

# Damage control resuscitation

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The concept of damage control has been broadened to include the techniques used in resuscitation as well as in surgery. The time in the emergency department is minimised and the majority of resuscitation of the patient is carried out in the operating theatre and not in the resuscitation bay (Table 29.6). Resuscitation is individualised through repeated point-of-care testing of haemoglobin, acidosis (pH and lactate) and clotting, and is therefore directed towards the early delivery of biologically active colloids, clotting products and whole blood in order to buy time. The physiological disturbances that are associated with the downward spiral of acidosis, coagulopathy and hypothermia in these serious injuries are predicted and attempts are made to avoid them rather than react to them. This is a key component of damage control resuscitation. The decision of whether damage control surgery is the appropriate course should be made early (Table 29.7) and allows the whole surgical and anaesthetic team to work together to limit the time in surgery and achieve the earliest possible admission of the patient to the ICU. Damage control is a staged process. The initial focus is haemorrhage control, followed by control and limitation of contamination, which are achieved using a range of abbreviated techniques including simple ligation of bleeding vessels, shunting of major arteries and veins, drainage, temporary stapling of bowel and therapeutic packing. Following the above, the abdomen is closed in a temporary fashion either by using commercially available products or by using a sheet of plastic (e.g. OPSITE or similar product) over the bowel, an intermediate pack to allow suction and a further sheet of adherent plastic drape to the skin to form a watertight and airtight seal. Suction is applied to the intermediate pack area to collect abdominal fluid. This technique is known as the 'Vac-Pac' or 'OPSITE sandwich' (Figure 29.12). As soon as control has been achieved the patient is transferred to the ICU, where resuscitation is continued.

(a) Outer layer Inner layer (OPSITE /loban™) (OPSITE Abdominal swab/ cotton drape) Abdominal content Suction drains (b) Figure 29.12 (a) Diagram showing temporary skin closure in damage control. (b) Abdominal closure following damage control surgery showing an OPSITE closure.

The next stage following damage control surgery and physiological stabilisation is definitive surgery. The team should aim to perform definitive anastomoses, vascular reconstruction and closure of the body cavity within 24–72 hours of injury. However, this must be individualised to the patient, the response to critical care resuscitation and the progression of injury. The abdomen is closed as soon as possible, bearing in mind the risks of abdominal compartment syndrome (ACS). The closure is not without its own morbidity.

Successful closure may require aggressive off-loading of fluid and even haemo filtration to achieve this if the patient will tolerate it. The best situation is closure of the abdominal fascia, or, if this cannot be achieved, then skin closure only. Occasionally, mesh closure can be used, with skin grafting over the mesh and subsequent abdominal wall reconstruction. Thoracic damage control is conceptually based on the same philosophy. This is that haemorrhage control and focused surgical procedures minimise further surgical insult and lead to improved survival in the unstable trauma patient. The aim is to control bleeding and limit air leaks using the fastest procedures available, such as staplers, to minimise the operative time. Surgery has already been described. Damage control applies equally to the extremities. In this case, it is shunting of blood vessels, identifying and marking damaged structures such as nerves, fasciotomy and removal of contaminated tissue that are the main tasks. Subsequent definitive management can be carried out at a later stage.

Summary box 29.9 Damage control

Stage Intervention I Patient selection II Control of haemorrhage and control of contamination III Resuscitation continued in the intensive care unit IV Definitive surgery V Abdominal closure

TABLE 29.7 Indications for damage control surgery. Inability to achieve haemostasis Anatomical Complex abdominal injury, e.g. liver and pancreas Combined vascular, solid and hollow organ injury, e.g. aortic or caval injury Inaccessible major venous injury, e.g. retrohepatic vena cava Demand for non-operative control of other injuries, e.g. fractured pelvis Anticipated need for a time-consuming procedure Physiological Temperature  $<34^{\circ}\text{C}$  (decline of pH  $<7.2$  physiological Serum lactate  $>5$  mmol/L (normal: reserve)  $<2.5$  mmol/L) Prothrombin time  $>16$  s Partial thromboplastin time  $>60$  s

“ 10 units blood transfused Systolic blood pressure  $<90$  mmHg for 60 min Environmental Operating time  $>60$  min (core temperature loss is usually  $2^{\circ}\text{C}/\text{h}$ ) Inability to approximate the abdominal incision Desire to reassess the intra-abdominal contents (directed relook) Resuscitation is carried out in the operating theatre using biologically active fluids (i.e. blood) – damage control resuscitation The surgery performed is the minimum needed to stabilise the patient The aims of surgery are to control haemorrhage and limit contamination Secondary surgery is aimed at definitive repair

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