

Outcome of Traumatic Hollow Viscus Injuries at Tertiary Care Center**Anup Desai¹, Ahmed Khan², Basvanth Patil³, Nandkishore Shinde⁴**^{1,3}Associate professor, Department of Surgery, Khaja Banda Nawaz University's, Faculty of Medical Sciences, Kalaburagi, Karnataka.²Assistant professor, Department of Surgery, Khaja Banda Nawaz University's, Faculty of Medical Sciences, Kalaburagi, Karnataka.⁴Professor, Department of Surgery, Khaja Banda Nawaz University's, Faculty of Medical Sciences, Kalaburagi, Karnataka.

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Conflict of interest: Nil

Abstract:**Background:** Traumatic hollow viscous injuries following road traffic motor vehicle accidents are rising due to urbanisation, modernisation and it is the main cause of morbidity and mortality in Trauma. The aim of this study is to know the factors in traumatic hollow viscous injuries which help in decreasing mortality.**Methods:** Retrospectively records of all the patients with a history of abdominal trauma due to road traffic accidents and diagnosed as hollow viscous injuries on X-ray abdomen and/or Ultrasound (USG) or/and Computer tomography (CT) were analyzed. Demographic data, mode of injury, mechanism of injury, nature of the injury, presentation to the hospital, hemodynamic stability, investigations, definitive treatment required and the outcome of patients were recorded.**Results:** There were 32 patients of abdominal trauma with hollow viscous perforation with male to female ratio of 4.3:1. Mean age was 33.61±14.61 years. 8 (25%) cases reached hospital 6 hours after abdominal injury. Blunt abdominal trauma was seen in 29 (90.6%) cases. Surgical interventions were required in all 32 (100%) cases. Most common were small bowel injuries (56.3%) followed by colon (25%). Surgical intervention in bowel consisted of laparotomy and simple closure of perforation in 12 (37.5%) patients, resection and anastomosis in 15 (46.88%) patients and stoma in 3 (9.3%). Closure of urinary bladder done in 2 (6.3%) patients. 3 patients (9.3%) of abdominal trauma with hollow viscous perforation succumbed to death. Among the factors leading to mortality, delayed presentation, hemodynamic instability, requirement of transfusion, resection and re-explorations were common.**Conclusion:** Delayed presentation and management, hemodynamic instability, site, mechanism of injury, resection and re-explorations are the factors deciding outcome in traumatic hollow viscous injuries.**Keywords:** Road Traffic Accidents, Abdominal Trauma, Hollow Viscous Injury, Intestinal Injury, Mortality.This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.**Introduction**

Trauma is the commonest cause of morbidity and mortality under 44 years of ages and the most dangerous types of injuries leading to mortality. [1,2,3]

Most common mechanisms for trauma are motor vehicle accidents followed by pedestrian injuries, falls, assaults and sports-related injuries. In recent years, due to urbanization, industrialization, increase in the vehicular traffic, terrorist activities and riots cases of trauma has been increasing. [1,2,3,4]

Blunt trauma is seen in most injuries. Penetrating trauma is less common, mostly caused by a gunshot wound or from stabbing. [1-5]

Hollow viscus injury (HVI) following blunt abdominal trauma is less common, represent 16% of

all injuries and are third in frequency after liver and splenic injury. However, Patients with penetrating abdominal trauma has high frequency of hollow viscus injuries. [2,3,6]

Hollow viscus injury occurs due to high-energy trauma following motor vehicle accidents in 70–90% of cases. [2,3,6,7] In motor vehicle accidents higher risk of hollow viscus injury to rear-seat passengers than for drivers. [8,9] Paradoxically, automobile seat belts potentially increase the risk of hollow viscous injury. Blunt trauma leads to compression, deceleration, or crushing forces exerted in abdominal cavity causing serious injuries. Direct impact, deceleration, and increased luminal pressure are the three mechanisms causing hollow viscus injury. Direct impact, transmit energy as a shock wave from the surface to the body core, causing compression. Velocity decides intensity of

impact energy which leads to hollow viscous injuries consisting tearing and lacerations located opposite to the force is exerted (contrecoup). [8,9,10]

Deceleration causes sudden velocity change within milliseconds of a body moving from high speed, due to brutal arrest of the body, the intestine and its mesentery have back and forth movement which leads to mesenteric tear and de-vascularization. [9,10]

X-ray erect abdomen, Abdominal ultrasonography (USG), Focused Assessment with Sonography for Trauma (FAST), computed tomography scans, laparoscopy, diagnostic peritoneal lavage (DPL) are the diagnostic tests to detect hollow viscous injuries in the abdominal trauma. [11,12,13,14]

There is rising tendency of nonoperative management for maximum solid visceral trauma in recent years. In contradiction to non-operative management for solid organ injury, management of hollow viscus injury is challenging, early surgical intervention is the paramount importance in hollow viscus injury. A delay in diagnosis and treatment increases morbidity and mortality in hollow viscus injury. Hence, it is important to recognize signs of traumatic hollow viscus injuries early to diagnose these difficult situations and manage it effectively. [2,3,6,7,15] Knowledge of factors like nature of injury, mode of injury, mechanisms of injury, type of injury, presentation and investigations which help in the early diagnosis and early management of the traumatic hollow viscous injuries is important. Hence, this study is done to know the factors in traumatic hollow viscous injuries which help in decreasing morbidity and mortality.

Material and Methods

This was the retrospective cross section study, conducted from June 2017 to May 2023. Ethics Committee clearance was taken for this study. Retrospectively records of all the patients with a history of abdominal trauma due to road traffic accidents and diagnosed as hollow viscous injuries on X-ray abdomen and/or Ultrasound (USG) or/and Computer tomography (CT) were analyzed from the case files from the medical record section between June 2017 to May 2023. Exclusion criteria included associated head and spine injuries, limb injuries, thoracic injuries, hollow viscous injuries associated with solid organ injuries.

Demographic data, mode of injury, mechanism of injury, nature of the injury, presentation to the hospital, hemodynamic stability, investigations (USG and CT scan reports), definitive treatment required, whether conservative or surgical and the outcome of patients were recorded from the case files.

Descriptive and inferential statistical analysis has been carried out in the present study. Results on continuous measurements are presented as Mean \pm SD (Min-Max) and results on categorical measurements are presented in percentile. The Statistical software IBM SPSS 24.0.(IBM, Armonk, NY, USA) were used for the analysis of the data. [16]

Results

There were 32 patients of abdominal trauma with hollow viscous perforation fulfilling inclusion criteria. There were 26 (76.2%) males and 6 (23.8 %) females with Male to Female ratio of 4.3:1. Age ranging from 6 months to 70 years with mean age 33.61 ± 14.61 years (Table 1).

Four-wheeler vehicle injury was most common vehicle for the trauma in our study constituting 46.88% (15/32) followed by heavy vehicle 21.88% (7/32) (Table 2).

8 (25%) cases reached hospital 6 hours after abdominal injury. 5 (15.6%) cases were hemodynamically unstable on presentation to the hospital. 10 (31.2%) patients required blood products transfusion in which 7 required PRBC and 3 required FFP transfusion.

In trauma patients, blunt abdominal trauma was seen in 29 (90.6%) cases, while penetrating abdominal trauma was seen in 3(9.4%) cases.

Surgical interventions were required in all 32 (100%) cases (Table 4);

All 32 patients of traumatic bowel perforation required surgical intervention. Out of the total of 32 cases of hollow viscus perforation, four had stomach, eight had jejunal, ten had ileal, two had caecal, four had splenic flexure of the colon perforation, two had sigmoid colon perforation and two had urinary bladder perforation (Table 3). Surgical intervention in bowel consisted of laparotomy and simple closure of perforation in 12 patients, resection and anastomosis in 15 patients and stoma in 3 patients in view of contamination and delayed presentation. Laparotomy and closure of urinary bladder underwent in 2 patients. Re-exploration required in 5 patients of closure of perforation among which three was of jejunal perforation which underwent resection and anastomosis and the other 2 was of ileal perforation which underwent ileostomy. One patient who underwent resection and anastomosis of ileum developed anastomotic leak which later underwent ileostomy after relaparotomy (Table 4).

3 patients (9.3%) of abdominal trauma with hollow viscous perforation succumbed to death. Among the factors leading to mortality, all the three patients (100%) had delayed presentation and management started after 6 hours, hemodynamically instable, required transfusion, surgical intervention and re-

explorations. 2 patients had ileal perforation and one had jejunal perforation, who underwent re-exploration and resection and anastomosis had mortality. These factors were identified as poor prognostic factors increasing mortality. Site and

mechanism of injury are the other factors contributing and deciding prognosis in abdominal trauma with hollow viscous injuries.

Tables

Table 1: Age distribution of patients studied

Age in years	Gender		Total
	Female	Male	
1-10 years	1(3.13%)	6(18.75%)	7(21.87%)
21-50 years	4(12.5%)	15(46.88%)	19(59.38%)
>50 years	1(3.13%)	5(15.63%)	6(18.75%)
Total	6(18.75%)	26(81.25%)	32(100%)

Table 2: Type of vehicle-Frequency distribution of patients studied.

Type of vehicle	Total
Heavy vehicle	7(21.88%)
2-wheeler	6(18.75%)
3 wheeler	4(12.5%)
4-wheeler	15(46.88%)
Total	32(100%)

Table 3: Hollow Viscous Perforation distribution.

Hollow viscera	Percentage of injuries	P value
Stomach	4(12.5%)	0.320
Small intestine	18(56.25%)	0.878
Large Intestine	8(25%)	0.230
Urinary Bladder	2(6.25%)	0.498
Total	32(100%)	

Table 4: Management of Hollow Viscous Perforation.

Surgical Intervention	Total
Laparotomy and closure of perforation	12(37.5%)
Laparotomy and resection and anastomosis	15(46.88%)
Laparotomy and stoma	3(9.38%)
Laparotomy and closure of urinary bladder	2(6.25%)
Reexploration	5(15.6%)
Total	32+5=37

Discussion

Trauma is the main cause of morbidity and mortality among the pediatric and adolescent population both in developed and developing countries and cause for a burden on developing countries with limited resources. [3,4,6,7,17,18] In our study, we had male predominance with 76.2% males and male to female ratio of 4.3:1. Traumatic hollow viscus injuries are higher in males in different studies. [7,17,18,19]

Two-third of traumatic hollow viscus injuries are caused by motor vehicle accidents and it is the common mode of trauma followed by fall. [3,4,6,17,18,19] We had included only traumatic hollow viscus injuries following motor vehicle accidents in this study.

In trauma, the most common mechanism was blunt trauma with incidence ranging from 86–97% cases and penetrating trauma is less frequent. Hollow

viscus injury (HVI) following blunt abdominal trauma is less common, represent 16% of all injuries seen in blunt abdominal trauma and are third in frequency after liver and splenic injury, however the incidence of traumatic hollow viscus injuries is higher following penetrating trauma but overall blunt trauma incidence is more. [7,17,18,19,20] In our study, blunt abdominal trauma contributes 90.6% and penetrating abdominal trauma contributes 09.4% for traumatic hollow viscus injuries.

CT scan abdomen accurately evaluates and early detects injuries. [11,21,22] Plain X-ray and/or computed tomography (CT) help in accurate localization and early diagnosis of traumatic hollow viscus injuries. [11-14] Ultrasound is useful in the context of FAST (Focused Assessment with Sonography for Trauma) in unstable patients, mainly for the detection of intraperitoneal blood or

fluid from a visceral injury in trauma patients. [12,13]

In our study, we noted that 25% cases reached hospital 6 hours after abdominal injury. 15.6% cases were hemodynamically unstable on presentation to the hospital and 31.2% patients required transfusion of blood or blood products. The initial management involves stabilizing the patient ensuring a patent airway, breathing, adequate oxygenation, circulation, IV fluid resuscitation and identifying other injuries. Resuscitation is done with crystalloid fluids and transfusion of blood or blood products as and when required. Ongoing monitoring with vital signs, abdominal examinations and urine output measurements are important. [3,4,6,7,17,18,19,20] The management of patients with traumatic hollow viscus injuries is emergency surgical intervention in contrast to nonoperative approach to other traumatic injuries. So, it is important to understand the signs of traumatic hollow viscus injuries early, in order to diagnose and effectively manage this difficult situation early. [6,7,17,18,19,20]

Surgical intervention with restoration of intestinal continuity in one-stage is performed in most small intestinal and colonic injuries, if detected early and underwent early surgery. Delayed presentation and delayed treatment of the hollow viscus injury results in peritonitis, hemodynamic instability and increased mortality and morbidity. Thus, the early diagnosis and treatment remains the most important part of the management. [23,24] In blunt abdominal trauma, intestinal and mesenteric injuries are less common and often leads to diagnostic difficulties that may result in delay in the surgical intervention. [25]

Any part of the intestine can be affected. Small intestinal injuries are the most common involving more than half of all intestinal injuries, with equal involvement of the jejunum and ileum. The second common location of injury is the colon; with left colon being commonly injured than the transverse or right colon. Duodenal injuries are less common, constituting only 10% of the total and injuries of the rectum and stomach are even less frequent, constituting only 5% of the total. [7,26,27] In our study, 18 (56.3%) case had small intestinal injuries and 8 (25%) cases had Colonic injuries and 2 (6.3%) had bladder injuries.

Mos of the intestinal injuries are serous or seromuscular tears, followed by full-thickness perforation, which may be a punctate blowout or a full-thickness tear of the intestinal wall. There are reports of post-traumatic intestinal strictures lately, presenting as intestinal obstruction, probably due to segmental ischemia that progresses to fibrotic stricture. [27]

Careful exploration is necessary to detect multiple wounds involving several intestinal segments.

Midline laparotomy is the accepted approach. The role of laparoscopy, at least for diagnosis, has been established. [28] Hemostasis of active mesenteric bleeding can be done by oversewing or by exploration of a mesenteric hematoma for suture control of an active bleeder. Intestinal laceration or perforation is treated by hand-sewn or stapled repair, in most cases with one-stage repair or resection with restoration of continuity. [29] Exploratory laparotomy, drainage of contaminated peritoneal fluid and saline lavage are mainstay of surgical intervention. Prophylactic antibiotics are required. Simple closure is usually adequate for single perforation of the small intestine. [4,7,17,19,20] In our study also, laparotomy and simple closure of perforation was done in 12 (37.5%) patients, resection and anastomosis was done in 15(46.88%) patients and stoma was done in 3 (9.38%) patients in view of contamination and delayed presentation. Laparotomy and closure of urinary bladder was done in 2 patients. Re-exploration were required in 5 (15.6%) patients of perforation closure. Simple closure of the perforation was the commonly used technique for gastric, duodenal and jejunal perforations, for single perforation with minimum contamination of the peritoneum in other studies also [17-20,24-29] and in multiple perforations of jejunum or ileum close to each other, resection and anastomosis is the best options. In toxic and moribund patients with grossly contaminated peritoneum a temporary ileostomy is best option though the maintenance postoperatively was cumbersome and required a second surgery. Resection and anastomosis carried high morbidity and mortality in various studies. [18,19,20,24-29]

Mortality was seen between 10 and 23%, in the various series of intestinal and mesenteric trauma. [30,31] A direct relation between delay time and post-operative morbidity has been demonstrated in many studies. [27,29,30,31] In our study, 9.3% patients of hollow viscous perforation succumbed to death. Among the factors leading to mortality, delayed presentation and management after 6 hours, hemodynamic instability, requirement of transfusion, resection and anastomosis and re-explorations are the factors increasing mortality.

There were few limitations to our study, like it addresses only traumatic hollow viscous injuries in abdominal trauma following road traffic motor vehicle accidents, it does not include multisystem injuries. This study was done in a single center. Hence to generalization of the results, multicenter studies required

Conclusion

Delayed presentation and management, hemodynamic instability, requirement of transfusion, site, mechanism of injury, resection and anastomosis and re-explorations are the factors

deciding outcome in traumatic hollow viscus injuries.

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