HOSTED BY
ELSEVIER

Contents lists available at ScienceDirect

Journal of Acute Disease

journal homepage: www.jadweb.org

Review article http://dx.doi.org/10.1016/j.joad.2015.07.003

Latest progress of research on acute abdominal injuries

Ionut Negoi[1,2*], Sorin Paun[1,2], Bogdan Stoica[2], Ioan Tanase[2], Mihaela Vartic[2], Ruxandra Irina Negoi[1], Sorin Hostiuc[1,3], Mircea Beuran[1,2]

[1]*Carol Davila University of Medicine and Pharmacy Bucharest, Bucharest, Romania*

[2]*Emergency Hospital of Bucharest, Bucharest, Romania*

[3]*National Institute of Legal Medicine Mina Minovici, Bucharest, Romania*

ARTICLE INFO

Article history:
Received 2 Mar 2015
Received in revised form 22 May 2015
Accepted 26 Jul 2015
Available online 9 Oct 2015

Keywords:
Polytrauma
Abdominal injuries
Management

ABSTRACT

Major abdominal trauma, both blunt and penetrating, is commonly seen nowadays, being particularly difficult to manage due to the frequent altered mental status of the patients and severity of associated injuries. The review article aims to make an uptodate study of the current strategies for therapeutic approach of abdominal injuries in polytrauma setting. Review of the medical literature is up to 2015, by using the PubMed/Medline, Science Direct, Cochrane Library and Web of Science databases. We have used different combinations of the keywords of "abdominal trauma", "liver", "spleen", "renal", to review the reference list of retrieved articles for further relevant studies. Nowadays, we are facing a major change in abdominal trauma therapeutic approach, due to the continuous extending indications and very high successful rate of selective nonoperative management, completed or not with minimally invasive techniques like angiography and angiographic embolization. New imaging methods offer a high-quality characterization of solid organ injuries, being a secure support for decision algorithm in polytrauma patients. After a continuous decrease in number of laparotomies for trauma, new techniques should be developed for maintaining and developing the trauma surgeons' skills. According to the current standards, for a low morbidity and mortality, the trauma patients may be approached by a multidisciplinary and experienced trauma team. Even if nonoperative management is continuously expanding, this may be applied only by a trained and skillful trauma surgeon, who is able to perform difficult surgical techniques at any moments.

1. Introduction

Like in all other European countries, blunt abdominal trauma is commonly seen in Romanian Emergency Departments[1]. These injuries are particularly difficult to manage due to the frequent altered mental status and associated injuries, and that the patients are often presented with a complex clinical picture of head, thoracic, abdominal and limb trauma[2]. The penetrating stab and gunshot wounds are much less common than blunt injuries compared to United States of America or South Africa[3]

In a 30-month prospective polytrauma study from our hospital, the most common were blunt injuries in 92.8% of cases and penetrating trauma in only 7.2% of cases. Most severe trauma was caused by road accidents (61.9%), either as drivers or an occupant of a vehicle or by vehicle-pedestrian collision. Motorcycle accidents were found in 2% of cases. They were followed by falls and human aggressions (15.0% and 15.6% respectively). Occupational injuries were the least common, being encountered in 4.8% and autoaggressions in 0.7% of cases respectively[4].

The prevalence of abdominal organ injuries among patients with blunt trauma examined in the Emergency Departments is approximately 13% of cases, the spleen being damaged in over 60% of these cases[5]. Although there are substantial diagnostic challenges, from a surgical perspective, only 4.7% of cases require therapeutic laparotomy or angiographic embolization[5]. The selective nonoperative management (SNOM) of abdominal visceral lesions is one of the most important and

*Corresponding author: Ionut Negoi, MD, PhD, General Surgery Department, Emergency Hospital of Bucharest, No 8 Floreasca Street, Sector 1, 014461, Bucharest, Romania.
Tel: +40 215992308
E-mail: negoiionut@gmail.com

Peer review under responsibility of Hainan Medical College.
Foundation Project: Supported by the European Social Fund and by the Romanian Government, under contract number POSDRU/159/1.5/S/137390.

challenging changes that occurred in the traumatized patients over the last 20 years, and the main advantage is the avoidance of an unnecessary or non-therapeutic laparotomy. More than 95% of blunt abdominal injuries may be nonoperatively managed, with a morbidity similar to or even lower than operative treatment[6].

Currently, the resuscitation of the trauma patients can be divided into two time periods: the 10 platinum minutes and the golden hour. During the 10 platinum minutes, the prehospital trauma team should address the airways as well as hinder the exsanguination and the critical patients should be transported from the trauma scenes. During the golden hour, the hospital trauma team should identify all the trauma lesions and address all life-threatening injuries[7].

Although polytrauma patients represent only 10% of trauma victims, they account for 50% of in-hospital mortality. The most frequent injured body areas in multi-trauma patients are the limbs and pelvis, but abdominal and thoracic lesions are strongly correlated with mortality in younger trauma victims[8,9]. The polytrauma deaths are generated by cranial injuries in 40%–50% of cases, by hemorrhage in 30%–35% and by multiple organ failure in 5%–10% of cases[9].

The clinical exam of abdominal injuries, depending on the clinical scenario, may be completed with the following diagnostic methods: peritoneal aspiration, abdominal ultrasonography, computed tomography (CT) and angiography.

According to the meta-analysis of Nishijima *et al.*, the intra-abdominal injuries are suggested by the presence of the seat belt sign [likelihood ratio (LR) range, 5.6–9.9], rebound tenderness (LR, 6.5), hypotension (LR, 5.2), abdominal distension (LR, 3.8), and abdominal guarding (LR, 3.7)[5].

The intraperitoneal free fluid or organ injuries on abdominal ultrasonography overpasses the accuracy of history and physical exam (LR, 30.0). The workup suggests abdominal visceral injuries when there is a base deficit less than −6 mEq/L (LR, 18.0), increased liver transaminases (LR range, 2.5–5.2), hematuria (LR range, 3.7–4.1), anemia (LR range, 2.2–3.3) and abnormal thoracic X-ray (LR range, 2.5–3.8)[5].

It is very important to recognize that overlooked injuries and delayed diagnosis are still common problems in the nowaday management of polytrauma patients[10]. After a review of the literature, Pfeifer and Pape found a widespread distribution of missed and delayed diagnosis incidence (1.3%–39.0%), as much as 22.3% of patients with missed injuries having significant missed lesions. The authors stress the importance of a standardized tertiary trauma survey for earlier detection of clinically significant missed injuries[11].

2. Imagistic workup

Ultrasonography – focused abdominal sonography for trauma (FAST) performed by radiologists, emergency medicine physicians or trauma surgeons is a rapid and highly accurate method for detecting haemoperitoneum[12,13]. Its valuable role is especially for haemodynamic compromise patients[14]. As FAST can miss or underestimate the degree of injury, a CT examination is recommended in haemodynamically stable patients with negative FAST[15–17], because of the recommendation of Miller *et al.*: not so fast[18].

CT is the most informative radiological technique for head and abdomino-pelvic trauma. During the latest decade, the major developments of CT technology, such as higher spatial resolution, faster image acquisition and reconstruction, and improved patient safety, made the “panscan” the fundamental element in early evaluation and decision-making algoritm[19]. An important but still less standardized use of CT examination is its ability to predict failure of SNOM for abdominal visceral lesions. Although the medical literature presents some imagistic parameters that correlate with SNOM failure, there is no a diagnostic algorithm for selecting patients who will benefit from SNOM. In our trauma center, the abdominal visceral lesions of high grade [grades III, IV or V according to organ injury scale (OIS)] or lesions with actively contrast extravasation on emergency CT scan, are evaluated through an emergency diagnostic and/or therapeutic angiography[20]. Ochsner shows that the presence of a contrast pool in liver trauma means active bleeding and significantly correlates with need for surgery[21]. For splenic injuries, the contrast extravasation in the arterial phase is associated with SNOM failure[21]. We consider contrast extravasation or high-grade visceral lesions, in a haemodynamically stable patient, as an indication for angiography and not for emergency laparotomy[22–24].

Angiography has evolved dramatically in the recent years, first as an assistance of the operative approach rather than the nonoperative one[25]. The angiographic embolization can be successfully done in liver, spleen, kidney or pelvic bleeding[22,26,27]. In their study, Velmahos *et al.* presented a success rate of 91% for angiographic hemostasis in these conditions[28].

3. Damage control surgery

The hemorrhagic shock is generated by a unique factor, the massive acute blood loss that causes a complex and heterogeneous clinical picture[29]. Blood *et al.* analyzed the hospital records of 210 fatal combat casualties who died after the medical treatment was started. About 25% of the deaths were produced by massive exsanguination and were beyond current medical resources, but 19% of additional deaths were preventable, of which 10% were due to thoracic exsanguination and 19% to peripheral exsanguination[30].

Bailout surgery or damage control surgery was one of the major changes in the thinking of trauma surgery during the last 20 years, challenging the traditional concept of definitive one-step surgery[31]. Nowadays, trauma surgeons have evolved surgical techniques and protocols for managing more and more severe thoracic, abdominal, extremity and peripheral vascular injuries according to principles of damage control[32,33].

Damage control laparotomy is usually performed in high-grade liver and major vascular injuries[34]. Major liver injuries should be explored after inflow occlusion by using the Pringle maneuver, surgical hemostasis through direct vessel ligation in depth of the laceration and the abbreviated technique ended with compression of the liver lesions between packs. We should stress that packing is only an adjunctive measure to be performed only after the hemostasis of the major hepatic vessel(s).

Major vascular injuries can be approached by using a combination of different techniques: (a) ligation of the bleeding vessel, excepting the aorta or the proximal superior mesenteric artery and retrohepatic vena cava; (b) temporary shunting of the vessel, even with a chest tube.