Paolo Mascagni, Ernest Alexandra Lauth and Marie Philibert Constant Sappey on the Dissection and Injection of the Lymphatics

Regis Olry[1] and Kaoru Motomiya[2]

1Departement de chimie-biologie, Universite du Quebec a Trois-Rivieres, Trois-Rivieres, Quebec, Canada
[2]Medical Museum, Medical Department, University of Tokyo, Hongo, Bunkyo ward, Tokyo, Japan

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Abstract

In the last centuries, many anatomists tried to describe and to understand the course and the function of the lymphatic system. Technical difficulties explain the numerous controversies which stand out as milestones in the history of lymph vessels and nodes. This paper aims at summarizing the main steps in the discovery of the lymphatic system, and at describing the important contributions of pivotal figures in this field of vascular anatomy: Paolo Mascagni, Ernest Alexandra Lauth and Marie Philibert Constant Sappey.

Introduction

There are a number of steps in the history of the lymphatic system. Discovered by chance, misunderstood for a very long time, lymphatics were the subject of much controversy up to the early twentieth century, when their accurate description was deemed necessary to promote advances in oncology (Rouviere, 1932). The purpose of this paper is to summarize the history of the discovery of the lymphatic system and the differents methods used by three pivotal figures in the history of lymphatics: the Italian Paolo Mascagni in the late eighteenth century and two Frenchmen, Ernest Alexandre Lauth and Marie Philibert Constant Sappey, in the nineteenth century.

The Forerunners

The most famous Alexandrian anatomists observed lymph vessels in animals. But Erasistrate mistook them for arteries and Herophile mistook them for veins. However, the latter also referred to «glandular bodies», which must be regarded as the current lymph nodes.

In the sixteenth century, Nicolas Massa described briefly some lymph vessels of the human kidneys (1536), and Bartolomeo Eustachi (1564) made the first accurate description of the thoracic duct in the horse, which he called « Vena alba thoracis». However, he only observed its thoracic course and its connection with the subclavian or internal jugular vein.

In the seventeenth century, Gaspare Aselli, Thomas Bartholin, Olof Rudbeck, Jean Pecquet and Frederik Ruysch made important contributions to the knowledge of the lymphatic system.The Italian surgeon Gaspare Aselli (1581-1626) had been a pupil of his famous compatriot Gabriele Falloppio. On July 22 (or 23), 1622, he discovered the lacteal vessels while displaying the abdominal viscera of a dog at an anatomical demonstration. As it happened, the animal had been fed shortly before the dissection, and Aselli could therefore observe milky "fibers" running on the mesentery. He first mistook them for nerves and decided to cut them in the course of his demonstration. He then observed a whitish liquid flowing out of these "fibers" and came to the conclusion that they were vessels. Some days later, he began to verify his observations in other animal species: cats, lambs, cows, pigs, and even a horse he bought only for this purpose (Sappey, 1869). Unfortunately, Aselli could not confirm the existence of lacteal vessels in humans before his death in 1626. Aselli's book was published post-

Address correspondence to: Dr R. Olry, Departement de chimie-biologie, Universite[1] du Quebec a Trois-Rivieres, C. P. 500, Trois-Rivieres, Quebec, Canada G9A 5H7. Telephone: 819 376 5053 /Fax: 819 376 5084 Email: Regis_Olry@uqtr.uquebec.ca

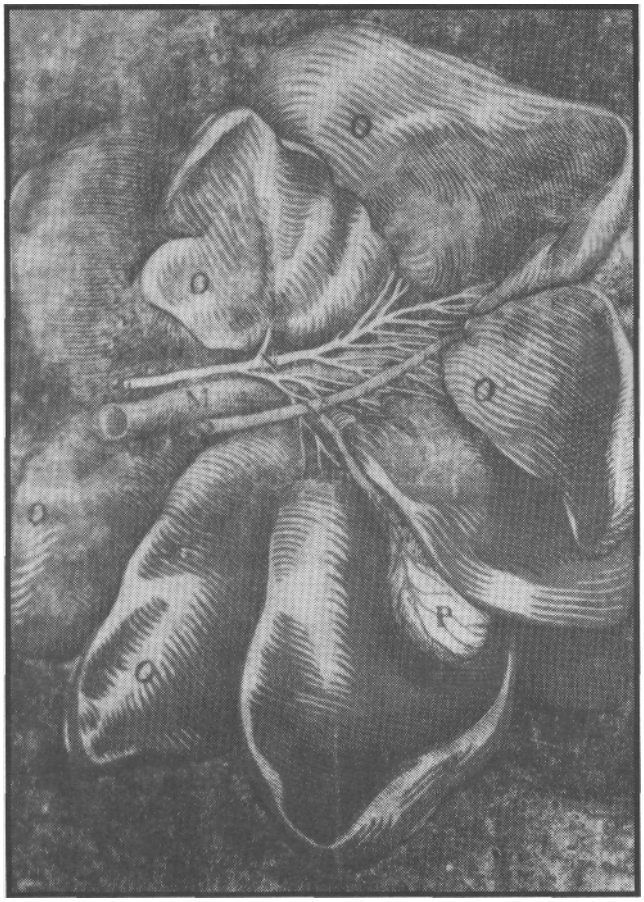

Figure 1. Aselli's plate of the lacteal vessels (1627). M - portal vein, N - lymphatic vessels, O - hepatic lobes, P - gall bladder, V - bile duct.

humously under the editorship of Alessandro Tadini and Luigi Settala (1627). In addition to its historical contribution to the history of the lymphatic system, this book also has the distinction of including the first anatomical plates printed in colour (figure 1), probably engraved by Cesare Bassano (Choulant, 1852; LeFanu, 1976; Norman, 1994). The Danish anatomists Thomas Bartholin (1616-1680) and Olof Rudbeck (1630-1702) published numerous studies on lymphatics and disagreed over their distribution (for a review, see Hagelin, 1989). Jean Pecquet (1622-1681) described the confluence of abdominal lymph trunks and the cysterna chyli at the origin of the thoracic duct in the dog (Pecquet, 1651). Eleven years later, Frederik Ruysch (1638-1731) established the existence of valves in the lymphatic vessels (figure 2) in a small book dedicated to his three much-admired teachers, Franciscus De Le Boe, Johann van Home and Florentius Schuyl (Ruysch, 1665; Luyendijk-Elshout, 1964).

Paolo Mascagni

The Italian anatomist Paolo Mascagni (1755-1815)

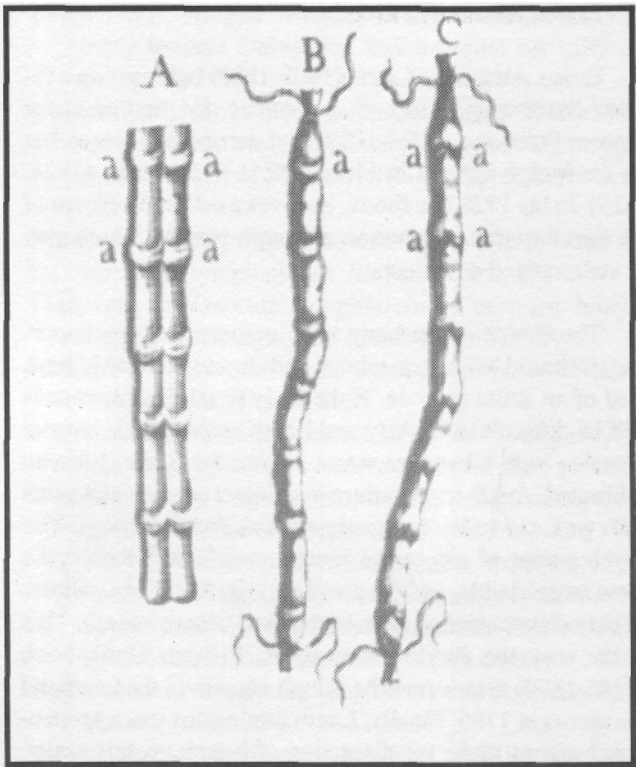

Figure 2. Valves in the lymphatics vessels (Ruysch, 1665). A - a lenghtwise cut lymphatic vessel, B-C - two lymphatic vessels full of water, so that the location of valves become visible, a - semilunar valves.

studied at Siena under Pietro Tabarrini (1702-1780). His most successful research was on lymphatics, and led first, to the submission of preliminary results (1784), to which the French Academy of Sciences awarded a prize, and second, to the publication of one of the most striking atlases of the eighteenth century (1787), illustrated by Giro Santi. By using a very simple method (a tubular needle bent at right angle), he was able to discover about fifty percent of all the lymphatic vessels now known (Norman, 1978). Moreover, he established that every lymph vessel must in its course enter at least one lymph node, disproved the existence of arterial and venous lymph vessels, and concluded that the lymphatic system originates from all the cavities and surfaces of the body.

Mascagni's procedure for the injection of superficial lymph vessels was widely used in the following century. In order to avoid filling the deep lymph vessels during the injection of the superficial ones, Mascagni recommended injecting glue in the arteries first, then cooling the specimen. In this way, all lymph vessels (superficial and deep) became collapsed. For the selective injection of the superficial vessels, he warmed up the surface of the specimen so that the glue could soften, therefore making the superficial lymph vessels permeable again.

Ernest Alexandra Lauth

Ernest Alexandre Lauth (1803-1837) belonged to a famous Strasbourg family of anatomists. He studied under Vincent Fohmann (1794-1837) and carried out researches on the lymph system in birds (1825) and in man (1824, 1829). In his 1829 handbook, he gives a detailed account of the injection and preparation of lymph vessels, which may be summarized as follows:

The choice of the body to be prepared is very important. It should be young, robust, and should preferably have died of an acute episode. If the body is fat, lymph vessels will be difficult to identify and Lauth recommends arterial injection with lukewarm water, so that the tissues become infiltrated. Another procedure is to inject arteries and veins with wax and to let the specimen soak for some days. The development of gas in the lymph vessels will then make them more visible, and the previous injection of wax allows an easy differenciation from arterial and venous vessels. This is the way the English anatomist William Cruikshank (1745-1800) discovered the lymph vessels of the heart and the uterus in 1786. Finally, Lauth reminds us that hypertrophied organs make the dissection of lymph vessels easier. According to Lauth, the lymph vessels of a gravid uterus are thicker in diameter than the feather of a crow!

In the nineteenth century, the lymph vessels were usually injected with mercury. Lauth stresses the fact that mercury must be as pure as possible, and must in any case be filtered through a piece of chamois leather. To check the purity of the mercury, he put a drop of mercury on an inclined plate. If the drop slid without dirtying the plate, the mercury was pure enough for the injection. If not, it meant it contained traces of lead or tin and must not be used for anatomical preparations. But other products could also be used. For the injection of thick lymph vessels (thoracic duct or right lymphatic duct), Lauth writes that plaster yields good results provided one takes care of the orientation of the valves. In addition, he reminds us that his colleague Andre Marie Constant Dumeril (1774-1860) made successful injections of lymph vessels with milk, provided the specimen was not intended to be preserved by drying. Other anatomists injected black ink by blowing into a tube connected with a thin glass needle. This procedure was used for the first study of lymphatics in Japan (Husiya, 1805).

To inject mercury into the superficial lymph vessels, Lauth removed carefully a small square of skin, located a vessel, made a small incision in its wall with a lancet, and introduced a thin glass or steel tube into the vessel. Owing to the high number of anastomoses, three injections are sufficient to inject all superficial lymph vessels of the lower limb: one injection on the hallux, a second on the fifth toe, and a third one behind the medial malleolus. For the same reason, three or four injections in various parts of the hand will fill all superficial lymph vessels of the upper limb (here he is at variance with Mascagni, who wrote that at least twenty injections are necessary for a whole limb).

Marie Philibert Constant Sappey

The French anatomist Marie Philibert Constant Sappey (1810-1896) conducted numerous studies on the lymphatic system (1843,1847,1874-75) (figure 3). In the second edition of his treatise on anatomy (1869, vol. 2: pp. 809-812), he gives a summary of the important points that have to be taken into consideration for a successful injection of the lymphatics.

Sappey differs with Lauth regarding the choice of body. Sappey recommends the body of man who died of a chronic disease because it will be sufficiently emaciated. The body of a child should only be used to study the lymphatics of the head, the tongue, the soft palate, the gums or the scrotum. Regardless of the specimen, however, Sappey thought the

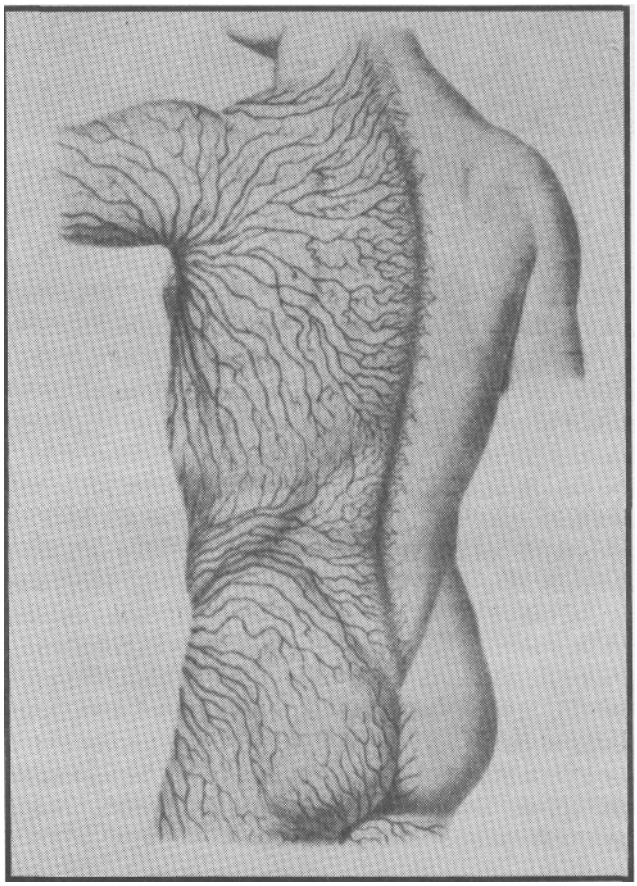

Figure 3. Superficial lymphatics of the trunk (Sappey, 1874-75).

injection of lymphatics should always be carried out in summer because a high temperature makes the progression of mercury easier.

Putrefaction also has an influence on the procedure. Early putrefaction helps the injection of superficial lymph networks (finger, toes and scalp, especially), but makes the main lymph trunks unusable.

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