

Crush injury and syndrome

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A crush injury occurs when a body part is subjected to a high degree of force or pressure, usually after being squeezed between two heavy or immobile objects. Damage related to a crush injury includes lacerations, fractures, bleeding, bruising, compartment syndrome and crush syndrome (Figure 33.18). The London Blitz is the name given to the German air raids on London between 7 September 1940 and 17 May 1941, during which it is estimated that more than 15 000 people were killed. Blitz is short for Blitzkrieg , which is German for 'lightning war'. The association between crush injury , rhabdomyolysis and acute kidney injury was first reported in victims trapped during the 'London Blitz'. It is seen in earthquake and mining accident survivors and in battlefield casualties. Prolonged crushing of muscle leads to a reperfusion injury when the casualty is rescued. This releases myoglobin and vasoactive mediators into the circulation. It also sequesters many litres of fluid, reducing the intravascular volume and resulting in renal vasoconstriction and ischaemia. The myoglobinuria leads to renal failure from tubular obstruction. The treatment of crushed casualties should begin as soon as they are discovered. Rescuers must be alert to the presence of associated injuries (Figure 33.19). Aggressive volume- loading of patients, preferably before extrication, is the best treatment. After provision of first aid and starting intravenous fluids the patient should be catheterised to measure urine output. In adults, a saline infusion of 1000–1500 mL/h should be initiated. This should be continued until myoglobin is no longer detectable in the urine. Mannitol administration can reduce the reperfusion component of this injury . Once a flow of urine is observed, a mannitol-alkaline diuresis of up to 8 litres per day should be maintained, keeping the urinary pH greater than 6.5. An early fasciotomy can decompress muscle compartments and prevent severe loss of limb function. A late fasciotomy , when it is obvious that the muscles of that compartment must be dead, is only likely to cause a massive release of myoglobin, as well as potentially introducing infection into dead tissue. It is therefore best not to perform a fasciotomy in cases where entrapment has been for over 12 hours. Intensive care is required with close attention to fluid balance and renal dialysis if required.

(b) (c) Figure 33.18 (a–c) Extensive crush injury in a man trapped in a fallen house. The depth to which the soft tissues have been devitalised is seen clearly. Figure 33.19 Rescuers must be prepared for injuries to the spine. Treatment of crush syndrome should start before extrication.

Crush syndrome **Compartment syndrome** A compartment syndrome develops when the pressure within a muscle compartment starts to rise as a result of trauma (see Chapter 32). This occurs in muscles enclosed in a fascia such as the calf and forearm muscles and the intrinsic muscles of the hand and foot. A tight bandage or plaster, haemorrhage from a fracture or severe blunt trauma leads to a rise in pressure in the compartment until it exceeds venous drainage pressure. If the pressure rises further, it will cut off perfusion of the muscle. Passive stretching of the affected muscle will cause extreme pain and this is diagnostic of the condition. If the condition is left unrelieved, then nerves passing through the compartment will cease to

function and the muscle will die and then undergo fibrosis and shortening, producing a Volkmann's ischaemic contracture. Removal of any constricting agent and, if necessary, a fasciotomy will relieve the pressure and muscle perfusion will restart. Pressure studies are not reliable; if in doubt, perform a fasciotomy. Summary box 33.11 Compartment syndrome

Arises as a result of reperfusion Acute kidney injury and renal failure from myoglobinuria is a complication A late fasciotomy may make things worse not better Commonest in a closed fracture or soft-tissue crush injury Pain on passive extension of the muscles is diagnostic Intracompartmental pressure studies are not reliable If there is any suspicion, then fasciotomy must be performed early

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