

The medical response to injury

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Initial management After initial assessment of the patient's condition at the scene of an accident, paramedics communicate with the nearest hospital, triggering activation of 'the trauma team on call' and allowing personnel to expect the patient's arrival in the resuscitation room. The team leader, according to the ATLS protocol, will assign trained nurses and doctors to specific duties. Protective clothing, such as gloves and lead aprons, is required to protect the personnel from fluids and radiation exposure. Optimum coordination of the trauma team throughout the resuscitation process is essential to avoid careless delays, which may compromise the response time and the patient's condition. Timely involvement of different disciplines in assessing and planning treatment of injuries in different body areas is crucial and may lead to issues around priority in terms of planning and interventions. This situation could lead to confusion and uncertainty: 'Who should go first?' or 'What investigation should be next?' It is the role of the team leader to ensure that this is avoided and that decisions which may be critical for the patient's well-being are executed smoothly. In situations where the system operates according to locally developed protocols, someone should have the responsibility of overruling the protocol if this is in the best interests of the patient, in order to keep the process moving along. Following common pathways to manage patients can save time and reduce errors. In this respect the development of the NICE guidelines for the initial assessment and treatment of standards documents, such as BOAST (British Orthopaedic Association Standards for Trauma), can be downloaded and - printed for display in hospitals and so can support planning and decision making. The development of local protocols, NICE guidelines and BOAST documents has contributed to the establishment of specific treatment pathways and to improved patient care and outcomes. Nonetheless, caution should prevail as, once a diagnosis (label) has been made, the pathway is set and it may not - be in the patient's best interests if the diagnosis is misleading and troublesome. For instance, an older male patient fell in his - garden and sustained a wrist fracture. He was given the label of 'accidental fall and wrist fracture', placed in a plaster of Paris back slab and arrangements were made for him to be admitted for fracture stabilisation. However, this patient had a number of medical comorbidities (heart failure, epilepsy, previous - myocardial infarction and high blood pressure). Consequently, - the label given as 'accidental fall and wrist fracture' may be associated with more severe underlying pathology and injuries. - The wrong label may disguise the seriousness of the injuries sustained and the patient's condition may rapidly deteriorate, putting their life at risk. Thus, the first clinician in the diagnostic chain has disproportionate responsibility. Early inappropriate assessment and incorrect labelling could place the patient on the wrong treatment care pathway. This can be avoided by conducting appropriate physiological triage with senior input. Beyond the first hour The objective of the first (golden) hour is to reach the end points of resuscitation and completion of the diagnostic procedures identifying the injuries sustained.

However, in polytraumatised patients, further interventions are necessary. For example, a spleen laceration, a lung contusion, a vertical shear pelvic fracture, an open right tibial fracture, a left femoral fracture or a distal humerus fracture are injuries necessitating treatment. The spleen laceration may be managed non-operatively or with embolisation, depending on its severity. The timing and priority of fixation of the other skeletal injuries and the type of fixation have been points of much discussion during the past decade. Two treatment strategies have prevailed: early total care (ETC) and damage control orthopaedic (DCO) surgery. Since the late 1990s the ETC approach (fix all fractures early within 24 hours) revolutionised the management of patients with multiple injuries. This practice became the gold standard of treatment for polytrauma patients. Nonetheless, in specific groups of patients, for example those with severe chest and/or head injuries or those in an extreme physiological state (with ongoing bleeding from different sources such as the abdomen, pelvis and chest), it was observed that the ETC concept led to early complications and mortality. With the advances made in the fields of molecular medicine, biology, intensive care and immunology the physiological response to injury was better understood. It was appreciated that the trauma sustained at the scene of an accident (first hit) induces an immune-inflammatory reaction that evolves with time and can prime the patient to reach an uncontrolled physiological state. Subsequently, surgical interventions can exhaust the biological reserve of the patient and lead to the development of adult respiratory distress syndrome (ARDS), multiple organ dysfunction syndrome (MODS) and mortality. These observations led to the acceptance of the so-called DCO philosophy, which is also called damage control surgery (DCS) in more generalised settings (see later chapters). The stages of DCO are: resuscitation; haemorrhage control; decompression; decontamination; fracture splintage. Application of the DCO concept includes temporary stabilisation of long bone fractures and pelvis with external fixators. This approach allows rapid procedures to stabilise the affected bones as part of the resuscitation process. Definitive fixation of the fractures (conversion of the external fixators to intramedullary nailing for the femur and plating of the pelvis) would usually take place 4 days later, when the physiological state of the patient has been normalised, or even later if necessary. The two strategies of fracture fixation – the ETC and DCS – are currently practised on the basis of some specific criteria. The vast majority of polytrauma patients are suitable for ETC (80–90%). Specific criteria are shown in Table 26.2. Lately, other fixation strategies that have been proposed include the Early Appropriate Care, Safe Definitive Surgery and Prompt Individualised Safe Management (PRISM) concepts. The PRISM concept accepts that the decision-making process should be based on the principles of doing no ‘further harm to the patient’, intervening promptly and utilising the idea of individualised/personalised medicine. It is based on the understanding that every patient responds differently to the same degree of trauma, every individual has a different genetic profile and the fact that each trauma centre may have different resources and staff available to deal successfully with every trauma eventuality. Irrespective of the treatment strategy selected, it is imperative to be aware that the patient’s condition can change and deteriorate quickly. In particular, patients with a high ISS are a challenge to a patient’s physiology is essential, with senior input involvement in order to deal successfully with the unexpected. Overall, a plan should always be made available to the trauma team to inform them about the details of treatment, particularly in the operating theatre environment. The plan can be recorded on a whiteboard with clear guidance on the alternative pathway to be implemented should the patient’s condition deteriorate. Ongoing monitoring of such parameters as core temperature, lactate, base excess and coagulation will provide knowledge of the patient’s condition at any time point during care. Appropriate decisions can then be taken to

ensure that the safety of the patient has not been compromised. For instance, if the ETC concept has been applied and a polytrauma patient with a head injury and chest trauma is on the operating table waiting to have a femoral fracture stabilised with intramedullary nailing and their condition deteriorates, the ETC plan can be changed to DCO (an external fixator can be applied quickly to stabilise the femoral fracture temporarily). This allows prompt transfer of the patient to the ICU, where resuscitation can continue within a safe environment with ongoing monitoring of vital organ function (lungs and brain). When injuries involve the input of different disciplines in terms of surgical intervention, for instance a general surgeon for a liver laceration, a neurosurgeon for an intracranial haematoma, an orthopaedic surgeon for a pelvic and femoral fracture and a maxillofacial surgeon for a depressed orbital fracture, the most important intervention should go first. Clearly, communication and prioritisation among the team members is essential. As each procedure nears completion, communication with the anaesthetist will allow a decision as to whether it is safe to go on to the next procedure. Not infrequently, and assuming that it is technically possible, two teams can work simultaneously to significantly shorten the time the patient will spend in the operating theatre and allow subsequent prompt transfer to the ICU for optimisation and ongoing monitoring.

TABLE 26.2 Criteria for damage control surgery (DCS) and early total care (ETC). Criteria for DCS
 Criteria for ETC Hypothermia: $<34^{\circ}\text{C}$ Stable haemodynamics Acidosis: $\text{pH} < 7.2$ No need for vasoactive/ inotropic stimulation Serum lactate $> 5 \text{ mmol/L}$ No hypoxaemia, no hypercapnia Coagulopathy Serum lactate $< 2 \text{ mmol/L}$ Blood pressure $< 70 \text{ mmHg}$ Normal coagulation Transfusion approaching 15 Normothermia units Injury severity score > 36 Urinary output $> 1 \text{ mL/kg/h}$

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Beyond the first hour The objective of the first (golden) hour is to reach the end points of resuscitation and completion of the diagnostic procedures identifying the injuries sustained. However, in polytraumatised patients, further interventions are necessary. For example, a spleen laceration, a lung contusion, a vertical shear pelvic fracture, an open right tibial fracture, a left femoral fracture or a distal humerus fracture are injuries necessitating treatment. The spleen laceration may be managed non-operatively or with embolisation, depending on its severity. The timing and priority of fixation of the other skeletal injuries and the type of fixation have been points of much discussion during the past decade. Two treatment strategies have prevailed: early total care (ETC) and damage control orthopaedic (DCO) surgery. Since the late 1990s the ETC approach (fix all fractures early within 24 hours) revolutionised the management of patients with multiple injuries. This practice became the gold standard of treatment for polytrauma patients.

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Revision #1
Created 2025-12-31 15:11:59 UTC by Omar Ayman
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