Definitive Perioperative Nurses Trauma Course

Liverpool Hospital

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Introduction to the Definitive Perioperative Nurses Trauma Course

The DPNTC Course is intended to equip perioperative nurses with the skills necessary to make them effective contributors to a team dealing with major trauma and to create strong communicators who can share their knowledge within their local environment.

The course is run alongside the Australian and New Zealand Definitive Surgical Trauma Care (DSTC™) Course, and the contribution of the DPNTC faculty and participants is indispensable to this surgical program. The interdisciplinary nature of the two courses reflects the essential role perioperative nurses play as part of a surgical team dealing with major trauma.

The DPNTC course is designed specifically for Perioperative Nurses, in particular nurses who assist the Surgeon with trauma patients. It is an appropriate course for Perioperative Nurses with a minimum of two years’ experience within the Operating Rooms. The DSTC course is for consultant surgeons and senior registrars (usually General Surgery). The components of the DSTC course are designed for them and taught at an appropriate level. It is assumed that all participants are familiar with EMST (Emergency Management of Severe Trauma) principles.

DPNTC had the inaugural course held in Sydney, Australia, in July, 2004 and the first international DPNTC course was held in New Zealand in August 2004.

As the faculty of the DPNTC, we are pleased to provide this course, which we believe will become a part of perioperative continuing education for perioperative nurses, who manage severely injured patients within the operating theatres, in collaboration with Surgeons.
Definitive Perioperative Nurses Trauma Course Manual 2016

Cover Photo – B Taylor
DPNTC Executive Committee 2005


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Overview of DPNTC

Jennifer O’Brien (RN)

The Definitive Perioperative Nurses Course (DPNTC) had its origins in a meeting held in August 2003. In previous years, nurses assisted in the practical session of the Definitive Surgical Trauma Care Courses (DSTC) in various countries and from this involvement, it became apparent to a number of surgeons familiar with running the DSTC that there was a specific need for further training in the aspects of surgical care of the trauma patient for Perioperative Nurses, particularly in teamwork and collaboration.

Under the support and guidance of, and in conjunction with the DSTC, the Definitive Perioperative Trauma Care Course (DPNTC) has been developed for nurses who may be challenged with the responsibility of caring for a patient with injuries within the operating environment.

It is not enough to be an excellent Perioperative Nurse. The effective practitioner, be they either a medical officer or a nurse, is part of a multidisciplinary team that plans for and is trained to provide, the essential medical, surgical and nursing response required in the management of the injured patient.

Therefore, planning a response to a trauma patient requires an understanding of:

- The causation of injuries produced in the local population; i.e. a metropolitan population with motorways, will have a different variety of injury to a country population.
- The condition in which the patient is delivered to the operating room will be determined by the earlier emergency response, and in many respects will determine the patient’s outcome.
• Equipment, staff, availability of resources and the priorities of emergency surgery.
• Multidisciplinary teamwork and collaboration in dealing with a trauma patient within a busy operating theatre environment.
• The DPNTC is designed for nurses, by nurses. Its intention is not to provide an in depth course in surgery or in perioperative nursing, but rather to teach those techniques particularly required for those patients who require surgery for trauma.

The course is a mixture of lecture based learning, case discussion, and surgical skills. The course materials will include:

• A course manual (DPNTC) and DSTC manual
• Slides and Videos
• Practical and technical skill stations
• Patient scenarios

We recognise the contribution of all who have been involved in the development of DPNTC in their quest to improve the comprehensive care of the injured patient in the Operating Room.
Overview of DSTC

Ken Boffard, FRCS, FRCS (Edin.), FACS

Injury (trauma) remains a major health problem world-wide, and in many countries continues to grow. The care of the injured patient should ideally be a sequence of events involving education, prevention, care, and rehabilitation. In addition to improving all the aspects of emergency care, and resuscitation, improved application of surgical skills will save further lives and contribute to minimising disability.

The standard general surgical training received in the management of trauma is often deficient, partly because traditional surgical training is more and more organ specific, concentrating on “super-specialties” such as vascular, hepatobiliary or endocrine surgery, and partly because in most developed training programs, there is limited exposure to the range of injured patients.

The Advanced Trauma Life Support (ATLS®) Programme of the American College of Surgeons, and the Emergency Management of Severe Trauma (EMSTTM) Course of the Royal Australasian College of Surgeons have had a dramatic effect in improving outcome of patients by standardising their resuscitation and assessment, and providing one safe, simple way for the initial care of such patients.

Throughout the early 1990’s it became apparent to a number of surgeons familiar with trauma management around the world that there was a specific need for further surgical training in the technical aspects of surgical care of the trauma patient, and that routine surgical training was too organ or area specific to allow appropriate judgement in traumatised patients with multisystem injuries. Particular emphasis
needed to be directed to those who were close to, or had completed their training.

It is not enough to be a good operator. The effective practitioner is part of a multidisciplinary team that plans for, and is trained to provide, the essential medical and surgical response required in the management of the injured patient.

Planning the response requires an understanding of:

- The causation of injuries produced in the local population. An urban population with motorways will have a different spectrum of injury to an armed inner-city population.
- The emergency, pre-hospital and emergency room care of the patient. The condition in which the patient is delivered to the hospital and subsequently to the operating room will be determined by the emergency response, and in many respects will determine outcome.
- The resources, both physical and intellectual within the hospital, and the ability to anticipate the specific problems associated with the patient with multiple injuries.
- Many situations require specialist trauma expertise, yet often this is simply not available within the time frame needed.

The International Association for the Surgery of Trauma and Surgical Intensive Care (IATSIC) is a founding organisation of the Société International de Chirurgie (International Society of Surgery). Under the patronage and supervision of IATSIC, the Definitive Surgical Trauma Care Course has been developed for surgeons who may be faced with the responsibility of the definitive care of a patient with multiple injuries.

The course had its origins in a meeting held in October 1993. Courses have been tested and run in Australia (1996), Austria,
Bethesda, France, South Africa, Sweden, the United Kingdom, and the Yemen.

The DSTC Course is designed for surgeons, by surgeons. Its intention is not to duplicate EMST, nor to provide an in depth course in surgery, but rather to teach those techniques particularly applicable to those patients who require surgery and intensive care for major trauma.

At the same time, trauma care is dynamic, and this course serves as an update of knowledge and information throughout the field of Trauma Care.

The course is a mixture of lecture based learning, case discussion, and surgical skills, demonstrated and practiced:

- Physiology and Organs Support
- Technical Surgical Strategies
- Strategic Thinking in Trauma Surgery
- Practical sessions addressing the above

The course materials will include:

- A course manual
- Slides
- Videos
- Practical and technical skill stations
- Patient scenarios
- Other techniques for skills development and assessment

We recognise the input of all who have been involved in the development of this course, its teachers and its students, in the quest to improve the comprehensive care of the injured patient.
Principles of EMST

Bronwyn Taylor (R Comp.N, BN)

Introduction

A prerequisite of the Definitive Surgical Trauma Care (DSTC) course is a complete understanding of all the principles outlined in general surgical training and the Emergency Management of Severe Trauma (EMST) course (Boffard, 2011). EMST is a mandatory course for all Royal Australasian College of Surgeons (RACS) surgical trainees (Royal Australasian College of Surgeons, 2015). EMST trains the participant in the management of trauma patients during the first one to two hours following injury. The course emphasises systematic clinical approach and life-saving skills to managing severe trauma. It is a two and a half day intensive course adapted from the Advanced Trauma Life Support (ATLS®) course of the American College of Surgeons in 1988 (Australia and New Zealand College of Anaesthetists, 2015). It is designed for doctors who are involved in the early treatment of serious injuries in urban or rural areas (Halpern, 1999).

As the content and format of the DSTC is based on the assumption that participants have completed the EMST course, there are no lectures on the basic principles of trauma surgery or the initial resuscitation of the patient with major injuries (Boffard, 2011). The following is designed to give the DPNTC participant an overview of the principles and concepts from the EMST course, to enable them to understand the decisions the surgical participants on the DSTC are making. The majority of the following section is obtained directly from the ATLS Student Course Manual (7th Edition).
EMST Course Overview

EMST is an intensive course in the management of injury victims in the first one to two hours following injury. The skills and content taught in the EMST course are designed to assist doctors in providing emergency care for the trauma patient. It provides skills and essential information that can be applied to identifying and treating life-threatening or potentially life-threatening injuries, under the stress and time pressure of the Emergency Department (ED). The course is designed to provide the participant a reliable, safe method for the immediate management of the seriously injured patient. The content includes the basic knowledge to assess the patient’s condition accurately and rapidly, stabilise and resuscitate the patient according to priorities and assure the patient is provided optimum care at all stages (Australia and New Zealand College of Anaesthetists, 2015).

Initial Assessment and Management

The treatment of the seriously injured patient requires rapid assessment of the patient’s injuries and institution of life-preserving therapies. A systematic approach is taught which includes;

- Preparation
- Triage
- Primary survey (ABCDE’s)
- Resuscitation
- Adjuncts to primary survey & resuscitation
- Consider need to transfer
- Secondary survey (head to toe evaluation and patient history)
- Adjuncts to secondary survey
- Continued post resuscitation monitoring and reevaluation
- Definitive care
Preparation includes both pre-hospital, where all events are coordinated with the receiving hospital, and the hospital phase which includes preparations are made to ensure the rapid resuscitation of the patient.

Triage is the sorting of patients based on the resources available and treatment needs. This is particularly important for multiple casualties. Treatment is based on the ABCDE priorities discussed in the primary survey.

The primary survey of trauma patients is where the patient is rapidly assessed and their priorities of care are identified based on their injuries, vital signs and mechanism of injury. During the primary survey, life threatening conditions are identified and treatment management instituted simultaneously though the algorithm suggests a set sequence. Priorities remain the same for paediatric and pregnant patients, although care is modified to the specific need of the patient (i.e.; the size of the paediatric patient and anatomic and physiologic changes in pregnancy). The sequence to assess the patient’s vital functions is;

Airway maintenance with cervical spine protection

Breathing and ventilation

Circulation with haemorrhage control

Disability: Neurological status

Exposure / Environmental control

Airway/ C-Spine Protection:

The airway is assessed to ascertain patency. This includes checking for foreign bodies and facial, jaw or airway related fractures that may cause obstruction. When ensuring a patent
Airway protection of the cervical spine by use of jaw thrust or chin lift techniques is initially recommended. Head injured patients with a Glasgow Coma Scale (GCS) score of 8 or less usually require definitive airway placement. Any patient with multi system trauma is assumed to have a cervical spine injury, especially with altered level of conscious or blunt injury above the clavicle. Protection of the spine and spinal cord is an important principle. The patient’s head and neck should not be hyper flexed, hyper extended or rotated when establishing or maintaining the airway. Immobilisation devices should be used to protect the patient’s spinal cord. If removed, then temporary inline stabilization techniques should be used by a designated member of the trauma team.

**Breathing**

Adequate ventilation is not assured with a patent airway. Each component of ventilation and gas exchange must be rapidly examined and evaluated. Auscultation, percussion, visual inspection, palpation may all be used to detect injuries. Injuries that may acutely impair ventilation are tension pneumothorax, flail chest with pulmonary contusion, massive haemothorax and open pneumothorax.

**Circulation / Haemorrhage Control**

Haemorrhage is the commonest cause of preventable deaths post injury. Unless proven otherwise, hypotension following injury is considered to be hypovolaemia. It is essential that the patient’s haemodynamic status is rapidly assessed. Information instantly gathered by clinical observation is level of consciousness, skin colour and pulses. Cerebral perfusion may be impaired in reduced circulating blood volume as indicated by altered levels of consciousness. Ashen gray facial skin and white extremities are warning signs of hypovolaemia. Pulses should be assessed using a femoral or carotid artery. A rapid thready pulse is usually a sign of hypovolaemia; an irregular pulse may be a warning of potential cardiac
dysfunction. Absent central pulses may warn the need for immediate resuscitative action to restore blood volume to ensure effective cardiac output. External haemorrhage is identified and controlled as part of the primary survey; this is usually managed by direct manual pressure on the wound.

**Disability**

At the end of the primary survey a rapid neurological examination is performed to establish the patient’s level of consciousness, pupillary size and reaction, lateralizing signs and spinal cord injury level. GCS may be assessed quickly in the primary survey or in more detail as part of the secondary survey. Revaluation of the patient’s oxygenation, ventilation and perfusion status is indicated by any altered level of consciousness.

**Exposure**

The patient should be completely undressed to facilitate thorough investigation and assessment. This is usually done by cutting the garments off the injured patient. In order to prevent hypothermia, the patient should be covered with warm blankets or an external warming device, IV fluids should be warmed and a warm room temperature should be ensured. Hypothermia is a potentially lethal complication in the injured patient.

**Resuscitation and Immediate Management**

Resuscitation and the management of life-threatening injuries are simultaneous with the primary survey. The airway should be protected in all patients and, when the potential for complications exists, should be secured. If there is any doubt that that patient is able to maintain airway integrity a definitive airway should be placed. This is achieved by placement of an endotracheal (ET) tube or surgical airway, ensuring protection
of the cervical spine. A tension pneumothorax will compromise ventilation and circulation dramatically and if suspected a chest decompression must be accomplished immediately. If the patient is not intubated they should receive supplemental oxygen via a mask or reservoir device to ensure optimal oxygenation. Bleeding should be controlled by direct pressure or surgical intervention. A minimum of two large bore IV catheters should be placed. Blood should be taken for type and crossmatch and for baseline haematology studies.

Adjuncts to the primary survey and resuscitation include ongoing monitoring of the patients vital signs by ECG, pulse oximetry, ventilatory rate and gas exchange in intubated patients. Placement of urinary and gastric catheters should be considered. Anteroposterior (AP) x-rays of the chest and pelvis may detect potentially life-threatening injuries and provide helpful information as part of the primary survey, but should not interrupt the resuscitation process. Diagnostic peritoneal lavage (DPL) and abdominal ultrasonography (usually known as FAST scans - Focused Assessment Sonography in Trauma) may be useful in detecting intra-abdominal bleeding.
References


Mechanisms of Injury

Bronwyn Taylor (RN, B.Comp.N)

Introduction

In contrast to elective surgery, often very little information is known about a trauma patient and the Perioperative team may only have minutes to prepare for the patient’s arrival (Kanne, 1999). In order for the perioperative nurse to anticipate and plan for the care of a trauma patient they must have an understanding of the event (mechanism) and the possible injuries associated with this. Mechanism of injury (MOI) or kinematics involves the action of forces on the human body and their effects (Kanne, 1999). Injury mechanisms can be associated with specific injury patterns and the teams can use this to plan and anticipate the patient’s needs, even prior to their arrival in hospital (Weigelt, & Klein, 2002).

Traumatic injuries result from an exposure to different types of energy. These types of energy may be kinetic (falls, crashes, bullets, knives), chemical, thermal, electrical, ionising radiation and / or deprivation of essential agents, such as, heat and oxygen. The effects of an injury are also dependent on the environmental and personal factors of the patient, such as age, sex, nutrition (diet, alcohol intake), underlying disease processes and geographic region (Halpern, 1999).

The term injury includes physiologic damage as well as physical, such as those cases by temperature extremes and the absence of life-sustaining substances such as oxygen. Extremes such as heat, cold and smoke create injuries that may not be visible (Weigelt, & Klein, 2002).

Pre-hospital Assessment and History

At the site of a Motor Vehicle Accident (MVA), prehospital care personnel quickly survey the scene, noting the appearance of
the vehicle(s) involved and the damage sustained to the passenger compartment. It is important to know the speed of the vehicle, the point of impact and the type of impact. The evaluating team determines if the patient was the driver or the passenger, if safety devices were used, and where the victim was found at the scene (Halpern, 1999). The condition of other victims also gives valuable information, for example; a death is clear evidence that the force was great enough to cause major injuries (Weigelt, & Klein, 2002).

Impact collisions will influence the injury patterns of the occupants. For example, frontal impacts are associated with head injuries, haemopneumothoraces, injuries to the spleen or liver and femur fractures. Whereas, side impact collisions produce contra lateral neck sprains, cervical fractures, head injuries, lacerations to the soft tissues, lateral rib fractures or flail chest, abdominal injuries and pelvic and acetabular fractures (Halpern, 1999).

**Mechanism of Injury**

Injury mechanisms can be described as a product of the type of injuring force and the resulting tissue response. The magnitude of the injury sustained is influenced by the velocity of the collision, shape of the object and flexibility of the tissue involved (Kanne, 1999). Injury occurs when the tissue is deformed beyond their recoverable limits, resulting in physiologic and anatomic damage. Anatomic damage, e.g. skeletal fractures, usually heal and function resumes. Physiologic damage, e.g. Central Nervous System (C.N.S.) injury may be permanent. MOI can help explain the type of injury, predict outcomes and suggest injury combinations. The injury can be structural and easily identified, or physiological and less easily determined (Weigelt, & Klein, 2002).

**Biomechanics**

An understanding of mechanical principles is also essential to understanding the body’s response to force. Force can be
penetrating or non-penetrating and the resulting injury depends on the area of contact and energy delivered (Kanne, 1999).

Penetrating injury usually involves a concentration of damage to a small body area. Non-penetrating injury distributes energy over larger areas and does not usually result in skin breakage. Non-penetrating injuries may have greater morbidity and mortality, because identification of injuries is less obvious and therefore more difficult to detect (Kanne, 1999). Injury can occur by slow deformation of tissue such as in a wringing injury. More commonly speed and violence are the predominant feature, for example the impact of a head against a windshield (Halpern, 1999).

Some of the factors that influence injury are velocity of collision, object shape and tissue rigidity. Body tissue has inertial resistance as well as tensile, elastic and compressive strength. Tensile strength equals the amount of tension a tissue can withstand and its ability to resist stretching forces. Elasticity is the ability to resist squeezing forces or inward pressure. Whenever the force exceeds maximum tissue strength a fracture or tear occurs.

Kinetic energy (energy-in-motion) transferred to the victim, determines the wounding potential of an event. Kinetic energy is determined by the mass of the object in motion and its amount of acceleration (velocity). Kinetic energy can be increased in two ways; doubling the mass doubles the kinetic energy, however doubling the velocity quadruples the kinetic energy (Weigelt, & Klein, 2002).

Force is a physical factor that changes the motion of a body either at rest or already in motion. It is calculated by the following equation: Force = mass x acceleration (Halpern, 1999). The forces most often applied are acceleration, deceleration, shearing and compression. Acceleration is a change in the rate of velocity or speed of a moving body. As velocity increases, so does tissue damage. Deceleration is a
decrease in the velocity of a moving object. Shearing forces occur across a plane, with structures slipping relative to each other. Compressive resistance is the ability of a structure to resist inward pressure or squeezing forces (Halpern, 1999).

Newton’s first law of motion holds that an object set in motion will remain in motion until acted on by an outside force. A person driving a car or falling will continue at that rate of acceleration until another force slows or stops (decelerates) them - the car crashes or the person lands on a surface. Because certain organs in the body are not anatomically ‘fixed’ (brain, heart, liver, spleen and intestine) they continue in motion until they strike a hard interior surface. For example; first impact is when a car hits a tree; second impact is the driver to the steering wheel; third impact is the heart to sternum (Weigelt, & Klein, 2002).

When tissues are deformed beyond their ability to absorb the energy or recover, injury occurs. This change can be described by the term strain, which can be divided into tensile, shear and compressive (crushing injuries). Examples of tensile and shear strain include femur and rib fractures. Compressive injuries may leave no obvious external signs of damage, with underlying contusions (Halpern, 1999).

The greatest injury occurs in direct force; when there is direct contact between the body surface and the injuring agent (Halpern, 1999). Indirect forces are transmitted internally and energy dissipated in all directions to internal organs and tissues, if pressure is not released, tissues will burst or break (Halpern, 1999). The liver, spleen and kidney are the most common abdominal organs injured, (Halpern, 1999), although head, thoracic, spinal and skeletal injuries are also seen (Kanne, 1999).

**Blunt Trauma**

Blunt injury results from a combination of forces such as acceleration, deceleration, shearing and compression (Kanne,
1999). Multiple injuries are common and blunt trauma is often more life-threatening than penetrating trauma as diagnosis is difficult and the extent of injuries unknown (Halpern, 1999).

Examples of blunt trauma include motor vehicle accidents (MVA), assault, falls and contact sports (Kanne, 1999), (Halpern, 1999). Common causes of blunt injuries are acceleration and deceleration forces (Halpern, 1999). Approximately 50% of all blunt trauma can be attributed to MVA’s.

In MVA’s speed is an important determinant of the likelihood and severity of injury. This is because dissipation of energy increases with the increase in velocity; force is increased approximately twofold when impact occurs at 70 miles-per-hour as compared to 50 miles-per-hour (Halpern, 1999). Prior to a collision the occupant is moving at the same speed as the car. During the collision the occupant and vehicle decelerate to zero speed, though not necessarily in the same time frame (Halpern, 1999). Also in MVA, three collisions occur; firstly the car hits another object, then the occupant’s body (or bodies) collides with the interior, the third impact is the internal body structures hitting bony surfaces (Kanne, 1999), (Halpern, 1999). Rapid deceleration injury is also shown in MVA’s where large vessels are stretched beyond their elastic ability (Kanne, 1999) and shearing damage is seen in the vessel walls, causing them to rupture, dissect or form an aneurysm. Damage such as this to the thoracic aorta has a very high mortality rate (Halpern, 1999).

Common injuries associated with unrestrained drivers include head, facial and neck injuries, fractured larynx, fractured sternum, cardiac contusion, pulmonary contusion, lacerated liver or spleen, lacerated great vessels, fractured patella and femur and fractured clavicle. Restrained drivers sustain pelvic, liver, spleen and pancreatic injuries from the lap restraint; cervical fractures and ruptured mitral valve or diaphragm from the shoulder restraint; and nasal and forearm fractures caused by air-bag deployment (Halpern, 1999).
Pedestrians hit by vehicles on the other hand have different injuries. These injuries are caused by three events, known as Waddell’s triad. In a child this is shown by; the hood and bumper impact the femur and or chest; upon impact the victim is thrown; and the force of impact injures the contra lateral skull. Adult pedestrians receive a lateral impact from contact with the bumper and hood, injuring the lower and upper leg, because adults try to protect themselves by turning sideway (Halpern, 1999).

Falls or jumps create a vertical deceleration injury, if the person lands on their feet, buttocks or top of their skull. The pattern and severity of injuries will depend on the distance traveled, impact surface and the body areas making initial contact on impact. The impacting force is transmitted along the axis of the skeleton causing compression fractures of the heel, long bones, pelvis and lumbar spine. If the person is propelled forwards they may stretch out their arms to inhibit the fall and fracture their wrists (Weigelt, & Klein, 2002).

Head injuries are produced by the initial impact, though the momentum dictates the type and degree of injury. Injury to the brain directly opposite to the impact site is known as contre-coup injuries. The two factors in contre-coup injuries are; a transient cavitation created by a vacuum caused by the velocity of the impact and, the brain substance being torn and damaged by sliding over bony protuberances within the cranial vault (Halpern, 1999). Acute subdural haematoma is the most significant cause of death associated with head injury due to its high incidence, high mortality, and high severity of injury (Glasgow Coma Scale score of 3, 4, 5) (Halpern, 1999).

Spinal cord injuries are most often seen in the junctional regions of the spine. Injury mechanisms associated with spinal cord damage include flexion, extension, rotation, lateral bending and axial loading (Halpern, 1999). Extreme movement of the spine beyond the normal range causes flexion injury. Hyperextension injuries are seen with acceleration forces, commonly called a ‘whiplash’ injury, the
spinal cord can be squeezed, resulting in acute central cervical cord syndrome injury (Halpern, 1999). Force applied upwards or downwards to the spinal column, without posterior or lateral bending of the spine, is called axial loading. This is seen in MVA’s when the person’s head is thrown upwards and hits the roof of the car (Halpern, 1999). Hanging causes distraction injury to the cervical spine, separation of the spinal column with cord transection (Halpern, 1999).

Fractures can be classified by their injury mechanism. Direct force causes tapping, crush and high or low velocity penetrating fractures. Indirect force causes traction, angulation, rotational, vertical compression, axial loading with angulation, or angulation with torsion and axial loading fractures (Halpern, 1999). It’s also important to note, pelvic fractures produce life-threatening hemorrhage and injuries to the lower genitourinary tract. Direct trauma to the perineum can cause straddle fractures. Urethral injury should be looked for in these patients (Halpern, 1999).

Penetrating Injuries

Penetrating trauma is a result of the passage through tissue of a foreign object. The injury pattern depends on the nature of the foreign object (for example knife or bullet caliber), degree of penetration, kinetic energy dissipation and the untoward affects the missile produces (Weigelt, & Klein, 2002) and is proportional to the amount of kinetic energy lost by it (Halpern, 1999). The most commonly affected organs are the liver, spleen, vascular structures and intestines (Halpern, 1999). Objects that enter the body with low velocity, produce stab wounds that are limited to the length of the object (e.g. knife), direction of motion and the structures in line with the wound tract (Weigelt, & Klein, 2002). Where possible impaled objects should be left in the wound tract to help tamponade any vascular injuries, aid diagnosis (Weigelt, & Klein, 2002), and determine treatment options. Objects that enter the body as missiles can be classified as impaled foreign objects or gunshot wounds (Weigelt, & Klein, 2002). Cavitation is a
process where a temporary cavity is created as the tissues are stretched and compressed by the penetration of a missile (Halpern, 1999). Cavitation in nonelastic tissues, such as brain, liver, spleen and bone, is the most destructive (Weigelt, & Klein, 2002).

The velocity of a missile determines the extent of tissue deformation and cavitation. A low velocity missile may be fatal if it hits a large vascular structure such as the aorta, or inconsequential if it strikes a less important structure. High velocity missiles can create just a laceration if it passes through muscle. However if it strikes less elastic tissue, such as bone, it will cause it to shatter and damaged neurovascular structures may be beyond repair (Weigelt, & Klein, 2002). The extent of damage from high velocity missiles is determined by compressibility and density of injured tissue, missile velocity, and fragmentation of the primary missile (Halpern, 1999). High velocity bullets cause a cavity around the tract, as they compress and accelerate tissue away from the missile. As the bullet transfers kinetic energy to the tissue the cavity enlarges, up to 30 to 40 times the diameter of the bullet (Halpern, 1999). As energy dissipates, the cavity collapses and tissue recoils. Elastic tissues recoil and experience less damage; whereas dense tissue absorbs more kinetic energy causing greater damage (Halpern, 1999). Exit wounds from high-velocity missiles may be larger than the entrance wound, as the energy has not dissipated at the exit point. If fragmentation of the missile occurs there may not be an exit wound (Halpern, 1999).

**Summary**

The experienced perioperative nurse is familiar with the needs of most patients requiring surgery. The unpredictability of trauma patients often brings a sense of unease to even the most proficient team-leader. Little information may be available on the patient, the team may be unprepared or under resourced and have been given only a few minutes’ notice of the patients arrival to the OR. A working knowledge of injury
mechanisms and the common injuries associated with these will assist you to prepare and set-up appropriately for these often unstable and acutely unwell patients.
References


Roles and Responsibilities

Catherine Steel & Fiona Newman

Introduction

A trauma patient’s outcome is optimised by an effective trauma team. Each member of the trauma response team is expected to perform their role and their assigned responsibilities to the best of their ability, every time. A trauma team may be compared to an orchestra; when they put on their best performance is when each individual is engaged and contributes to the collective effort (Chhangani, Papadakos, Wilson, Wasif, & Acosta, 2013).

But how do we ensure this occurs?

Inter-professional teamwork is achieved through interactive effort between all the professionals involved good communication, and respect for and understanding of the roles of other team members (Gillespie, Gwinner, Fairweather, & Chaboyer, 2013; Nancarrow, Booth, Ariss, Smith, Enderby, & Roots, 2013). The aim of the DSTC/DPNTC course is to educate and support trauma clinicians in their roles and how that translates into the trauma care they deliver. Collaborative trauma work practices ensure the provision of timely holistic health care.

The surgical environment is complex and includes many variables that affect each trauma patient’s presentation. When each clinician plays their role effectively and the team performs well, great outcomes are achieved. When optimal outcomes are not achieved, governance structures and processes ensure that efforts are made to review and revise, providing learning opportunities and ensuring future outcomes are improved. Patient safety incidents are diverse and tend to be reported more often in emergency versus elective situations, in-patient versus ambulatory settings and when
patients suffer co-morbidities and require more complex procedures (Choy, 2006 cited in Reid & Catchpole, 2011). Most errors that occur during surgery can be attributed to failures in the non-technical skills such as situation awareness, decision-making, communication, teamwork and leadership (Gillespie, et al., 2013; Panesar, Noble, Mirza, Patel, Mann, Emerton, Cleary, Sheikh, & Bhandari, 2011). Efforts to mitigate the risks of errors in surgery have resulted in the implementation of several surgical quality improvement initiatives.

In 1999, ‘To Err is Human’ challenged clinicians to embrace a culture of ‘no blame’. This encourages the reporting and the review of incidents, looks for trends, and implements and evaluates risk minimisation strategies (Kohn, Corrigan, & Donaldson, 1999). Reid and Catchpole (2011) so aptly describe this as ‘changing the culture to learn versus blame’. In 2007, The World Health Organisation set the standard of practice with the introduction of the “Safe Surgery Saves Lives” campaign, which incorporates the Surgical Safety Checklist (SSC). The SSC is a framework for perioperative multidisciplinary teams to communicate and evaluate the care provided. Since the SSC implementation in 2008, it has been endorsed as best practice to minimise wrong site surgery and is mandatory in both elective and emergency surgery.

The SSC is a communication script for teams to collectively focus on one patient, at a one time. Teams using the SSC are better prepared, less rushed and more professional, which in turn leads to enhanced accountability, mutual respect for each team member’s role and the creation of a less stressed environment (Jones, 2011). Trauma teams, through routine and consistent use of the SSC in their everyday practice, abbreviate this practice in a trauma situation to focus on the core components to facilitate efficient and effective summative team briefings.
During the elective surgery pre-operative briefing, the team is expected to introduce themselves, identify their role and discuss the patients and the day or session plan. This remains an essential component in a trauma scenario but efficiency is important. Communicating a concise plan of care during trauma minimises the risk of deviation or variations. Omission or lack of information may distract the team and create a sense of insecurity, which may affect the patient’s outcome (Barach and Weinger, 2013). Some omissions, though perceived to be small, may reduce the team’s efficiency and increase the risk of error (Reid & Catchpole, 2011). In the trauma surgery efficiency is essential as each minute added to the surgical intervention may have catastrophic effects on the patient’s outcome.

As team culture and work practices vary with each situation, the method of allocating roles and responsibilities may also vary. Some teams may self-select roles while others leave the responsibility to the senior clinician. Most importantly when allocating or confirming roles and responsibilities, trauma team leaders must ensure that roles and responsibilities align with scope of practice and avoid duplication, rework or redundant processes (Sarcevic, Marsic, & Burd, 2012).

Post-sessional debriefings enable the team to: evaluate what went well or not so well; review unexpected outcomes, including near misses; and foster competence, future threat awareness and mitigation of errors (Marshall & Manus, 2007). Teams make fewer mistakes than individuals, especially when all team members know their individual responsibilities and as well as those of the other team members (Barach & Weinger, 2013) and relay the information during handovers to ensure consistent management of the trauma patient.

Factors that influence inter-professional team performance include the size and psychological composition of the group or the group structure, what happens when the group works together, their processes and/or dynamics (Barach and
Weinger, 2013) and how the group is led (leadership style) (WHO, 2009).

**Group Structure**

During trauma surgery, the lack of team stability may introduce additional risk into an already complex situation. When inter-professional teams are familiar with each other’s roles and responsibilities, they are able to anticipate the needs and actions of team members and have a high level of adaptive capacity (Barach and Weinger, 2013). Adaptive capacity is affected by staff turnover, which has an effect on the team’s performance and may extend the procedure time. Nursing teams have a higher incidence of changeovers compared to other disciplines (Courtenay, Nancarrow, & Dawson, 2013). Also, changeover counts, handover and other forms of deviation or variation from the norm increase the risk of errors or omissions. The effectiveness of group structure stability must also be moderated by the value of additional safety factors. Fatigue guidelines assist in the provision of a safe environment where clinicians function at an optimal level by limiting the hours of continuous work and supporting rest periods (Barach and Weinger, 2013). Handover procedures must be utilised when there are changes in the team participants, to ensure the exchange of pertinent information. This ensures the flow of information for the ongoing management of care (ACORN, 2012).

**Group Dynamics**

The dynamics within the trauma team are dependent upon the interpersonal communication of all clinicians. As individuals, each clinician brings their own experiences and knowledge to the situation, and they must be empowered to effectively communicate, speaking up to challenge decisions or the lack of decision (Barach and Weinger, 2013). Communication and escalation strategies must be in place, when clinicians perceive additional support is required.
The team leader is a critical component to ensure patient safety through effective coordination of the trauma team. The team leader assumes the responsibility to ensure team members use appropriate behaviours throughout the situation. Expertise is simply having the factual knowledge and technical skills but not necessarily the complementary attitudes and non-technical skills. Effectual leadership requires psychological traits such as self-confidence, excellent communication skills, adaptability and risk tolerance with cognitive skills. This includes a highly developed sense of what is relevant, the ability to identify the exceptions to the rule, flexibility in changing situations, ability to perform under stress and make decisions, and the capacity to initiate actions based on incomplete data (Barach and Weinger, 2013).

**Leadership**

Effective leaders display enabling characteristics such as emotional intelligence, self-awareness and self-management (Barach & Weinger, 2013). They must be socially aware of the people and relationship within the team as they may, at times, require management. Leaders must communicate effectively to the entire team to ensure consensus in achieving a common goal (Jacobsson, Hargestam, Hultin, & Burlin, 2012). Team leaders must display self-confidence rather than arrogance or low self-confidence. An effective team leader in the trauma team must utilise good interpersonal skills, demonstrating warmth and empathy to the internal and external team members (Barach & Weinger, 2013). Jacobsson et al (2012) stated that an engaging leader, who efficiently acknowledges and includes each team members, create a positive environment where outcomes are optimised.

Transactional leaders are traditionally appointed or delegated. The transactional leader works by supporting the day-to-day operations; incorporates planning and control of available resources in order to achieve the vision and strategy set by the organisation (Barach & Weinger, 2013). This may be the
leader's dominant style or that of a novice leader, who once confidence is gained, may transition to an alternative style.

Ferguson (2007) identified transformational leadership as more strategic; they know and appreciate the climate within the organisation and communicate a future vision, which engages and motivates high performing teams. Transformation leaders encourage innovation, share power, and demonstrate a sense of trust within the team through leading by example. (Ferguson, 2007)

The trauma situation may dictate that leaders use different styles at different times. Though each person has a dominant leadership style, situations arise which require the leader to use their less dominant traits to effectively manage a person or a situation. This may be challenging for the inexperienced leader as they will require education and support in preparation for taking on and refining their leadership style.

The trauma team leader (Anaesthetic, Surgical or Nursing team) may take a global or active role in the operating theatre. From the global perspective, the team leader provides governance by ensuring the flow of information; ensuring each member or discipline is cognizant of the patient, their condition and the plan of care. Leaders must also oversee the delegation of tasks and assess the level of supervision required. In delegating roles, each team member's scope of practice must be assessed as this dictates the level of supervision and direction required (Ferguson, 2007). The members in an effectively managed team are confident in fulfilling their responsibilities when appropriate task delegation is made.

**Communication**

To facilitate the flow of information, all organisations must have an identified communication cascade appropriate to the level of activation or urgency. Generally the level of activation clearly identifies whether the team member is required to be in
attendance or on standby should there be a need for their assistance.

As the trauma patient’s journey starts outside the perioperative environment, it is essential that an effective communication cascade exists between the various trauma care environments. Effective communication builds a shared awareness of the situation and enables clinician’s situational awareness and facilitates minimisation of hazards and their associated risks (Gillespie, et al., 2013). The trauma leader must evaluate the effectiveness of the activation, ensuring all disciplines have received notification and the appropriate information to initiate a plan of care. If a breakdown in the cascade is apparent, the trauma leader must intervene to facilitate the flow of information and ensure ongoing quality improvements.

Within the trauma theatre, information sharing is vital for the entire team to appreciate the situation and to anticipate and minimise risk. If information is not shared, an accurate assessment of the situation cannot be made and the desired response may not be as demonstrated (Gillespie et al, (2013).

Situations may require the team leader to take a more active role in the delivery of trauma care. During weekdays and business hours, healthcare facilities are staffed to respond to predicted elective and emergency work demands. In the off-peak hours, which includes evenings, nights and weekends, facilities allocate their workforces differently, ensuring safe work rostering practices are maintained. The staff rostering may include the clinicians to be at work, on the healthcare premises, or on-call but ready to attend work as required. The rostering practices vary between urban, rural and remote facilities.

In off peak hours or in rural and remote facilities, the team leader may be required to take on an active role in the operating theatre as an Anaesthetist, Surgeon or Nurse. In these roles they may also need to coordinate staff and
allocate theatres.

The trauma team leader must be aware of environmental risks to patient and staff safety and intervene when hazards are identified. The environment has a direct correlation to the outcome of the patient and the effectiveness of the trauma team within the operating theatre. Factors to be controlled include:

- Noise
- Lighting
- Temperature and humidity
- Motion and vibration
- Physical constraints (crowding)
- Distractions

Through minimising the risks within the operating theatre, the trauma team is able to focus on the patient and the provision of care.

To facilitate the patient’s arrival and team’s preparation, the team leader must ensure that the team is aware of:

- Mechanism of injury
- Injuries and procedures to be performed
- Priority of surgical procedures, if multiple injuries exist
- Patient’s estimated time of arrival

Specifically for Nursing:

- Lead clinicians; as this will indicate the equipment and instrumentation preferences

In leading the team, the designated leader may take on or delegate the following:

- Assisting with the traffic flow in the operating room and ensuring equipment is not obstructing work flow or exits
- Ensuring patient privacy and security
- Setting the temperature in the operating room to 28°C
- Ensuring that all forensic and/or personal items are packaged, labelled, recorded appropriately on the
patient's notes and delivered to the post-operative care area.

As this article is prepared from the DPNTC perspective, we shall not include the responsibilities of the medical staff's roles. Additionally, while the DPNTC respects the anaesthetic assistant role could be occupied by technicians or nurses (ANZCA PS08, 2012), we will specifically refer to the Anaesthetic Nurse.

All Nurses are responsible for:
- Ensuring an effective handover occurs which facilitates optimal outcomes through the exchange of pertinent information during the transfer of care
- Confirming patient identity, patient details and surgical site
- Advocating for, comforting and reassuring the patient
- Accommodating the patient's support person/s (if the patient is accompanied)
- Ensuring appropriate staff and skill mix are available and maintained throughout the procedure
- DVT prophylaxis
- Preventing pressure injuries
- Communicating and escalating, if concerns arise

**Anaesthetic Nurse's Role**

The anaesthetic nurse is an integral member of the trauma team and is educated in the specific responsibilities within this role as endorsed by ASPAAN and ACORN. Often times, depending on the size of the facility and the number of anaesthetic nurses available, there could be more than one anaesthetic nurse present in a trauma. If this is the case, there should be discussion prior to patient arrival, about the allocation of the following roles and responsibilities. This will
ensure preparedness, timely communication and safe patient care. The anaesthetic nurse is responsible for:

Collecting, checking and/or setting up the anaesthetic equipment, including:

Airway
- Anaesthetic machine
- Patient assessment of the airway with the Anaesthetist prior to arrival (where necessary) to prepare appropriate equipment
- Assisting the Anaesthetist during the induction, intubation, extubation, resuscitation
- Difficult intubation, bronchoscopy trolley and intubating aids including glidescope
- Massive blood transfusion protocol (MTP) activation, delivery and documentation

Circulation
- Anaesthetic drug trolley, fully restocked
- Ensure narcotics (S8 drugs) available
- Large bore access lines including central lines, rapid infusion catheters, insertion and maintenance
- Collection of equipment to assist with insertion of IV, Central lines such as ultrasound.
- Labeling of medicines fluids and lines as per the ACQSHC National Standard (ACQSHC, 2012)
- IV fluids, warmed and/or IV fluid warming devices
- Rapid infuser (Belmont or Level 1 Infuser - whichever is available in the facility)
- Cell saver (if applicable/available)

Monitoring
- Arterial line set up and insertion and central venous line set up and insertion
- Connecting the appropriate monitoring devices
- Collecting Pathology samples as required
- Preparing for and facilitating the analysis of blood gas samples
- Patient pressure area prevention regularly by assessing skin integrity and positioning
Patient Care and Thermoregulation:
- Patient warming devices (bair hugger, warmed blankets) Liaising with the operating theatre nursing staff to ensure operating theatre is maintained at 28°C
- As mentioned above, warmed IV fluids/ fluid warming devices
- Pressure area care during transfer of patient and throughout the surgical procedure
- Application of VTE prophylaxis devices (SCDs and TEDs)
- Appropriate positioning of the patient onto the operating theatre table and ensuring access to IV lines as necessary

Documentation
- Accurately recording the patient’s fluid intake including crystalloids, colloids, bloods and blood products
- Completing any paperwork with regards to pathology requests, rapid transfusers, blood collection
- Completing handover to intensive care unit or post anaesthetic care units

Instrument Nurse Role

The instrument nurse allocated to a trauma team needs to be competent with the complexities of the predicted procedure, equipment and be able to prioritise effectively.

The instrument nurse must:
- Continually assess and anticipate the needs of the surgeon and team throughout the surgery and facilitate the exchange of pertinent information.
- Maintain asepsis
- Minimise the risk of unintentionally retained items either through performing a surgical count or by following ACORN and the healthcare facilities
approved procedures when a count is not performed.
• Correctly preserve any forensic evidence, if required.

**Circulating Nurse Role**

The old saying ‘an instrument nurse is only as good as the circulating nurse’ remains true today. The scrubbed surgical team is isolated and access to resources is limited. The circulating nurse is the surgical team’s conduit to resources while overseeing that surgical asepsis is maintained. The circulating nurse’s role includes but is not limited to the following:

**Resource management**
• Ensure appropriate and adequate instrumentation and equipment is present
• Communicate and delegate tasks to allied healthcare assistants as appropriate
• Remain attentive, continually assessing and anticipating the needs of the surgical team throughout the surgery

**Safety**
- Assist with the traffic flow in the room and ensure equipment placement is not a hazard
- Appropriate handling of specimens - tissue & forensics

**Documentation**
- Accountable items
- Implants, high cost consumables
- Sterilization verification

The instrument and circulating nurses may alternate roles during care of a multi-trauma patient when simultaneous procedures occur. This prevents fatigue, enables nurses to work within their scope and improves patient safety. For student and/or novice clinicians, the opportunity to participate
in a trauma patient’s care is advantageous. It is essential that the novice or student take on a role appropriate for their experience and receive adequate support.

**Additional Team Members**

Extra personnel may be required initially or throughout the trauma procedure. The additional team members may provide supplementary skill to assist the trauma team and improve the patient’s outcome. Additional trauma team members may include, but not limited to:

- PACU Nurses
- Orderly/Theatre Support Officer
- Radiographer
- Pathology
- Emergency department staff
- Perfusionist
- Sterilisation services
- Students
- Videographer/Photographer
- Police

It is essential that the trauma team minimises the risks of infection and workplace health and safety through the management of an over-attended trauma procedure.

**Governance**

Clinical governance is a process by which leaders and clinicians have a shared responsibility and accountability for patient care, minimising risks through active participation in quality improvements (ACQSHC, 2012)

Trauma governance encompasses the quality cycle. The trauma team must review the team’s performance, monitor clinical supervision and patient outcomes. Organisations must develop guidelines and structures, which enable clinicians to safely discuss the care delivered and reflect on the outcome of their decisions.
Trauma governance may include a review committee of interested clinicians, which offers recommendations for improvement to the organisation’s executive team. It is essential that open communication exist between the trauma review and executive team. If issues arise, the review committee must be able to escalate their concerns to the executive team.

**Conclusion**

In conclusion, the trauma team performs well when conducted effectively. The Definitive Perioperative Trauma Nursing faculty acknowledges that in discussing trauma team member's roles and responsibilities, the topic is interdependent with teamwork and effective communication. To minimise risk to patients, members of the trauma team must know their role and responsibilities to optimise the trauma patient’s outcomes.
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Communication in the Operating Room

Jilda Levene (BSc)

Introduction

Communication in the operating room is steeped with tradition and ritual. The rules, which govern the communication patterns, remain clearly visible in the form of communication anomalies in some operating rooms. This paper outlines the communication barriers in the operating room and includes suggestions for dealing with these. It also highlights the importance of effective communication in preventing medical error.

Communication Patterns

The communication patterns in the operating room are unique to other areas because of the close proximity of the multidisciplinary team. Clearly there remain some rules or norms in the operating room which have different degrees of distinction. There are some less traditional operating rooms and personnel that choose to ignore or break the rules on a regular basis, some observe them at all times and still others use a mixture of both. According to Firth-Cozens, (2004), a combination of power, status, culture, personality and gender issues forms the root cause of the unusual communication patterns. Communication differences and barriers emerge depending on the individuals involved. The limiting factors to the effectiveness of interactions is based on the combination of surgeon to surgeon discussion, nurse to surgeon, nurse to nurse and other medical or support staff. Firth-Cozens (2004) explains that miscommunication can be associated with the struggle for balance between solidarity with colleagues and personal power. A further dimension to the power paradigm is the use of professional languages, which can tend to restrict the generalisability of the interaction.
Communication Failure

According to Lingard et al, (2004) Communication failures in the operating room occur at a “rate of almost 1 out of 3 communications”. These have been studied observationally and include, timing issues, or when they take place at a later time than they should, content (insufficient or inaccurate information), ineffectual messages (not achieving the purpose) and failure to communicate with the relevant people. This may be further compounded by other issues such as team cohesion and understanding, organisation and team policies, reduction of distractions in the operating room, and long standing team composition.

Improving communication in the OR

Interest in communication patterns and identifying areas for quality improvement has occurred in the wake attention centred around “the medical error issue plaguing our health care system”. “Communication failure is the most significant factor leading to medical error” and can be addressed by attention to “safety, effectiveness, efficiency, timeliness, patient-centeredness and equity.” (Lingard et al 2004). The team of nurses and the scrub nurse in particular have been stated as having a significant influence on the successful functioning of the surgical team. (Lingard et al, 2004)

According to Firth-Cozens (2004), an important step to improving communication is transcending the professional boundaries and including a degree of shared training or education.
Communication in Trauma

The leadership role in communication is one of control and dissemination of the information. It is important that messages are clarified, questions are asked to ensure that there is a complete message, and that assumptions are not made, especially about who knows what. One of the risks in a hierarchical system is that a person can sometimes assume that anyone on a higher level of the hierarchy knows more. This has proven to be a fallacious and dangerous assumption especially in emergency situations. Experience with medical simulation, similarly to flight and military training, has demonstrated some interesting phenomena concerning human responses to intensely urgent situations. During periods of intense pressure communication becomes distorted, as the individuals perceptions change. As concentration intensifies, the persons focus becomes extremely narrow, and failure to perceive outside a pinpoint perception is demonstrated. One leadership strategy for dealing with this intensely heightened state is to ensure that when allocating tasks, rather than a general request for action, that a specific person is identified, named and then asked. A response from the person is then required, indicating that they have understood. This would seem to be time consuming at first consideration, however the few seconds spent, ensure that the message is received and the activity will be carried out immediately.

Communication with OR staff during trauma admissions, from the emergency department or trauma surgeon has traditionally been fraught with difficulty. The operating room nurses are frequently given scant details to enable them to adequately prepare for an impending trauma patient. This has been recognised as an ongoing issue and attempts have been made in recent times to assess the communication patterns and identify potential areas for improvement. Stonybrook Medical Centre in New York has published their classification tool for assigning an operating room urgency to a
trauma patient. This is a simple scale which allocates a level of need for surgery based on the time lapse urgency of the required surgery. It is the attending trauma surgeon who allocates the urgency according to the scale and the surgeon is responsible for notifying the anaesthetist on duty.

Table 1: Definitions of Levels of Need

<table>
<thead>
<tr>
<th>Level of need</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1</td>
<td>OR required within 15 min</td>
</tr>
<tr>
<td>Level 2</td>
<td>OR required within 1 h</td>
</tr>
<tr>
<td>Level 3</td>
<td>OR required within 6 h</td>
</tr>
<tr>
<td>Level 4</td>
<td>OR required within 12 h</td>
</tr>
<tr>
<td>Level 5</td>
<td>OR not likely to be required</td>
</tr>
</tbody>
</table>

(http://www.uhmc.sunysb.edu/surgery/edu/general/trauma/trauma-4.html)

Further to the medical staff communications, the nurse in charge of the operating suite must be notified. The protocol does not specify who is responsible for notifying the OR nurse although it is implied that it should be an Emergency Department nurse. There is a minimum information requirement which is stated as “the Medical Record Number, expected areas of operative intervention (i.e., head, chest, abdomen, extremity) and the Attending Surgeon.” This would be the bare bones of expectations for communication and most operating theatres would also require at least a patient name and age. As the level of need for surgery would have been assigned it is anticipated that this would also be included in the minimum communication as this is the reason for producing the scoring system - ‘improving communication’.

According to Smith (2004) an aviation style checklist for use in the operating room is a useful tool to ensure communication on core issues is effective. This adage has popular support in trauma and emergency centres where algorithms are used to support decision making and aid communication. To this end
Liverpool Hospital has developed checklists for communication and preparation of the operating theatre for the trauma patient.

**Conclusion**

Communication in the operating room is difficult when one considers the social and hierarchical factors in effect. When one adds a sense of urgency to the scenario further distortion can occur. There are various strategies evolving to deal with communication issues, especially in the wake of medical quality and governance and the development of medical simulation. Various trauma centres are developing simple and effective means of improving communication, such as checklists and guidelines. Social and training issues are important underlying factors which influence communication effectiveness and these have recently re-emerged as a focus for study.
References


Forensic Evidence Collection in the OR Complex

Eraine La Galle

Introduction

As nurses, we interact with both victims and perpetrators of violence. Our goal is to save the patient; however, we also play a role in the legal outcome of that violence. What we do in caring for these patients is important. As everyone who handles the person or property involved in a crime leaves trace evidence of himself or herself.

Chain of Custody

Any individual involved in the collection and transport of evidence is involved in the chain of custody. The chain of custody must be established whenever evidence is presented in court as an exhibit. To avoid confusion and retain control of evidence, the chain of custody should be kept to a minimum.

All items of physical evidence should be carefully packaged and marked upon retrieval.

All transfer of evidence to another person must be recorded in notes or on appropriate forms. Every person who has handled or examined the evidence must be recorded. The minimum amount of information required is:

- The collector's name,
- Location of the evidence, and
- Date of collection.
Glossary of Forensic Terms

- Forensic medicine: The relation and application of medical facts to legal matters, or the law, in its bearing on the practice of medicine. Synonym: medical jurisprudence.
- Coroner: An official whose duty is to investigate sudden, suspicious, or violent death to determine the cause. In some communities, the office has been replaced by a medical examiner.
- Deoxyribonucleic acid (DNA) fingerprinting: A pattern obtained from a technique used to compare individuals by molecular genotyping. The DNA is isolated from a specific individual, digested, and fractionated according to size.
- Trace: An extremely small amount or barely discernible indication of a substance.
- Criminology: The branch of science concerned with the physical and mental characteristics and behavior of criminals.
- Rigor mortis: Stiffening of the body, which occurs one to seven hours after death and disappears after one to six days, or when decomposition begins. Rigor mortis reflects the hardening of the muscular tissues due to the coagulation of the myosinogen and paramysosinogen in the muscles.
- Livid: Having a black and blue or a leaden or ash-like gray color, similar to the discoloration from a contusion, congestion, or cyanosis.
- Postmortem livedo: A purple coloration of dependent parts of the body after death, except in areas of contact pressure. Livedo appears within two hours of death as a result of gravitational movement of blood within the vessels.
- Wound: Trauma to any of the tissues of the body, with interruption of its continuity, especially that caused by physical means.
- Non-penetrating wound: Injury, especially within the thorax or abdomen, produced without disruption of the surface of the body.
- Penetrating wound: A disruption of the body surface that extends into underlying tissue or into a body cavity.
- Perforating wound: A wound with an entrance and exit opening.
- Puncture wound: A wound in which the opening is relatively small as compared to the depth. Usually produced by a narrow, pointed object.
- Stab wound: A puncture wound produced by the stabbing motion of a knife or similar object.
- Gunshot wound: A wound made with a bullet or other missile projected by a firearm.


**Common Types of Physical Evidence**

- Blood, semen, and saliva: These substances are serologically and biochemically analysed to determine identity and possible origin. They may be dried into fabrics or other objects. Bloodstains and splatter patterns can reveal what events occurred to produce the bleeding. All three may be used for DNA analysis.
- Documents: Any related items submitted to determine authenticity or source of evidence (e.g., a dated dinner receipt in the pocket of a victim could place the individual at a particular place).
- Medications: The presence or absence of illegal or prescription medications.
- Explosives: All objects removed from the scene of an explosion are suspected of containing residues of an explosive.
- Fibres: Any synthetic or natural fibre whose transfer may be useful in establishing a relationship between people or objects.
- Fingerprints: All prints latent (i.e., invisible) and visible. Visible prints are made by fingers touching a surface after contact with a coloured material (e.g., blood, paint, ink, grease). Plastic prints are ridge impressions left on soft materials (e.g., wax, soap, dust). True latent prints are impressions caused by the transfer of body oils on the finger ridges to the surface of an object. Multiple methods exist for lifting fingerprints from various objects. When processing belongings possibly associated with a crime, handle the object as little as possible, and use gloves. Try to grasp objects in places they would not be held normally or on portions with rough surfaces that are less likely to contain usable prints.
- Firearms and ammunition: Any firearm, as well as intact or discharged ammunition, can be tested and matched in a criminal offence. With two national firearm databases available to match firearms to multiple crimes, this can be very valuable physical evidence.
- Glass: Any glass particle or fragment that may have been transferred to a person or object involved in a crime. For example, windshield glass found in the clothing of a hit-and-run victim.
- Hair: Any animal or human hair that could link a person with a crime. Hair can be used for DNA analysis. Most police crime laboratories do nuclear DNA testing, which requires hair with the follicle attached.
- Impressions: Any mark left by a person, object, or substance (e.g., tire marks, shoe prints, glove and fabric impressions, and bite marks on skin). Human bite marks on skin have proven to be important evidence in a number of rape and homicide cases.
• Organs and physiologic fluids: Fluids submitted for toxicology to detect the presence of drugs or poisons (e.g., urine, vitreous from the eye.
• Paint: Any paint that may have been transferred from the surface of one object to another.
• Petroleum products: Any removed or recovered petroleum products, such as oil or gas.
• Powder residues: Any item suspected of containing firearm discharge residue (e.g., clothing from a gunshot victim).
• Soil and minerals: This evidence could link a person or an object to a location (e.g., soil imbedded in shoes).
• Tool marks: An impression of an object that served as a tool in a crime (e.g., hatchet marks in a skull).
• Wood and other vegetative matter: Fragments discovered on clothing, shoes, or tools that could link someone to a crime scene.


**Gunpowder Residue**

• Skin Prep. If the victim has been prepped for surgery, any residue present on the skin may be removed.
• Documentation. Noting the presence of residue before the preparation is of vital importance.
• Photography. Ideally, photos should be taken to demonstrate the presence of gunpowder residue or bullet wipe.
• Paper bags. The use of paper bags is important, as they prevent the decomposition of evidence that can occur if a plastic bag is used. Placing paper bags on
trauma patients’ hands can help prove or disprove their story.

- With suspected self-inflicted gunshot wounds, primer residue on the patient’s hands becomes valuable physical evidence.
- IV lines. If possible, IV lines should not be inserted in the hands of patients with gunshot wounds. Paper bags that can accommodate the back of the hand and the thumb web space should be used to cover the trauma patient's hands.

**Documentation and Photography**

Documentation. From a legal standpoint, wounds do not exist unless they can be seen in photographs or are mentioned in the documentation. The presence of defensive wounds should be documented. If photography is not possible, document or diagram the wound in the nursing notes. This is very important in situations of delayed death because defensive injuries may have healed by the time death occurs. If a camera is available, take photographs of the wounds. If the case is a criminal case and you do not have the ability to take photographs, alert the proper authorities, which may want to take their own photographs.

**Weapons**

Handling:

- The surgeon may be able to grasp the object in areas unlikely to have been held by the perpetrator.
- The object should be placed in a large rigid specimen container.
- The object should not be wiped or washed in any way.
- Awkward-sized items. If the item is too large for a specimen container, you may have to be creative or
call to see if a police officer is available to receive the weapon immediately.

**Clothing and DNA Evidence**

Only a few cells are needed for DNA typing, and DNA can be collected virtually anywhere (sweat, skin, blood, tissue, semen, dandruff, saliva, and even earwax). Rape, assault, and murder victims can carry DNA specimens from their attackers. Bite marks, semen stains on clothing, or skin under fingernails all are sources that can be swabbed and tested for DNA.

Ideally, the clothing from victims is placed in individual paper bags until it can be air dried, tested, and packaged appropriately for evidence storage. Environmental factors, such as heat, sunlight, bacteria, moisture, and mould, all can render DNA unusable. Clothing removed and bagged in the early stages of resuscitation prevents cross-contamination with our own DNA. Bagging clothing immediately, rather than throwing it on the trauma bay floor, prevents accidental contamination from hospital sources.

With obvious criminal cases, nurses should not itemise or handle belongings any more than is absolutely necessary. If your hospital requires a personal belonging checklist be completed, simply write “all belongings bagged and sent with the body to the Coroner’s office” or “all belongings given to (insert name of police officer) as evidence in a criminal case.” One of the more unfortunate things that can occur during resuscitation is that the clothing does not get removed at all.

Physical evidence on a victim’s clothing can be unusable after massive transfusion of blood products and fluid contamination from prep and irrigating solutions.
Most trauma protocols mandate that rolling gunshot and stab wound victims is checked for wounds on their backs. If clothing can be removed during this procedure, valuable evidence may be saved.

**Top 10 Police Requests**

Police officers have 10 requests of medical personnel involved in trauma cases related to violence;

1. Evidence. Do not throw away the evidence, even if articles are badly soiled, ruined, or covered with body fluids. Do not throw away anything associated with the patient.
2. Questioning. If the patient is stable and a police officer is present, let the patient answer some questions. This gives the police something to work with early in the investigation of a crime or accident scene.
3. Clothing. Do not cut through clothing in places where evidence is visible (e.g., bullet holes, stab or slash holes, areas with obvious blood splatters or gun-powder).
4. Bullets. With gunshot victims, be alert for bullets loose in the clothing or on the gurney. Bullets may have exited the body and been caught in the clothing the victim is wearing.
5. Confessions. Be careful about questioning suspects of crimes. Confessions heard may lead to excessive time spent in court by the recipient of the confession. A dying declaration should be documented, but asking unnecessary questions can result in a long-term relationship with the judicial system.
6. Hypotheses. Do not hypothesise or make statements concerning victims or suspects unless you know what you are saying is accurate. Police tend to believe and document what medical people say. Do not let ill-chosen words come back to haunt you.
The final four requests involve medical workers present at the scene of a crime.

7. If the victim is dead, do not move the body.
8. After you have ascertained the victim is dead, try to affect the crime scene as little as possible, and control entry to the crime scene until the police arrive.
9. If the victim is not dead, provide medical help, but try to disturb or affect the crime scene as little as possible.
10. If you or someone else alters the scene, tell the police who altered the crime scene and how it was changed. Lines and tubes placed during the resuscitation attempt should remain intact after the resuscitation is finished.

Tissue and Organs

Organs or body parts removed during the course of resuscitation should be placed in a specimen container, labelled, and sent with the body.

Victims of Violence

With cases of violent death, stricter rules apply:

- The body should not be explored, altered, or washed.
- Obvious impaled objects should not be removed.
- When resuscitation efforts have failed, no attempt to retrieve bullets or further examination of inflicted wounds should occur.
- Stab wounds and gunshot wounds should not be explored during the course of resuscitation unless necessary for patient survival.
- Chest tubes should not be placed through pre-existing wounds.
• Surgical Incisions. An effort also should be made by the surgeon to avoid placing a surgical incision through a pre-existing wound.

• Wounds. If the patient dies, traumatic wounds should be left open.

• Paper bags should be placed and secured over the hands of the deceased to preserve potential evidence on the hands or under the fingernails.

Personal Property

Personal property of the deceased is physical evidence in all Coroner cases. Care should be taken during initial contact to avoid cutting through any obvious knife or bullet holes in the clothing.

Documentation

All clothing and materials removed from the patient are itemized, secured in a property bag, and labelled with patient identification stickers.

Chain of Evidence

If possible, the police officer should witness the removal of these materials from the patient. A property evidence form, including a brief description of each item, needs to be completed by the police officer. The hospital personal belonging checklist should have a notation on it indicating that a property evidence form was used and possessions were given to a police officer.

Releasing Property to Relatives

Unless directed to do so by police or the Coroner, no belongings should be given to the family members of the deceased.
Weapons

Weapons removed from trauma patient’s fall into another chain of evidence category. These are usually given only to police officers. If no officer is present, weapons are removed from the patient and given to a security officer until a police officer is available to receive the weapon.

If the weapon is a hunting knife or a weapon legally registered to the patient and is not related to a crime, security retains possession until the patient is discharged.

Bullets

Two common ways marring occurs include grasping the bullet with a metal instrument, or dropping it in a metal basin. When handling try to use non-marring instruments to grasp the bullet. Rubber shods, such as those used on bowel clamps, can be placed on a forceps or peon clamps for use as a bullet removal instrument. The bullet should not be dropped in a metal basin. Additionally, no attempt should be made to clean the bullet or remove any blood or tissue attached to the bullet or bullet fragments.

After the bullet is removed from the body, it is placed in a bullet box which consists of a screw top specimen container, with a coin-sized paper envelope inside. The circulating nurse should label the envelope with the time, date, initials of team members, and location from which the bullet was removed. A patient sticker is placed on the opposite side of the envelope. The bullet is placed in the envelope, which then is sealed, placed in the specimen container, and the lid secured.

The container is sealed with patient labels and labelled with the time, date, names of people who handled the bullet, and body part from which the bullet was retrieved.
After the labels have been applied, tape (preferably evidence tape) is used around the top to seal the container lid completely. If you do not have evidence tape, scotch tape renders the container sealed to avoid tampering.

If multiple bullets are involved, each should be placed in a separate bullet box, numbered in order of removal, and fully labelled with pertinent information. Bullet fragments are placed together in one bullet box. The fewer people that handle the bullet, the better for the chain of evidence.

The bullet is not shown to anyone, including curious police officers. The police should be notified by telephone of the removal and disposition of the bullet. Documentation must outline all of the steps taken in the care and handling of the bullet. When the bullet is released to a police officer, the nurse and receiving officer should complete the appropriate chain of evidence form.

**Other Concerns for Criminal Cases**

Several other things deserve special mention when dealing with possible criminal cases.

If a trauma patient makes a verbal confession or accusation, his or her words, as heard and understood by staff members, should be documented. Health care workers should also refrain from speculation concerning wounds to police officers without scientific proof.

Entry and exit bullet wounds, while sometimes obvious, are not easy to generalize about. If a camera is available to take pictures of wounds before prepping and potentially destroying evidence, it should be used. If a camera is not available, document a description of what the wounds looked like before the prep or exploration of the wound.
References

NSW Health Department Circular. 2000/105 - NSW health position on the carrying out of forensic procedures

NSW Health Department Circular. 98/74 - classification of victims of crime patients


NSW Health Department Circular. 2001/2 - handling of possible evidence following a patient's suicide attempt

NSW Health Department Circular. 2002/5 - firearms security