



TRAUMA AND CRITICAL CARE UPDATE

Radiology and imaging techniques in severe trauma[☆]



Radiología e imagen en el traumatismo grave

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Introduction

Traumatic disease is the leading cause of mortality among individuals under 40 years of age, as well as the main cause of disabilities and sequelae—many of which are avoidable, while some are related to shortcomings in the organization and provision of medical care.¹ For years there have been reports of important deficiencies in the management of severe trauma patients (STPs), reflected through differences in mortality among countries with similar economical levels and among different hospitals, as a result of unwarranted delays or care provided by professionals with insufficient preparation.^{1–4} Survival and functional recovery are directly dependent upon promptness in recognizing and repairing the anatomical and physiological alterations caused by trauma. In this regard, the initial patient care provided is of capital importance.¹ Such an initial management fundamentally aims to identify and secure immediate, systematic and prioritized solutions to serious problems affecting the airway, respiration and circulation, since these are globally responsible for an important proportion of avoidable deaths. In this respect, the most widely accepted clinical

protocol in the world today is the Advanced Trauma Life Support (ATLS®)⁵ instrument, which constitutes the management standard for STPs. As a last priority in the first evaluation of the patient we must assess possible neurological damage. Cervical immobilization must be ensured until computed tomography (CT) can confirm the absence of injuries. In this first phase we only obtain X-rays of the chest and pelvis, and perform focused assessment with sonography in trauma (FAST).⁶ Posteriorly, in the course of secondary evaluation, we conduct a patient study “from head to foot”, using the opportune imaging diagnostic techniques.

Physical examination of STPs can allow the immediate suspicion of risk injuries such as tension pneumothorax, pelvic fractures or internal bleeding. However, the reliability of physical examination is limited, particularly when the patient level of consciousness is altered or other important injuries are also present.⁷ There is also a risk of “unnoticed injuries”, particularly in seriously injured elderly patients, with traumatic brain injury or visible vascular damage⁸ (Fig. 1). The information collected on the trauma scene can provide clues as to the possible mechanism and pattern of injuries, but is subjective and has low sensitivity as an indicator of serious injury.⁹

Worldwide diffusion of the ATLS protocol has been an important step forward in the systematic management of STPs, though in relation to imaging diagnosis it has some shortcomings—particularly referred to the use of CT.^{10–12} ATLS adopts a “step by step” clinical approach, performing

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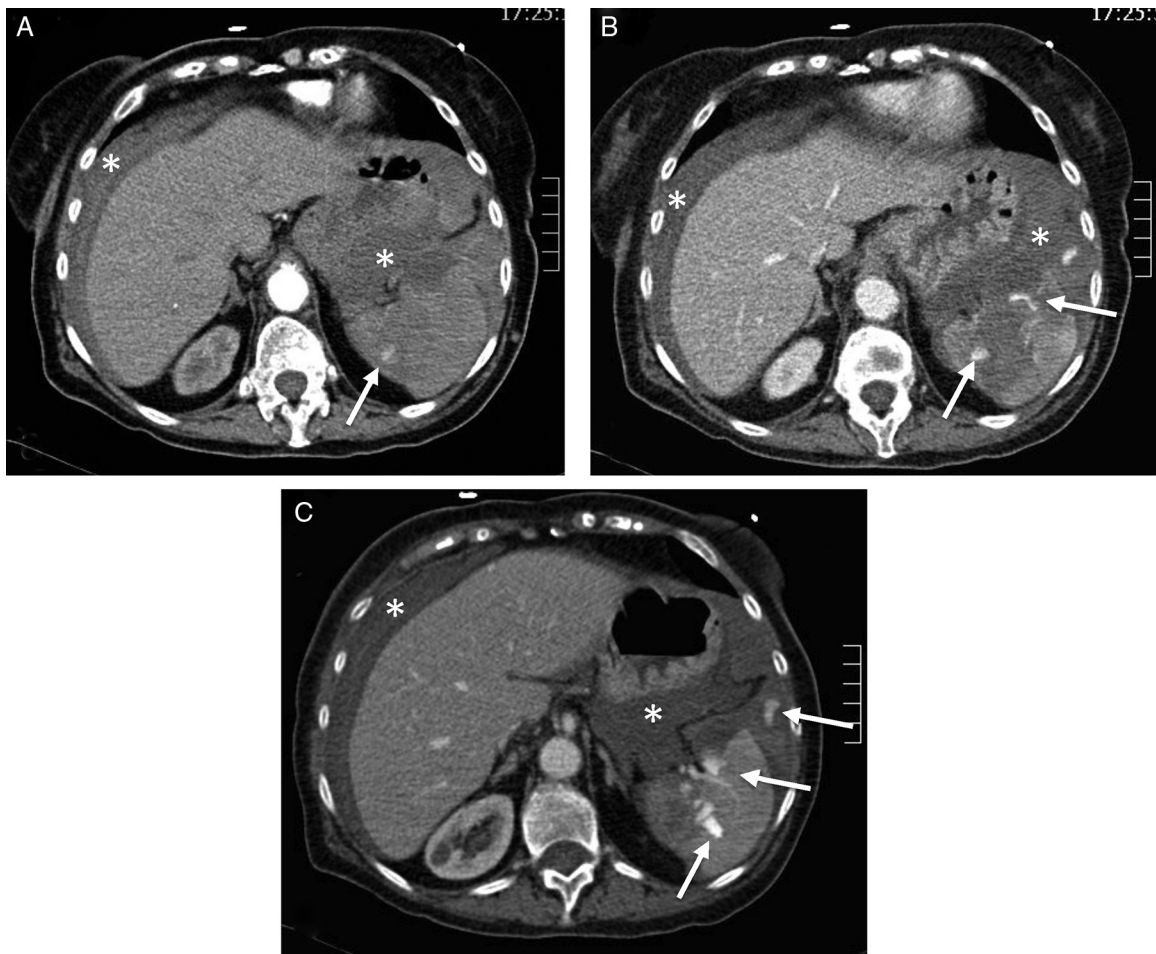


Figure 1 Splenic damage. A 77-year-old woman subjected to anticoagulation, who suffered a fall at home as a result of “dizziness”. In the emergency room she presented hypotension and abdominal distension. (A) WBCT with contrast, axial acquisitions of the upper abdomen in arterial phase. (B and C) Imaging in venous phase. Hemoperitoneum (*). Intravenous contrast leakage into splenic parenchyma and peritoneal cavity (arrow), increasing in size and density in the portal phase (b and c) due to splenic laceration with active bleeding.

resuscitation maneuvers while the patient is quickly evaluated to identify and “manage” possible risk injuries. At the same time, definitive treatment is considered. However, application of the ATLS protocol is inevitably not the same when applied by a rescue team at the trauma site—where little more than clinical skill is available—as when applied by a polytrauma team belonging to a reference hospital, in a critical care ward with adequate equipment, and with a nearby CT exploration room.

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The British Royal College of Radiologists (RCR), through its severe trauma radiology guide, has established a series of specifications referred to the design, location and technological equipment of imaging diagnostic facilities destined for use in STPs¹³:

- Quick action is essential.

- Both the number and distance of patient transfers are to be minimized.
- In general, imaging is more precise than clinical exploration.
- The technique of choice should be that offering conclusive findings—usually whole-body CT (WBCT).
- A conclusive imaging technique should not be postponed in order to perform other less precise explorations.
- The radiology facilities are to be equipped with the same life support resources available in the critical care ward.
- Trauma centers in which the multidetector CT (MDCT) room is not located within or near the critical care area should rehearse patient transfer according to pre-established protocols, with the adoption of plans to modify the location of the MDCT room in future.

The ideal imaging procedure in STPs should be rapid, exhaustive, and capable of immediately and systematically identifying all life-threatening injuries, following the same ABCD priorities.¹⁴

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