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PAEDIATRIC DUODENAL INJURY FOLLOWING TRIVIAL ABDOMINAL TRAUMA.

General Surgery

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ABSTRACT

Isolated duodenal injury following blunt abdominal trauma (BAT) is relatively rare. The incidence of duodenal injuries is 11.2-26% due to blunt trauma. The choice of treatment must be tailored to the nature of the defect and the amount of tissue lost. We present a series of three cases of duodenal injury due to trivial trauma of which two cases of duodenal perforation were treated surgically and one was a duodenal hematoma managed conservatively. Varieties of surgical techniques have been described for the management of patients with duodenal injuries. The surgeon should select the most appropriate procedure based on the type and conditions of the duodenal injury. CECT scan of abdomen remains valuable tool in children with BAT for diagnosis and further management.

KEYWORDS

Paediatric, Blunt trauma abdomen (BAT), retroperitoneal air, duodenal injuries.

INTRODUCTION:

Blunt trauma is a leading cause of death during childhood.1 The incidence of duodenal injuries is 11.2-26% due to blunt trauma.2 The choice of treatment must be tailored to the nature of the defect and the amount of tissue lost.[3]

Solid organ injury and gastrointestinal perforations are the main complications of blunt abdominal trauma (BAT). After BAT, duodenum and pancreas are the fourth most commonly injured intra-abdominal organs after kidney, spleen and liver with duodenal injury occurring in 2% to 10% of children.[4,5]

Blunt duodenal injuries (BDIs) pose a diagnostic and therapeutic challenge, because of nonspecific signs and symptoms, associated injuries, unreliable history, and the duodenum's retroperitoneal location. Early diagnosis of BDI in children is critical and can be dependent on subtle clinical and radiographic findings. Moreover, the interval between injury and surgical intervention can determine the incidence of morbidity and mortality.[6]

The surgeon should select the most appropriate procedure according to the type and conditions of the patient's injury.7 Early diagnosis and treatment is essential to ensure a good outcome.8 Following BAT, CT scan with intravenous contrast has become the diagnostic test of choice in the haemodynamically stable child.

CASE REPORT 1:

A 15 year old female came to Emergency department, 9 hours after an accidental fall from a chair causing blunt trauma to the abdomen. She had abdominal pain and vomiting. On examination, patient was haemodynamically stable. Bruise noted in epigastric region of 3*4 cm. Tenderness present over entire upper abdomen. Blood investigations showed Hb 14.2g/dl, WBC of 9290cells/cumm, amylase level of 494.9U/L and lipase level of 198.0U/L. Initial resuscitation done. Chest X-ray and erect X-ray abdomen and pelvis were normal.

Patient was initially admitted for observation and patient developed guarding and rigidity during this course. Considering hollow viscus perforation, IV contrast enhanced Computed tomography scanning without oral contrast was done. This showed breach in the junction of D2 and D3 with retroperitoneal free air suggestive of perforation of duodenum and a Grade 2 right renal injury (Fig 1 & 2).

On exploration, duodenal perforation of size 5cm*1cm noted at the junction of D2 and D3 (Fig 3). Grade 3 duodenal injury (American Association for the Surgery of Trauma, AAST) was noted (Table 1). The perforation was closed in two layers. 1st layer was sutured with Prolene 3-0 and 2nd layer was sutured with PDS in interrupted fashion. A 18F trans-anastomotic drainage tube placed through gastrostomy, nasogastric tube and a 26F Paraduodenal drain were placed. Feeding jejunostomy was done (Fig 4).

Feeding through feeding jejunostomy was started on POD 6. An oral contrast study was done on POD 10, which showed no leak. Oral feeds started after the contrast. Post-op period was otherwise uneventful and discharged on POD 15. Patient was followed up to 18 months with no complaints (Fig 5).

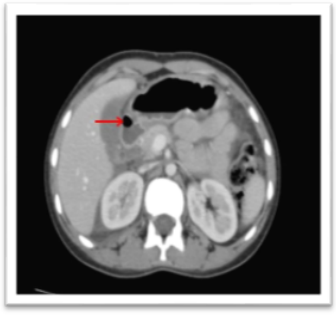


Fig 1: CT scan showing breach in the duodenal wall (arrow).

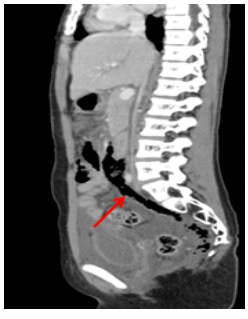


Fig 2: CT scan showing retroperitoneal air (arrow).

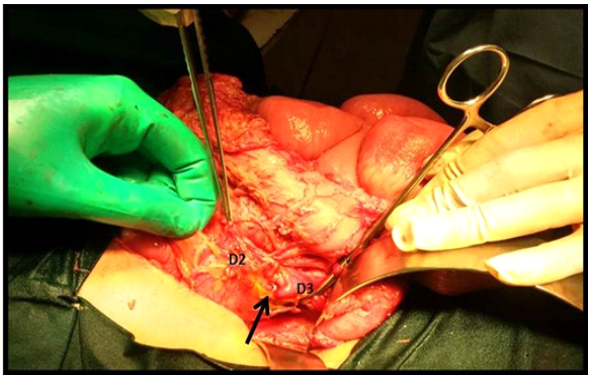


Fig 3: Perforation at the junction of D2-D3 (arrow).

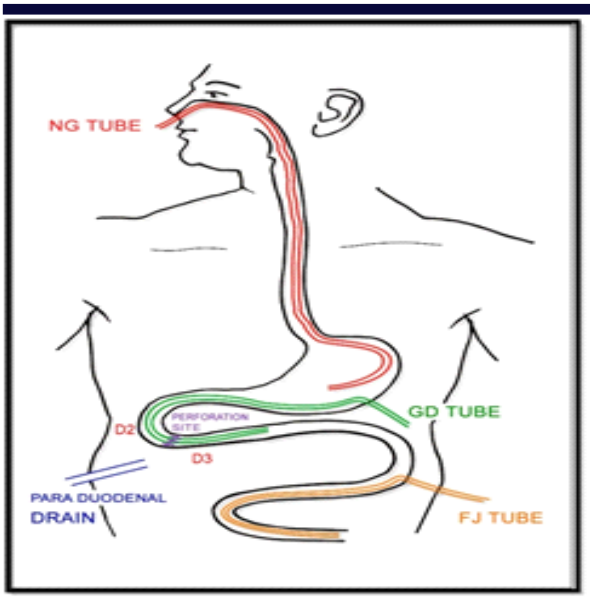


Fig 4: Showing triple tube decompression (NG Tube – nasogastric, GD Tube – Transanastomotic gastrostomy tube and FJ Tube – Feeding jejunostomy tube)

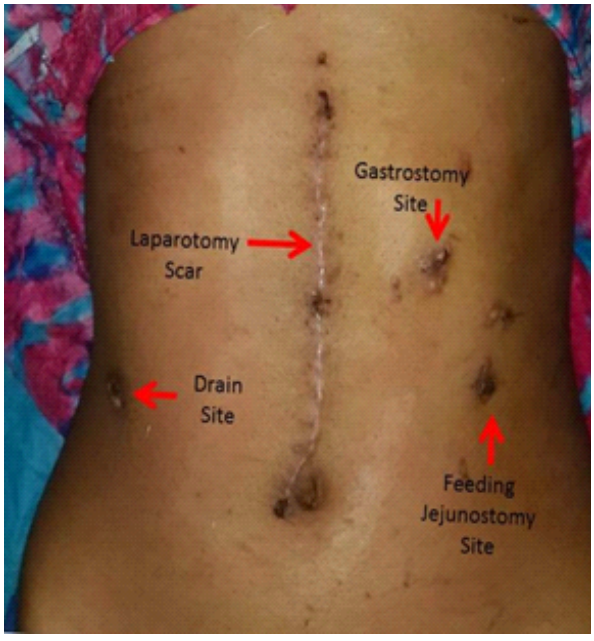


Fig 5: Post-operative wound at follow up.

DUODENUM ORGAN INJURY SCALE ACCORDING TO AAST (AMERICAN ASSOCIATION FOR THE SURGERY OF TRAUMA)

Grade		Injury description
I	Haematoma Laceration	Involving single portion of duodenum Partial thickness, no perforation
II	Haematoma Laceration	Involving more than one portion of duodenum Disruption <50% of circumference
III	Laceration	Disruption 50-75% of circumference of D2 Disruption 50-100% of circumference of D1, D3, D4
IV	Laceration	Disruption > 75% of circumference of D2 Involving ampulla or distal common bile duct
V	Laceration	Massive disruption of duodenopancreatic complex
	Vascular	Devascularisation of duodenum

D1: 1st portion; D2: 2nd portion; D3: 3rd portion; D4: 4th portion of duodenum.

Table 1: American association for the surgery of trauma (AAST): Grading of duodenal injuries.

CASE REPORT 2:

A 12 year old male child presented to casualty following accidental fall from bicycle and sustained handle bar injury to upper abdomen. Patient presented with upper abdominal pain and abdominal distension. Physical examination revealed tachycardia, with upper abdominal guarding and rigidity. Blood analysis showed a Hb 14 g/dl, a WBC of 6300 cells/cumm, amylase 41.6 U/L and lipase 101 U/L. Plain abdominal and chest x-rays were normal and did not show any evidence of pneumoperitoneum. Patient was suspected to have hollow viscus perforation. IV contrast enhanced computed tomography scanning without oral contrast, revealed retroperitoneal free air suggestive of duodenal perforation in 3rd/4th part of duodenum. (Fig 6 & 7) On exploration, perforation noted in the 3rd part of duodenum involving 30% of circumference (Grade 2 duodenal injury according to AAST). Duodenum mobilized. Duodenum closed primarily in layers, 1st layer with 3-0 prolene and 2nd layer with 2-0 PDS. Duodenal closure secured with omental patch. Gastrostomy and feeding jejunostomy was done. 24F drain placed in left hypochondrium. Wound closed in layers.

Contrast study was done on POD 5 showed no extravasation of contrast (Fig 8).

Patient was started on feeding through feeding jejunostomy on POD 6 with normal saline 10ml/hr which was gradually increased. Catheter, nasogastric tube were removed on POD 10 and POD 11 respectively. Patient was allowed orally on POD 11. Gastrostomy tube was removed on POD 13. Jejunostomy tube and left hypochondrial drain was removed on POD 13 and POD 14 respectively.

Post-op period was otherwise uneventful and discharged on POD 15. Patient was followed up to 18 months with no complaints (Fig 9).

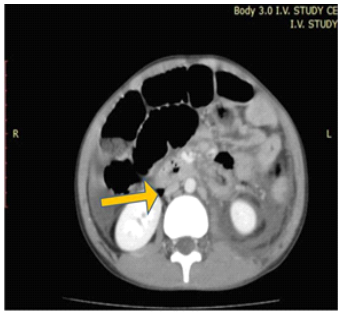


Fig 6: breach in the duodenal wall free air (arrow).



Fig 7: Retroperitoneal (arrow).

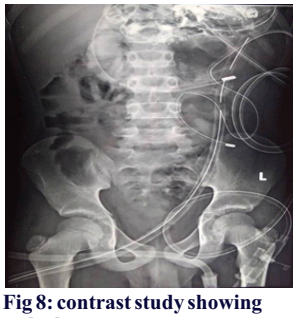


Fig 8: contrast study showing no leak.



Fig 9: Post-operative wound at followup.

CASE REPORT 3:

A 5year old female child accidentally fell from a study table. Patient presented to casualty 18 hours after the fall with persistent vomiting. Examination revealed mild tenderness in epigastrium. Patient was admitted for observation. Blood investigations showed Hb 12.3g/dl, WBC 12710 cells/cumm, amylase 109 U/L and lipase 123.0 U/L. Plain abdominal x-ray and chest radiographs were normal. Patient was kept NPO and nasogastric tube was placed. Contrast enhanced CT of

abdomen and pelvis revealed intramural hematoma completely obliterating the lumen of 2nd and 3rd part of duodenum (Fig 10). Duodenal injury was graded according to AAST, grade 2 (Table 1).

Patient had persistent vomiting and not tolerating feed. Patient was closely monitored conservatively. An oral upper GI contrast study was done to check patency of duodenum on day 5, which showed no extravasation of contrast and resolved hematoma with normal duodenal patency (Fig 12). Patient was allowed oral sips of clear water on day 6. Patient tolerated orally well. Patient was discharged on day 8. Patient was followed at 14 months with no complaints.

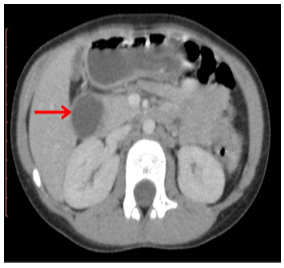


Fig 10: CECT showing intramural hematoma in the duodenum (arrow).



Fig 11: hematoma compressing Inferior vena cava (arrow).

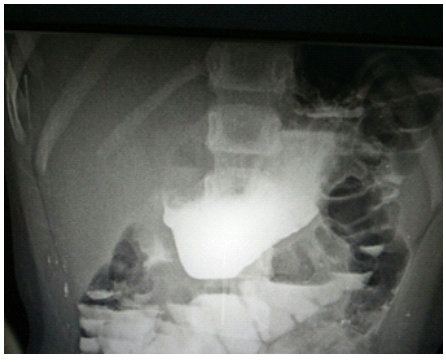


Fig 12: Contrast study showing no leak.

DISCUSSION:

Trauma has overtaken infectious disease as a leading cause of death in developed countries.9 As nutrition and infection control has improved, trauma is becoming a serious childhood health problem in developing countries.

Duodenal injuries in children usually result from BAT.10 Bicycle accidents are a frequent cause of childhood injuries.11 Bicycle handlebar is responsible for approximately half of all cases of BAT in childhood bicycle accidents.[12]

Duodenum is mobile at the pylorus and its fourth part. Disruption of the duodenum by blunt injury can occur either by crushing the duodenum against the rigid vertebral column (as from a direct blow to the abdomen), from the impact of shearing forces (as may occur during falls) or bursting energy (as with a seat belt injury).13 Early diagnosis of blunt duodenal trauma is frequently delayed because of minimal findings on physical and radiological examination.

In our case series, two patients had duodenal perforation who underwent early exploration. Duodenal perforation was primarily closed in two layers. Nasogastric tube was placed to drain gastric contents, a 18F transanastomotic tube was placed through gastrostomy to drain the duodenal contents and feeding jejunostomy for early enteral nutrition. Paraduodenal drain was placed intraperitoneally and secured. Abdomen was closed in layers primarily without any tension. Postoperative period of both duodenal perforation patients was uneventful.

A patient with duodenal hematoma was managed conservatively with close monitoring. Patient had persistent vomiting and did not tolerate the feeds during course hospital stay. Patient was kept NPO, started orally after oral upper GI contrast study which showed no leak and patency of the duodenum was maintained. Patient recovered well with conservative management.

The factors that influence the outcome are the anatomical relation of the injured segment to the bile duct, the type of the injury (simple laceration or destruction of the duodenal wall), the circumference of the duodenum involved, associated injuries to pancreas or major vascular injury, and the time elapsed until the patient received definite management.[14]

Early treatment of a patient with a duodenal rupture is critical and the time interval from trauma to definitive management influences morbidity and mortality. An 11% mortality rate in patients who underwent a surgery less than 24 hours after an injury, increases up to 40% in those who were managed after 24 hours of being injured.[8]

At the time of laparotomy complete mobilization of duodenum should be performed because most of the injuries are seen in 3rd and 4th part of duodenum and needed for tension free anastomosis. The use of drainage procedures for the purpose of protecting the duodenal closure has been suggested to reduce the morbidity of duodenal perforation.15 Feeding jejunostomy potentially aided in early initiation of enteral nutrition. CT has been added to the diagnostic algorithm for subtle duodenal injury. CECT abdomen is sensitive to small amounts of retroperitoneal air, blood and contrast extravasation especially in children.[16]

CONCLUSION:

High degree of suspicion is essential to diagnose duodenal injury following blunt trauma to abdomen especially in children. Many children will only have trivial trauma as a cause, without other organ injury. Contrast Enhanced Computed Tomography is a must for early diagnosis. It is equally clear that surgery is unnecessary for patients with duodenal hematoma without perforation. Early exploration and management with appropriate treatment modalities such as Gastrostomy, Feeding jejunostomy and adequate drainage will improve surgical outcome and thus reduce duodenal perforation related morbidity and mortality.

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