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REVIEW

Penetrating pelvic trauma: Initial assessment and surgical management in emergency



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Summary Penetrating pelvic trauma (PPT) is defined as a wound extending within the bony confines of the pelvis to involve the vascular, intestinal or urinary pelvic organs. The gravity of PPT is related to initial hemorrhage and the high risk of late infection. If the patient is hemodynamically unstable and in hemorrhagic shock, the urgent treatment goal is rapid achievement of hemostasis. Initial strategy relies on insertion of an intra-aortic occlusion balloon and/or extraperitoneal pelvic packing, performed while damage control resuscitation is ongoing before proceeding to arteriography. If hemodynamic instability persists, a laparotomy for hemostasis is performed without delay. In a hemodynamically stable patient, contrast-enhanced CT is systematically performed to obtain a comprehensive assessment of the lesions prior to surgery. At surgery, damage control principles should be applied to all involved systems (digestive, vascular, urinary and bone), with exteriorization of digestive and urinary channels, arterial revascularization, and wide drainage of peri-rectal and pelvic soft tissues. When immediate definitive surgery is performed, management must address the frequent associated lesions in order to reduce the risk of postoperative sepsis and fistula.

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Introduction

Penetrating pelvic trauma (PPT) is defined as a wound extending within the bony confines of the pelvis to involve the vascular, intestinal or urinary pelvic organs. The most common injury mechanisms are gunshot and stab wounds and impalement. Iatrogenic wounds do not fall within the scope of polytrauma and will not be addressed in this review.

The severity of PPT is related to initial bleeding and to the high risk of infection due to associated lesions, which occur more frequently than in blunt trauma. The mortality of PPT exceeds 30% [1]. Emergency management of PPT should be performed in a level 1 trauma center. The initial clinical presentation is often dominated by hemorrhagic shock in a hemodynamically unstable patient. Management must quickly obtain hemostasis by either surgical or radiological means. For the hemodynamically stable patient, comprehensive assessment of vascular, digestive, urinary and bony lesions should be performed at the outset in order to adapt emergency surgical treatment to the findings. Associated lesions require specific surgical treatment.

The authors base the recommendations of this clinical update on the experience gained during recent armed conflicts in Afghanistan, Mali, and the Central African Republic and on data from the international literature.

Specific aspects of fluid resuscitation for shock in PPT

When a patient with PPT arrives in the emergency room, immediate management centers on intravenous volume resuscitation according to standard management protocols for severe trauma. Because of the potential for exsanguinating hemorrhage, the protocol for massive transfusion is instituted as soon as the ambulance notification is received.

When the victim arrives, initial treatment is the same as for blunt trauma, i.e.: chest and pelvis X-rays and focal assessment sonogram for trauma (FAST).

A quick physical examination of the pelvic area, perineum and buttocks is made. The dorsal surface must always be inspected by rolling the patient into the lateral position, while maintaining alignment of the spine. Examination should identify both the entry and exit wounds, permitting estimation of the trajectory of the weapon or projectile. For external bleeding, hemostatic compresses of the Quickclot® type are inserted through the hole for tamponnade and held in place by placement of a compressive pelvic belt. If there is no evidence of urethral bleeding, a Foley urinary catheter is inserted. If there is evidence of urethral injury, the bladder is drained by insertion of a suprapubic catheter.

In the hemodynamically unstable patient, central venous access is obtained via the internal jugular vein rather than the groin, to preserve free access to Scarpa's femoral triangle and to allow intraoperative iliac vein clamping. For the same reasons, a radial artery catheter should be inserted to allow arterial pressure monitoring. The target is a mean arterial pressure of 60 mmHg (permissive hypotension). Transfusion of concentrated red blood cells, clotting factors and platelets with a ratio of 1/1/1 is started immediately [2].

After initial hemostasis and resuscitation efforts, two situations may apply:

- the patient remains hemodynamically unstable despite initial resuscitation, a situation best described as

catastrophic. Performance of CT or embolization is unthinkable in such patients because of the time delay and duration of the exam while bleeding is ongoing;

- the patient is initially hemodynamically stable or has been stabilized. This allows time for a complete physical examination and a full-body CT to guide surgical management.

Management of hemodynamically unstable PPT

Management algorithm

For a hemodynamically unstable patient who does not respond to initial resuscitation, first-line surgery with instrumental hemostasis is necessary.

The management algorithm corresponds to the red part of Fig. 1:

- if FAST is negative, the authors recommend the immediate performance of extraperitoneal pelvic packing (EPP) and, depending on the expertise of the center, the placement of a resuscitative endovascular balloon occlusion of the aorta (REBOA) while the patient is in the resuscitation unit. EPP is effective in slowing venous bleeding and the REBOA allows distal aortic occlusion providing time to bring the patient to the arteriography suite for arterial embolization or the insertion of a coated stent;
- if FAST is positive or if the above measures are ineffective, the patient should be promptly moved to the operating room for emergency laparotomy and hemostasis. In centers with expertise, pre-surgical insertion of an REBOA may be considered.

Indications, performance and details of hemostatic techniques

Extraperitoneal pelvic packing (EPP)

Indications

The initial description of EPP was published in 1994 [3] and the technique has seen increasing use from 2000 onward [4–9]. EPP has been shown to be effective in patients who remain unstable despite conventional management including bony fixation and arteriography [7,10]. In their 2009 case-control study of 40 patients, Osborn et al. [11] concluded that EPP was as effective as pelvic angiography for stabilizing hemorrhage in hemodynamically unstable pelvic fracture victims. It reduced the need for pelvic embolization and the volume of post-procedure blood transfusions.

However, there is no consensus on the role of EPP, as illustrated by the differences between American and European recommendations. In American recommendations [12], EPP is considered effective for bleeding control but only as a salvage technique after embolization (Grade III level of evidence). In the European recommendations [13], an early resort to EPP is recommended for patients with bleeding despite effective bony stabilization of the pelvic ring, and/or embolization or surgical control of bleeding. Finally, EPP has the disadvantage of being an invasive procedure, and some cases of surgical site infection have been reported [7,10]. This risk seems particularly high when EPP is performed in the trauma bay. Some authors have reported an increased risk of abdominal compartment syndrome [5,14]. In addition, the need for re-operation and de-packing at 24–48 hours is another theoretical disadvantage.

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