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The operative management of liver injuries can be summarised as ‘the four Ps’: /uni25CF Pressure; /uni25CF Pringle; /uni25CF Plug; /uni25CF Pack. At laparotomy the liver is reconstituted and bleeding is con - trolled by direct bimanual compression to achieve its normal architecture as best as possible (Pressure). The inflow from the portal triad is contr olled by a Pringle’s manoeuvre, with direct compression of the portal triad, either digitally or using a soft clamp (Figure 29.9). This has the e ff ect of reducing arterial and portal venous inflow into the liver, although it does not control the backflow from the inferior vena cava and hepatic veins. Any holes due to penetrating injury can be plugged directly using silicone tubing or a Sengstaken–Blakemore tube; after controlling any arterial bleeding, the liver can then be - packed (see Damage control surgery). Bleeding points should be controlled locally when possible, and such patients, if required, subsequently undergo angioembolisation. It is not usually necessary to suture penetrating injuries of the liver unless haemostasis cannot be controlled by other means . If there has been direct damage to the hepatic artery , it can be tied o ff . Damage to the portal vein must be repaired, as tying o ff the portal vein carries a greater than 50% mortality rate. If it is not technically feasible to repair the vein at the time of surgery , it should be shunted and the patient referred to a specialist centre. A drainage system must be left in situ following hepatic surgery . Finally , the liver can be definitively packed, restoring the anatomy as closely as possible. Placing omentum into cracks in the liver is not recommended. Arthur Hendley Blakemore , 1897–1970, Associate Professor of Surgery , Summary box 29.6 Liver trauma /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF

Hepatic artery Portal vein Figure 29.9 The Pringle manoeuvre. Blunt trauma occurs as the result of direct compression Penetrating trauma of the upper abdomen or lower thorax can damage the liver CT scanning is the investigation of choice in a stable patient Surgical management consists of: Pressure, Pringle, Plug and Pack The hepatic artery can be tied off but not the portal vein (which should be stented) Closed drainage should always be used

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The treatment for bleeding is to stop the bleeding! The priorities for resuscitating patients with pelvic fractures are no di ff erent from the standard. These injuries can produce a real thr eat to the circulation, and management is geared towards controlling this threat. Initial management requires the use of a compression binder or a sheet, applied around the true pelvis at the level of the greater trochanters (‘reduce the pelvic volume’), a potentially life-saving procedure that has to - be done in the emergency department. Eighty-five per cent of bleeding originating from the pelvis is of venous origin and can be controlled by non-operative means, including compression either by binding or external fixator or by extraperitoneal pelvic packing (i.e. packing the loose space between the bon y wall of the pelvis and the perito - neum) to compress the pelvic veins. If other sources of bleed - ing have been ruled out, the extraperitoneal pelvic packing is done without

entering the peritoneal cavity . This may be combined with external fixation. - If the b leeding is of arterial origin, interventional angio - embolisation is the next choice for bleeding control. The tech - - niques for bleeding control (compression, packing, fixation and angioembolisation) do not exclude each other but rather may complement each other. Persistent bleeding after packing may require angioembolisation and vice v ersa. Severe pelvic injuries require a multidisciplinary team approach. If adequate orthopaedic experience is unavailable, consideration should be given towards early transfer of this pa tient to an institution with the necessary expertise. If the source of the bleeding is in doubt or FAST/CT results are positive, showing a significant amount of blood in the peritoneal cavity , concurrent intra-abdominal injury can - not be excluded and it is wise to perfor m an exploratory lapa - rotomy to treat or rule out intra-abdominal bleeding. Management

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