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REVIEW

Management of penetrating abdominal and thoraco-abdominal wounds: A retrospective study of 186 patients

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Summary This is a single center retrospective review of abdominal or abdomino-thoracic penetrating wounds treated between 2004 and 2013 in the gastrointestinal and emergency unit of the university hospital of Grenoble, France. This study did not include patients who sustained blunt trauma or non-traumatic wounds, as well as patients with penetrating head and neck injury, limb injury, ano-perineal injury, or isolated thoracic injury above the fifth costal interspace. In addition, we also included cases that were reviewed in emergency department morbidity and mortality conferences during the same period. Mortality was 5.9% (11/186 patients). Mean age was 36 years (range: 13—87). Seventy-eight percent (145 patients) suffered stab wounds. Most patients were hemodynamically stable or stabilized upon arrival at the hospital (163 patients: 87.6%). Six resuscitative thoracotomies were performed, five for gunshot wounds, one for a stab wound. When abdominal exploration was necessary, laparotomy was chosen most often (78/186: 41.9%), while laparoscopy was performed in 46 cases (24.7%), with conversion to laparotomy in nine cases. Abdominal penetration was found in 103 cases (55.4%) and thoracic penetration in 44 patients (23.7%). Twenty-nine patients (15.6%) had both thoracic and abdominal penetration (with 16 diaphragmatic wounds). Suicide attempts were recorded in 43 patients (23.1%), 31 (72.1%) with peritoneal penetration. Two patients (1.1%) required operation for delayed peritonitis, one who had had a laparotomy qualified as ''negative'', and another who had undergone surgical exploration of his wound under general anesthesia. In conclusion, management of clear-cut or suspected penetrating injury represents a medico-surgical challenge and requires effective management protocols.

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Introduction

While the Anglo-Saxon and particularly the North American literature is very rich, French studies on penetrating abdominal injury are rarer and often smaller [1,2]. Notwithstanding, increasing civil urban violence makes this a present-day topic. In the Isère department of France, between 5000 and 6000 cases are recorded every year by the Police and National Gendarmerie services [3]; the number of abdominal penetrating injuries managed in our unit are directly proportional to these numbers (Fig. 1).

Torso injuries are particularly challenging for the general visceral surgeon, essentially when there is simultaneous penetration of more than one compartment [4] (right and left pleural cavities), mediastinum, peritoneal cavity, retroperitoneal space, entailing diagnostic difficulties and often requiring surgical management. Based on this retrospective 10 year study, our goal was to determine the epidemiological characteristics in these cases, as well as to determine the strategies used by the surgical and intensive care teams to diagnose and treat these patients, and ultimately to propose coherent decision algorithms adapted to the trauma care organization in France.

Patients and methods

This was a single center retrospective review of abdominal or abdomino-thoracic penetrating wounds treated between January 1, 2004 and December 31, 2013 in the gastrointestinal and emergency unit of the university hospital of Grenoble.

Data collection

In the absence of a dedicated registry, our review collated patient records using computer-assisted research with the keyword ''wound'' in operative reports and/or electronic diagnostic records in our unit; this produced 668 hits.

Of these, records involving blunt trauma patients ($n = 139$), non-traumatic or iatrogenic wounds ($n = 91$), head and neck wounds ($n = 15$), upper ($n = 50$) or lower ($n = 122$) extremity wounds, ano-perineal and pelvic-gluteal wounds ($n = 43$), isolated thoracic wounds above the 5th intercostal space or the nipple line ($n = 16$) as well as patients undergoing operation at another center ($n = 5$) were not included. Five records were eliminated because of insufficient exploitable data. Four patient records originating from the emergency room morbidity and mortality conference were added, leading to a total of 186 patients. This study was registered with the National Commission for Electronics and Freedom (CNIL No. 1823916 v 0).

Number of operating surgeons

During this study period, 18 different surgeons participated in the on-call list: six senior surgeons, 10 juniors (assistants/chief residents) and two surgeons that graduated from junior to senior status according to the year the patient underwent operation.

Definitions

Hemodynamic instability was defined by systolic blood pressure less than 90 mmHg and/or pulse rate greater than 120 beats/minute.

Protocol for immediate admission to the operating room is based on a multi-disciplinary consensus, adapted in the Grenoble university hospital since 2008; the protocol is activated whenever a patient presents with an open wound and is in hemorrhagic shock.

Unnecessary laparotomy or laparoscopy is defined as a procedure without any peritoneal violation or where there are no intraperitoneal lesions.

Non-therapeutic laparotomy or laparoscopy signifies that the intra-abdominal lesions discovered did not require any surgical treatment.

Statistical analysis of clinical data

Data were analyzed with the Stata software (version 13, Stata Corp, College Station, Texas). Data were summarized in terms of numbers and frequencies for categorical variables. Qualitative variables were analyzed with the Chi^2 or Fischer's exact test (when the expected value in one of the contingency tables was less than 5). Cuzick's test was used to evaluate the presence of any tendency over time. *P* values less than 0.05 were considered as statistically significant.

Results

Of the 186 patients with penetrating or potentially penetrating abdominal or abdomino-thoracic wounds managed by our team, 169 (90.9%) were male. Mean age was 36 (13—87) years. The cause was an assault in 124 patients (66.7%), suicide attempt in 43 patients (23.1%), and accident (domestic, work, animal horn goring, impalement [Fig. 2]) in 19 patients (10.2%). Stab wounds (SW) were most frequent ($n = 145$; 78%), followed by gunshot wounds (GSW) ($n = 26$; 14%) and other causes ($n = 15$; 8%). Eleven patients died for an overall mortality in our series of 5.9%; 2.8% due to SW (4/145) and 26.9% secondary to GSW (7/26). Twenty-three patients (12.4%) were unstable upon arrival as were the 11 patients who died. Six patients were in cardio-respiratory arrest upon arrival (Table 1). Of the 23 unstable patients, 11 (47.8%) were admitted directly to the operating room, according to the above-mentioned protocol. One hundred forty-six patients (78.5%) were admitted during on-call hours, either during the night (between 6:30 PM and 8 AM) in 123 patients (66.1%), or during the weekend or a holiday in 23 patients (12.3%).

The torso wounds were multiple in 76 patients (40.9%) and/or associated with other traumatic lesions in 102 patients (54.8%). One hundred and forty-two patients (76.3%) patients were stable or pauci-symptomatic. Wounds were anterior and abdominal in 96 patients (51.6%) and supra-umbilical in 52 instances (28%), thoraco-abdominal (between the nipple line and the costal margin anteriorly and the scapular tip and costal margin posteriorly) in 82 patients (44.1%), postero-lateral in 42 patients (22.6%), thoracic (above the 5th intercostal space but associated with abdominal wounds) in 20 patients (10.8%) and para-sternal in 17 patients (9.1%). Abdominal penetration was detected in 103 patients (55.4%) and thoracic penetration in 44 patients (23.7%). The Injury Severity Score (ISS) was higher for patients with GSW than those with SW, and exceeded 25 for 34.6% (9/26) and 3.5% (5/145) of patients with GSW and SW, respectively.

Ninety CT scans were performed, of which 15 (16.7%) were for patients who were treated non-operatively. In 75 patients where the CT report could be compared with