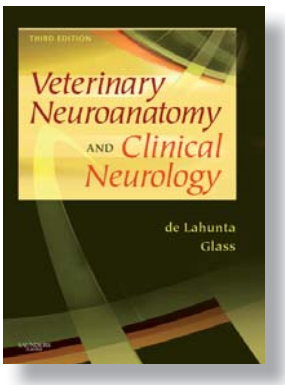
The current fourth edition of the manual of Small Animal Ophthalmology – A Problem-Orientated Approach continues the tradition of the previous edition, its hallmark being an original and practical presentation for diagnosing and treating the most common ophthalmic conditions encouteered in pets. In the preface to the first edition the author, Robert Peiffer, writes that he hopes the handbook will be useful to the general practitioner. The new edition is certainly interesting, not only to the general practitioner but to the student and the beginner in ophthalmology. It is a very pleasant book to read and the small size makes it easy to carry making it readily available when needed.. In this new edition Dr Simon Petersen-Jones joins Dr Robert Peiffer as co-editor. There are 17 other contributors.
The book is organised into seven chapters. The title of each of them reflects the practical style of the book (1: Clinical basic Science; 2: Diagnostics; 3: Therapeutics; 4: Abnormal Appearance; 5: Visual Impairment; 6: Orbital and Ocular Pain; 7: Ocular Discharge). There is an Ophthalmic Formulary in an appendix. The book contains good quality photographs and drawings.
In addition there is a CD-Rom describing 40 clinical cases. The way of presenting the cases is very instructive and interactive. This is a very enjoyable method of learning how to diagnose and treat ophthalmic cases. For each case there is a brief history and details of clinical findings, with photos of the lesion and in some cases even a video. The reader is then asked to participate by answering questions regarding the diagnosis and management of the case. The solutions are given with a concise but complete explanation.
In conclusion, this is an excellent handbook, pleasant and easy to read. The reviewer especially likes the interactive way the clinical cases are presented on the CD-Rom. This is the type of reading one can enjoy even after a hard day's work.

Maurice Roze DipECVO (France)

Veterinary Neuroanatomy and Clinical Neurology (3rd Edition)

Alexander de Lahunta and Eric Glass

Published by Elsevier Saunders (www.elsevierhealth.com)552 pages, 750 illustrations Paperback
ISBN: 978-0-7216-6706-5 € 93.99 / £ 63.99



I still have my copy of the second edition of this classic book. I have always regarded it almost as the veterinary neurologist's bible so I was interested to see whether a third edition could maintain this reputation. I was not disappointed although I recog-

nise some big changes both in content and general approach to the subject of veterinary neurology. I had always thought that the first paragraph of the second edition was rather optimistic if it was truly expected that this erudite text would be considered as primarily for the veterinary student. Most students find the style of an anatomy textbook to be hard work and the book is surely a ready reference text for the established neurologist and neuroanatomist. However, the third edition really does cater for everyone; undergraduates, practitioners and specialist neurologists will all find this book an absolute delight.

Sandy de La hunta himself, indisputably the best known veterinary neurologist in the world, has joined forces with Eric Glass, a clinical neurologist in referral practice, to revise and add to this excellent book. The result is an outstanding combination of neuroanatomy, neuropathology and clinical neurology. A major innovation is the inclusion of text to compliment a series of video clips available for view on a Cornell website. The system works really well, drawing on the authors' vast archive of examples of clinical conditions in all the domestic species. There is even a facility for self-assessment in that the diagnosis and lesion localisation can be hidden until required. There are 382 video clips available, each one with relevant text in the book. A further feature is a search provision to allow the selection of specific clinical conditions.

There are 524 pages of text to this book. The paper is good quality and the reproduction of the photographs is very good indeed. Colour is used to great advantage throughout the book, a big improvement on the second edition! The many photographs and drawings are of high quality with one exception. If I was to make one criticism it would concern the quality of the MR images in Chapter 2. MRI technology has advanced so far in recent years that I am surprised that these images are not of equivalent quality to the rest of the illustrations; proton density weighting was a mistake especially if a low-field magnet was used.

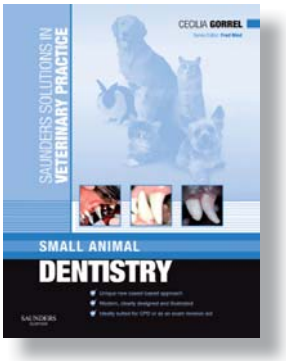
The attention to detail in this book is truly impressive and, if the reader wants further information on any topic, there is a comprehensive list of references at the end of each chapter. Much more could be said about this great book but I recommend buying it for oneself; it will be money well-spent.

Geoff Skerritt BVSc DECVN FRCVS (UK)

Saunders Solutions in Veterinary Practice: Small Animal Dentistry

Cecilia Gorrel
Series Editor Fred Nind

Published by Elsevier Saunders (www.elsevierhealth.com)260 pages, 263 illustrations Paperback (2008) ISBN: 978-0-7020-2871-7 € 56.99 / £ 39 99



Nowadays there is a tendency in veterinary medicine to embark on specialisation. Graduates, after several years of practice, start to think about further but more specialised professional education. Dentistry is well recognised as a discipline which requires radiological, surgical and manual expertise. In addition quite a lot of theoretical knowledge is needed if a high quality of service is to be provided. Potential dental specialists realise this and will find this book a good source of knowledge when grappling with both the clinical and theoretical approaches to dental problems. The clinical protocols, supported by high quality radiographic imaging and its interpretation, show the complex nature of diagnoses in small animal dentistry. The role of dental charting is rightly emphasised as an important part of the clinical records.

The author's note includes mention of her determination that the book should not just be the typical standard reference textbook and she succeeds admirably in this objective. This book should be used in every place where the veterinary dentistry is recognised as a challenge and as something more than just teeth scaling. Case notes should be regularly analysed and discussed and the value of day to day experience noted, thereby ensuring that ones skills continually improve.

A very important strength of this publication is that it emphasises the links between oral and general health. These links, when neglected, can be a common cause of life threatening conditions in small animal patients. The reader will be greatly impressed with all 260 pages which contain numerous appropriate pictures, drawings, and radiographs.

Dental problems are discussed based on real cases which are chosen as being the most representative ones in specific fields. Each case is described starting from the initial presentation followed by the taking of patient details and clinical history. This is followed by an oral examination of both the fully conscious and sedated animal, together with consideration of radiographic findings. Treatment options, the treatment performed, rechecks and prognosis are then detailed. Two particular parts are highlighted: "clinical tips" and "a theory refresher". Both are dedicated on one hand to those who need quick and practical advice, and on the other to those who require much more detailed knowledge. The oral cavity is a very specific field of operative medicine. It is difficult to visualize the area of concern and even more difficult to operate in this region. Most of the illustrations are very clear providing on the spot guidance.

Clinicians may value the opportunity to participate in a multiple choice test at the end of the book. Learning is always fun - and for those who may later consider taking specialist examinations this exercise provides some good practise.

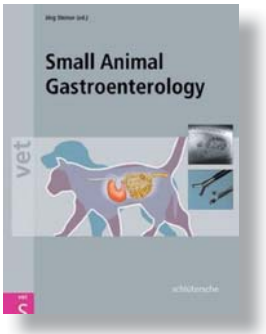
All in all, the book is an excellent educational tool and can be highly recommended to the general practitioner. For sure those who feel that dentistry will be their field of interest, it really offers very good value for money.

Jerzy Gawor DVM (Poland)

Small animal Gastroenterology

Edited by Jörg Steiner

Published by Schlütersche Verlagsgellschaft GmbH & Co. KG, Hanover. (www.schluetersche.de) 366pages, Hardback, ISBN: 978-3-89993-027-6. € 129 / £99 NB Wiley seen to the Selling on the Internet € 110 / £88



The veterinary surgeon in General Practice has long considered small animal gastroenterology a "black art". Great advances have been made recently in this field and this book discusses these changes with a different approach to the subject reflecting the current interest in evidence-based medicine. In the introduction, the editor states that the goal was to produce a textbook that is both scientific and practical. The team of thirty authors, including the editor, have succeeded in their objective. As with any textbook featuring multiple authors, there are variations in style but the 30 authors are all world renowned experts in the field so this is not a problem.

The book is divided into two sections. Part 1 is entitled "Diagnosis of Gastro-intestinal Disorders. This, in turn, is sub-divided into two units, Diagnostic Tools and secondly, Clinical Evaluation of Specific Clinical Signs. The former unit adopts a "cross organ" approach in that the discussion on Diagnostic Tools features a variety of chapters ranging from Clinical History to Assessment of Gastrointestinal Motility. The second unit attempts to evaluate specific clinical signs e.g. vomiting. Part 11, in contrast, is based on the traditional organ-by-organ approach although there is an interesting catch-all last chapter that covers diseases affecting more than part of the gastrointestinal tract.

This is a beautiful book. The illustrations are outstanding with excellent colour representation of endoscopic, histological and clinical pictures. The diagnostic images are clear with good reproduction of radiographs and ultrasound scans including the use of colour with Doppler photographs. The text is logically set out on good quality paper and I found the book a pleasure to read. Although there are chapters on cutting-edge topics such as Inflammatory Bowel Disease and Molecular-Genetics-Based Laboratory Tests, the authors have avoided the trap of producing a purely scientific treatise. There is solid, practical help in every chapter such as suggested criteria for assessment of Canine Inflammatory Bowel Disease. Each chapter finishes with a summary box featuring a bulleted list of Key Facts, which, by definition, will be the author's subjective opinion but is nevertheless a useful feature.

No gastroenterology textbook has ever got round the problem of classifying "vomiting" or "diarrhoea". The book makes a worthy attempt to tackle clinical evaluation but this reviewer finds a table featuring 60 possible causes of chronic vomiting of limited value. The same criticism could be applied to diagnostic flow charts containing forty boxes. In contrast, the suggested, well illustrated faecal scoring system, complete with observation codes, could be of immense value if widely adopted by the veterinary profession.

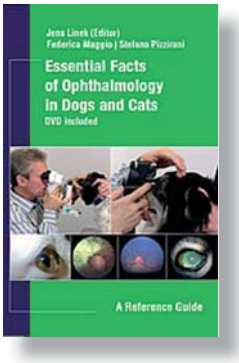
This is a relatively expensive text book but the cost is more than offset by the quality of the production making it good value for money. This is definitely the best text book that has been published on Small Animal Gastroenterology and should find a place in every Practice library.

David B. Murdoch BVMS DVR (UK)

Essential Facts of Ophthalmology in Dogs and Cats. A Reference Guide

Edited by Jens Linek
Federica Maggio, Stefano Pizzirani

Published by VBS VetVerlag, Babenhausen, Germany (www.be-vetverlag.com) 235 pages many excellent illustrations Paperback plus DVD with videos
ISBN 798-3-938274-21-7 € ?? £??



The book, written for the veterinarian in general practice and the veterinary student, is a practical book that covers the basics of small animal ophthalmology. Together with the book a DVD is provided, which includes a demonstration of examination techniques plus a selection of surgical procedures.

The first part of the DVD is informative and useful for general practitioners. Likewise, the surgical demonstrations are very good and easy to follow. However, the selection of surgical procedures is more unclear. Three of the procedures are relevant, cataract surgery however is hardly a procedure performed by students and general practitioners and as such should have been replaced with another, more relevant procedure. An overview of equipment needed and steps to prepare the surgical field for each surgical procedure would have been useful.

The book is divided into the following chapters: Examination of the eye, Which part of the eye is affected?, Problem oriented approach and Ocular emergencies. There is a certain overlap between the chapters, which maybe is inevitable. In some cases, the description of diseases may also appear a little disorganised, as in retinal diseases where congenital and acquired conditions are mixed. The appendix contains a drug list, a list of breed specific eye disorders, abbreviations, supply sources and a literature list. The photographs are numerous and of good quality. They are not however referenced in the text and the corresponding information may therefore be difficult to find. In addition, there are photographs that completely lack further explanation in the text, e.g. "white dot syndrome" in the pug, a condition that is not generally known, and that is not listed in the overview of breed related diseases. This example also shows some of the major objections to the book: The reference list consists of only four textbook references. Especially in the list of breed related diseases references would have been valuable, as this list seems a little outdated and incomplete.

The content of the book shows that it has been written by clinicians with long practical experience. However the tendency to refer to one's own experience and detail how the author himself prefers to perform a procedure, is a practice not usually employed in textbooks, even though this book is defined as a tutorial rather than a text book. More serious, however, is that unfortunately the theoretical parts of the book contain too many errors and sometimes appear rather imprecise. For example, the definition of ptosis is not correct, likewise the cause of decreased intraocular pressure in uveitis, the reference to the vision centre in the cerebellum, the layers of the retina, the sclera being defined as the deepest retinal layer, Clamydia now termed Chlamydophila and so on. The drawing of the Stades procedure for dorsal entropion is also imprecise. The rather high number of facts that are not correct is a matter of concern.

Although the book contains much good and practical information, one would have appreciated a more distinct division between dog and cat disease. More thorough recommendations for treating, for example,feline upper airway viral diseases causing ocular signs would have added to the value of the book, as these are often conditions that affect multiple cat households. One would also have appre-

ciated more focus on pain management, for example after superficial keratotomy.

As to language, the text should have been corrected by a native speaking English person, and the proof reading should have been more thorough. "Split lamb" as an examination procedure listed on the label of the DVD is a strange way of expressing a slit lamp examination.

This said, the book contains good practical information for the group at which it is aimed.

Prof. Ellen Bjerkås DVM Dip ECVO
(Norway)

Calendar of main European National Meetings and other continuing education opportunities

WSAVA & FECAVA Congresses (Red)
Principal annual meetings (blue)

A list of the addresses and telephone numbers of the Secretariat or person holding information is attached.

2-5 April	BSAVA	Birmingham	Annual Congress	English*
14-18 April	ESAVS	Luxembourg (LUX)	Radiology in Small Animals I	English
18 April	VÖK	Gmunden	Case Report Seminar 3	German
18th April	AIVPA	Grugliasco (Torino)	Seminar: Lower urinary tract and prostate: diagnosis, treatment and comparative aspects	Italian
21 April	BSAVA	BSAVA HQ, Gloucester	CE Infectious Disease	English
22 April	VÖK	Vienna	CE Oncology	German
23-25 April	NACAM	Amsterdam	Voorjaarsdagen	Dutch/ English and others
25-27 April	RSAVA	Moscow	17th RussianMoscow Veterinary Congress	Russian (mainly)
30 April	BSAVA	Thorpe Park Hotel & Spa, Leeds	CE Cardiovascular Medicine	English
7-9 May	SVK/ASMPA	St. Gallen	National Congress	German
9 May	VÖK	Vienna	CE Dermatology	German
12 May	BSAVA	BSAVA HQ, Gloucester	CE Ophthalmology III – Out of sight – out of mind, The retina and beyond – Mini modular course	English
16th May	AIVPA/CARDIEC	Padova	Seminar in cooperation with CARDIEC	Italian
16-17 May	VÖK	Vienna- Schönbrunn	CE Clinical updates in Vet Practice	German
19 May	BSAVA	BSAVA HQ, Gloucester	CE Endocrinology I	English
23-24th May	AIVPA -AIVPAFE	Perugia	Haematology of the dog and cat (Theory &Practice)	Italian
28 May	BSAVA	Thorpe Park Hotel & Spa, Leeds	CE Endocrinology II	English
6 June	EVSSAR	Wroclow (PL)	6th Annual Symposium	English/Polish
8-12 June	ESAVS	Halmstad (S)	Dentistry II (Course with wet lab)	English
8-12 June	ESAVS	Vienna (A)	Rehabilitation and Physiotherapy of Small Animals I	English
9 June	BSAVA	BSAVA HQ Gloucester	CE Introduction to Cytology	English
15-26 June	ESAVS	Toulouse (F)	Ophthalmology II	English
19-21June	ESFM	Cavtat-Dubrovnik (Croatia)	ESFM annual Congress	English
20-21June	VÖK	Rankweil	CE Orthopaedics	German
22-26 June	ESAVS	Berne (CH)	Emergency and Critical Care II(course with wet lab)	English
23 June	BSAVA	BSAVA HQ, Gloucester	CE Oncology I	English
24 June	BSAVA	Nottingham University, Sutton Bonington	CE Anaesthesia of the Critical Patient for Nurses	English
25 June	BSAVA	Thorpe Park Hotel & Spa, Leeds	CE Clinical Pathology	English
2-4 July	ECVS	Nantes (F)	15th Annual Scientific Meeting	English
6-17 July	ESAVS	Vienna (A)	Dermatology I (course with workshops)	English
8-12 July	ESAVS	Berne(CH)	Diagnostic Ultrasound II(course with wet lab)	English
20-31 July	ESAVS	Vienna (A)	Dermatology II(course with workshops)	English
27 July - 1 Aug.	ESAVS	Luxembourg(LUX)	Cardiology III (advanced course)	English
22-26 August	ESAVS	Berne(CH)	Neurology III (advanced course)	English
24-28 August	ESAVS	Halmstad (S)	Dentistry III (advanced course with wet lab)	English
31 Aug. - 4 Sept.	ESAVS	Lisbon (PT)	Oncology I	English
31 Aug. - 4 Sept.	ESAVS	Giessen (D)	Endoscopy (intensive course with workshops)	English
31 Aug. - 4 Sept.	ESAVS	Vienna (A)	Rehabilitation and Physiotherapy of Small Animals II	English
31 Aug. - 4 Sept.	ESAVS	Nantes (F)	Small Animal Reproduction I	English
5-9 September	ESAVS	Berne (CH)	Neurology I	English
7-11 September	ESAVS	Luxembourg (LUX)	Behavioural Medicine I	English
9-13 September	ESVOT	Munich(D)	ESVOT Courses	English
10 September	BSAVA	BSAVA HQ, Gloucester	CE Practical Haematology – Detective work for nurses	English
10-12 September	EVDS	Zurich (CH)	18th European Congress of Veterinary Dentistry	English/German
10-14 September	ESAVS	Vienna (A)	Soft Tissue Surgery (advanced course with workshops)	English
14-18 September	ESAVS	Brno (CZ)	Exotic Pets Medicine & Surgery (course with wet lab)	English
17-19 September	ECVD-ESVD	Bled (Slovenia)	23 rd Annual Congress	English
19-20 September	VÖK	Salzburg	24th VÖK-Annual-Meeting	German, English

22 September	BSAVA	BSAVA HQ, Gloucester	CE Oncology II	English
24 September	BSAVA	Thorpe Park Hotel & Spa, Leeds	CE - GIT	English
September	ESAVS	Zurich(CH)	Feline Medicine & Surgery II (course with wet lab)	English
2-4 October	AVEPA	Barcelona	AVEPA Annual Congress /SEVC - Southern European Veterinary Conference	English, Spanish, French, German, Polish
10-11 October	VÖK	Kufstein	CE GI Diseases	German
10-11 October	AIVPA	Modena	National Congress-Puppies and kittens: new patients; clinical medicine and management	Italian/English
17 October	VÖK	Vienna	Emergencies Seminar	German
20 October	BSAVA	BSAVA HQ, Gloucester	CE Clinical Nutrition	English
22 October	BSAVA	Thorpe Park Hotel & Spa	GIT II	English
23-24 October	TSAVA	Istanbul	4th TSAVA Anadolum Congress	Turkish/English
23-25 October	PSAVA	Lublin	CE From Traumatology to Rehabilitation	Polish/English
23-25 October	SASAP	Belgrade	Annual Symposium	Serbian/English
24-25th October	AIVPA -CELEMASCHE	Legnaro (Padova)	Practical and theorical course - Radiographic diagnosis of congenital/genetic diseases of the skeleton (HD, ED, SP, WS) DNA analysis	Italian
24-25th October	AIVPA -AIVPAFE	Grugliasco (Torino	Haematology and cytology of the dog and cat (Theoretical & Practical	Italian
26-30 October	ESAVS	Berne(CH)	Neuropathology – Intensive Course for Pathologists, Neurologists and MRT Users	English
October	LSAPS	TBA	WSAVA CE lectures	English TBA
5-6 November	SSAVA	Uppsala	Annual Veterinary Congress (Neurology)	Swedish, English
7-8th November	AIVPA	Pisa	Basic Dermatology of the dog (Theoretical & Practical)	Italian
13-14 November	DSAVA	Aarhus	Annual Meeting	Danish/English
14-15 November	VÖK	Steyr	Ultrasound Seminar	German
15th November	AIVPA-CARDIEC	Bologna	Seminar - The critical patient: from anaesthesia to awakening	Italian
16-20 November	ESAVS	Halmstad (S)	Dentistry IV Oral Surgery (course with wet lab)	English
16-27 November	ESAVS	Utrecht (NL)	Internal Medicine	English
17 November	BSAVA	BSAVA HQ, Gloucester	CE Neurology	English
19 November	BSAVA	Thorpe Park Hotel & Spa, Leeds	CE Haematology	English
21-22 November	VÖK	Krems	X-Ray Seminar	German
22nd November	AIVPA-CELEMASCHE	Varese	Seminar -Diseases of the hip, elbow and stifle	Italian
26-29 November	FECAVA/AFVAC/ LAK/SAVAB	Lille	15th FECAVA/AFVAC/LAK/ SAVAB Eurocongress www.fecavalille2009.com	French, English- possibly others
28 November	VÖK	Vienna	Patella Seminar	German
30 November-4 December	ESAVS	Lisbon (PT)	Internal Medicine and Emergency Care Course	English
1-5 December	ESAVS	Halmstad (S)	Oral Surgery Course	English
7-12 December	ESAVS	Lisbon (PT)	Ophthalmology and Neurology	English
* 60 Veterinary surgeons or 70 Nurse registrations required for simultaneous translation to be provided				

ADVANCE NOTICE		
2010	BSAVA Birmingham 8-11 April Annual Congress FECAVA/WSAVA/SVK Geneva 2-5 June ESVD-ECVD Florence (I) 23-25 September Annual congress, ESVOT /VOS Bologna(I) 15-18 September World Veterinary Orthopaedic Congress AVEPA Barcelona 1-3 October AVEPA/SEVC Annual Congress DSAVA 12-13 November Annual Meeting	Voorjaarsdagen Amsterdam 22-24 April ECVS Helsinki (Fi) 1-3 July 19th Annual Meeting VÖK Salzburg 25-26 September Annual Meeting AFVAC Paris 10 to 12 December Annual Congress
2111	BSAVA 31 March-3 April Annual Congress SVK/ASMPA Interlaken 18-21 May VÖK Salzburg 17-18 Sept AFVAC 2 to 4 December Annual Congress Lyon	Voorjaarsdagen 28-30 April FECAVA/TSAVA Istanbul 7-11 September Euro Congress, AVEPA, 30 September - 3 October Barcelona, AVEPA/SEVC Annual Congress
2012	FECAVA /WSAVA/BSAVA April 12-15 April	Voorjaarsdagen 26-28 April
2013	Voorjaarsdagen 25-27 April	

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(Full Association names are given at the front of the Journal)

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