Surgery on ships: constraints and difficult realities

Captain Ian Jones, RFD, MB ChM, MHA, GradCertED, FRCOG, FRANZCOG, FACS, RANR

Synopsis

- Health care facilities on ships vary according to need, but are always constrained by limited space and resources.
- Health care is not usually the primary function for a ship, and the demands of the military mission come first.
- Naval combat, the unpredictable and sometimes hostile nature of the sea, maritime conditions and materials stored on ships create an extremely dangerous environment.
- The key to surgery on ships is to keep it simple. Medical staff have to be realistic about what can be achieved at sea, know the limits and their role, which is to stabilise the condition of patients and prepare them for safe transport to centres elsewhere where definitive management can be carried out.

ADF Health 2000; 1: 119-123

WITH THE RETURN OF the amphibious transport HMAS MANOORA to active duty following her extensive refit and role change, it is timely for ADF Health Service members and line officers to review the unique environment of surgery on ships. Very few naval vessels operate purely as hospital ships. Notable exceptions include the US Navy's T-AH 19 (MERCY) and T-AH 20 (COMFORT) — two ships that are extremely expensive to staff, store and maintain. The Royal Australian Navy does not currently require and cannot afford the luxury of dedicated hospital ships. This in itself alerts us to a misconception engrained in Health Service personnel that the health aspect of their ships' activities is paramount, when in effect such activities during wartime (and sometimes during peacetime) are merely supplementary to the ship's primary role, which is usually troop transport. In war, the ship is a method of getting troops towards the battle zone to achieve specific mission objectives. Once troops are delivered, the ship, a valued military asset, is moved out of harm's way and so remains available for other tasks.

(The outcome of the Falklands War may well have been different if the troops could not have been delivered to the battlefield — fortunately for Britain the Argentinians attacked the escorts and allowed the troop carriers and support ships to undertake their vital tasks).

Ships with health service capabilities may operate quite differently if they are being employed for humanitarian purposes in a non-hostile environment. Similarly, in combat situations, ships taken up from trade for casualty care (such as the SS UGANDA during the Falklands War) may be relatively immune from direct hostile attack if certified as compliant with the Hague and Geneva conventions by the International Committee of the Red Cross, and if granted protection by the adversary. However, in this article I concentrate on surgery and medical care as they must be practised on troopships during active military service.

Captain Ian Jones has seen service afloat on HMAS STALWART, HMAS TORRENS and USS ESSEX. Recent postings include Director Reserve Health Support Navy, Bougainville and East Timor.

Constraints and limitations

The mission: The primary role of the ship is likely to take precedence over health care activities, making the first call on resources, staff and time.

Ships with hospital facilities may be unable to operate close to the scene of casualties for many reasons, so that transport to and from the ship becomes a rate-limiting step in the overall scheme of patient management.

Military ships must be able to fight to protect themselves and any unarmed merchant ships that are in company. If a ship shares a military function with a health service one, it cannot expect to be exempt from attack — in any event, missiles and mines cannot distinguish between combatants and non-combatants.

Combat: Naval combat is dangerous, with risks of fire, flooding, smoke, blast effects from explosions and exposure to extremes of temperature. Warships are full of dangerous substances — fuel, munitions, machinery — and this risky work-

1 HMAS MANOORA

HMAS MANOORA was a US Navy Newport class amphibious landing ship-tank and has been refitted as an amphibious transport with naval training and medical facilities for the RAN. MANOORA is 1590 m long, displaces 8450 tons and has a ship's company of 178 RAN and 18 ship's Army detachment, and can carry 450 troops.

◀ *High dependency unit on HMAS MANOORA*

ing environment is made more dangerous by the enemy's efforts to sink or incapacitate the ship.

In combat any treatment may need to be delivered under primitive conditions. The mission and the state of the ship (floating, moving, and fighting) have priority. Damage to the ship may affect the major health facilities, leaving secondary centres and staff from other parts of the ship to provide the health care. Health care providers are not immune to becoming casualties themselves.

The environment at sea is unpredictable and sometimes hostile. Humidity, extremes of temperature, vibration, dust, salt water and the effects of battle plus the lack of highly skilled regular maintenance of specialised equipment can also limit health service activities.

When a ship is pitching and tossing or rolling from side to side during bad weather, any type of surgery may be prohibited and even the simplest health care can be difficult. The larger the ship on which one is working, the greater the stability, although size is not the only factor. Flat-bottomed ships and ships with a high freeboard tend to roll more than most other ships. Fitting stabilisers to ships may reduce roll, but it will not eliminate this problem altogether. Moving ships into harbours may exchange one hazard for navigational or military ones.

Space: Ships have definite spatial limitations — on land more tents can usually be pitched to accommodate an unexpected patient overflow; at sea, despite much ingenuity from sailors, any expansion of patient accommodation is severely constrained.

Logistics: It is not always easy or even possible to replenish out-of-date or consumed stores when away from Aus-

2 US Hospital Ship COMFORT

When fully mobilised, this converted oil tanker has a crew of 1214 to support the 1000-bed hospital, which includes 12 operating theatres.

3 Patrol boat HMAS GERALDTON

One of the RAN's 15 Fremantle class patrol boats, built between 1977 and 1984. The GERALDTON has a crew of 22, is 42 m long and displaces 220 tonnes.

tralia, and the medical staff cannot call a locum service to replace exhausted, injured or ill doctors.

Facilities: Even large ships cannot carry the wide range of medical and surgical equipment that would be expected in most hospitals on shore. Health care providers, however important they see themselves in their own minds, must adapt their skills to the very limited environment on a ship. They must also remember their mission. Their role is to stabilise the condition of patients and prepare them for safe transport to centres elsewhere where definitive management can be carried out.

Such restrictions may apply equally when the team is providing humanitarian services to a civilian population. Resources are at a premium and they must be used to provide the greatest good to as many people as possible.

Health care facilities on RAN ships

As a general rule, the larger the ship, the larger the health care facilities (equipment, stores and accommodation for staff and patients) available on board. On a Fremantle-class patrol boat (220 tonnes) health care facilities consist of a medicine cabinet, first aid equipment, a mess table and a coxswain. HMAS MANOORA (8450 tonnes) has a health care staff that includes surgeons, anaesthetists, general duties doctors, specialised and general trained nursing staff, technical staff plus medics. This staff has the facilities to provide level three health care — operating tables, six high dependency beds, x-ray and laboratory services, plus 32 low dependency beds.[1]

4 Requirements for providing care

- Can the ship reach the patients or the patients reach the ship?
- Are there suitable port facilities, navigable channels, wharf facilities?
- Is the weather favourable for air or sea transfer of casualties?
- Is there spare capacity to handle a further workload?
- Is the ship adequately supplied and resupplied?
- Are the staff physically and mentally fit?
- Does the mission allow the provision of health care?
- Do the conditions of battle allow the provision of health care?
- Do aeromedical evacuation vehicles have the fuel capacity to complete a round trip from ship to shore?
- Can the casualty evacuation chain free up the ship's medical facility to allow more patients to be handled?

Casualty care at sea

The military aim of health care facilities is to act as a *force multiplier,* returning the injured to service as quickly as possible.

The principles of trauma care still apply at sea. Time elapsed between wounding and the delivery of medical treatment is vital. First aid should be followed by stabilising surgery, organised evacuation and definitive management. Speed is crucial: the wounded should be treated if possible within six hours of injury (the golden period). Receiving effective care during the first "golden" hour is vital in achieving maximum patient salvage.

Ship-borne trauma care for patients brought to the ship, whether in war or on a humanitarian mission, must still be able to satisfy the requirements listed in Box 4. Effective casualty care at sea follows the well-tried doctrines of triage and the evacuation chain. The outcome of treatment depends on the severity of the injuries, the number of injured, the maximum limits of survivability, and events in the golden period and the golden hour.

Surgery at sea

The health care professional team must consider many factors when preparing for surgery at sea (Box 5). The first question must be whether surgery should be attempted at all. The wisdom of the Swiss surgeon, Professor Emil Kocher (1841–1917), the pioneer of thyroid surgery, should never be forgotten: "A sur-

5 Preparing for surgery at sea

Consider:

- the patient's present condition
- the type of injuries/illness
- the number of casualties waiting for treatment
- the importance of triage
- the current facilities
- the availability of blood replacement
- the doctor's abilities
- the staff available
- the distance from help
- the ability to reach that help
- the presence of ships in company
- the seaworthiness of all medical equipment and stores
- the availability of medical resupply
- the weather conditions
- the mission.

The key is to KEEP IT SIMPLE and adapt practices to the situation.

6 Combat injuries

- Massive wounds
- Contaminated wounds
- Infection prone from the combat environment
- Burns
- Blast injury
- Smoke/toxic gas inhalation injuries
- Nuclear biological or chemical injuries
- Combinations of these types of injury
- *Tropical diseases may add to battle injuries*

geon is a doctor who can operate and who knows when not to". Smith warns us that doctors training in peacetime are expected to understand the unique requirements of treating combat injuries.[2] However, in reality, injuries like those produced in combat (Box 6) are not commonly found in peacetime prac-

7 Lessons from history

In World War Two, penetrating wounds and burns made up over 60% of wounds in ships under attack.[3]

On 6 January 1945, the battleship USS NEW MEXICO was damaged by a kamikaze attack. Thirty sailors were killed and 129 were injured. For the next four days NEW MEXICO was under repeated air attack and all crewmembers stayed at their battle stations. *Only at night could the health care teams render definitive care to those wounded in the initial attack.* It was not possible to evacuate the wounded from the ship for 13 days.[3]

On 19 March 1945, two armour piercing bombs struck the aircraft carrier USS FRANKLIN. The bombs penetrated the flight deck and exploded in the hangar deck below, resulting in 1000 casualties out of a total of 3300 crew. Eight hundred died (210 due to burns, 133 of smoke and gas induced asphyxia).[3] The remaining crew managed to keep the ship afloat and return to harbour.

Immersion blast injuries were sustained by some of the survivors of the Israeli destroyer EILAT in 1967 when an explosion happened near survivors in the water.[3] The blast resulted in internal chest and intra-abdominal compression injuries.

During the Falklands War of 1982, the Argentinian cruiser GENERAL BELGRANO was struck by two torpedoes and slowly sank. Sixty-nine of 71 survivors from the sinking suffered hypothermia and 18 died.[3]

During the Falklands War, the RFA SIR GALAHAD was bombed, resulting in 179 casualties. Of these casualties, 83 had burns, many had smoke inhalation injuries and others had extensive trauma.[4]

Missile damage to USS STARK FFG-31. The STARK is a similar vessel to the six RAN frigates. It was hit by two Exocet missiles launched by Iraqi forces in the Persian Gulf in 1987.

tice, so doctors may be underprepared. At the same time, in the Gulf War there were instances of doctors who joined forward-deploying units not understanding that their role was to stabilise patients and evacuate them to the rear for definitive management.

If surgery is undertaken, it should be kept as simple as possible. Health care staff must have realistic objectives, remembering that, beyond the initial patient contact and treatment, they must continue this care until the patient is transferred to level 4 care.

"Getting real"

The lessons of history (Box 7) remind us that health services in combat operate under serious constraints. A ship cannot reproduce a tertiary-level hospital at sea. A 500-bed city hospital offering care to trauma victims consumes resources that cannot be kept up to a ship. The hospital requires an extensive roster of highly trained technicians, plus large numbers of medical and nursing staff, all working to cover 24 hours of every day, all year round.

"Getting real" in what we can reasonably expect from the health services at sea during wartime includes influencing the current attitudes of both health professionals and fleet commanders. Misconceptions concerning the abilities of these maritime health facilities could adversely affect operational planning and execution. In the RAN all of our health facilities are but secondary or tertiary activities in military assets that are primarily designed to help commanders win the fight at sea. The small band of dedicated, highly professional men and women who provide excellent heath care at sea routinely during peacetime have to remember this reality in all their planning and training.

Naval health professionals also need to recognise that they will be working jointly with other branches of the ADF Health Service in many situations, especially during amphibious activities. All health professionals are an asset and, despite inter-service rivalries, all must work together to get the best results for our patients.

Acknowledgement

I thank Captain Arthur Smith USNR (Retired) for his helpful suggestions when reviewing this paper.

References

1. Schweikert M. Hatch, match and dispatch. *The Navy: Magazine of the Navy League of Australia* 2000: 62:1: 29.
2. Smith AM. Getting them out alive. *US Naval Institute Proceedings*, February 1989: 41.
3. Smith AM. War at sea: unique challenges for navy medicine. *Navy Medicine* 1993; 84(1): 10-16.
4. Leicester RJ. SS Uganda — surgery in the hospital ship. *Trans Med Soc London* 1984: 99: 89-93. ❑