# Chapter 2

# PREPARING THE TEAM

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**INTRODUCTION**

**HUMAN FACTORS IN DEFENSE ANESTHESIA**
- **Communication**
- **Use of Standard Operating Procedures**
- **Situational Awareness**
- **Leadership/Followership**
- **Familiarization With the Environment and Equipment**

**THE MULTIDISCIPLINARY TRAUMA TEAM**

**TRAINING THE TRAUMA TEAM**

**LIKELY ANESTHESIA TASKS AND CONSIDERATIONS**
- **Scenario 1. Bilateral Above-Knee Amputations**
- **Scenario 2. Possible Hypovolemic Shock**
- **Scenario 3. Damage Control Surgery With Multiple Injuries**
- **Scenario 4. Fluid Replacement With Multiple Injuries**

**SUMMARY**

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## INTRODUCTION

As an introduction to this chapter on preparing the team and environment for a deployment as a military anesthesiologist, it is important to point out that there are several differences between United Kingdom Defence Medical Services (UK-DMS) anesthetists and US military anesthesiologists.

UK-DMS anesthetists predominantly work in the National Health Service (NHS) and deploy on operations once every 6 to 18 months depending on their role. Both regular and reserve personnel contribute to a consultant cadre of about 180. A number of trainee anesthetists also deploy and complete a higher military training module in accordance with the Royal College of Anaesthetists program.[1] Hospital units tend to change at 3 or 6 monthly intervals, and individuals are often "trickle posted" as individual replacements deploying for 8 to 12 weeks.

US military anesthesiologists include both active duty and reserve component personnel. Active duty anesthesiologists are full time uniformed officers working within the military health system at military medical treatment facilities around the world at both operational and fixed facilities. The average deployment cycle is every 5 years across the services. This infrequent deployment cycle is mostly due to the rapid turnover of personnel retiring to civilian practice after their initial service obligation has been completed. Reserve personnel have a similar deployment cycle; however, when not on duty they work within the civilian healthcare sector. The average turnover for US forces is 6 months to 1 year, although specialists within the US Army and US Air Force may be reposted more frequently. Despite these differences, the two groups share similarities of practice, which will be discussed in terms of predeployment training.

Military hospitals in Iraq and Afghanistan managed considerably more severe trauma than an average UK or US hospital.[2] As a consequence, the injury patterns seen with military trauma (mainly blast and ballistic injury) are very different than the blunt trauma that predominates in UK and US civilian trauma practice.[3–5] Deployed anesthesiologists are required to work with equipment they are not familiar with and therefore must train to become competent with the equipment prior to deploying. Additionally, the military has unique guidelines or standard operating procedures (SOPs). In the UK these are written as Clinical Guidelines for Operations,[6] and the US Army Institute for Surgical Research publishes the Joint Theater Trauma System Clinical Practice Guidelines.[7] In military trauma, the traditional resuscitation guidelines of airway, breathing, and circulation (ABC) are modified to <C>ABC,[8] where <C> indicates the control of catastrophic hemorrhage. Other differences include the early and rapid use of blood and blood products as part of damage control resuscitation.[9,10]

Predeployment training allows individuals the opportunity to become fully immersed in the operational environment and familiar with the new equipment. The busy operating room schedule in the deployed environment necessitates that individuals are comfortable with the unfamiliar equipment and environment.[11] For instance, in a conflict environment an alarm bell might be a signal to drop down flat on the floor ("on your belt buckle") because of an incoming mortar attack, whereas in a civilian setting it might signify a fire alarm or a patient's cardiac arrest. First-rate human factors or nontechnical skills are important in this environment, and effective clinicians use them as part of their working routine.[12] The clinical tempo in theater precludes the potential for any significant "just-in-time" training. The whole medical system must be prepared to work in the deployed environment and rapidly integrate individuals into the team when they arrive.

## HUMAN FACTORS IN DEFENSE ANESTHESIA

In the 1970s simulation in healthcare began gaining recognition as a means to limit human error and improve patient safety. The advantages of simulation training had been clearly demonstrated in the aviation and nuclear power industries as well as the National Aeronautics and Space Administration (NASA). Previously, NASA had shown that 70% of its errors were due to human factors such as failed interpersonal communication, decision-making, and leadership.[13] Similar figures have been seen in an analysis of adverse events in anesthesia[14] and also in the landmark report *To Err Is Human,* which showed that between 44,000 and 98,000 people die in the United States every year from medical errors.[15] Multiple case reports and a report from the UK National Patient Safety Agency also suggest that human factors contribute to the majority of medical errors.[16–19]

Research on human behaviors has led to the development of a set of behavioral principles initially termed Crew Resource Management (CRM). CRM, also called human factors, is defined as "the cognitive, social, and personal resource skills that complement

technical skills, and contribute to safe and efficient task performance."[20] As adapted for anesthesia, these principles are listed in Exhibit 2-1.

Carthey et al[21] reported that highly performing surgeons demonstrated nontechnical skills as an integral part of their surgical expertise, and these attributes were thought to play an equally significant role as technical skills. Ineffective communication was found to be a causal factor in 43% of errors by surgeons in three US teaching hospitals.[12] Human factors are also very important in the critical care environment, where patients have life-threatening illness, diagnostic uncertainties, and the potential for rapidly changing medical conditions, and are managed along variable treatment pathways. Patient care is carried out over a 24-hour period involving multiple team transitions and moves to different areas of the hospital, which can result in lapses and discontinuities in communication.[22] In the UK, the Houses of Parliament Health Committee has recently acknowledged that a paucity of nontechnical skills can have lethal consequences for patients and that the NHS as a whole lags unacceptably behind other safety-critical industries, such as aviation, in this respect.[23] The following are key human factors that are essential to the effective working of the trauma team.

**EXHIBIT 2-1**

**CREW RESOURCE MANAGEMENT KEY PRINCIPLES**

- Know the environment.
- Anticipate and plan.
- Call for help early.
- Exercise leadership and followership.
- Distribute the workload.
- Mobilize all available resources.
- Communicate effectively.
- Use all available information.
- Prevent and manage fixation errors.
- Cross (double) check.
- Use cognitive aids.
- Reevaluate repeatedly.
- Use good teamwork.
- Allocate attention wisely.
- Set priorities dynamically.

Data source: Rall M, Gaba D. Human performance and patient safety. In Miller R, ed. *Miller´s Anesthesia.* Philadelphia, PA: Elsevier Churchill Livingstone; 2005: 3021–3072.

**Communication**

It is essential that the flow of information from the point of wounding to the trauma team in the field hospital is accurate. The initial military communication tool is the "9 liner"[24] evacuation request, which medics on the ground use to request the evacuation of a casualty. Once the casualty has arrived at the Role 3 field hospital, a standardized report is given by the evacuation team detailing the trauma incident. Unless an obvious problem must be immediately addressed (eg, airway compromise), it is important that all receiving team members remain silent and listen during this exchange to maintain their own personal situational awareness.

Other essential lines of communication for the trauma team include the following:

- The trauma surgeon needs to liaison with the team leader about the timing of procedures and movement to the operating room or computed tomography (CT) scanner.
- Radiology personnel are often present in the emergency department to provide immediate digital x-rays or ultrasound scans. They also require communication for CT scans if appropriate.
- Staff providing transfusions need to be updated on resuscitation requirements if additional "shock packs" or other blood products are required.
- Operating room staff must understand the patient's injuries to prepare the operating room to receive the casualty.
- Critical care unit services are often required after surgery.
- Evacuation assets should receive early communication in preparation for transfer to Role 4.

**Use of Standard Operating Procedures**

SOPs are developed from available evidence and expert opinion and provide guidance to ensure a consistent approach to patient management, which may improve the quality of care.[25] SOPs have been commonplace in the airline industry for many years, covering all phases of flight, with the aim of preventing disaster.[26] Recently the World Health Organization has introduced a surgical checklist[27] to improve patient safety; it has now been implemented in many UK hospitals, where its use is mandatory prior to starting a procedure. For unusual or acute conditions, an SOP can provide important guidance to clinicians.[27] Decisions about the performance of standard emergency

procedures should be made in advance with the benefit of expert opinion[28] and best evidence. During stressful situations memory can be error-prone, resulting in omissions of treatment,[29] and incorrect actions may cause harm with serious consequences.[30]

**Situational Awareness**

Situational awareness has been defined as "the perception of the elements in the environment within a volume of time and space, the comprehension of their meaning and the projection of their status in the near future."[31] There are three elements to situational awareness[32]:

1. **Gathering information**. This first element consists of collecting information from the surroundings to monitor the state of the work environment and facilitate progress on tasks. Errors can arise if data is not available, if it is misinterpreted, or if individuals display "tunnel vision" or develop fixation errors.
2. **Interpreting information**. In the second element, gathered information is processed to improve understanding of the current situation. This stage is improved when individuals have developed experienced-based mental models from previous deployments or have similar predeployment training. Errors can arise when there is a failure to comprehend the situation due to a lack of or incorrect mental model, or from individual memory failure.
3. **Anticipating future states.** The final element allows the individual to anticipate and plan for future possibilities, refining the mental model.[32]

A loss of situational awareness may arise when there is ambiguity, fixation, confusion, a lack of information, or a failure to maintain critical tasks.[32] Situational awareness is also affected when individuals are fatigued, stressed, or distracted. Strategies to maintain situational awareness have been suggested,[33] including routines for scanning vital signs and instrument functions. In the operating room, strategies for improved awareness involve the use of checklists, training to allocate attention more effectively, learning to multitask, and surgical team briefings to minimize distraction during critical stages of the procedure (eg, induction of anesthesia). Over 10 years of experience in theater has allowed UK and US anesthetists the opportunity to build up mental models and refine techniques in damage control resuscitation. Predeployment training reinforces these tools, ensuring that every member of the team is effectively following the same practices.

**Leadership/Followership**

Effective military trauma team function depends on effective communication among all members of the team. This objective requires both capable leadership and willingness of team members to display proficient followership skills. Seriously injured patients require early treatment pathway decisions to be made immediately, and these decisions must be accurately communicated to all team members. Everyone must know who the leader is at each stage; the team leader may change as the patient moves from the emergency department to operating room and on to intensive care.

So that the resuscitation area does not become too crowded, it is vital that the team leader is able to exercise a degree of crowd control. Specialists will often stand back until invited by the trauma team leader to offer advice. At times the team leader's job is similar to that of an orchestra conductor, with multiple teams working on a severely injured patient and numerous others supporting the resuscitation.[34] Orders for surgical interventions and additional imaging requirements must also be clearly established within the team. It is vital that the team leader maintains situational awareness and is able to anticipate and effectively respond to physiological changes.

**Familiarization With the Environment and Equipment**

Predeployment training allows for hands-on opportunities to use unfamiliar equipment prior to stressful situations. High-fidelity simulation is employed to recreate certain aspects of the deployed environment (discussed below).

## THE MULTIDISCIPLINARY TRAUMA TEAM

Figure 2-1 shows the make-up of a generic trauma team, and Table 2-1 describes each member's role. This team represents a best practice model. Where there are limited resources, individuals in the team will assume more than one role and specialist resources (eg, surgeon) may move serially from one patient to another depending on the need for specialist assessment and intervention skills. When there are multiple casualties, the emergency medicine consultant will often coordinate the whole department and delegate the team

leader role to another suitably qualified individual.

The process of activating the trauma team is crucial. In the deployed environment, the same team is often on call for prolonged periods. Frequent unnecessary activation calls, particularly in the middle of the night, will leave teams fatigued. The activation criteria, as laid down by CGOs,[6] is described in Exhibit 2-2. Once activated, the trauma team will begin preparing the trauma bay, checking equipment, and organizing drugs.

## TRAINING THE TRAUMA TEAM

Using simulation, which allows the delivery of facilitated learning, trainers have the ability to set the training agenda with predefined learning objectives and instant feedback in a safe environment.[35] Simulation is becoming increasing important; the Chief Medical Officer of England and Wales has recently suggested that simulation-based training be fully funded and integrated within training programs for clinicians at all stages.[36] A recent survey of UK military anesthetists has shown general support for simulation in predeployment training.[37] Teaching damage control surgery using a team-oriented approach has been described as an innovative educational method and found to be beneficial.[38]

## LIKELY ANESTHESIA TASKS AND CONSIDERATIONS

### Scenario 1. Bilateral Above-Knee Amputations

A 22-year-old soldier arrives at the field hospital via helicopter. He has been injured by an improvised explosive device (IED) and has sustained bilateral above-knee amputations with fragmentation injuries to the left hand.

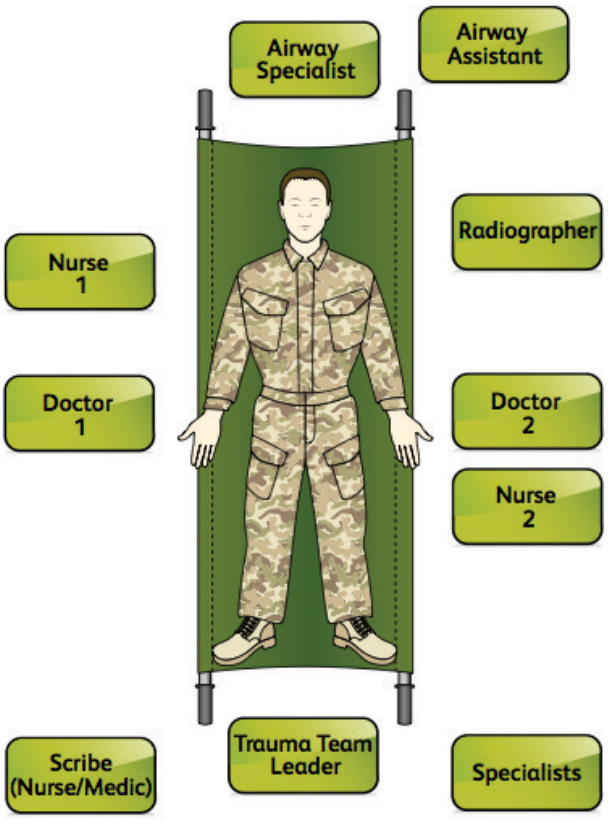


**Figure 2-1.** Trauma team roles and positions.

#### *Decisions*

The notice to the trauma team and the amount of information available will vary. However, upon being alerted to the impending admission, the trauma team must decide on and confirm roles and prepare to receive the patient.

- Roles are assigned.
- The need for surgery is clear but the timing of surgery needs to be determined.
- Should the patient be admitted to the emergency department or move directly into the operating room?
- If the patient is stable after initial resuscitation, is a move to CT scan safe or should damage control surgery be first?

#### *Human Factor Elements*

- Assemble trauma team per hospital protocol.
- Balance must be reached between assembling the trauma team and denying members sleep before the next busy workday.
- Careful anticipation and planning ensure that equipment is in the correct location and is functioning.
- Mobilize other key staff:
  - Radiographer to prepare CT scanner.
  - Laboratory staff to prepare for the possibility of a massive transfusion.
- All team members must be aware of their environment:
  - Situation brief by team leader.
  - Overall team composition.
  - Equipment and preparation.

**TABLE 2-1**

**THE ROLES OF THE TRAUMA TEAM**

| Position | Responsibilities and Skills |
|---|---|
| Team leader (usually the emergency physician) | • Controls and manages resuscitation.<br>• Team leader (usually the emergency physician)<br>• Prioritizes investigations and treatment.<br>• Makes time-critical decisions.<br>• Has good leadership skills.<br>• Ensures the environment is such that only his or her own voice can be heard.<br>• Clearly communicates and delegates tasks. |
| Airway specialist (anesthetist) | • Responsible for assessment and management of the airway and ventilation.<br>• Counts the initial respiratory rate.<br>• Administers oxygen.<br>• Performs suction.<br>• Inserts airway adjuncts.<br>• Performs endotracheal intubation (RSI)<br>• Maintains cervical spine immobilization and controls the log roll.<br>• Takes an initial history (AMPLE). |
| Airway assistant | • Assists in preparing equipment for advanced airway intervention.<br>• Assists with advanced airway intervention, eg, applies cricoid pressure. |
| Doctor 1 | • Undertakes the primary survey: <C>+B to E.<br>• Clearly communicates clinical findings to team leader (recorded by scribe).<br>• Performs procedures depending on skill level and training. |
| Doctor 2 | • Performs procedures depending on skill level and training. |
| Nurse 1 (emergency department nurse responsible for airway) | • Applies monitoring equipment.<br>• Assists advanced airway intervention (unless ODP is present).<br>• Assists with procedures. |
| Nurse 2 (emergency department nurse responsible for circulation) | • Undresses patient.<br>• Assists with procedures. |
| Scribe (emergency department nurse or medic or HCA) | • Collates all information and records decisions on trauma chart<br>• NOTE: All team members are responsible for ensuring their findings and decisions are correctly recorded. |
| Radiographer | • Takes x-rays as directed by the team leader . |
| Hospital specialists | • Undertakes secondary survey and advanced procedures (eg, general surgeon to undertake secondary survey of the head and torso; orthopedic surgeon to undertake secondary survey of the limbs, pelvis, and spine; surgeon, emergency physician, or ultrasonographer to undertake FAST). |

AMPLE: allergies; medications; past medical history, injuries, illnesses; last oral intake and menstruation; events leading up to the injury and/or illness
<C>+B to E: control of catastrophic hemorrhage, breathing, circulation, disability, exposure
FAST: focused assessment with sonography for trauma
HCA: health care assistant
ODP: operating department practitioner
RSI: rapid sequence induction

    - Standard operating procedures.
- Crosscheck and double-check:
    - Primary and secondary survey per the Battlefield Advanced Trauma Life Support Course.[39]
    - Communicate findings to team leader.
- Cognitive aids:
    - Local SOPs.
    - Clinical Guidelines for Operations.
    - Surgeon General's policy letters.

- Leadership will change if the patient is transferred to the operating theater.

**Scenario 2. Possible Hypovolemic Shock**

A 24-year-old is involved in a vehicle explosion from an IED. He arrives via the Medical Emergency Response Team and has bilateral above knee amputations with perineal penetration and buttock wounds. Cardiopulmonary resuscitation is in progress for pulseless electrical activity arrest. A decision is made to move the patient directly to the operating theater, where the trauma team is assembled. The most likely diagnosis is hypovolemic shock.

***Decisions***

- Timing of thoracotomy vs securing intravenous access.
- There are problems with vascular access due to lost limbs and soft tissue damaged by blast or thermal injury.
- Special equipment is needed for vascular access (eg, catheters, ultrasound).

***Human Factors Elements***

- This scenario is common in the current military theater environment.
- Train with rehearsals.
- Acquire preformed mental models built up from prior experience.
- Continuous practice and refinement of damage control resuscitation has led to much success: individuals are tuned into to their environment, knowing their roles, theater-specific equipment, and communication issues.
- Crowd control requires effective leadership.
- Use cognitive aids.
- Assemble the trauma team early.
- Anesthetic team will have a person responsible for:
  - Leading the anesthetic intervention.
  - Airway management.
  - Vascular access.
- If there is a high index of suspicion that a casualty may require a direct transfer to the operating room, equipment such as the rapid infuser and central line kit will be set up and ready to go in both the emergency room and the operating room.
- Decisions are made quickly but with discussions among the team leader, anesthetic personnel, and surgical teams.
- Anesthetist is aware of the stage of the resuscitation.
- Surgeon is focused on thoracotomy and vascular control.
- Communication between surgeons and anesthetists is vital during damage control surgery because bleeding can be due to a cause amenable to surgery or to derangement of clotting that could be corrected as guided by thromboelastometry.
- Priorities are set dynamically and the situation is constantly reevaluated.
- Additional communication with:
  - Laboratory staff.
  - Intensive care.

**Scenario 3. Damage Control Surgery With Multiple Injuries**

A multiply injured patient is anesthetized in the operating room for damage control surgery with multiple surgical teams.

***Decisions***

- Sequence of surgical procedures depending on the priority.
- Need to move patient to CT scanner following damage control surgery.
- The process of achieving vascular control in damaged limbs.
- Where to site vascular access.

***Human Factors Elements***

- This is a clinical situation that does not frequently occur in routine NHS practice.
- Predeployment training includes:
  - Familiarization with environment.
  - Familiarization with equipment and SOPs.
- SOPs will to encourage teamwork, communication, and effective leadership and followership.
- Leader must:
  - Communicate with the surgical teams over when to operate and when to pause, depending on the patient's physiology and the stage of resuscitation.
  - Coordinate with the anesthetist responsible for vascular access.
  - Coordinate with the anesthetist responsible for airway management.
  - Coordinate with operating room staff about running the rapid infusion device.

  - Maintain situational awareness, which is crucial to success because anticipation and planning for frequent changes in the patient's condition will be necessary.
- Patient's condition and management are constantly reevaluated in case changes need to be made to the original plan.
- Additional communication with:
  - Laboratory regarding additional blood products.
  - Critical care unit to plan timing for critical care evacuation.

**Scenario 4. Fluid Replacement With Multiple Injuries**

A multiply injured patient is anesthetized in the operating room and receiving a high volume fluid replacement.

*Decisions*

- Where to site intravenous access (the current practice is a large-bore subclavian central venous pressure line); will be influenced by site of injury.
- Blood and blood products.
- The rate of fluid administration.
- Anesthetic drugs.
- Which clinical parameters are being aimed for.
- Monitoring and management of hyperkalemia, hypocalcemia, and coagulopathy.
- Pain management plan.

*Human Factors Elements*

- Ongoing experience with damage control resuscitation has allowed the practice and refinement of this process.
- It is important that all member of the team are following the damage control resuscitation flow sheet.
- Use of SOPs improves teamwork and communication.
- Communication with:
  - The team controlling the level one infuser.
  - Laboratory staff.
  - Intensive care.

*Further Crew Resource Management (If Patient Goes to Operating Room)*

- Effective leadership handover and timing.
- Designated leader in operating room.
- Personnel must understand:
  - The plan.
  - SOPs.
  - Sequence of surgical procedures.
  - Who is in charge (although leadership roles may change).
- Communication with surgical teams about:
  - When to operate.
  - When to pause, depending on the patient's physiology.
  - The stage of the resuscitation.
  - Vascular control in damaged limbs.
  - Whether there is a time limit.
  - Whether further CT imaging is needed.

## SUMMARY

This chapter outlines the key human factors that are required by the whole trauma team in dealing with a patient with complex injuries. The human factors have been illustrated with examples, concentrating on communication, decision-making, leadership, and teamwork. It is believed that exemplary human factors are responsible for the success of the trauma team in recent conflicts.

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