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# AN APPRAISAL OF HOLLOW VISCUS INJURY IN ABDOMINAL TRAUMA

Surgery

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## ABSTRACT

**INTRODUCTION** Hollow viscus injury (HVI) following abdominal trauma is a clinical diagnostic challenge resulting in delayed intervention and poor outcomes. The specific aims were to determine patterns of abdominal trauma and factors determining outcome in patients of HVI.

**METHODS** An observational study was performed in a tertiary care hospital from January 2015 to may 2017. Parameters studied were age; sex; time, mode, site and grade of injury; associated injuries; diagnostic tests; types/timing of treatment; morbidity and mortality and factors affecting outcome.

**RESULTS** 24.07% patients of all recorded abdominal trauma cases had HVI. Overall mortality and morbidity rates were 49.45% and 16.4% respectively. Morbidity was independently related to hemodynamic instability (P=0.061), multiple site bowel injury (P = 0.159), grades of injury and co-morbidities (P=0.045). Mean duration of hospital stay was 9 days.

**CONCLUSION**

There is a lack of conclusive data regarding HVI in India. Proper documentation, along with formulation of effective management strategies is required to reduce morbidity and mortality associated with HVI.

## KEYWORDS

abdominal trauma, hollow viscus injury

## INTRODUCTION

In the twenty-first century, abdominal trauma accounts for 13% of all injuries and is associated with a mortality rate of 7.7%.1 The incidence of hollow viscus injuries (HVI) after penetrating and blunt abdominal trauma has been documented in 21.8% and 2.7% cases respectively in the NTDB (National Trauma Data Bank). In about 80% cases, exploratory laparotomy in penetrating trauma is prompt leading to early diagnosis of HVI. Current trend of non-operative management of solid organ injury has led to delayed diagnosis and treatment of HVI – the latter being uncommon in blunt abdominal trauma.

India was declared as the trauma capital of the world by WHO in 2009. Still there is paucity of data from India regarding etiology, prognostic indicators, and morbidity and mortality patterns in patients of abdominal trauma. This study describes the patterns of hollow viscus injuries and the factors determining outcome in a tertiary care hospital.

## MATERIALS AND METHODS

### STUDY DESIGN

It is a descriptive, non randomized, non interventional, longitudinal study.

### STUDY SETTINGS

Department of General Surgery, in a tertiary care hospital.

### STUDY DURATION

Study duration was one year and six months. After receiving institutional ethical clearance, data was collected from selected consenting patients for 10 months and individual subjects were followed up for 6 months.

### STUDY POPULATION

All patients presenting to the Department of General Surgery of a tertiary care hospital, with HVI due to blunt or penetrating abdominal trauma as documented on laparotomy.

### INCLUSION CRITERIA

Patient presenting with abdominal trauma with clinical and/or radiological features suggestive of hollow viscus injury and subsequently proved at laparotomy.

### PARAMETERS TO BE STUDIED:

- Average age of study subjects
- Proportion of male and female patient
- Temporal relationship between time of injury and presentation
- Proportion of patients with different modes of injury
- Proportion of patients with hemodynamic stability/ instability
- Proportion of patients receiving different diagnostic tests
- Proportion of patients with different sites of injury
- Proportion of patients with different grades of injury
- Proportion of patients with other associated injury
- Treatment received by the patients
- Proportion of patients with different complications
- Average duration of post-operative hospital stay
- Factors affecting outcomes in the study subjects

### DEFINITION OF OUTCOME:

To assess the demographic profile, site of injury and post-operative complications.

## RESULTS

Analysis of the obtained data revealed the following observations. In the study period, a total of 378 patients presented to the tertiary care hospital. All these patients underwent laparotomy, out of which 91 (24.07%) were found to have HVI. Majority of the patients (30.77%) belonged to the age group of 31-40 years closely followed by 29.67% in the age group of 21-30 years and least in the age group of 51-60 years (1.1%). There was a male predominance with the male to female ratio being 6.6:1. The time of presentation to the emergency since injury varied from 2 to 112 hours and most of the patients (52.6%) were operated within 24 hours since injury. A total of 73 patients sustained blunt abdominal trauma (80.22%) while penetrating injuries were seen in 18 patients (19.78%). Hemodynamic stability at admission was found in 67 patients (73.62%). In our study, 57% of patients had equivocal clinical examination and 40% had obvious signs of

peritoneal irritation. Focussed Assessment with Sonography in Trauma (FAST) was positive in 62% of patients, having been performed in 47 (51.65%) cases. Out of 85 patients who had abdominal X-rays performed, only 5 cases (5.88%) displayed pneumope ritoneum. Computerised Tomography Scan (CT Scan) performed in 37 patients gave positive results in 35 cases (96%). The sites of injuries found are depicted in Table 1 with the most affected site being proximal jejunum (26.4%). Isolated HVI was noted in 82.4% cases of hollow viscus injuries with grade II injuries being most common (55.26%). Other injuries associated with intestinal lesions were seen in 77.25% patients. Most common surgical intervention was resection and anastomosis (37.36%), followed by primary repair in 30.77% patients, stomas in 28.57% patients and suprapubic cystostomy in 3.3% patients. The recognized post-operative complications were – surgical site infections (20.8%), sepsis (15.4%), and pneumonia (7.7%) and wound dehiscence (5.5%). In this study, the hospital stay ranged from 6 to27 days with mean stay of 9 days. There was 16.4% mortality in our series.

| | SITES OF INJURY | NUMBER OF PATIENTS |
|---|---|---|
| **A** | **HOLLOW VISCUS** | |
| 1) | STOMACH | 2 |
| 2) | SMALL INTESTINE | 75 |
| a. | DUODENUM | 3 |
| b. | PROXIMAL JEJUNUM | 24 |
| c. | DISTAL JEJUNUM | 11 |
| d. | PROXIMAL ILEUM | 14 |
| e. | DISTAL ILEUM | 23 |
| 3) | LARGE INTESTINE | 11 |
| a. | ASCENDING COLON | 2 |
| b. | TRANSVERSE COLON | 3 |
| c. | DESCENDING COLON | 2 |
| d. | SIGMOID COLON | 2 |
| e. | RECTUM | 2 |
| 4) | URINARY BLADDER | 3 |
| **B** | **SOLID ORGANS** | |
| 1 | URETER AND URETHRA | 3 |
| 2 | SPLEEN AND HOLLOW VISCUS | 6 |
| 3 | LIVER AND HOLLOW VISCUS | 2 |
| 4 | PANCREAS AND HOLLOW VISCUS | 3 |
| 5 | LIVER, SPLEEN AND HOLLOW VISCUS | 1 |
| 6 | SPLEEN, PANCREAS AND HOLLOW VISCUS | 1 |
| 7 | SPLEEN | 27 |
| 8 | LIVER | 18 |
| 9 | KIDNEY | 6 |
| 10 | PANCREAS | 2 |
| 11 | SPLEEN AAND KIDNEY | 3 |
| 12 | SPLEEN AND PANCREAS | 3 |
| 13 | LIVER AND SPLEEN | 2 |
| 14 | LIVER AND PANCREAS | 1 |

**TABLE 1: Sites of Injury due to Abdominal Trauma**

The average mean age in patients without having post-operative complications is 29.04 years with a standard deviation of 10.95 years. The median age in this group was 28 years with minimum and maximum age is 10 and 63 years respectively. The mean age in patients having post-operative complications was 34.76 years with standard deviation of 13.96 years. The median age was 33 years with minimum and maximum age was 9 and 68 years. 5 of 12 females (41.67%) and 37 of 42 males (88.1%) patients had post-operative complications. 7 out of 18 (38.89%) patients with penetrating abdominal injuries have post operative complications. The mean time of presentation to the emergency since injury in patients with and without post-operative complications were 11.12 hours (minimum and maximum time being 2 and 62 hours) and 26.50 hours (minimum and maximum time being 3 and 112 hours) respectively. Hemodynamically unstable patients at the time of admission were associated with increased post-operative complications than their counterparts (P = 0.061). Post-operative complications were higher with multiple site bowel injuries compared to single site bowel injuries (P = 0.159) 44.7% patients with multiple injuries have post-operative complications whereas 44.2% patients with single injury had complications. With the increasing grades of injury, post-operative complications were found to increase. This is evident as 14.3% patients in grade 3, 44.4% patients with grade 4 and 69.6% patients with grade 5 injuries had post-operative complications. Patients having comorbidities had increased post-operative complications (P = 0.045 which is significant). Factors affecting post-operative outcomes have been compiled in Table 2.

| | | POST-OPERATIVE COMPLICATIONS | |
|---|---|---|---|
| | | PRESENT | ABSENT |
| 1 | MEAN AGE | 34.76 (SD 13.96) | 29.04 (SD 10.95) |
| 2 | MEDIAN AGE | 33 | 28 |
| 3 | MEAN TIME OF PRESENTATION SINCE INJURY | 26.5 HRS | 11.12 HRS |
| 4 | SEX | | |
| | MALE | 88.10% | 11.90% |
| | FEMALE | 41.67% | 58.33% |
| 5 | HAEMODYNAMIC STABILITY | | |
| | UNSTABLE | 62.50% | 37.50% |
| | STABLE | 40.30% | 59.70% |
| 6 | NUMBER OF SITES OF BOWEL INVOLVED | | |
| | MULTIPLE | 60% | 40% |
| | SINGLE | 42.25% | 57.75% |
| 7 | NUMBER OF INJURIES | | |
| | MULTIPLE | 44.70% | 55.30% |
| | SINGLE | 44.20% | 55.80% |
| 8 | GRADE OF INJURY | | |
| | I | | |
| | II | | |
| | III | 14.30% | 85.70% |
| | IV | 44.40% | 55.60% |
| | V | 69.60% | 30.40% |

**TABLE 2: Factors Affecting Post-operative Complications**

## DISCUSSION

Global incidence of abdominal trauma is highest in the active segment of the population in the 21-40 years age group.2-5 In this study, 60.44% of patients were in this age group. Males were more commonly affected which is comparable to the study done by Musau et al. at Kenyatta National Hospital were male to female ratio was 12.3:1.6 This finding maybe attributed to occupational hazards and other socio-economical activities of men.

Most common cause of blunt abdominal trauma is road traffic accidents.1,5,7-9 Out of 91 cases in this study, 78.18% were accidental, 18.18%cases were homicidal and 3.64%cases were suicidal. Blunt trauma was the most common of abdominal injury (80.22%) which matches with Udeyop et al., but opposite to Edino and others who reported higher incidence of penetrating abdominal injuries.10-12 In this study penetrating abdominal injury was found in 19.78% of cases. Most of the patients with penetrating injury were involved in assaults (91.7%) and only 3 patients had gunshot injuries. The prehospital care of trauma patients has been reported to be the most important factor in determining the final outcome after the injury.13 In this study, 67 patients (73.62%) were brought to the hospital by ambulance as referred cases from the various hospitals with some form of pre hospital care. The remainder were either brought by relatives, police or others. This is in contrast to Chalya et al in their study in Mwanza Tanzania where very few patients were brought by ambulance.14

In most cases of HVI, there are no reliable initial clinical symptoms or signs of intestinal injury. Diagnosis thus depends on high clinical suspiscion followed by a thorough US examination and/or CT scan, resulting in diagnostic delay. Patients with a significant history of blunt abdominal trauma and minimal clinical signs should be observed closely, with serial clinical examinations being performed on a regular

basis. Physical examination may be non-specific and unreliable, especially in unconscious or intubated patients. Diagnostic tests utilised to assess blunt abdominal trauma include ultrasonography (US), diagnostic peritoneal lavage (DPL), computed tomography (CT) and diagnostic laparoscopy (DL). A positive ultrasound test is defined as presence of free fluid or solid organ parenchymal injury.15 DPL for evaluating blunt abdominal injury has been replaced by CT imaging.16 DPL probably is an important tool in cases of bowel injury.17,18 Diagnostic CT findings include contrast extravasation and/or extraluminal air. Non-diagnostic but important findings are; free fluid without solid organ injury, small bowel thickening and dilatation.19,20 CT diagnosis for small bowel perforation has a sensitivity of 92% and specificity of 94%.19 In haemodynamically stable patients laparoscopy efficaciously determines bowel injuries. In recent years, there have been reports of therapeutic laparoscopy and repair of bowel perforations.20 In this study, FAST was the commonest tool (in 62% patients) used to diagnose patients with abdominal injuries contrary to other centers where CT has been used as the first method of choice.21 FAST has high sensitivity for detecting intraperitoneal fluid in dependent areas.22 Clinical decision may not be well guided by FAST when dealing with patients with haemoperitoneum without significant injury to the organs or those with prior ascites.

It was seen that the proximal jejunum (26.4%) and distal ileum (25.27%) were more prone to perforation. This is mainly due to its location and the lack of redundancy in this part of the bowel as observed in earlier reports.23,24 But other studies have suggested differently.4,5,7,8,25 For example, Dauterve et al. in their study found that less than half of the perforations had occurred in these zone.25 However, according to their study, mesenteric injuries had occurred more frequently than it was assumed earlier. We have seen mesenteric injuries in 23.7% cases. Associated Colonic injuries occurred frequently with small intestinal injuries but less in numbers compared to the mesenteric injuries.4,5,7 Isolated small bowel injury noted in 82.4% of cases in our study with grade II injuries being most common (55.26%) is in agreement with others studies.4,8,24-26 Stomach and urinary bladder were injured in 2.2% and 3.3% cases respectively. Tonge et al. reported the incidence of stomach and urinary bladder injuries at 0.8% and 4.9%.8 Patients with traumatic brain injuries had Glasgow Coma scores of 13 to 15 indicating that they had mild only traumatic brain injuries. This can be due to some of these patients dying before arrival to the hospital. Skeletal injuries were treated with fixations and chest injuries were treated either conservatively or by intercostal chest drain insertion. These associated injuries had significant effect on the length of hospital stay -- a finding is in agreement to other studies.14 Most of our patients (52.6%) were operated within less than 24 hours since injury; this too was reflected in previous studies.27 Exploratory laparotomy with drainage under the cover of prophylactic antibiotics were the mainstay of treatment.3 Simple closure is usually adequate for single perforation of the small intestine, but more extensive injuries like multiple perforations and gangrene from mesenteric injuries usually require resection and anastomosis. Large bowel injuries may require creation of stoma.8

Complications in patients with intestinal trauma depends on concomitant injuries, the death rates being considerably lower for patients with isolated intestinal lesions (22.75% in our study) compared to patients sustaining additional intra-abdominal injuries (77.25%). Over 60% of these were accompanied by other severe injuries, mainly head trauma and pelvic injuries. The length of hospital stay has been reported to be an important measure of morbidity among trauma patients. Prolonged hospitalization is associated with a burden on resources of health services and undermines the productive potential of the population.23 In this study, the hospital stay ranged from 6 to27 days with mean stay of 9 days. This is not in agreement to Ayoade et at in their study whose duration of hospital stay ranged from 1 to 130 days with the mean of 24.6days.2 The relatively short hospital stay in this study reflects early death in the deceased group and mild to moderate degree of injury among the survivors. This also could be due to early identification and treatment of the associated injuries. Patients with penetrating injuries were found to have shorter period of hospital stay compared to those who sustained blunt injuries. This could be due to less immediate complications among these patients or due to patients with penetrating injuries getting immediate surgical attention compared to those with blunt injuries who needed evaluations and investigations to assess their injuries. Fang et al. documented that delay in surgery of more than a day after the injury in patients with small bowel perforation did not increase mortality, but was associated with an increase in morbidity.29 Complications in our study were surgical site infections in 20.8%, sepsis in15.4%, pneumonia in 7.7% and wound dehiscence in 5.5% which is comparable to other studies.2,29 Reports have shown that mortality increases with increasing number of associated injuries which was noticed in this study too.8,30-33 There was 16.4% mortality in our series which was within range (4%-32%) of previously reported studies and was mostly due to peritoneal sepsis followed by bronchopneumonia and hemorrhagic shock.

## CONCLUSION

Hollow viscus injuries (HVIs) are uncommon and found in ~1% of all blunt abdominal trauma patients.35 Due to their rarity, experience with this injury is limited and no strong consensus exists in the literature regarding diagnosis and management of bowel injuries. Moreover, clinical and radiological diagnoses of these injuries are relatively difficult leading to undetected blunt HVI. Thus patients who might have otherwise been diagnosed at laparotomy, could potentially progress to sepsis, multiple organ failure, and death.

Most of our patients were male (88.1%) and the most affected was 21 to 40 years (60.44%) with a mean age of 31years. Blunt trauma (80.22%) due to road traffic accidents (42%) was the predominant cause of traumatic small bowel perforation. For most of the patients (52.6%), time elapsed between injury and surgical intervention was within 24 hours. Small intestine was the most common hollow viscus involved -- - 82.4%. Most common part of the small bowel affected was proximal jejunum (26.4%) with grade II injury (55.26%) being the commonest. Mesenteric injury was the most common associated injury noted (23.7%) in our study. As the age group affected was quiet young so comorbidity was not significant in our patients. Most common operative procedure performed was resection and anastomosis -- 37.36% of the perforation cases. Of the various documented complications, surgical site infections were the most common (20.8%) whereas sepsis had the most catastrophic consequences. Most of the patients were discharged in between 7 to14 days (39.4%). Mortality rate was 16.4%. In our study there is a positive co- relation between the length of hospital stay and the time of intervention since injury.

In summation, morbidity and mortality were mostly associated with advanced age, male sex, delayed presentation, higher grades of injury, other associated injuries and co-morbidities. HVI in Indian scenario first needs proper documentation. Prevention, optimum pre-hospital care along with appropriate management strategies will play an important role in reducing morbidity and mortality related to abdominal trauma.

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