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# Damage control laparotomy in a paediatric trauma patient in a regional hospital

Jonathan Wiener<sup>a,\*</sup>, Mariya Abdulla<sup>b</sup><sup>a</sup> James Cook University, Australia<sup>b</sup> Acme Pariyaram Kerala, India

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## ABSTRACT

**INTRODUCTION:** Trauma is a major cause of death in children (Brown et al., 2001). It has far-reaching impacts on a child's development and function, and is a major contributing factor to disability in the young. Pediatric patients in trauma demonstrate different clinical signs and have different resuscitation requirements, often masking symptoms and compensating well before rapidly deteriorating.

**CASE PRESENTATION:** The authors present a case of a 13-year-old patient with major trauma receiving surgical management in an adult regional hospital. The patient was involved in a high-speed head on motorcar collision. This report emphasizes the importance of early mobilisation of a trauma team and appropriate surgical stabilisation of a child in an adult regional centre without access to specialised paediatric surgeons.

**DISCUSSION:** Approximately 600 individuals aged 19 or less are fatally injured in Australia each year. Management of pediatric trauma requires early mobilization of a trauma team, to ensure high levels of expertise are available. However, managing these patients with specialized pediatric surgery teams is not always possible. As such, peripheral hospitals need to have trained general surgeons who can manage the deteriorating pediatric patient.

**CONCLUSION:** All peripheral hospitals with access to emergency operating should have general surgeons willing and able to manage pediatric trauma, with the confidence for a low threshold for laparotomy.

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## 1. Introduction

Trauma is a major cause of death in children [1]. It has far-reaching impacts on a child's development and function, and is a major contributing factor to disability in the young. Management of pediatric trauma requires early mobilization of a trauma team, to ensure high levels of expertise are available [1]. The authors present a life-threatening pediatric trauma which presented to a regional hospital, with the nearest pediatric surgical support 344 km away.

## 2. Case report

A 13-year-old boy arrived via a 'hot' helicopter retrieval to a regional adult hospital in Far North Queensland, Australia, following a high-speed motor vehicle accident. The patient was a back-seat passenger in a car versus truck head-on collision at 80 km/hour. There was significant cabin intrusion requiring extrication by retrieval services. The hospital received early notification

and he was resuscitated en route. On arrival to the emergency department, the patient was peripherally shut down and hemodynamically unstable with a systolic blood pressure of 85 mmHg and a heart rate of 120 bpm despite fluid resuscitation. His abdomen was soft with generalised tenderness, maximally epigastrium, with minor bruising. His examination did not otherwise reveal any penetrating injuries or external trauma. A FAST scan was positive for fluid in the right upper quadrant and a poor-quality pelvic x-ray showed potential open book pelvic fracture. His haemodynamics deteriorated and he remained unresponsive to fluids so, a decision was made for red blanket trauma laparotomy.

Once anaesthetized, screening was done which showed no fractures. On entering the abdominal cavity, there was moderate haemoperitoneum with active bleeding from the hilum of the spleen. A large upper abdominal central haematoma was found extending to the right over the right kidney.

Upon full mobilisation of the right colon and Kocherisation of the duodenum, 90% circumferential disruption of the 3rd part of the duodenum was evident, with 3 cm of ischaemic duodenum distal to the laceration. Brisk venous bleeding obscured the anatomy and was controlled with digital pressure. In the setting of progressive haemodynamic shock, with a drop systolic blood pressure

\* Corresponding author at: 4 Knott Court, Whitfield, Cairns, 4870, Australia.  
E-mail address: [jonowiener@gmail.com](mailto:jonowiener@gmail.com) (J. Wiener).

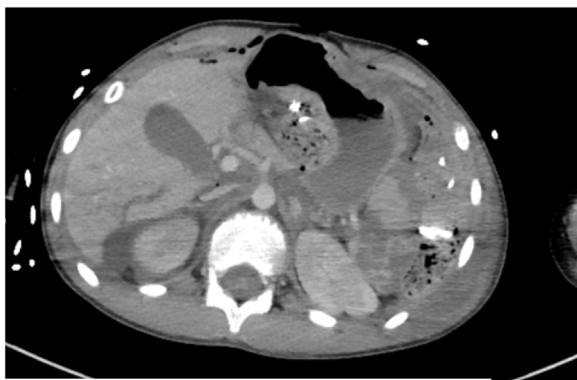


Fig. 1. CT images showing liver laceration.

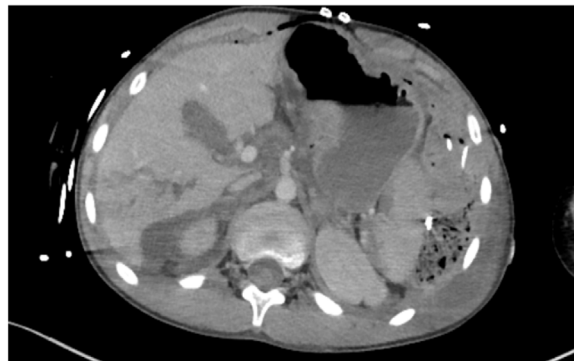


Fig. 2. CT images showing liver lacerations and extensive irregular renal contusions.

22 mmHg, the supraceliac aorta was cross-clamped to increase proximal perfusion. The bleeding vein was then identified as the superior mesenteric vein with two injuries just inferior to the confluence of the splenic vein. Distal and proximal control of the vein were achieved and a primary repair with 6-0 prolene sutures was performed.

Slow removal of the supraceliac aorta clamps began 21 min after cross-clamping. Small bleeding vessels in the hilum of the spleen were clipped with Liga clips. Once vascular control was achieved, the remaining duodenum was mobilized and explored. Throughout the operation the patient was acidotic at pH 7.1, hypothermic with a temperature of 36 °C, and persistently hypotensive systolic blood pressure of 70 mmHg. He remained too unstable for repair and removal of his ischaemic duodenum. As such, devitalized tissue was used to close the abdomen to prevent contamination. A surgical drain was placed in-situ with a VAC dressing.

A post-operative computed tomography (CT) pan scan revealed the extent of his injuries. CT head and CT angiogram of the neck were normal. CT chest showed a large left pleural effusion, with multiple bilateral pulmonary contusions and an associated small right pneumothorax. There was an extensive laceration to the liver involving segments 6 and segment 7, however, there was no arterial blush to indicate a significant active bleed. There was a contusion of the spleen at the lower pole, in association with a subcapsular hematoma. Both kidneys showed extensive irregular contusions. Post-operatively the patient went to the intensive care unit for stabilization and monitoring. He was then transferred to a tertiary pediatric centre for ongoing management by a specialist team. He underwent planned re-look laparotomy two days later, and a beta-tine test of the duodenal repair showed a small defect that was closed with 4-0 PDS sutures and an omental patch. The inferior pole of the spleen was ischaemic and required partial splenectomy. There was a left sided diaphragmatic defect with a 10 cm intercostal defect that was also repaired and closed. No other bleeding or injuries were identified. Ultimately, the patient was able to be discharged home where he could begin rehabilitation and make a full recovery (Figs. 1–3).

### 3. Discussion

Approximately 600 individuals aged 19 or less are fatally injured in Australia each year. In addition, around 95 000 young people are hospitalised annually as a result of an injury [2]. Motor vehicle accidents are a common cause of serious injury in children [1]. Traumatic injury is a major cause of disability in children and insufficient evaluation and early management of these patients results in inadequate treatment and long-term poor outcomes. All peripheral hospitals managing trauma patients are expected to rapidly



Fig. 3. CT images showing pneumothorax.

and expertly assess injury severity and initiate early management in pediatric patients, in order to prevent early deaths and delayed complications [1]. Major trauma patients often receive their initial resuscitation and stabilisation at an adult trauma centre before transfer to a pediatric trauma centre [2]. There have been several studies that have evaluated the outcomes of pediatric patients who receive treatment in pediatric versus non-pediatric centres, with this population group showing improved overall outcomes when treated in pediatric trauma centres.

Pediatric trauma management should include a multidisciplinary approach. Consideration should be given to the anatomical, physiological, and psychological differences between children and adults. These pose significant implications in the initial assessment and management of pediatric trauma patients [3]. Mitchell et al. did a comparative analysis of trends in pediatric patients in New South Wales; they found that children who received their definitive care at an adult tertiary centre had between three to six times higher odds of not surviving their injuries [2]. They emphasised that outcomes in this population group would likely be improved with enhanced psychological support, multidisciplinary team and specialized allied health input [2].

The above patient was retrieved and taken to a peripheral hospital in Far North Queensland, Australia. The hospital has 531 beds and a 24-h on call surgical consultant, with most surgical and medical specialties available. It manages a disproportionately large cohort of adult trauma patients due to its vast geographical catchment area and its rurality, several hours away from the closest tertiary hospital and trauma centre. The lack of pediatric trauma services in this hospital poses a variety of issues when urgent trauma care is required, as immediate transfer to other centres is not always possible due to patient acuity or access to transport. More so, the

case is a clear example of this ongoing healthy provision disparity that still exists in regional cities in Australia.

The general approach to managing trauma remains the same, with securing a patient's airway, while assessing their breathing and circulation. However, pediatric patients in trauma demonstrate different clinical signs and have different resuscitation requirements, often masking symptoms and compensating well before rapidly deteriorating. The threshold for imaging and surgery in a pediatric patient is also different to adult patients. Therefore, peripheral hospitals need consultant general surgeons who are confident in the operative and non-operative management of pediatric trauma. With adequate skillset, surgeons are able to safely stabilise pediatric patients when transfer is unsafe or unavailable, and will feel confident in their threshold for laparotomy and damage-control surgery.

This case was reported in line with the SCARE guideline and presents a life-threatening pediatric trauma with derangement out of proportion to clinical findings, and the early decision for laparotomy was life-saving [4]. This demonstrates how smaller peripheral hospitals need to be equipped and trained to manage the deteriorating pediatric trauma patient as a next-best option to tertiary care. From a practical perspective, all peripheral sites with access to emergency operating should have surgeons willing and able to manage pediatric trauma, with the confidence for a low threshold for laparotomy.

#### Declaration of Competing Interest

The authors report no declarations of interest.

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#### Ethical approval

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#### Consent

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#### Author contribution

Jonathan Wiener – main writer.  
Mariya Abdulla – editor.

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#### Guarantor

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