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Original Research Article

Challenges in management of blunt abdominal trauma: a prospective study

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ABSTRACT

Background: Trauma meets the pandemic criteria, with a daily worldwide mortality as high as 16000. Abdominal trauma remains a leading cause of mortality in all age groups. Blunt abdominal trauma (BAT) mainly results from motor vehicle accident, fall from height and assaults. The commonest organ injured is the spleen, followed by the liver and small bowel. Lately, the management of BAT has changed from operative to non-operative management. This study was done to analyse the incidence, patterns, current management practiced, and challenges encountered in BAT treated operatively.
Methods: This Prospective study was conducted in tertiary care centre in Bangalore during August 2015 to December 2017. 475 patients with blunt abdominal injuries who reported to emergency department were selected for the study based on following inclusion and exclusion criteria.
Results: A total of 475 cases of BAT were assessed with a mean age of males and females was 32.6 and 28.3year respectively. Most patients (65%) were between 21 to 30 years of life. Most common mode of injury was motor vehicle accident (57.68%), 60% patients presented to hospital within the initial 4 hours. Abdominal CT had highest accuracy. Most common solid organ injury being spleen (26.5%). 80.84% patients were selected for SNOM and 15.62% had Failed SNOM. 28.48% patients had complications with most common complication wound infection followed by aspiration pneumonia and 7 patients had mortality.
Conclusions: Initial resuscitation with thorough clinical examination with correct usage of imaging modalities with timely and proper decision making is the key of management of patients with BAT and there is a need to identify newer imaging modality/procedure which helps to determine better management scheme in all blunt trauma patients.

Keywords: ATLS (Advanced trauma life support), BAT, MVA (Motor vehicle accidents), SNOM (Selective non-operative management)

INTRODUCTION

Trauma meets the pandemic criteria with a daily worldwide mortality as high as 16000.[1] Now a days abdominal trauma remains a leading cause of mortality in all age groups. Blunt abdominal injury (BAI) can result from road traffic accident (RTA), fall from heights and assaults. Trauma to the abdomen causes compression and crushing injury to abdominal viscera and pelvis leading to rupture of viscera with secondary haemorrage, contamination by visceral content and associated peritonitis. The most common organ injured is the spleen, followed by the liver and small bowel.[2] mortality is secondary to blood loss, peritonitis and delay in appropriate management. The availability of high quality computerized tomography scanning (CT) provides the ability to readily recognize and follow abdominal injuries hence during the last few decades, management of blunt

abdominal injuries has changed from operative management to selective non-operative management (SNOM).[3,4] The objective of this Prospective study was to document patterns of BAI, current management practiced, and outcome of the patients treated operatively.

METHODS

This Prospective clinical study was conducted in tertiary care centre attached to Bangalore medical college and research institute during the period between August 2015 and December 2017. 475 patients with blunt abdominal injuries who reported to emergency department were selected for the study based on following inclusion and exclusion criteria.

Inclusion criteria

- Age >18 years
- All gastrointestinal tract injuries (stomach, small intestine, large intestine, liver, spleen, diaphragm, mesentery).

Exclusion criteria

- Retroperitoneal injuries
- Associated chest/ head/ musculoskeletal injuries needing emergency surgical intervention.

Clinical data regarding patient demographics, mechanism of injury, hemodynamic status on presentation was noted. Basic investigations like complete hemogram, serology, abdominal ultrasonography, chest X-ray and erect X-ray abdomen were performed in all the cases. Patients with pneumoperitoneum on radiography and with signs of peritonitis were taken for exploratory laparotomy directly. Rest of the patients were divided into two main groups based on hemodynamic status at presentation as stable and unstable according to current Advanced Trauma Life Support (ATLS) protocols. Hemodynamically stable patient was further evaluated with CECT abdomen and pelvis and classified into those with solid organ injury and hollow viscus injury. The first were treated based on grading system by World Society of Emergency Surgery (WSES). Grade I to III were offered Selective Non-Operative Management (SNOM) and Grade IV managed surgically. Failed SNOM pateints were taken up for surgery the later group was treated surgically. Hemodynamically unstable patients were resuscitated. Post resuscitation stable patients were evaluated with CECT abdomen and pelvis and treated accordingly as described earlier. Those who continued to be unstable even after resuscitation were taken up for Surgery.

Indication of emergency laparotomy in our center was Hemodynamic instability Signs of peritonitis Pneumoperitoneum on radiograph. Patients with WSES grade IV solid organ injury and multi organ injuries. Epidemiological, clinical, radiological and surgical data was collected and tabulated. Age, sex distribution, time of presentation, pattern of injury, intraoperative findings, morbidity and mortality were noted.

RESULTS

Demographic profile

This study included 475 patients with blunt abdominal injury out of which 421 (88.64%) were males and 54 (11.36%) were females. Male: female ratio was found to be 9.2:1 (Figure 1). The mean age of involvement males was 32.6 years and in females 28.3 years and the predominant group of involvement in both was 21 to 30 years (40 %) followed by 31 to 40 years (23 %) (Figure 2).

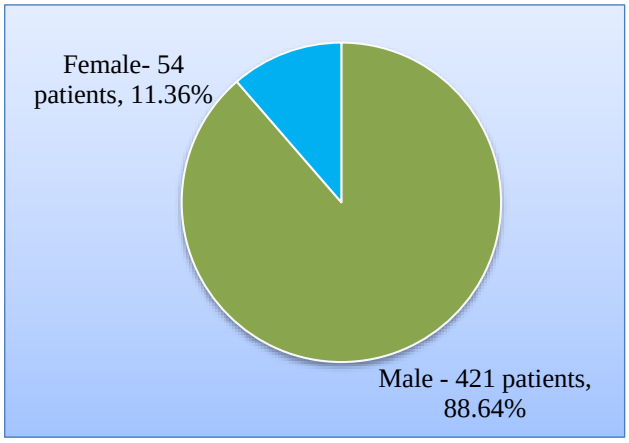

Figure 1: Male: female ratio in blunt injury abdomen.

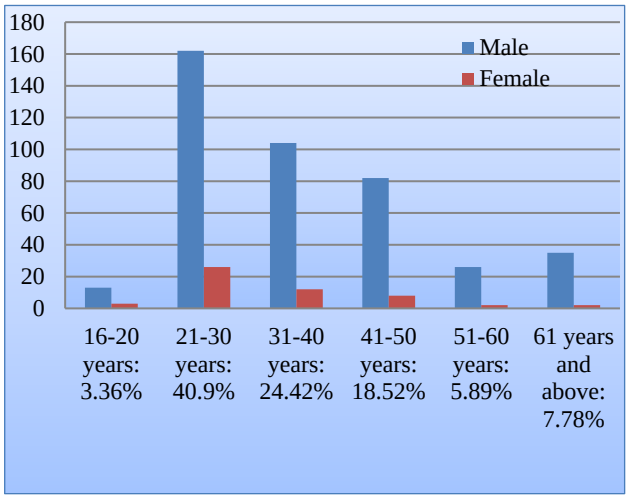

Figure 2: Age of involvement in blunt injury abdomen.

Epidemiological factors

When examining the mechanism of abdominal trauma in patients, the following results were obtained tabulated in (Table 1).

Table 1: Mechanism of injuries.

Mechanism of injury	No. of patient	Percentage
Road traffic accident	274	57.68
Fall from height	120	25.26
Assault	52	10.94
Sports injury	15	3.16
Fall of heavy object on abdomen	9	1.89
Bull gore injury	5	1.05

Time of presentation

More than 60 % patients presented to hospital within the initial 4 hours. Patients referred from other hospitals and patients with isolated organ injuries presented even as late as 1week 2 days with increased morbidity. The mean time from injury to surgery was 13 hours 45 minutes, ranging from 20 minutes to 1 week 2 days. Earlier the presenting time, management and outcome of the patient was better (Table 2).

Clinical presentation

Symptoms

- Pain abdomen- 460 cases (96.84%)
- Musculoskeletal pain-386 Cases (81.26%)
- Nausea and vomiting -320 cases (67.36%)
- Bruising of the external abdomen 142 cases (29.89%)
- Difficulty in breathing- 86 cases (18.10%)

Signs (percentages)

- Abdominal tenderness- 456 cases (96 %)
- Guarding- 370 cases (77.89 %)
- Rigidity- 211 cases (44.42 %)
- Rebound tenderness- 210 cases (44.23%)
- Abdominal distension-120 cases (25.26%)
- Signs of hypovolemic shock-119 cases (25.05%)
- Diminished bowel sounds- 46 cases (9.68%)

Associated extra abdominal injuries requiring no surgical intervention

- Head injury-116 cases (24.42%)
- Rib fractures- 97 cases (20.42 %)
- Pelvic fracture- 77 cases (16.21%)
- Long bone fractures-57 cases (12%)

Table 2: Time of presentation-time from incident to hospitalization.

Duration of Presentation	No. of Patient	%
<1 hour	89	18.73
1-24 hour	285	6
24-48 hour	50	10.52
>48 hour - 1 Week	42	8.84
>1 Week	9	1.89
Total	475	100

Table 3: The different radiological modalities used in study and their sensitivity and specificity.

Test	No. of patients	Results	Sensitivity %	Specificity %
Erect X ray abdomen	475	Pneumoperitoneum-36	72	100
USG Abdomen and pelvis	460	Hemoperitoneum-350	76.08	92.68
		Solid organ Injury 332	79.04	90.26
CECT Abdoen and	384	Spleenic injury-159	94.26	97.44
		Hepatic injury-169		
Pelvis		Pneumoperitoneum-30		

Table 4: The percentage of patients treated in SNOM (selective non-operative management) and patients taken up for direct exploratory laparotomy.

Abd organ injury	Total No. of patients	No. of patients selected for SNOM	Failed SNOM	Direct exploratory laparotomy
Spleen	225	169 /225 patients (75.1%)	18/169 patients (10.65%)	56 patients (24.8%)
Liver	200	180/200 patients (90%)	10/180 patients (5.55%)	20 patients (10%)
Hollow Viscera	50	35/50 patients (70%)	32/35 patients (91.44%)	15 patients (30%)
Total	475	384/475 patients (80.84%)	60/384 patients (15.62%)	91 patients (19.16%)

Imaging

Abdominal Ultrasonography was done in 460 cases (96.84%) and showed hemoperitoneum in 350 cases (76.08% sensitivity, 92.68% specificity) and Solid Organ Injury in 332 patients (79.04 % sensitivity, 90.26% specificity).

Erect X-ray abdomen and Chest radiograph showed air under diaphragm in 36 cases (72% sensitivity, 100% specificity). CECT Abdomen and pelvis was done in 384 hemodynamically stable cases and showed splenic injury in 159 cases (low grade -151, high grade- 8). Hepatic injury in 169 cases (low grade- 164, high grade -5), pneumoperitoneum in 30 cases with a sensitivity of 94.26 % and specificity of 97.44% (Table 3).

Treatment approach

Out of total 475 patients selected for the study, based on their clinical condition 384 patients (80.84% of total cases) were taken for conservative management- SNOM, of which 60 patients failed (15.62% of SNOM patients).

Table 4 depicts the number of patients selected for SNOM with respect to the abdominal organ injured and their failure rates.

Remaining 91 patients (19.16% of total cases) required surgical intervention immediately and were taken for surgery directly. (Table 4)

Intra-operative findings and procedures performed

A total of 151 patients (31.78%) were taken for surgery which included patients taken for direct exploratory laparotomy- 91patients (19.15% of total cases) (60.26% of operated cases) as well as failed SNOM- 60 patients (39.74 % of operated cases) (12.63% of total cases).

Table 5: The intra-operative findings and procedures performed.

Type of organ	Injured organ	No .	% out of operated cases	Procedure done	No	%
Solid organ	Isolated spleen	69	45.69	Spleenectomy	69	100
	Isolated liver	26	17.21	Packing	26	100
Gastrointestinal tract	Total HVI	47				
	Stomach	1	0.66	Primary repair with grahams omental patch	1	100
	D-J Flexure	1	0.66	Primary repair	1	100
	Jejunum	17	11.25	Primary repair	15	88.23
				Resection and anastamosis	2	11.77
				Iliostomy	2	11.77
	ileum	21	13.90	Primary repair	17	80.95
				Resection and anastamosis	4	19.04
				Diversion Iliostomy	6	28.57
	Ascending colon	1	0.66	Primary repair with diversion iliostomy	1	100
	Transverse colon	1	0.66	Resection and anastomosis with diversion Colostomy	1	100
	Sigmoid colon	1	0.66	Primary closure with diversion Colostomy	1	100
	rectum	1	0.66	Primary repair with diversion Colostomy	1	100
Multi organ injuries	Liver+spleen	3	1.98	Splenectomy + packing	3	100
	Liver HVI	1	0.66	Packing of hepatic laceration + primary closure of perforation	1	100
	Spleen+HVI	2	1.32	Spleenectomy +prinary closure of perforation		100
Other associated injuries	diaphragm	1	0.66	Primary repair		100
	Mesenteric tear	62	41.05	Repair		100

Table 5: The frequency of individual organ damaged and the procedures performed.Splenic injury was reported in 74 cases (49% of operated cases) of which isolated Splenic injury was seen in 69 cases for which splenectomy was done in 69 cases, associated hepatic injury was seen in 3 cases for which splenectomy with hepatic packing was done and associated. Hollow visceral injury was seen in 2 cases for which Splenectomy with primary closure of perforation was done.Hollow visceral injuries was seen in 47 cases (31.13% of operated cases) of which gastric perforation was seen in 1 case for which primary closure with grahams omental patch was done.

Table 6: The Mortality associated with different injuries.

Injury	No. of patient died		Cause of death
	Operated immediately	Failed SNOM	
Spleenic injury	2	1	Hypovolemic shock- 2
			ARDS -1
Hepatic injury	2	0	ARDS -1
			DVT/pulmonary embolism-1
Hollow visceral injury	1	5	Septicemic shock -5
			ARDS-1
Total	5	6	Hypovolemic shock- 2
			ARDS-3
			DVT/pulmonary embolism- 1
			Septicemic shock -5

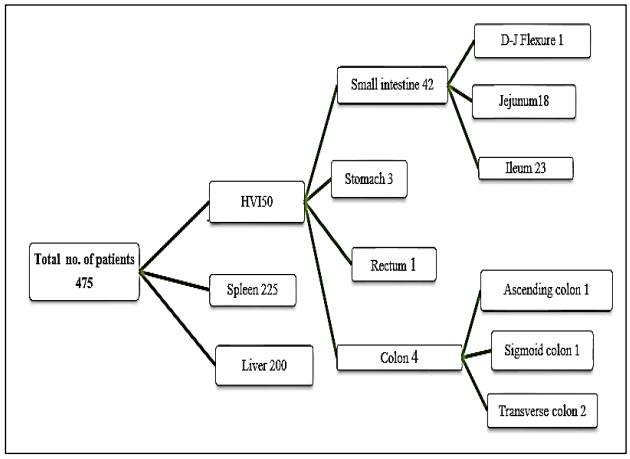

Figure 3: The spectrum of different organs injured in blunt injury abdomen.

Isolated small bowel injury was seen in 39 cases (D-J Flexure- 1, Jejunum-17, ileum-21) for which primary closure was done in 35 cases, resection and anastamosis was done in 6 cases associated with bowel gangrene and multiple perforations, diversion procedures was performed in 8 cases.

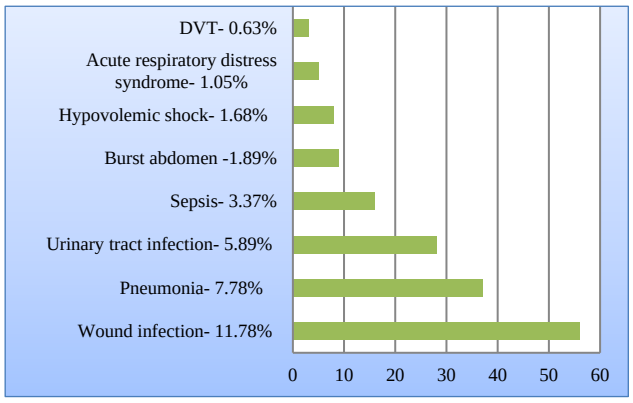

Figure 4: Complications associated with management of blunt injury abdomen patients.

Isolated large bowl injury was seen in 4 cases (Ascending colon-1, Transverse colon-1 Sigmoid colon-1, rectum-1) for which primary closure was done in 3 cases and resection and anastomosed was done in 1 case, colostomies was done in 3 cases.

Hepatic injury was reported in 30 cases (19.87 % of operated cases) of which isolated hepatic injury was seen in 26 cases for which packing was done, associated splenic injury was seen in 3 cases for which splenectomy with hepatic packing was done and associated Hollow visceral injury was seen in 1 case for which hepatic packing with primary closure of perforation was done. Figure 3 shows the spectrum of different organs injured in blunt injury abdomen in the present study.

All patients received prophylactic injectable antibiotic before surgery and antibiotics were continued for 7-10 days postoperatively. Splenectomies patients were given *Pneumococcal* vaccine within 24hours of surgery followed by *Meningococcal* and *Hib* vaccines after 2 weeks.

Outcome

Out of 475 cases selected for the study, 340 cases (71.50% of total case) had uneventful course on hospital and discharged home in good general condition. Complications (Figure 4) were encountered in 135 cases (28.48%) of which mortality (Table 6) related to septicemic shock, hypovolemic shock and ARDS was seen in 11 cases (2.31% of total cases).

DISCUSSION

This study shows the frequency, cause, clinical presentation, pattern of intra-abdominal organ injured, current management practiced, outcome of the patients and challenges encountered in management of blunt abdominal injury in a tertiary care centre.

Present study established that the number of abdominal injuries was higher among the young male population with a male to a female ratio of 9.2:1, similarly a previous study conducted in South Asia by Lone GN et al. done demonstrated a higher male predominance with male to female ratio of 4.4:1.[6] Further present study showed that the higher proportion of patients who sustained abdominal injuries were in their most productive age (21 to 30 years -40 %) which correlated with a recent study conducted in Egypt by Gad MA et al. and other similar studies.[7-12]

Road traffic accident was the most common mechanism of abdominal trauma followed by fall from height which correlates with earlier studies.[7,13] This is due to the rapid increase in the usage of automobiles and increasing number of constructions posing financial burden on the healthcare system of county.

Table 7: Comparison with different studies.

Parameters	Present study	Lone GN, Peer GQ et al.[6]	Gad MA, Saber et al.[7]	Smith J, Caldwell et al.[18]
M:F Ratio	9.2:1	3:1	6:1	8.6:1
Age (21 to 30)	40.1 %	38%	36%	-
MOI-accidents	58%	42%	62.8%	61%
Organs injured				
Spleen	29%	35%	-	32%
Liver	16%	25%	-	36%
Mortality	2.1%	8.2%	8.2%	3%

Among patients with multiple trauma, abdomen is the third most frequently injured body part next to musculoskeletal injury and head injury.[14]

In present study spleen was found to be the most common injured abdominal organ followed by liver and hollow visceral injury, similarly several studies have reported spleen to be the most common organ injured.[14-17] However, a few studies have reported liver to be the most common injured solid organs followed by spleen in blunt abdominal trauma.[18-20]

Although, hollow viscous injuries after blunt trauma are rare, it remains the third most common injured organ with an incidence of 10.52% of all blunt trauma cases which correlated with study conducted by Costa et al.[21,22]

Among all the cases of blunt abdominal trauma taken for exploratory laparotomy, about 31.12% was due to hollow visceral injury which correlated with the study conducted by Hildebrand et al. which reported an overall incidence of hollow viscous injuries to be 21% in blunt abdominal trauma patients requiring laparotomies.[23]

This increase in overall incidence of laparotomies due to hollow visceral injury was because of increased failure rate of SNOM in hollow visceral injury (97.14% failure rate) compared to failure rates of SNOM in spleen and liver (5.16%, 5.6% respectively).

The most common complication in present study was found to be wound infection with an incidence of 11.8% of the total cases. The overall incidence of sepsis was 3.36 %, which is relatively comparable to that reported by Osborn et al., where the incidence of sepsis was 2% and the most common cause of mortality was found to be septicemic shock accounting for 45.45% of total deaths.[24] Table 7 shows the Comparison of present study with different studies.

CONCLUSION

Trauma predominantly affects male population in their most productive age and hence eventually poses economic burden to national economy as well as on families. Initial resuscitation with correct clinical and radiological assessment and timely management is the most important step in the management of blunt abdominal injury. Shorter the time interval between trauma to intervention, better was the patient outcome. It is proved beyond doubt that nonoperative management is best in hemodynamically stable patients and patients with isolated, low grade solid organ injury, prompt evaluation of abdomen with frequent monitoring for signs of peritonitis and hemodynamic instability increases nonoperative management and minimizes unwanted laparotomies and morbidity associated with it. Hence SNOM has widely replaced operative management in isolated solid organ injuries, but still failure rates of SNOM is higher in hollow visceral injury and needs high suspicion and prompt surgical intervention.

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