**Laparotomy for blunt abdominal trauma—some uncommon indications**

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**ABSTRACT**

Trauma laparotomy after blunt abdominal trauma is conventionally indicated for patients with features of hemodynamic instability and peritonitis to achieve control of hemorrhage and control of spillage. In addition, surgery is clearly indicated for the repair of posttraumatic diaphragmatic injury with herniation. Some other indications for laparotomy have been presented and discussed. Five patients with blunt abdominal injury who underwent laparotomy for nonroutine indications have been presented. These patients were hemodynamically stable and had no overt signs of peritonitis. Three patients had solid organ (spleen, kidney) infarction due to posttraumatic occlusion of the blood supply. One patient had mesenteric tear with internal herniation of bowel loops causing intestinal obstruction. One patient underwent surgery for traumatic abdominal wall hernia. In addition to standard indications for surgery in blunt abdominal trauma, laparotomy may be needed for vascular thrombosis of end arteries supplying solid organs, internal or external herniation through a mesenteric tear or anterior abdominal wall musculature, respectively.

**Key Words:** Abdomen, blunt, indications, internal hernia, laparotomy, trauma, traumatic abdominal wall hernia, vascular injury

**INTRODUCTION**

Blunt abdominal trauma warranting emergent laparotomy has conventionally been indicated in patients presenting with hypotension for hemorrhage control, solid organ injury, features of peritonitis following blunt or penetrating abdominal injury or due to diaphragmatic injury.\(^1,2\) The decision to do a laparotomy is taken based on the hemodynamic status of the patient in conjunction with examination of the abdomen, Focused Assessment with Sonography in Trauma (FAST) exam, and computed tomography (CT) scan. But this does not cover the entire spectrum of indications for laparotomy in a case of blunt abdominal trauma.

**CASE REPORTS**

We present five patients with blunt abdominal injury who underwent semi-emergent laparotomy for nonroutine indications. These patients were hemodynamically stable and had no overt signs of peritonitis.

**Case 1**

A 36-year-old male presented after a road traffic accident (RTA) with blunt abdomen injury and a right tibiofibular fracture. He has the pulse of 72/min and blood pressure (BP) of 112/70 mm Hg with a normal FAST exam. The patient was transferred to the...
orthopedic unit for further management but developed complaints of vomiting and constipation with abdominal distension over the next 3 days. Abdominal X-ray [Figure 1] revealed multiple air fluid levels and a contrast CT with oral and intravenous (IV) contrast revealed an obstruction at the jejunoileal junction. A decision was taken to do a diagnostic laparoscopy on day 4 after injury, which was converted to open laparotomy due to findings of internal herniation of ileal loops through the transverse mesocolon. This herniated ileal loop had vascular compromise so it was resected, and an ileo-ileo end to end anastomosis was done. The postoperative period was uneventful, and the patient was discharged on postoperative day 7.

**Case 2**
A 50-year-old male presented a day after sustaining blunt abdominal injury by a bull horn to the right side of his abdomen. He presented with right lower abdominal swelling. He was hemodynamically stable with a pulse of 82/min and a BP of 130/90 mm Hg. A chest X-ray diagnosed a right simple pneumothorax for which a chest tube was inserted. FAST exam was normal, but contrast CT revealed herniation of bowel through a defect in the anterior abdominal wall [Figure 2]. 3 days after injury, an exploratory laparotomy was done which showed no associated intraperitoneal injury and the hernia was reduced, and the defect reinforced with a mesh. The patient was discharged on postoperative day 7.

**Case 3**
A 23-year-old male presented with deceleration injury following an RTA. His hemodynamic parameters were within the normal range; he had a pulse of 80/min and a BP of 110/78 mm Hg. Examination revealed a soft abdomen. The FAST exam was positive, and a CT with oral and IV contrast revealed a completely devascularized spleen. The patient was conservatively managed and started on a liquid diet but developed abdominal pain with associated fever after a week. An exploratory laparotomy was done 8 days after injury, and a splenectomy was done for splenic infarction with abscess formation. He had an uneventful postoperative period and went home on postoperative day 7.

**Case 4**
A 9-year-old male child presented with deceleration injury after falling from a height of 12 feet. He had normal hemodynamic parameters with a pulse of 100/min and a BP of 100/70 mm Hg. Examination revealed a soft abdomen. The FAST exam done was positive. A contrast-enhanced CT (CECT) with oral and IV contrast revealed a completely devascularized right kidney [Figure 3]. As the patient had pain and hematuria, a laparotomy was performed 6 days after injury and the right kidney showed infarction, so a right nephrectomy was done. He had an uneventful postoperative period and went home on postoperative day 6.

**Case 5**
A 35-year-old male presented with blunt abdominal trauma after an RTA along with injury to left lower limb. His
CT with IV contrast revealed no enhancement in both kidneys in the arterial phase suggestive of bilateral renal pedicle injury [Figure 4]. Endovascular stenting of both renal arteries was attempted unsuccessfully the next day after injury. Laparotomy was done 2 days after the injury due to the failure of endovascular stenting, and a right aortorenal artery polytetrafluoroethylene grafting was done on the right side. On the left side, a splenectomy was done, and the splenic artery anastomosed with the left renal artery. Patient underwent repeated dialysis in the postoperative period. His urine output returned to normal but after 4 days, he succumbed due to his injury. Table 1 summarizes all the cases.

**DISCUSSION**

Alternate possible indications for laparotomy should be kept in mind while managing patients with blunt abdominal trauma. CT with IV and oral contrast has been particularly useful in the diagnosis of both external as well as internal hernias and vascular injuries following trauma.[3]

In addition to diaphragmatic injury and herniation, mesenteric injury with herniation can be missed initially, and the presentation may be delayed. In case of diaphragmatic injuries, the delay has been reported to be months and even years.[4] In this case, although the internal herniation presented during the same hospital stay; Aref and Felemban have reported it to present 7 months later.[5] The role of laparoscopy in blunt trauma is limited. It is useful in the diagnosis of diaphragmatic hernia.[6] The authors used laparoscopy in the diagnosis of post traumatic internal herniation of the bowel. This internal herniation occurred through a defect after a traumatic mesenteric tear. Such an injury affecting the end artery supplying the corresponding part of the intestine resulting in devascularization of that segment will lead to the patient presenting earlier with signs of peritonitis. These injuries

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**Table 1: Summary of all cases**

| Case details | Case 1 | Case 2 | Case 3 | Case 4 | Case 5 |
|--------------|--------|--------|--------|--------|--------|
| Age/gender   | 36/male| 50/male| 23/male| 9/male | 35/male|
| Mode of injury| RTA    | Bullhorn injury | RTA    | Fall from a height of 12 feet | RTA    |
| Hemodynamic parameters (pulse and BP) | Stable | Stable | Stable | Stable | Stable |
| Abdominal examination | Normal on day 1; developed abdominal distension on day 3 | Swelling of the anterior abdominal wall in the right lower abdomen | Soft | Soft | Generalized tenderness |
| FAST | Negative | Negative | Positive | Positive | Positive |
| X-rays and associated injuries | Abdominal X-ray after 3 days-multiple air fluid levels | Chest-right simple pneumothorax | None | None | Left femur fracture |
| CECT abdomen | Intestinal obstruction - jejunoileal level | Abdominal wall hernia | Complete nonenhancement of spleen without any parenchymal injury | Complete nonenhancement of right kidney without any parenchymal injury | Bilateral renal nonenhancement without parenchymal injury |
| Laparotomy performed (number of days after injury) | 4 | 3 | 8 | 6 | 3 |
| Laparotomy findings | Internal herniation with vascular compromise of ileal loop through transverse mesocolon | Herniation of bowel through the anterior abdominal wall with no associated intraabdominal injury | Complete splenic infarction with splenic abscess | Right renal infarction | Bilateral renal ischemia |
| Therapeutic intervention | Resection of herniated ileal loop with ileo-ileal end to end anastomosis | Hernioplasty with mesh placement | Splenectomy | Right nephrectomy | Right renal artery PTFE grafting to the aorta done on the right side. Splenectomy and the splenic artery anastomosed with the left renal artery on the left side |
| Outcome | Discharge on POD 7 | Discharge on POD 7 | Discharge on POD 7 | Discharge on POD 6 | Died after 4 days |

POD: Postoperative day; RTA: Road traffic accident; BP: Blood pressure; FAST: Focused assessment sonograph trauma; CECT: Contrast-enhanced computed tomography; PTFE: Polytetrafluoroethylene
manifests as vascular engorgement with wall thickening on CT scan and may be missed unless specifically looked for.[1]

Traumatic abdominal wall hernia (TAWH) is a rare entity with <50 reported cases. TAWH is diagnosed by the onset of the hernia through the damaged muscle and fascia after blunt abdominal trauma with intact overlying skin.[2] Unlike the case of internal herniation, the patient with TAWH in this series presented with an obvious external swelling. However, there are reports that the swelling may not always be clinically apparent.[3] On operation, the defect was not as well-delineated as with conventional abdominal wall hernia surgery. It was accompanied by local hematoma and contusion of the affected muscle. Therefore, the defect was reinforced with a prosthetic mesh after the closure. Exploratory laparotomy in the immediate period with surgical repair of the hernia with meshplasty is a tested form of treatment in the presence of a clinically apparent hernia.[4] The key concern in TAWH is the presence of associated injuries like the small bowel or large bowel injuries as well as solid organ injuries which can be detected by either CT scan or during exploratory laparotomy. In the absence of intraabdominal contamination due to bowel injury, a meshplasty can be performed to reinforce the defect especially if it is large. In the presence of a contaminated field, the use of a biological mesh can be considered to reduce the risk of postoperative infection.[5] In case of small defects, the TAWH can be closed primarily.[6]

Splenic infarction is commonly seen associated with hematological conditions, collagen vascular disease, and nonhematological malignancies.[7] Splenic infarction following blunt abdominal trauma is a rare presentation which can be diagnosed using CECT abdomen.[8] It is diagnosed by nonenhancement of the spleen with IV contrast during CECT abdomen. Patients with segmental splenic infarction can have resolution identified by repeat CT scan with no need for any surgical intervention while patients who develop complications like abscess or delayed rupture may need angiographic or surgical intervention.[9]

Renal artery injuries are associated with rapid deceleration injuries which may lead to tears in the intima followed by thrombosis of the blood which enters the vessel wall.[10] Higher grades of injury following renal artery trauma are adverse prognostic factors for kidney survival and warrant nephrectomy if there is a contralateral functioning kidney.[11] In case an infarcted kidney is managed conservatively, there is a possibility of complications like abscess or delayed rupture which may lead to tears in the intima followed by thrombosis of the blood which enters the vessel wall. Therefore, the defect was reinforced with a prosthetic mesh after the closure. Exploratory laparotomy in the immediate period with surgical repair of the hernia with meshplasty is a tested form of treatment in the presence of a clinically apparent hernia.[4] The key concern in TAWH is the presence of associated injuries like the small bowel or large bowel injuries as well as solid organ injuries which can be detected by either CT scan or during exploratory laparotomy. In the absence of intraabdominal contamination due to bowel injury, a meshplasty can be performed to reinforce the defect especially if it is large. In the presence of a contaminated field, the use of a biological mesh can be considered to reduce the risk of postoperative infection.[5] In case of small defects, the TAWH can be closed primarily.[6]

In case of bilateral renal artery injury, an attempt at revascularization must be undertaken. Although angiography is commonly used in hemorrhage control after renal artery injury, in this patient, endovascular intervention was utilized to attempt stenting both renal arteries after injury.[12] As the stenting was not successful, a major bilateral revascularization procedure was undertaken.

CONCLUSION

The common indications for laparotomy in blunt abdominal trauma in hemodynamically stable patients are hollow viscus perforation, solid organ injury and diaphragmatic hernia. In a vitally stable patient, imaging helps in the diagnosis of these conditions as well as uncommon conditions which need laparotomy. CECT scan can help in the diagnosis of internal herniation after mesenteric injury as well as external herniation following injury to the anterior abdominal wall. In addition, CT scan can diagnose vascular injuries to end organs such as the spleen and kidney which lead to infarction without associated parenchymal injury. In case of unilateral renal injury, early nephrectomy is indicated but splenic infarction can be managed conservatively unless a complication like abscess develops for which splenectomy is needed.

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Conflicts of interest
There are no conflicts of interest

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