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BATLS

Battlefield Advanced Trauma Life Support (BATLS)

A new BATLS manual has now been prepared under the Authority of the Professor of Military Surgery. In order to disseminate this information widely within the Corps, this Manual will appear in sections in the Corps Journal. This version of the Manual supercedes all previous versions and is now in use on current and future courses.

CHAPTER 1 INTRODUCTION

History of Advanced Trauma Life Support

0101. There are marked differences in the epidemiology of trauma in different countries. In 1983, only eight people died from gunshot wounds in the United Kingdom. In the same year, the figure in West Germany was 53, approximately one per million of population. Canada had the same ratio with 20 deaths, but in the United States of America with a population of 226 million the figure was 10,838. By 1994, this figure had risen to a shattering 37,500 deaths due to firearms related injury from all causes. In the same year, the United Kingdom with a population of 58.5 million had 261 deaths from firearms. It is not surprising the Americans have a concept of trauma that we in Britain do not have. In America there is also a geographical problem: the nearest major trauma centre can be 150 miles away.

0102. In February 1976, a surgeon piloting his own aeroplane crashed in a rural cornfield in Nebraska. He was badly injured, his wife was killed, three of his children had critical injuries and a fourth child minor injuries. He considered the treatment that he and his children received to be woefully inadequate and said "*When I can provide better care in the field with limited resources than what my children and I received at the primary care facility, there is something wrong with the system and the system has to be changed.*" (Sic).

0103. As a consequence of this incident the need for training was identified. With the help of the Lincoln Medical Education Foundation and the Southeast Nebraska Emergency Medical Services, a prototype Advanced Trauma Life Support (ATLS©) course was devised.

0104. The project developed and was adopted in 1979 by the American College of Surgeons Committee on Trauma. As a result and with further revisions, a national trauma programme was established. The original targets were those doctors who do not normally deal with trauma as part of their daily lives, but now all doctors are expected to be capable of managing the trauma patient during the immediate post-trauma phase.

0105. The Advanced Trauma Life Support courses are now run in many centres throughout the United Kingdom. It has also been modified in various parts of the world. In Australia, for example, it has become the Early Management for Severe Trauma (EMST) course.

0106. In the United Kingdom, road traffic accidents are the most common cause of trauma deaths in peacetime; this is still true in most states in America but the proporation of penetrating trauma (gunshot and stab wounds) is much higher.

In America and Australia, trauma services are regionalized with all major cases bypassing the smaller hospitals in favour of a regional trauma centre. In general, this does not apply in the United Kingdom.

History of Battlefield Advanced Trauma Life Support

0107. Following the attendance on one of the American courses by the late Brigadier Ian Haywood, a former Professor of Military Surgery, the need was identified for a similar course modified for military requirements. The Department of Military Surgery at the Royal Army Medical College [now the Royal Defence Medical College (RDMC)] and the Army Medical Services Training Group [now the Defence Medical Services Training Centre (DMSTC)] were tasked with devising a course for the British Army.

0108. Although the Battlefield Advanced Trauma Life Support (BATLS) Course is about training doctors for war, there is nothing new in this. Medical officers in former times had to deal with the injuries of the day - contusions, lacerations, penetrating wounds and broken bones - and under the primitive conditions prevailing at the time.

The Modern Era

0109. Today's medical services still have to deal with similar wounds, but they also have to contend with injuries produced by modern weapons - including not only gunshot wounds, but more importantly, multiple injuries produced by fragments with relatively high velocities and capable of producing high energy-transfer wounds. They also have the problems of the effects of blast and the horrors of extensive burns.

Fragments and bullets

0110. Bombs, shells, grenades and other explosive devices, cause death and injury due to victims being hit by primary and secondary fragments and due to the effects of blast. In older weapons, primary fragments were derived from the weapon casing and, as such, had wide variation in size, shape and weight. These weapons produced *random fragmentation*.

0111. Modern fragmentation munitions are designed to deliver many hundreds of preformed fragments of different types. These fragments are much more uniform in size, shape and weight. Examples include, the pre-notched wire in a hand grenade, flechets in bomblets and etched plates in shells and mortar bombs. These weapons are referred to as *improved (pre-formed) fragmentation devices*.

0112. Improved fragmentation devices are designed not to increase lethality but, to increase the likelihood of a hit. In fact, the lethality has fallen (See Table 1-1). The concept of the use of these weapons is a simple one: increase the likelihood of a hit, generate more enemy casualties and choke his logistic evacuation chain. The same concept also applies when these weapons are used by the enemy against friendly forces!

Table 1-1 Lethality of penetrating missiles

Type	*Lethality*
Random fragmentation devices	1 in 5 (Shell) 1 in 10 (Grenade)
Improved (Pre-formed) Fragmentation devices	1 in 7 (Shell) 1 in 20 (Grenade)
Military bullet	1 in 3

0113. Early rifle bullets depended on their mass and shape in order to produce injury, velocity was less important. For modern rifle and machine gun bullets, mass has fallen considerably but velocity risen dramatically. Given that the energy of a missile is derived from the formula 1/2JMV2 [M = mass, V = velocity], this means the available energy in a modern military bullet has risen several fold. The potential lethality of these bullets is shown in Table 1-1 and well illustrated by the figures in Table 1-2.

Table 1-2 Site of injury and outcome for 67 soldiers injured by Armalite rifle bullets (5.56mm), Northern Ireland 1969-1979 (1)

Site of Injury	*Dead on arrival*	*Died in hospital*	*Survived*
Head (brain)	7	1	
Head (face)			4
Neck			2
Chest	7	2	9
Thoracoabdominal		1	1
Abdominal		4	5
Upper limb			11
Lower limb			13
Total	**14**	**8**	**45**

Injuries caused by fragments and bullets

0114. The severity of injuries caused by fragments and bullets is not just a question of what hits you and what is struck, it is multifactorial. Amongst the many factors that determine the severity of injury caused by missiles are:

- Mass
- Velocity
- Shape and stability: both are determinants of the amount of energy deposited in the tissue struck.
- Density of tissue: the denser the tissue the greater the retardation of fragment or bullet allowing for higher absorption of energy with more tissue damage.
- Length of wound track: the longer the track the greater the chance of energy exchange.
- Cavitation/shock wave: high-energy transfer wounds caused by military rifle bullets cause both. The role of cavitation in causing tissue damage remains controversial, the role of the shock wave in damaging structures such as bone, arteries and nerves is well established.

0115. The ballistic characteristics of a fragment or bullet should not be confused with the pathophysiological effects of injury. A bullet may enter a thigh, hit the femur and deposit all its energy. In so doing, it can shatter the femur causing considerable tissue damage. The same bullet can enter the thigh, miss the femur and exit without hitting any vital structures causing considerably less tissue damage. The ballistic characteristics are the same, the pathophysiological results are fundamentally different.

0116. Despite advances in weapon technology, the hospital mortality following battlefield injury has been reduced significantly during this century; from 8.1% in World War One, to half that in World War Two (due mainly to advances in resuscitation and surgery) and reduced still further in Korea and Vietnam.

0117. In the Falklands Campaign of 1982 there were over 250 deaths; the majority occurring before arrival at a surgical facility. Those casualties who reached a field hospital had a survival rate of 99.5%. In the Gulf War of 1991, casualties were fewer than anticipated and the survival rate was high. In one British Army field hospital, 63 casualties with penetrating missile injuries underwent surgery; most had multiple fragment wounds involving two or more body systems, ranging from 1 to 47 hits with an average of 9 hits. The average lag-time before surgery was over 10 hours for allied casualties and 24 hours for enemy casualties.

0118. To continue to improve survival rates we must look at the situation before casualties reach hospital. They must be kept alive from point of wounding to arrival at a surgical centre, otherwise the expert facilities there will be to no avail.

The aim of BATLS is to give the surgeon a live casualty.

Scope of the BATLS/BARTS Course

0119. Much research has been devoted to finding out why and when casualites die. A United States Army Medical Corps officer, Colonel Ronald F Bellamy, has analysed a large number of deaths in battle. His data are supported by analysis of various British campaigns including that of Urban Terrorist activity in Northern Ireland. These data provide a model for a military trauma population and for the role of resuscitation in the field.

Killed in action (KIA)

0120. This group are those who die on the battlefield before reaching a fixed medical facility; 90% of US soldiers fatally wounded in Vietnam were in this category and 70% of these died within five minutes of wounding.

0121. The common causes of KIAs are:
- Exsanguinating haemorrhage (46%) (2):
- 80% bleeding from major vessels and structures within the torso (non compressible haemorrhage).
- 20% bleeding from major vessel and soft tissue injury in one or more limbs (compressible haemorrhage).
- Penetrating brain injury (21%)(2). These are devastating injuries and offer little potential for improved outcome even with early surgical intervention.
- Respiratory injury (4.5%)(2):
- Airway obstructions.
- Open penumothorax.
- Tension penumothorax.
- Combinsations of the above (9%)(2). A combination of brain injury and exsanguination is the most common.
- Mutilating blast injury (10%)(2).

Died of wounds (DoW)

0122. These are casualties who expire after reaching a fixed treatment facility and constitute 10% of this military trauma population. Available data indicate half of them die within 24 hours of wounding. There are three main causes of death:
- Brain injury (4%).
- Hypovolaemic shock (2%). This was usually due to continued bleeding from the liver and/or pelvis with or without coagulopathy.
- Sepsis and multi-organ failure (4%).

0123. Analysis of mainly civilian trauma data shows a trimodal death distribution:
- *Instantaneous*. These occur within seconds to minutes of injury and include injuries to the brain, spinal cord, heart and major vessels.
- *Early*. These extend from the first few minutes to a few hours. Examples include airway and respiratory compromise, continuing haemorrhage and subdural and extra-dural haematomas. It is in this phase, often referred to as The Golden Hour of trauma management, that properly trained individuals can save many lives.
- *Late*. These occur from a few hours to days or even weeks after injury. The majority are due to sepsis with associated multi-organ failure.

The role of BATLS and BARTS

0124. The concept of managing the severely injured within the *golden hour* may be applicable during operations other than war. In war fighting, this concept will be severely constrained by the tactical situation on the battlefield, particularly the problems of time and distance. So where does BATLS fit into the concept of medical care on the battlefield in war fighting? Rather than consider a trimodal death distribution, it is probably better to think of three casualty population groups:
- KIAs (17-20%). This group have fatal injuries and will die irrespective of the level of sophistication of available medical care.
- Moderate to minor injuries (65-70%). This group require the well documented methods of battlefield care for example, analgesia, antibiotics, limb splintage and soft tissue wound excision. The majority of this group are limb injuries.
- Severe but potentially survivable injury (10-15%). A favourable outcome for this group is effected by timely application of sophisticated trauma care. This group is recognised by appropriate triage and includes; airway and respiratory compromise, management of compressible haemorrhage, recognising those with non compressible haemorrhage needing urgent or early surgery and appropriate use of intravenous fluid resuscitation. BATLS and *BARTS training is aimed at giving you the skills to save lives in this third group.* You can also significantly influence the late outcome (death due to multi-organ failure) by vigorous and correct initial management, for example: restoration of tissue perfusion - oxygenation, minimizing wound sepsis and, vitally, by recognising the need for early surgical intervention, followed by intensive medical and nursing care.

0125. The battlefield casualty's chance of survival improves significantly after arrival at a field hospital. Military constraints limit how far forward hospital surgical facilities can be deployed. This is why it is vital to provide trauma life support in the pre-hospital phase of casualty management. Despite changing concepts of the deployment of surgical teams on the battlefield of the future, it is vital that:

Every medical attendant possesses the basic skills to keep casualties alive at Role One and Role Two or until they reach a surgical facility.

0126. The BATLS course concentrates on teaching these skills. You must learn to assess casualties using the five senses, tempered by the sixth sense - commonsense! These are likely to be the only diagnostic aids available to you until the casualty is moved to a field medical facility. The correct application of BATLS/BARTS principles, particularly in an austere and potentially hostile environment with limited equipment and diagnostic aids, will enable you to save lives.

0127. The responsibility for BATLS training rests with the Professor of Military Surgery. Under his guidance, a group of experienced lecturers from all three Services - both Regular and Reserve, form the BATLS Training Team.

0128. Satisfactory performers receive a BATLS or BARTS certificate. The certificate is valid for six years for BATLS and four years for BARTS, after which a revalidation course is necessary.

References

1. Derived from Hostile Action Casualty System Survey of British Service personnel injured - NI.
2. Percentage figures derived from the collective date referred to in paragraph 0119.

CHAPTER 2 INITIAL ASSESSMENT & MANAGEMENT

0201. On successfully completing this topic, you will be able to:

- Identify the correct sequence to be followed in assessing and managing battlefield casualties.
- Understand the concept of *primary and secondary survey*.
- Carry out an *initial assessment and management survey on a casualty*.

Trauma Management

0202. Managing trauma is stressful even in a good working environment. On the battlefield, conditions are far from ideal. It may be dark and uncomfortable, noisy, wet and cold; it will certainly be dangerous and you may be tired, hungry and frightened.

0203. Training allows you to respond automatically regardless of fear and environment. In military terms you acquire a drill. In the heat of battle you can perform, with a minimum of mental effort, a drill (a practical skill) that you have learnt in peacetime.

0204. When dealing with casualites you must consider their management in four phases:

• **Primary survey**	Identify life-threatening problems
• **Resuscitation**	Deal with these problems
• **Secondary survey**	Top-to-toe examination
• **Definitive care**	Specific management

Primary Survey

0205. The primary survey is the most important phase; it is easily remembered as

A B C D E

Airway and cervical spine control.
Breathing and ventilation.
Circulation and haemorrhage control.
Disability (Displaced brain) or neurological status.
Exposure depending on environment.

0206. Do the primary survey as follows:

- ***A****irway and cervical spine control. Do not be distracted by other injuries; the airway must take priority*. BATLS does not attribute the same emphasis to potential cervical spine injury as the equivalent civilian course (ATLS©). Nevertheless, the integrity of the cervical spine must be considered. It is always safer to assume a cervical spine fracture in casualties with multiple injuries, especially if there is blunt injury above the level of the clavicle or in an unconscious casualty. Then consider:
- **B***reathing and ventilation*. Look at the neck to see if the trachea is deviated or the neck veins engorged. Look at the casualty's chest to see if it is expanding equally and for obvious open chest wounds. If there is compromised ventilation:

What is the reason? Do something about it!

Remember that of all those who die from chest injuries, 25% die unnecessarily and 85% of these could be saved by primary care! Then consider:

- ***C****irculation and haemorrahge control*. Haemorrhage must be arrested if possible and the circulating volume restored to an acceptable level. This applies to casualties with compressible haemorrhage. Uncontrollable (non compressible) haemorrhage requires urgent surgical intervention and a different approach to fluid volume restoration (see paragraph 0527 and Table 5.2). Only now should you consider:
- ***D****isability or neurological status*. This is a simple **AVPU** assessment of the casualty's

level of consciousness and pupil state. You want to know if the casualty is:

Alert. **V**oice responsive. **P**ain responsive. **U**nresponsive.

You also want to know if the pupils are equal, the pupillary size and if they react to light (indicating **D**isplaced brain). There is not much you can do about the neurological state at this stage other than ensuring cerebral oxygenation and perfusion, but you need to record the findings so that any change can be appreciated later. Remember that the level of consciousness not only refelcts the neurological status, but can be influenced by hypovolaemia and hypoperfusion.

- Exposure. In hospital, this must be total but at Role One and Role Two there may be constraints.

0207. Remember also to speak to the casualty at the very beginning; an alert response can tell you a lot about his respiration and cerebral perfusion. To be able to speak, the casualty must:

- Have a patent airway.
- Have a reasonable tidal volume to phonate.
- Have reasonable cerebral perfusion to comprehend and answer.

Resuscitation

0208. The resuscitation phase is carried out simultaneously with the primary survey, with life-threatening conditions not only identified but managed as they are found.

0209. If available, administer supplementary oxygen to all serious casualties with maximum flow rate through a tight-fitting mask and reservoir. Establish and maintain a minimum of two large-calibre intravenous lines; 16 gauge is the smallest adequate size. Assess resuscitation efforts and monitor the casualty by measuring physiological parameters. These include:

- Alertness, is it improving or deteriorating?
  - Respiratory rate
  - Pulse rate and rhythm
  - Pulse pressure
  - Capillary refill time
  - Blood pressure (presence of radial, femoral, or carotid pulse (See paragraph 0517)
  - Urinary output
  - Arterial blood gases (if facilities are available)

0210. Consider the insertion of urinary and nasogastric catheters during this phase. Once you have successfully completed the primary survey and resuscitation phases, you can then proceed to the secondary survey.

Secondary Survey

0211. You carry out the secondary survey when the casualty is stable. Remember that casualties have backs and sides as well as fronts; bottoms as well as tops; and lots of holes, both natural and as a result of injury. You must be systematic, going through a top-to-toe process as follows:

- Scalp and vault of skull
- Face and base of skull
- Neck and cervical spine
- Chest
- Abdomen
- Pelvis
- Remainder of spine and limbs
- Neurological examination

0212. Do not forget the holes. *Every orifice merits a finger, a light or a tube.*

Definitive Care

0213. In the forward areas, you will rarely be concerned with definitive care. This is more likely to take place in the rear areas. Nevertheless, it is important to realize that definitive care forms the fourth and final phase in BATLS management. It is equally important to remember that if you do not get the primary survey and resuscitation phases correct, definitive care may be in the hands of the War Graves Commission!

Summary

- No matter where you are, remember - as you approach every casualty the following questions should be going through your mind;
- Is the airway patent?
- Is the casualty breathing?
- Is there life-threatening external or internal blood loss?

A consistent, systematic approach to the primary survey is vital to the casualty's survival.

The BATLS manual is prepared by the BATLS Training Team under the authority of the Professor of Military Surgery who remains responsible for its technical content.