Injury, Int. J. Care Injured 45 (2014) 183–191

Contents lists available at SciVerse ScienceDirect

Injury

journal homepage: www.elsevier.com/locate/injury

Blunt abdominal aortic trauma in paediatric patients

Nirvana Sadaghianloo [a,b], Elixène Jean-Baptiste [a,b], Jean Breaud [a,c], Serge Declemy [a,b], Jean-Yves Kurzenne [a,c], Réda Hassen-Khodja [a,b,*]

[a] Université de Nice Sophia Antipolis, France
[b] Service de chirurgie vasculaire, Pôle cardio-vasculaire, thoracique et métabolique du Haut Pasteur, CHU de Nice, France
[c] Service de chirurgie pédiatrique, pôle mères enfants Hôpital Lenval, CHU de Nice, France

ARTICLE INFO

Article history:
Received 5 April 2012
Received in revised form 6 October 2012
Accepted 27 October 2012

Keywords:
Blunt abdominal trauma
Aortic trauma
Aortic injury
Paediatrics
Children
Seat-belt syndrome

ABSTRACT

Background: Blunt abdominal aortic trauma (BAAT) is a very rare occurrence in children, with significant morbidity and mortality. Varied clinical presentations and sparse literature evidence make it difficult to define the proper management policy for paediatric patients.
Method: We report our centre's data on three consecutive children with BAAT managed between 2006 and 2010. A Medline search was also performed for relevant publications since 1966, together with a review of references in retrieved publications.
Results: Forty children (range 1–16 years) were included in our final analysis. Motor vehicle crashes (MVC) were the leading cause of injury (65%). The in-hospital mortality rate was 7.5% (3/40). Nine patients (22.5%) ended up with residual sequelae. Main primary aortic lesions were complete wall rupture (12.5%), intimal transection (70%) and pseudoaneurysm (15%). Twenty-eight children underwent aortic surgical repair (70%). Among the 12 non-operatively managed patients, 41.6% had complications, including one death.
Conclusion: Symptomatic lesions and complete ruptures should undergo immediate surgical repair. Circumferential intimal transections are at high risk of complication and should also receive intervention. Partial intimal transections and delayed pseudoaneurysms can be initially observed by clinical examination and imaging. Patients with these latter pathologies should be operated on at any sign of deterioration.

Introduction

Blunt abdominal aortic trauma (BAAT) is a very rare occurrence, which can result in significant in-hospital morbidity and mortality. In a large Canadian retrospective survey that included 11,465 trauma admissions, only 15 cases involved the abdominal aorta amongst 179 who sustained blunt aortic injuries.[1] Most patients suffering from this condition die instantaneously on the accident scene.[2,3] Major motor vehicle crashes (MVC) led to most BAAT cases reported so far.[4–6] Children are especially vulnerable because of their particular anatomy and incorrect seat belt positioning.[7] To the best of our knowledge, no consensus guidelines have been published on the proper management of children who survive the pre-hospital phase after blunt abdominal aortic injury. Relevant data is infrequently cited in the literature. In this study, we report our experience with BAAT in paediatric patients and review the literature in order to suggest optimal treatment policy for this condition in this subset of patients.

Material and methods

The data on three consecutive children who survived the pre-hospital phase after BAAT and who were admitted to our level-1 trauma centre between October 2006 and November 2010 were analysed with regard to: age, gender, mechanism of injury, clinical features, radiological findings, treatment modalities and outcomes. A search of the English literature was also carried-out using MEDLINE from 1966 to 2011 in order to locate all case reports, case series or clinical reviews mentioning BAAT in children aged 16 and under. Terms searched for included BAAT, blunt abdominal aortic injury, abdominal vascular injury, seat belt injury, children, and paediatric patients.

Patient 1

A 15-year-old male, helmeted scooter rider was involved in a high-speed frontal impact motor vehicle crash. At the scene evaluation, he was hemodynamically stable with abdominal and

* Corresponding author at: Service de chirurgie vasculaire, Hôpital Saint-Roch, 5 rue Pierre Dévoluy, BP 1319, 06006 NICE Cedex 1, France. Tel.: +33 4 92 03 38 35; fax: +33 4 92 03 38 39.
E-mail address: hassen-khodja.r@chu-nice.fr (R. Hassen-Khodja).

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http://dx.doi.org/10.1016/j.injury.2012.10.033

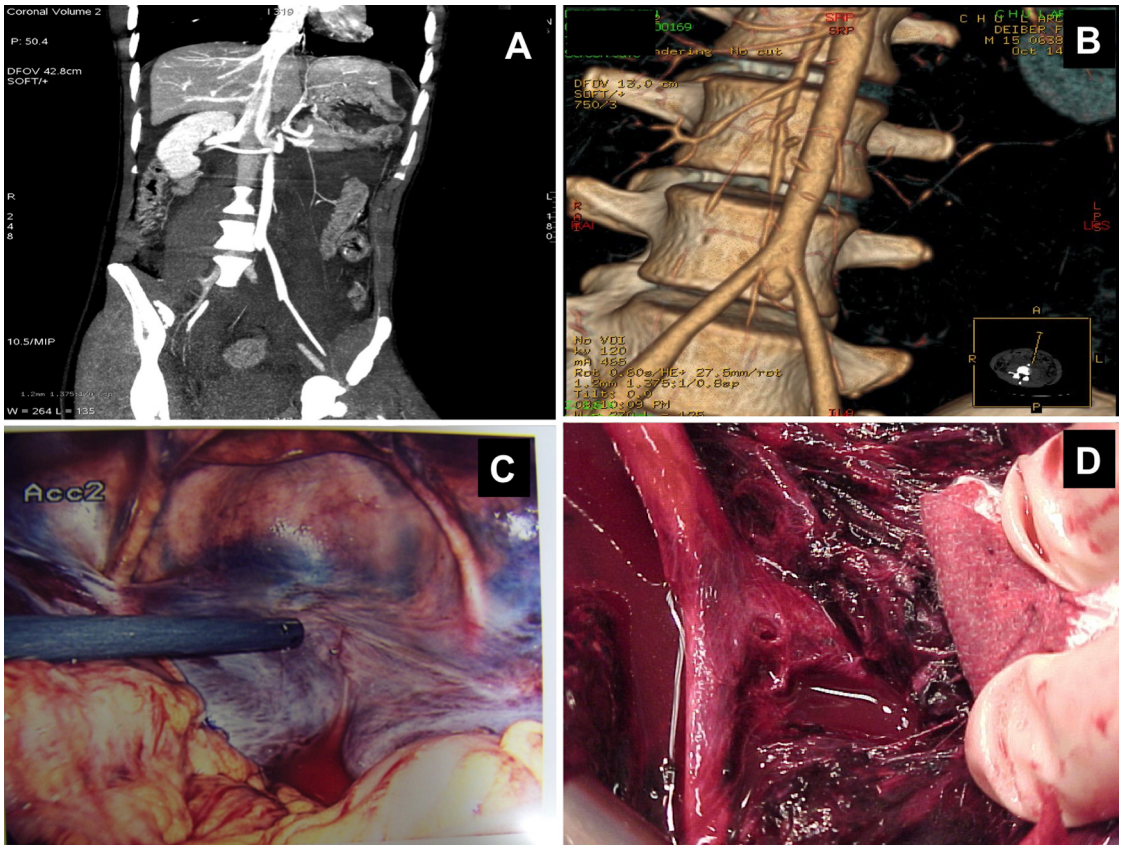

Fig. 1. Case 1. (A) Multiplanar reconstruction CT angiography showing contrast material bulging from the aortic lumen. (B) Volume rendering CT showing the post-traumatic aortic false aneurysm. (C) Zone-III retroperitoneal haematoma as noted during laparoscopy. (D) The aortic rupture site evidenced at autopsy.

perineal trauma. Upon arrival at our children's hospital, he manifested early signs of haemodynamic instability. A physical examination showed periumbilical contusion, bleeding at the root of the penis, contraction and distension of the abdomen. A full-body CT scan revealed an open pelvic fracture with pubic symphysis separation, free intraperitoneal air and fluid, pelvic retroperitoneal haematoma, and contrast material bulging from the aortic lumen (Fig. 1A and B). These findings were consistent with a false aneurysm of the aortic bifurcation (Fig. 1A and B) without overt radiologic signs of free rupture or dissection.

Exploratory laparoscopy revealed gastric rupture, multiple serosal injuries of the colon and a pelvis limited zone-III retroperitoneal haematoma (Fig. 1C) that was attributed to the pelvic fracture.

The patient underwent subsequent laparotomy to repair gastric and bowel injuries and to deepen exploration. No evidence of zone-I preaortic haematoma was found, and the patient was still hemodynamically stable. With respect to the aortic lesion, a conservative management policy was adopted. This decision was made mainly due to the risk of septic contamination from associated bowel lesions. Serial physical examinations were undertaken and a CT scan was scheduled for the next day. Eight hours later, the patient showed signs of haemorrhagic shock and died in the intensive care unit despite resuscitation.

An autopsy found a periaortic retroperitoneal haematoma and an aortic rupture site (Fig. 1D). Further histopathological analysis revealed Alcian-blue stained spaces between elastic fibres, indicating a possible connective tissue disorder (Marfan syndrome).

Patient 2

A 7-year-old girl was restrained with a lap belt in the rear seat of a vehicle involved in a high-speed frontal impact motor vehicle crash. Initial examination revealed a seat-belt sign across her abdomen. She was hemodynamically stable and asymptomatic. The first interpretation of the urgent abdominal CT scan demonstrated only minor intraperitoneal free fluid, without any other injuries. The patient had been hospitalised and under observation for 8 days when she felt faint and underwent another CT scan. This CT scan revealed an L2 Chance fracture and a focal 1 cm-long circumferential intimal flap of the infra-renal aorta. A sub-adventitial infrarenal aortic rupture was discovered during surgical exploration (Fig. 2C). Surgical management consisted of a primary repair (Fig. 2D) with non-absorbable interrupted suture. She had an uneventful recovery. Secondary analysis of the first abdominal CT scan, with the help of dedicated software, clearly showed the circumferential intimal transection (Fig. 2A and B).

Patient 3

A 4-year-old boy was a rear seat passenger in a high-speed frontal impact motor crash vehicle. He had been restrained incorrectly with a shoulder belt lowered under the armpit.

On arrival, he was pale but stable, alert and responsive. He had palpable peripheral pulses. Abdomen examination revealed periumbilical tenderness. An urgent full-body CT scan demonstrated an L3 Chance fracture and a medio-aortic focal 1 cm-long posterior intimal flap. He was hospitalised in the intensive care unit and an easily removable surgical corset was made for his vertebral fracture. He underwent daily vascular duplex ultrasound examination, which revealed on day 5 a moderate aortic false aneurysm (Fig. 3A) at the initial intimal tear flap location. On day 8, a follow-up CT scan demonstrated stability of the vertebral fracture but increasing aortic false aneurysm diameter (Fig. 3B). Surgical reparation of the aortic injury was decided and performed