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Case Report

Conservative management of traumatic pneumoperitoneum in a child

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ABSTRACT

Clinical practice guidelines for blunt trauma abdomen in children and adults advocate exploratory laparotomy when free air is detected on imaging. This conventional algorithmic approach of taking up for surgery when pneumoperitoneum is picked up, has its pitfalls as is illustrated in the case study where a child with polytrauma was managed conservatively despite free air on computed tomography (CT). The role of CT to detect bowel perforation, reasons for false positivity of free air in the abdomen and the key points in the successful non-operative treatment of the child have been discussed. Unlike, the only other report in a child with conservative management of pneumoperitoneum where the pneumoperitoneum can be explained secondary to blunt trauma chest, our report was unique in having other markers of bowel injury on CT and was in the absence of chest trauma. Response to injury in children is different compared to adults and allows for a higher success rate in conservative management. Hence, clinical judgement may override trauma protocols in select cases.

Keywords: Paediatric trauma, Pneumoperitoneum, Conservative, Child

INTRODUCTION

Managing paediatric trauma is challenging compared to adults, given the dearth of literature and protocol. This is in spite of having approximately 1,86,300 children from around the world die annually from road traffic accidents (RTAs).[1] Road traffic injury accounts for being the sixth most common cause of mortality in children and adolescents aged 1-15years.[2]

The incidence of injury as well as death is increasing in low and middle income countries commensurate with the trend of increased vehicular traffic and urbanization, with mortality rate because of childhood injury being around 40% in these countries.[2]

Paediatric trauma protocols lack clarity about initial emergency management and hence discretion of the treating surgeon/physician is vital in the management of these injuries. In this regard we presented a case report of a 13-year-old boy who suffered a RTA with multiple abdominal injuries including pneumoperitoneum but who could be conservatively managed.

CASE REPORT

A 13-year-old male presented with an alleged history of a high impact road traffic accident sustaining injury to his abdomen, left forearm, elbow. On examination he was conscious, oriented, hemodynamically stable with a heart rate of 140/min, BP 130/88 mmHg and had deformity of his left elbow region and forearm. Abrasions on the abdominal wall were seen on the left side, however, the abdomen was mildly tender and not distended. X-ray revealed fracture of both bones of left forearm. FAST scan was positive following which a pan-CT (brain, chest and abdomen computed tomography) was done. CT brain and cervical spine were normal. Contrast enhanced CT abdomen revealed moderate pneumoperitoneum with multiple air foci in the mesentery along with mild

hemoperitoneum, grade IV splenic injury, grade II liver laceration, mesenteric hematoma in the right lumbar region, fracture of left transverse processes of L1 to L5 vertebrae with features of intermuscular hematoma. At admission, he had a hemoglobin of 8.5 g% and total count was 18,400 cells/cumm. He was admitted for observation in the intensive care unit and managed conservatively with 2nd hourly monitoring of vitals, abdominal girth and urine output. The output of the nasogastric tube was replaced 6th hourly and intravenous antibiotics and analgesics were initiated. A lumbar brace was applied for the vertebral fractures. Laparotomy was deferred in spite of CT finding of pneumoperitoneum in view of discordant clinical findings (Figure 1 and 2). Although, the boy's abdomen had mild diffuse tenderness secondary to the abrasions externally on the abdominal wall and due to the internal solid organ injury, but was not peritonitic. By the 4th day of admission, heart rate had settled to 100/min, blood pressure was 116/70 mmHg, abdomen was soft, there was no deterioration in hematological parameters and no evidence of sepsis. He was electively posted for left forearm debridement with external fixation for the fracture both bones forearm. He was subsequently shifted to the ward and gradually started on normal diet by the 6th day of admission. He had no abdominal symptoms and after orthopaedic management was discharged with stable vitals and on a normal diet.

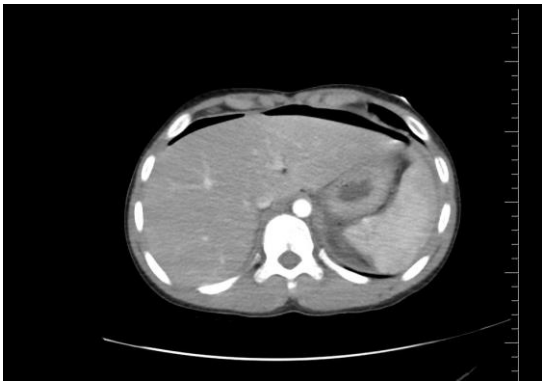

Figure 1: Coronal section of contrast CT of the abdomen showing pneumoperitoneum.

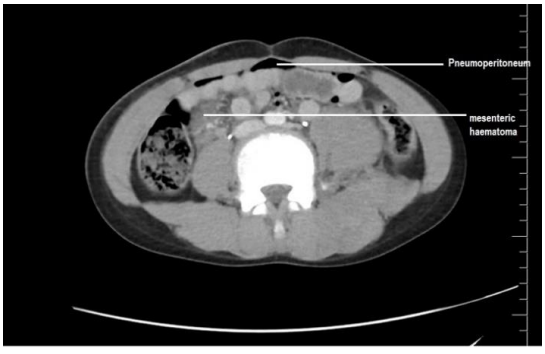

Figure 2: Coronal section of contrast CT of abdomen showing mesenteric hematoma and pneumoperitoneum.

DISCUSSION

Injuries of the abdomen may be blunt or penetrating and include solid organ injury, bowel perforations, mesenteric tears, retroperitoneal hematomas, major vascular injuries, abdominal wall hernias and urinary leaks. Children are more challenging to assess than adults because they might be preverbal or unable to give adequate history, uncooperative for examination, physiologically more vulnerable to shock and hypothermia and can deteriorate rapidly. Imaging therefore, plays an important role in diagnosis of internal abdominal injury and its further management.

As per protocol, abdominal imaging is done by a CT scan and an erect X-ray abdomen is reserved only for strong suspicion of peritonitis by clinical examination and may not be feasible if the child has polytrauma. Unlike, paediatric solid organ trauma which can be conservatively managed in majority of the cases, pneumoperitoneum detected on imaging warrants prompt exploration because it reduces sepsis induced complications.

The index patient had a normal chest X-ray, was FAST positive on ultrasound and being stable hemodynamically, underwent a CECT abdomen. The CT imaging revealed multiple organ injury with hemoperitoneum and a pneumoperitoneum with suspected mesenteric injury. However, the child could be conservatively managed in spite of the pneumoperitoneum. This may have been possible because of two reasons: first, the free air detected on imaging was a pseudo-pneumoperitoneum and not secondary to bowel injury; second being that the free air was indeed because of bowel injury but the injury was minor and contained.

False positivity of free air in the abdomen in trauma may be because of dissection of interstitial air from the chest.[3] This may be especially true if there was associated blunt trauma chest, aggressive CPR or if the patient was on high expiratory pressure mechanical ventilation in an intensive care setting. Pneumothorax can track centrally into the central space of the mediastinum through broncho-vascular bundles (Macklin effect), across the diaphragmatic along the superior epigastric vessels.[4,5] Air may be also present around fractures by what was known as the vacuum phenomenon. Drastic changes in pressure following a high velocity crash causes dissolution of nitrogen gas around fractures and disrupted soft tissue.[6] The index patient had multiple fractures of the transverse processes of the lumbar vertebrae, however the gas formation was not around the bone as expected but intraperitoneal. A pseudo pneumoperitoneum associated with a vertebral fracture has been reported in only one previously published case report in an adult.[7]

The sensitivity of CT to detect free intraperitoneal air was 50% and it had a specificity of 95.4%. However, the

positive predictive value for detecting bowel perforation on CT was only 9.5% with a negative predictive value of 99.5%.[8] Hence, the CT finding of pneumoperitoneum was useful but not pathognomonic of bowel perforation. Associated findings like number of air pockets more than 2, volume of air >10 mm, free intraperitoneal fluid, bowel wall thickening, signs of mesenteric injury and air being present in the right hypochondrium, midline or in between bowel loops correlate with bowel perforation than an isolated finding of pneumoperitoneum.[8,9]

The index patient had pneumoperitoneum which was >10 mm, air in the midline, fluid in the abdomen, bowel thickening and signs of mesenteric injury which went in favour of a bowel perforation. It is possible that healing and regenerative response to injury is superior in children and a pinpoint bowel perforation may have spontaneously closed. It is also possible that the pneumoperitoneum was a false positive finding secondary to a minor undetected injury in the chest which travelled into the peritoneum or because of vertebral fractures. In spite of the radiological findings however, the clinical findings and course helped in avoiding unnecessary surgical exploration in the child. Close monitoring of the patient in the ICU setting was crucial to detect early hemodynamic instability or worsening of abdominal signs. If the child had not settled clinically, a diagnostic peritoneal lavage would have been considered in making the decision for laparotomy.[10] This case study has been presented not to show that deviation from existing protocols is acceptable, but rather to bring to notice the inherent pitfalls in CT imaging in a child with trauma and that investigations needed to be augmented with repeated physical assessments to determine the final treatment strategy. Counselling of care-givers was important with consent and documentation to ensure that they fully understood why surgery was being withheld and that operative exploration will be immediately undertaken if the child showed any signs of deterioration.

CONCLUSION

Paediatric trauma management is challenging and imaging is crucial to plan management. The finding of pneumoperitoneum incidentally on CT scan should be clinically correlated before planning a laparotomy. Though numerous guidelines, protocols and scores exist for trauma, a decision based on clinical findings is vital.

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