Initial Approach to Damage Control Resuscitation

14

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- Non-medical examples of damage control
- Philiosophy of damage control in trauma
- History of damage control surgery
- Damage control anaesthesia and resuscitation
- Other examples of damage control resusitation

What Is Damage Control?

Damage control is a concept that comes from Naval warfare and was first implemented by the German Navy at the battle of Jutland in World War One [1]. It was subsequently adopted and refined by the US Navy and came to prominence in the Battle of the Coral Sea and the Battle of Midway in World War Two with the efforts of the USS Yorktown to stay afloat after taking heavy damage [2]. When a ship is damaged in combat, if it is still under fire then simultaneous activity must take place to concurrently fix the damage

that has been caused while maintaining the ability to fire and manoeuvre, and "take the fight to the enemy". A balance must be struck in the division of labour in these two areas; sufficient manpower should be assigned to repair damage threatening to sink the ship without compromising combat effectiveness. The idea is that only damage which is an immediate threat to the ship is addressed via quick interventions. Definitive repairs are not performed, as what is needed in the acute situation is to keep the ship afloat and functional. Temporising techniques such as sealing compartments which are flooding, putting bands of metal around ruptured pipes and sealing them with clamps, and removal of floodwater are used in preference to definitive repairs. These measures are temporising, and all Naval personnel are commonly trained and assessed in their application before a vessel and her crew are certified as seaworthy.

A more commonly known example of a damage control approach is the Apollo 13 mission, in which an explosion mid-way into the flight to the moon crippled the Command and Service module, threatening the lives of the three astronauts on board. By minimising consumption of oxygen, power and water, and use of the Lunar Excursion Module as a lifeboat (as well as many novel procedures from Mission Control), the damage was mitigated, and the astronauts returned safely to Earth. This took a well-led, well-coordinated and well-understood effort to achieve the ultimate goal. This brings forward an essential parallel

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between damage control on ships, spacecraft and in medicine: there has to be a systemic awareness, appreciation and application of the approach rather than personnel working in isolation for it to be optimally effective. There needs to be a whole team working together to the same end rather than individual practitioners in silos, else the approach will be uncoordinated, haphazard and ultimately counterproductive.

Similarly, a second parallel is that the damage control in both medical and mechanical terms does not emphasise a return to normality, but aims for prompt action to prevent further damage and restore essential (rather than complete) function. To compare Naval and medical approaches, a damaged ship is made waterproof and then returns to port for repairs before a new coat of paint is applied; painting is not essential to survival but needs doing at some point. A damage control laparotomy deals with bleeding and source control, but not forming stomas in the first instance; they need doing but are not a survival priority in the first operation.

Philosophy of Damage Control Resuscitation

While the acute stress of surgery has long been recognised as a potential contributor to morbidity and mortality, previous paradigms of care emphasised early, definitive operative intervention [3]. The theory behind this was that by performing all necessary surgical interventions early, the chances of recovery were optimised as there was only one significant "hit" for the patient to get over. The prevailing idea was to adequately resuscitate the patient before surgery and then do everything in one sitting. While the thought process behind this course of action is understandable, what it led to was patients arriving post-operatively in the ICU who were cold, acidotic, often under-resuscitated and in severe metabolic derangement despite the best efforts of staff in the operating theatre. This approach, unfortunately, led to significant morbidity and mortality. As our understanding of trauma-induced coagulopathy, haemostasis and surgical decision making has changed, so too has the approach to the sickest and most complex patients.

Damage control resuscitation is a group of complementary approaches in resuscitation, surgery, anaesthesia and critical care. This culminates in an early and intense focus on expeditious surgery to arrest haemorrhage and prevent contamination, resuscitation with balanced ratios of blood products and aggressive treatment of acidosis, hypothermia, hypocalcaemia and coagulopathy. It is explicitly not definitive surgery, it is not the required approach for every trauma patient, nor is it limited to a particular surgical speciality; damage control options exist in abdominal, thoracic and orthopaedic injuries. Once the initial surgery has been performed, some time for stabilisation is allowed on ICU. When the patient is optimised, they can return for definitive surgical procedures.

History and Concepts Around Damage Control Surgery

Damage control surgery is defined as a multi-step operative intervention, which includes a brief initial surgical procedure that aims to control mechanical bleeding, a massive air leak, and/or gross contamination [4]. The concept of damage control surgery has evolved from multiple military and civilian surgical concepts over the last 100 years. The first reports of techniques that could be broadly described as Damage Control were from cases in 1902 by Pringle [5], in which he described supra-hepatic liver packing for control of haemorrhage which was not amenable to primary ligation. This technique fell in and out of favour over many years as other surgical options developed for managing liver trauma, but it is still a useful technique which is employed in certain circumstances today. The first publication which espoused damage control principles was by Stone et al. in 1983 [6]. This paper advocated early termination of surgery when it was recognised that patients were developing a coagulopathy during surgery due to hypothermia, acidosis and bleeding. This coagulopathy was exacerbated by prolonged surgery and was recognised as potentially contributing to morbidity and mortality. This led to the development of the "staged laparotomy" concept in

which a short initial procedure was followed by a period of resuscitation on ICU and then a return to theatre for definitive surgery. If a patient was identified as suffering from a coagulopathy intraoperatively, the protocol advocated techniques which we now consider part of damage control surgery. These included "…immediate termination of the operation; repair of only those vessels vital to survival, with ligation of all others; ligation of bowel ends… The spleen and kidney, if bleeding, were removed unless the renal injury was bilateral, for which the kidneys were packed. Ureteral wounds were managed by simple ligation, while the bladder was closed with a one-layered purse-string suture. If the pancreas had been resected, the stump was ligated with an umbilical tape. Gallbladder wounds were closed by a purse-string suture, yet major bile duct injuries were merely isolated by laparotomy pack" [6].

This approach was refined further and formally termed Damage Control Surgery in a publication by Rotondo and Schwab in 1993 [7]. Rotondo was an ex-Navy surgeon who appreciated the parallels between this surgical approach and strategies to keep ships afloat during battle. Further publications from their surgical group refined the concept of damage control into three distinct stages—initial operation (DC1), ICU resuscitation (DC2) and definitive surgery (DC3). Subsequent definitive abdominal closure in cases where the abdomen was left open for a prolonged period was termed DC4, and resuscitation before initial surgery was subsequently termed damage control ground zero (DC0) [8]. What is notable in Rotondo's publications is that he identifies explicitly that there is no mortality benefit in applying damage control principles to patients who do not require it. Specifically, there is no benefit in applying damage control principles to patients who have less severe injuries as opposed to a definitive laparotomy as the initial treatment. However, in those who have a significant vascular injury AND two or more visceral injuries, the survival rate in the damage control group was 77% compared to 11% in those who had definitive surgery at the time of their first operation [7].

The hallmark of damage control surgery is that it only addresses issues which may be fatal or pose a severe threat to life within the first 72 hours. Acute haemorrhage control and revascularisation, as well as prevention of gross contamination and subsequent infection, are the main principles. For patients who require immediate or urgent intervention, the initial surgery should last no more than 1 hour from incision to closing. Examples of strategies employed in this initial phase for haemorrhage control would include primary splenectomy (if needed), cautery or use of clotting agents on large, raw areas of bleeding such as liver edges, and use of packs on areas which ooze and which can be left in situ for 48–72 hours. A true trauma laparotomy will mandate a "second-look" operation within 48–72 hours to address any outstanding issues and remove these intentionally retained packs. Acutely, packing may prove life-saving for ongoing non-compressible haemorrhage. However, blood is a perfect culture medium, so packs need to be removed before they start to become a potential source of infection. Due to this, occasionally abdomens are left open with the use of a silastic pouch or Bogota bag as a temporary mechanism of closure which may also decrease the incidence of acute abdominal compartment syndrome [9, 10].

Bowel injuries are also not definitively managed, insofar as formal ileostomies or colostomies should not be formed at the initial operation. Bowel and mesenteries should be examined, and any perforations that are amenable to oversewing should be quickly closed. For more extensive damage, removal of the affected segment should be performed with stapled ends, and the two blind ends not rejoined at the initial surgery. In the initial period, higher than normal circulating levels of catecholamines (whether endogenous or therapeutic) may divert blood from the alimentary tract and cause a threefold risk of anastomotic leak or breakdown [11]. The time taken to form an anastomosis or stoma is also not inconsiderable, and given that neither is an essential or acutely life-saving procedure they should not be undertaken during the initial surgery as part of the damage control strategy. A similar thought process applies to the acute formation of tissue

flaps by plastic surgery. While they may be required subsequently, temporary coverage should be applied until the patient is adequately resuscitated and able to tolerate a prolonged procedure. Performing flap or graft surgery at the first damage control operation will ultimately prove deleterious to the patient; it will unacceptably prolong operative time, have a high chance of the flap failing and eliminate a donor site for tissue coverage that may be more appropriate to use in 72 hours or thereafter. Temporary closure or use of a vacuum system at the end of initial surgical debridement is usually appropriate in these cases unless there are contraindications such as the presence of fistulae [10].

Damage control orthopaedic surgery has also been well described [12, 13], and the first surgical approach usually consists of external fixation of fractures rather than definitive repair. In common with abdominal damage control surgery, the rationale is to maintain or restore the integrity of blood supply to the limb or pelvis, provide a degree of fracture stabilisation for analgesia and to minimise the early risk of further bleeding or fat embolus. Intramedullary nailing or plating should not be performed in these patients acutely, but be deferred until physiological stability has been achieved.

For a more thorough overview of damage control surgery, refer to the relevant decision making and surgical chapters later in this textbook.

Damage Control Anaesthesia

Anaesthesia for acutely injured patients can be challenging, as many agents in common use have undesirable and dose-related side effects (such as hypotension) which may cause further morbidity and mortality. Patients requiring damage control resuscitation are usually unfasted and may be unable to give any information that may affect the choice of anaesthetic. In addition, they will invariably be bleeding, may have injury patterns requiring different anaesthetic strategies (e.g. permissive hypotension for bleeding, but with a concurrent head injury requiring normo/hypertension) and yet there will be little (if any) time

for optimisation. These patients are some of the most challenging that an anaesthetist can deal with, and often require two or more clinicians to ensure optimum care. The general principle in these patients is to ensure that they have adequate circulating volume and blood pressure to perfuse vital organs and ensure adequate oxygen delivery. Once that has been achieved, amnesia, analgesia and anaesthesia can then be prioritised.

Multiple strategies have been employed; however, an excellent paper by Sikorski et al. [14] outlines the various options. In terms of ensuring cardiostability, amnesia, analgesia and anaesthesia, a strategy of periodic boluses of high dose opioids is advised, with large doses of fentanyl given at increments as permitted by blood pressure. This has the advantage of blunting the intrinsic catecholamine response, preserving microvascular flow, limiting damage to the glycocalyx (which has been implicated in the development of trauma-induced coagulopathy) and avoiding vasodilation with inhalational agents. Techniques such as propofol TIVA (total intravenous anaesthesia) by infusions are unreliable as computed models of vascular compartments and subsequent distribution of drugs are not valid when there is sizeable circulating volume loss or replacement. This is in addition to propofol's unfavourable pharmacodynamic profile in these patients. In patients who are sick enough to require a damage control approach, waking at the end of an operation is not usually a consideration. These patients will universally require admission to intensive care and will usually be kept sedated until they have had definitive surgery after adequate resuscitation. It is common to give 20–30 μg/kg of fentanyl in total to these patients, if not more (the author has used up to 5 mg in total in some cases). The restoration of microvascular flow in conjunction with blood product volume replacement rapidly assists in resolving acidosis and restoring base deficit to normal by improving perfusion and oxygen delivery.

The typical division of labour in these cases between anaesthetists involves one clinician managing blood transfusion and large venous access, and the other administering drugs and monitoring oxygenation/ventilation parameters

and adequacy of anaesthesia. The transfusion anaesthetist should ensure an appropriate ratio of blood products is given, ideally with monitoring of response both clinically and in terms of using near-patient testing such as TEG or ROTEM to guide further product administration. Asking surgeons if patients are forming clots in the surgical field may give a broad indication as to the overall haemostatic picture. The transfusion anaesthetist should also be responsible for liaising with the blood bank, haematologists and the administration of agents such as tranexamic acid and calcium as needed. The second anaesthetist should monitor response to transfusion, ensure communication with the surgical teams, ensure an adequate balance between depth of anaesthesia/analgesia and adequate blood pressure, liaise with ICU to arrange postoperative care and ensure other relevant drugs such as antibiotics are administered. This was the general approach that was developed and modified in Camp Bastion during the Afghanistan conflict [15, 16] and was one of the factors which saw massive improvements in survival from injuries previously thought to be unsurvivable [17]. Several mnemonics or aide memoirs can be used in civilian practice, and the TRAUMATIC mnemonic developed by the University Hospital of Coventry and Warwickshire in the UK is an excellent example (see Fig. 14.1).

When to Start Damage Control Resuscitation: Indications

As mentioned above, damage control resuscitation is a systemic approach to trauma. Consequently, there needs to be a systemic acknowledgement that this is the strategy which is being employed. In terms of triggers to use damage control, there are several factors which can prompt the team to consider adopting this approach at various stages.

The first indications that a patient may require damage control resuscitation can be from the initial physiological observations or mechanism of injury. When dealing with pre-hospital trauma care in the UK, trauma triage tools have been implemented to identify patients who will benefit from transport to Major Trauma Centres (MTC) versus those who can safely be dealt with at local Trauma Units (TU) or smaller hospitals. The absolute triggers for transfer to an MTC are primarily based on physiological data such as systolic blood pressure less than 90 mmHg, GCS less than 13 or extremes of respiratory rate following trauma. However, in some areas, mechanism of injury can also be used as absolute based on anatomical considerations (e.g. penetrating trauma to head, neck or torso mandate MTC transfer) or relative indications (e.g. fall from more than 20 ft, ejection from a vehicle in the case of road traffic collisions or death in the same vehicle). An example of this is the West Midlands Major Trauma tool (Fig. 14.2).

Any triage tool that may be used will not be absolute, and clinical discretion is needed to avoid both under- and over-triaging patients to MTC care, hence the involvement of senior clinicians on the regional trauma desk. As discussed in the mechanism of injury chapter, some trauma systems (e.g. London) are moving away from using non-anatomical mechanism of injury factors when deciding on destination hospital based on locally gathered audit data (Fig. 14.3). When the patient arrives in hospital, a rapid reassessment of the casualty takes place, and similar vital signs to those outlined in the PHEM trauma tool or other significant deterioration may also prompt the adoption of a damage control strategy.

Damage Control Resuscitation in PHEM

The first clinician with a patient may be the best placed to highlight and initiate the need for damage control practices. The presenting physiology and the context in which the patient has been injured are likely to be the most apparent, and how the pre-hospital teams work will set the tempo for subsequent care. This is not only a medical matter, as the speed of extrication and patient handling by firefighters can also be considered as part of the damage control paradigm. If the patient is visibly deteriorating, the balance

Major Trauma?
Major Haemorrhage? Then...

T	**Tranexamic Acid**	• Initial 1g bolus: • Often already given pre-hospital • Otherwise, administer only if within 3 hours of injury or ongoing hyperfibrinolysis • Do not delay, every minute counts • Subsequent 1g infusion over 8 hours
R	**Resuscitation**	• Activate Major Haemorrhage Protocol • Initial Transfusion Ratio 1:1:1 and consider: • Rapid infuser and cell salvage • Time-limited hypotensive resuscitation • Pelvic binder / splint fractures / tourniquet • Avoid any crystalloid use
A	**Avoid Hypothermia**	• Target temperature > 36°C • Increase ambient theatre temperature • Remove wet clothing and sheets • Warm all blood products & irrigation fluids • Warm the patient using forced-air warming device / blanket / mattress
U	**Unstable?** **Damage Control Surgery**	• If unstable, coagulopathic, hypothermic or acidotic, perform damage control surgery of: • Haemorrhage control, decompression, decontamination and splintage • Time surgery aiming to finish < 90mins and conduct Surgical Pauses at least every 30mins
M	**Metabolic**	• Perform regular blood gas analysis • Base excess and lactate guide resuscitation • Adequate resuscitation corrects acidosis • If lactate > 5mmol/L or rising, consider stopping surgery, splint and transfer to ICU • Haemoglobin results are misleading
A	**Avoid Vasoconstrictors**	• Use of vasoconstrictors doubles mortality • However, use may be required in cases of spinal cord or traumatic brain injury • Anaesthetic induction - Suggest Ketamine • Maintenance - When BP allows, titrate high dose Fentanyl and consider Midazolam
T	**Test Clotting**	• Check clotting regularly to target transfusion: • Laboratory or point of care (TEG / ROTEM) • Aim platelets > 100x10⁹/L • Aim INR & aPTTR ≤ 1.5 • Aim fibrinogen > 2g/L
I	**Imaging**	• Consider: • CT: Most severely injured / haemodynamically unstable patients gain most from CT • Interventional radiology
C	**Calcium**	• Maintain ionised Calcium > 1.0 mmol/L • Administer 10mls of 10% Calcium Chloride over 10 minutes, repeating as required • Monitor Potassium and treat hyperkalaemia with Calcium and Insulin / Glucose

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Fig. 14.1 TRAUMATIC Mnemonic for Trauma Anaesthesia

Fig. 14.2   West Midlands Major Trauma Triage Tool (Reproduced thanks to West Midlands Ambulance Service)
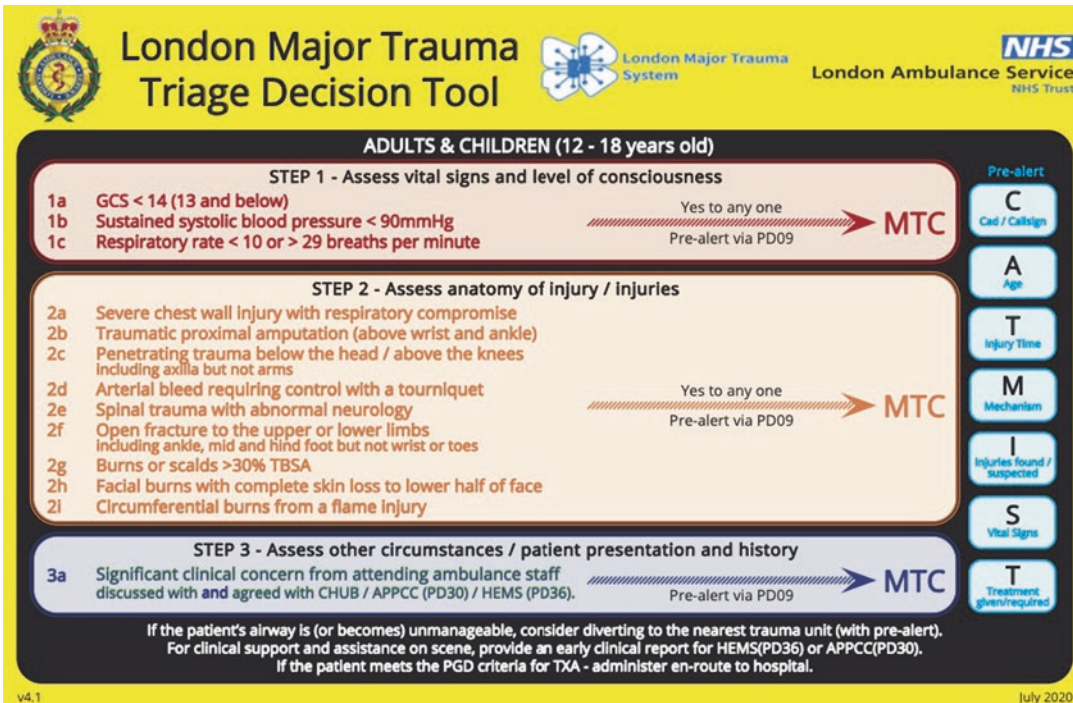

Fig. 14.3   New London Major Trauma tool, de-emphasising mechanism of injury as a screening criteria

between minimising movement and maximising speed for access to the patient and treatment may shift so that the compromise between the two favours speed over finesse. The often-quoted dichotomy of "Scoop and run vs stay and play" [18, 19] is a false one. Meaningful interventions should be undertaken on scene that maximise the chance of a good patient outcome without delaying transport to hospital and other life-saving interventions. This balance can change depending on patient injury pattern, level of pre-hospital response, distance to hospital et cetera, but a general rule is that major haemorrhage control, airway and breathing interventions should be performed on scene with everything else done en route.

PHEM damage control measures are targeted primarily at circulation preservation and ensuring adequate oxygenation and ventilation. These interventions include the application of tourniquets, pelvic binders and occasionally femoral traction splints, airway measures appropriate to the level of clinician and patient need, and establishing sufficient respiratory support. Beyond this, measures such as blood or fluid administration, advanced analgesia etc. can be accomplished on the way to the hospital. Even during transfer, damage control principles should be applied. For example, fluids should be withheld if there is adequate blood pressure (in line with a permissive hypotension/novel hybrid resuscitation strategy) and tranexamic acid should be given to help avoid fibrinolysis of the first clots that have formed. Patients should also be kept as warm as possible by minimising passive heat loss and actively heating fluids or the environment in the ambulance where possible.

The caveat to "A and B on scene, C and D en route" is when drug or blood administration is required to safely facilitate the management of an airway or breathing problem (e.g. administration of a unit of blood to a hypotensive head-injured patient who requires RSI as part of their care). A second instance may also be when scene times are prolonged due to entrapment or other immediately insurmountable factors preventing patient transport. In those cases, additional scene time should not be wasted, and the emphasis should

still be on minimising delays while enhancing patient care and decreasing the time to surgery and ICU beyond.

Ensuring that activity is continuous, complementary and running in parallel while the factors that are causing the delay are dealt with is the hallmark of good pre-hospital care. The ability of pre-hospital teams to think three steps ahead of where they are now is an essential requirement; even if they are incapable of performing advanced interventions themselves, they can set the conditions to minimise scene times. This spectrum of activity must also include extrication, so only necessary interventions and monitoring should be performed in order to avoid impeding firefighters and increasing scene times further. An example of good crew management decreasing scene times might be a technician level ambulance crew arriving first on scene at a remote accident and identifying a patient who requires RSI for a head injury. After requesting appropriate backup and performing a primary survey to deal with any immediate life-threatening injuries within their scope of practice, the first crew should appropriately expose and position the patient on a stretcher in an area with good all-round access. When their backup arrives, the patient can be anaesthetised much more quickly and leave the scene in a shorter period than if the backup crew had to start from the beginning of positioning and exposing the patient. Improving all-round access to facilitate a rapid further assessment, performing any necessary interventions on scene and minimising further delays assists everyone.

Damage Control Resuscitation in ED

As well as being a guide to patient dispersal (MTC vs TU) for pre-hospital clinicians, the initial pre-alert/report from scene can prompt in-hospital teams to prepare for a patient who has a high likelihood of needing damage control resuscitation. At a systemic level in the emergency department, this can lead to the activation of a mass transfusion protocol before the patient arrives, drawing up emergency anaesthesia drugs, preparing invasive monitoring or ensuring that
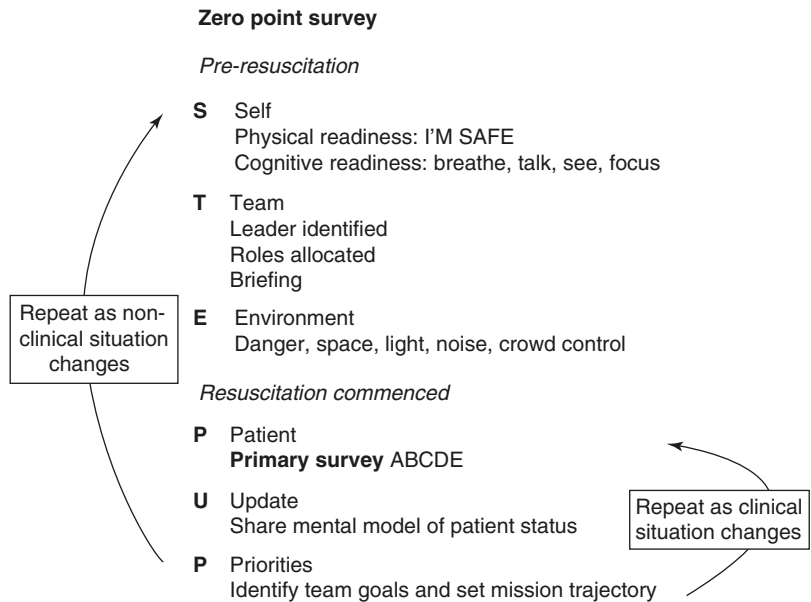
the CT scanner or operating theatre is ready to receive an urgent patient. Sharing a mental model and conducting a "Zero point survey" [20] is a useful way to ensure that each member of the team is expecting to manage the patient in the same manner (see Fig. 14.4). This involves briefing and preparing the in-hospital team and facilities before the arrival of the patient based on the information from the pre-alert.

On arrival of the patient, the MABCD assessment will begin again to confirm the injuries that have been suspected in the pre-hospital phase and monitor any progression of physiology. In addition to a reassessment of vital signs and calculation of the shock index [21] (ratio of systolic blood pressure to heart rate), there are several additional diagnostic point of care tests that can be performed in ED that may not be available pre-hospital. These can aid in the assessment of shock, triggering a damage control approach and include blood gas analysis for pH, lactate levels and haemoglobin. The evidence behind these tests is considered in the circulation chapter, and an excellent article by Petrosniak and Hicks [22] discusses how they can be integrated into ED to optimise resuscitation. One pitfall to avoid is false reassurance from an apparently normal blood pressure on arrival in the ED in a previ-ously hypotensive patient. Patients with isolated hypotension in the pre-hospital phase of their care which resolves spontaneously in ED have been found to have higher injury severity scores, higher rates of admission to ICU with longer lengths of stay, a nearly four-fold increase in the need for blood transfusion in the first 24 h and increased mortality [23, 24].

In the same way that PHEM damage control aims to preserve the patients' own circulating volume, avoid heat loss and ensure quick transport, the goals of ED damage control are mostly similar. Patients should be rapidly assessed and a decision made whether to image the patient with CT or ultrasound, to take the patient straight to the operating theatre, or even to operate in the ED. The emergency department is better equipped and has more personnel than the pre-hospital environment (usually), so the occasional temptation in this scenario is for personnel to perform multiple procedures which may not be strictly necessary and ultimately slow the progression of care. An example may be siting an arterial line in a head-injured patient—it is likely to be unnecessary before a CT and may ultimately delay time to diagnosis. Similarly, in an intubated patient a thoracostomy may be necessary for pneumothorax. However, formal intercostal drain insertion

Fig. 14.4 Zero point survey from Reid et al. [20]

Zero point survey

Pre-resuscitation

S   Self
       Physical readiness: I'M SAFE
       Cognitive readiness: breathe, talk, see, focus

T   Team
       Leader identified
       Roles allocated
       Briefing

E   Environment
       Danger, space, light, noise, crowd control

Repeat as non-clinical situation changes

Resuscitation commenced

P   Patient
       Primary survey ABCDE

U   Update
       Share mental model of patient status

P   Priorities
       Identify team goals and set mission trajectory

Repeat as clinical situation changes

is a time-consuming process that puts the patient further away from definitive diagnostics and treatment. Perform the thoracostomy if necessary but do not put the drain in until the patient has been to CT—time that is wasted during insertion, and the logistics of moving a patient with a chest drain in situ are more troublesome than one with a simple thoracostomy. A final example is tranexamic acid infusions; give the 1 g bolus in ED if it has not been given pre-hospital, but there is little benefit (and potential logistical challenges) in commencing the subsequent 8-hour infusion via a syringe driver before the patient has been to CT.

The second-order effects of an intervention should also be considered in the sequence of events; if the patient requires intubation, it is rarely so urgent that it needs to be done as soon as they arrive in the department. An assessment of their haemodynamic state and injury pattern may change the order in which interventions are performed. For example, a hypotensive trauma patient with a chest injury, suspected pneumothorax and decreasing GCS has competing management priorities and may require intubation. The team leader should take an overall view and prioritise; resuscitate with blood products, prepare for a thoracostomy and once the patient has been optimised then induce anaesthesia with a reduced dose of induction agents. If a rigid, historical "vertical" ABCD sequence of interventions was followed, inducing anaesthesia and managing the airway without any of the other interventions could result in worsening hypotension due to the effects of positive pressure ventilation on an under-filled patient with evolving chest pathology. Parallel actions rather than sequential ones are the key to smooth and efficient care.

Consider ED damage control resuscitation to be a prime example of marginal gains theory [25, 26]—multiple small changes can lead to a substantial overall improvement in the standard of care. Once immediately life-threatening injuries have been identified and temporised as needed, the decision comes as to what the appropriate disposition of the patient is. Do they require ongoing damage control in theatre? Do they need to be admitted to ICU or HDU, or has their treatment been sufficient to allow them to be monitored on a ward level?

Damage Control: More Than Surgery

Damage control is a paradigm, not an operation. It requires a large group of people all with the same understanding and mindset to achieve necessary but not definitive care and an understanding that perfect may be the enemy of good. By implementing strategies which allow appropriately selected patients to be diagnosed and resuscitated as rapidly as possible, then allowing ongoing resuscitation on critical care before definitive surgery, outcomes have demonstrably improved.

Questions

1. Damage control surgery should be used for *all* trauma patients who require an operation.
   (a) True
   (b) False
2. Critically unwell patients who require skin grafts or tissue flaps to cover soft tissue loss should have these procedures deferred until they have been adequately resuscitated and stable for >24 h.
   (a) True
   (b) False
3. Patients who have had a damage control procedure will usually require post-operative care in an Intensive Care Unit
   (a) True
   (b) False
4. Once a decision has been made to perform damage control or a definitive procedure, it cannot be changed
   (a) True
   (b) False
5. Triage tools may be overridden by clinical judgement of staff to divert patients to or away from Major Trauma Centres
   (a) True
   (b) False

Answers

1. b
2. a
3. a
4. b
5. a

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