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Original Research Article

A study to assess the 30 days outcome of penetrating injuries to the abdomen

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ABSTRACT

Background: Abdominal trauma is among the leading causes of morbidity and mortality in all age groups in the world. Many injuries may not manifest during the initial assessment and treatment period. The study was conducted to determine the different characteristics of the patients with abdominal trauma, to analyse the extent of organ involvement and to determine the surgical interventions done for the same and to understand the morbidity caused by various operative procedures, especially due to negative laparotomy.
Methods: A descriptive, prospective, hospital-based study involving observation of patients from admission to final outcome of management at discharge or death was carried out. Consecutive admissions of 54 patients with abdominal injuries attended to at the department of surgery, Lokmanya Tilak Medical College, Sion, Mumbai were enrolled in the study. The study was conducted from September 2013 to September 2015. The data were analyzed using SPSS software.
Results: 54 patients were enrolled in the study. Male to female ratio was 5.75:1. Mean age was 29.31 years. Majority of the patients (83.33%) were affected with homicidal stab wounds. The object causing penetrating injury was most commonly a knife, which was used in 44 patients (81.5%). Thirty patients (55.55%) had isolated penetrating injuries to the abdomen whereas 24 patients (44.45%) had associated injuries. Amongst the stab wounds, the commonest site of injury was the umbilical region. The average systolic BP was measured in all the patients. The mean revised trauma score of all patients was 7.66. The contingency values of patients undergoing chest X-ray, FAST, CT scan and peritoneal breach v/s patients undergoing exploratory laparotomy were noted. Primary closure of jejunal perforation (12.5%) and gastric perforation (12.5%) were the most common operative procedures done. Jejunum was the most frequently damaged organ in most of the patients. The average penetrating abdominal trauma index of the patients was 6.77. The operative time, time spent on ventilator, days stayed in ICU, length of hospital stay, time taken by the patients to walk , to sip and to remove mid line suture were noted.
Conclusions: Increased efforts to repair early are likely to reduce the incidence and mortality in patients with abdominal trauma. Selective non operative management can be practiced in tertiary care centers but its benefits must be weighed against the risk of missed injuries.

Keywords: Abdominal trauma, Conservative management, Exploratory laparotomy, Morbidity score

INTRODUCTION

Trauma is the most frequent cause of death in the first four decades of life, and it remains a major public health problem in every country, regardless of the level of socioeconomic development.[1] The abdomen is the third most common injured region, with surgery required in about 25% of civilian cases.[2,3] Penetrating abdominal trauma typically involves the violation of the abdominal cavity by a gunshot wound or stab wound. It is on the rise

because of growth of violence in our society which mostly involves the younger, productive age group. Appropriate and expeditious assessment and investigation of individuals with traumatic injury facilitate definitive management and minimize the risk of complications.[4,5]

There are a number of factors that determine outcome in abdominal trauma, therefore this study was aimed to determine the age and gender pattern, mode and mechanism of injury, associated injuries and the use of various investigations to diagnose penetrating trauma to the abdomen, referral systems and resuscitative protocols used, to analyse the extent of organ involvement and to determine the surgical interventions done for the same, to find out the mortality and causes of early and late mortality as well as the factors associated with mortality and to understand the morbidity caused by various operative procedures, especially due to negative laparotomy.

METHODS

A descriptive, prospective and unicentric hospital based study of patients with abdominal trauma was undertaken over a period of two years from September 2013 to September 2015 at the department of surgery, Lokmanya Tilak Medical College, Sion, Mumbai. Demographic information, mechanism and severity of injury, delay before hospitalization and surgery, clinical presentation, management, outcome and number of deaths were all documented. 54 patients with penetrating trauma to the abdomen admitted to the trauma ward were included in the study.

Exclusion criteria were patients with penetrating abdominal trauma who are not willing to participate in the study and patients found dead on arrival.

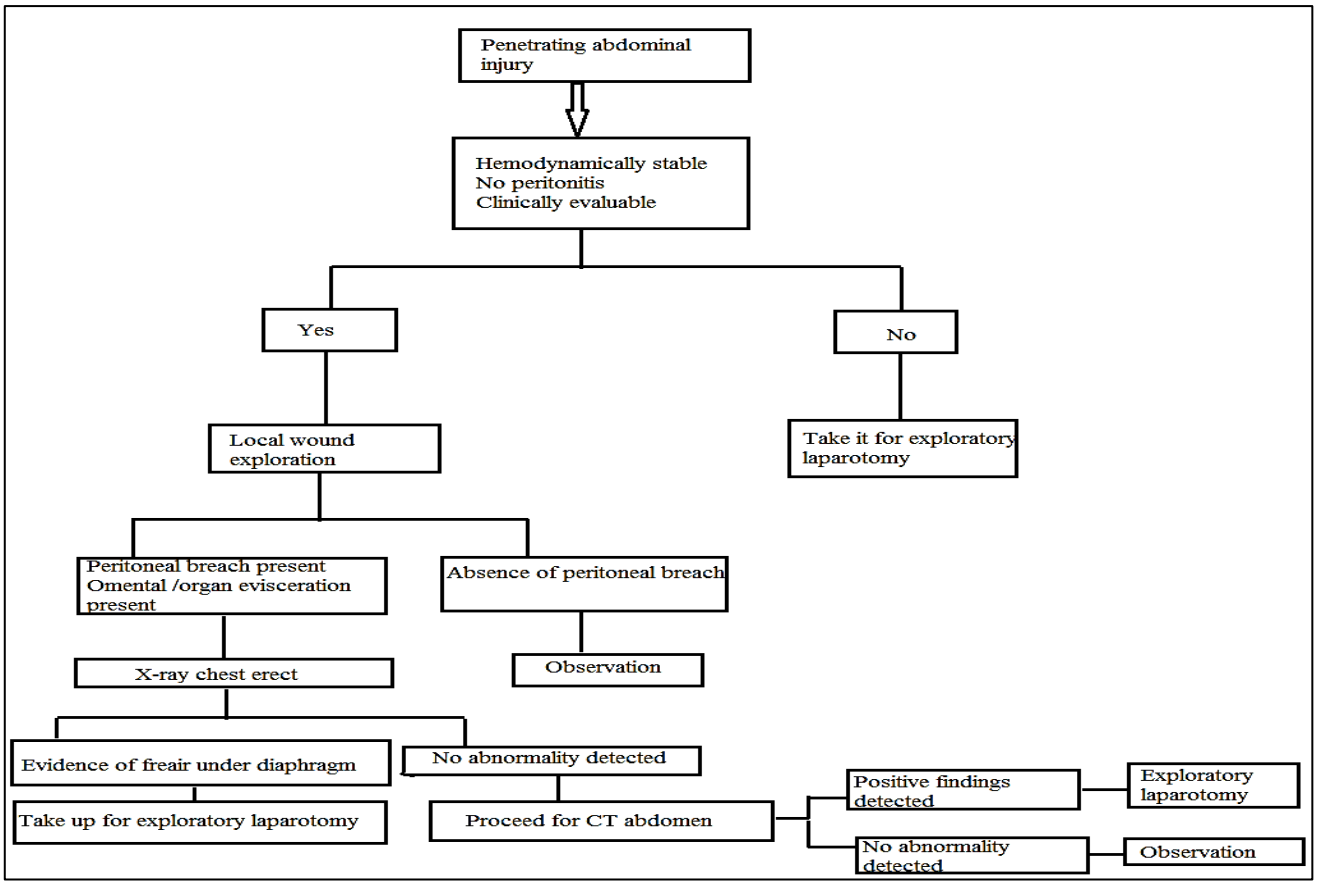

Figure 1: Study flowchart.

A policy of selective conservative management was adopted. Patients with peritonitis or shock (systolic blood pressure of 90 mmHg or less) on initial clinical examination underwent laparotomy after resuscitation without further investigation. In general the following algorithm as shown in Figure 1was followed for the evaluation and management of abdominal stab injuries in the present study.

Data were analyzed using the Statistical Package for the Social Sciences (SPSS), for Windows (release 10.0.1; SPSS Inc., Chicago, IL, USA). A p value <0.05 was taken as significant.

RESULTS

54 patients were selected for the study with male to female ratio of 5.75:1 from which maximum of cases were in 16-30 age group (68.5%). Mean age was 29.31 years. The most common cause of penetrating trauma found was stab wounds; out of which majority were homicidal in 45 patients (83.33%). The object causing penetrating injury was most commonly a knife, which was used in 44 patients (81.5%). Thirty patients (55.55%) had isolated penetrating injuries to the abdomen whereas 24 patients (44.45%) had associated injuries. Some patients had more than one associated injury with a total number of 34 associated injuries as presented in Table 1.

Table 1: Characteristics of the patients with abdominal trauma.

Characteristics	Frequency (%)
Age in years	
0-15	2 (3.7)
16-30	37 (68.5)
31-45	12 (22.2)
>45	3 (5.6)
Gender	
Male	46 (85.2)
Female	8 (14.8)
Mode of injury	
Homicidal stab	45 (83.3)
Accidental stab	5 (9.26)
Self-inflicted stab	4 (7.41)
Gunshot wounds	0 (0)
Objects causing injury	
Knife	44
Unknown	3
Others	
Scissors/Fence/construction rod/glass objects)	7
Associated injuries	
Chest	10 (29.4)
Limb	14 (41.17)
Head	9 (26.47)
Neck	1 (2.96)

Some patients had multiple penetrating injuries to the abdomen. Our study had 64 sites of penetrating injuries in the nine regions of the abdomen. Amongst the stab wounds, the commonest site of injury was the umbilical region, which was found 14 times (21.9%) as given in Table 2.

Figure 2 represents that 11 out of 54 patients were under influence of alcohol at the time of the injury. 9 (16.66) out of 11 patients were under influence of alcohol whereas 2 (3.7) were under influence of illicit substances. Out of 11 patients under influence, 7 were homicidal stab wounds, 2 were suicidal stab wounds and 2 were accidental stab wounds as produced in Table 3. The association between homicidal stab wounds and patients under influence of alcohol was not statistically significant (P = 0.1897).

Table 2: Nine regions of the abdomen with percentage of total number of abdominal injuries in each region.

Region	Frequency (%)
Left hypochondrium	13 (20.3)
Epigastrium	12 (18.75)
Right hypochondrium	6 (9.37)
Left lumbar	8 (12.5)
Umbilical	14 (21.9)
Right lumbar	5 (7.8)
Left iliac fossa	4 (6.25)
Hypogastrium	0 (0)
Right iliac fossa	2 (3.13)

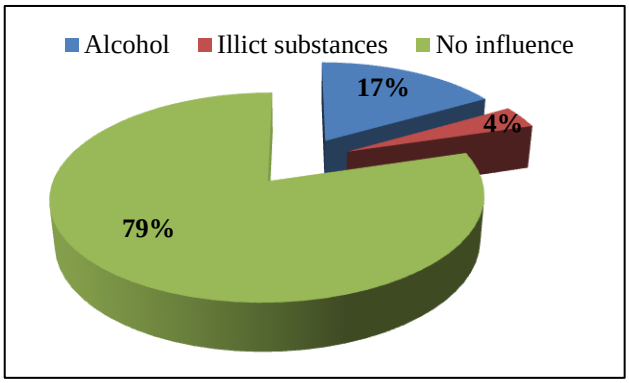

Figure 2: Frequency of patients under influence of alcohol/ illicit substances.

Table 3: Association between influence of illicit drugs/ alcohol and homicidal/suicidal stab wounds.

	Accidental stab wounds	Homicidal and suicidal stab wounds	Total
Patients under influence	2	7	9
Patients not under influence	3	42	45

In this study, 32 patients (57.4%) were first seen and then discharged, referred or transferred from another private/ public hospital whereas 22 (42.6%) patients came directly to our hospital as given in Table 4. The average systolic BP of patients transferred/ referred / discharged from other centres was 103.3 mmHg and the average systolic BP of patients arriving directly to our centre was 115.6. Out of 32 patients arriving from other centres, 8 were hypotensive

(systolic BP ≤ 90 mm Hg), and amongst 22 patients arriving directly to the centre, 3 were hypotensive. The association between arrival from other centres and hypotension was not found to be statistically significant (P =0.4302).

Table 4: Patients transferred from other centres/ referred/ discharged with average GCS and systolic BP.

	Frequency (%)	Average systolic BP	Average GCS
Transferred/ referred/ discharged from other centres	31 (59.25)	103.3	14.8
Direct arrival	23 (40.75)	115.6	14.5

36 patients (66.67%) arrived to the hospital by an ambulance and the rest 18 (33.33%) patients arrived by a private vehicle. The average time taken from the time of injury to the time of arrival to our hospital was 5.15 hours. The average time take for patients transferred/ referred/ discharged from other hospitals was 6.96 hours whereas the average time taken for patients arriving directly was 2.52 hours as shown in Figure 3.

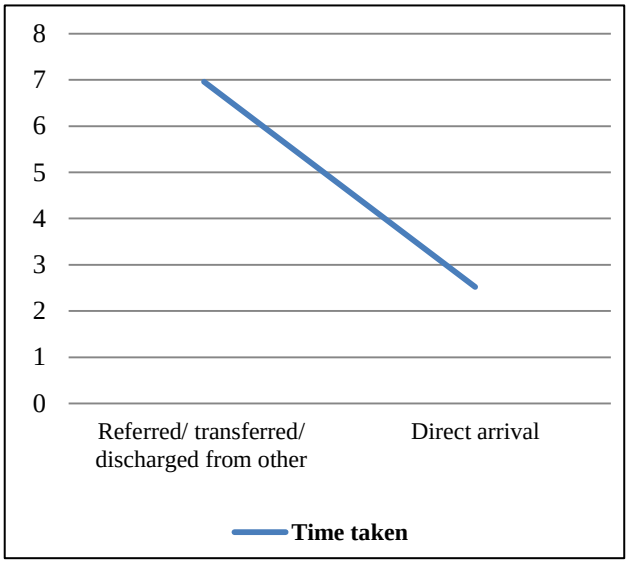

Figure 3: Average time between injury and arrival taken by patients referred/ transferred/discharged from other hospitals and those arriving directly to the centre.

Table 5: Clinical presentation of patients with penetrating trauma to the abdomen.

	Mean	Mode	Range	Standard deviation
Heart rate	100.44	100	56 to 140	14.75
Systolic BP	106.29	110	60 to 130	15.6
Respiratory rate	22.79	20	18 to 30	3.72
GCS	14.64	15	6 to 15	1.41

Table 6: Relationship between mortality and hypotension.

Status	Hypotensive	Non-hypotensive	Total
Dead	2	1	3
Not dead	10	41	51
Total	**12**	**42**	**54**

Table 5 demonstrates the clinical presentation of patients with penetrating trauma to the abdomen. The average heart rate of patients presenting with penetrating trauma to the abdomen was 100.44, average systolic blood pressure was 106.29, average respiratory rate was 22.79 and average GCS of patients with penetrating abdominal trauma was 14.64.

In the present study out of 54, 3 of the patients with abdominal trauma were dead. Of them, 2 were hypotensive and 1 was non-hypotensive and the difference between them was not significant (P =0.1206) as given in Table 6.

The mean revised trauma score (RTS) of all patients was 7.66. The difference between the RTS of patients managed conservatively and patients undergoing operative procedure were found to be non-significant (P = 0.2164).

The patient who expired before operative procedure was excluded and the difference between the RTS of patients who were discharged and those who died was found to be statistically significant (p <0.0001) as given in Table 7.

Table 8 presents the laboratory investigations of the patients with abdominal trauma. The average haemoglobin of patients presenting to the emergency ward was 12.71 and the mean value of creatinine on admission was 1.06.

Table 7: The difference between the RTS of patients survived and died after conservative management and by operation.

	Patients managed conservatively	Patients taken up for exploratory laparotomy	Patients who were discharged	Patients who died
Average mean	7.678214	7.840800	7.4581652	6.3186667
Standard deviation	0.407702	0	0.1204798	1.3803766
Standard error of mean	0.062174	0	0.0170384	0.7969608
N	43	10	51	3

Table 8: Laboratory investigations of patients presenting with penetrating abdominal injury.

Laboratory investigations	Average	Highest value	Least value	Standard deviation
Haemoglobin	12.71	6.8	16.8	2.36
Creatinine	1.06	3.63	0.6	0.505

Table 9: Contingency table of patients undergoing X-ray chest erect, FAST, CT scan and local wound exploration versus patients undergoing exploratory laparotomy.

Contigency values	Positive findings on exploration	Negative findings on exploration/ non operative management
X-ray chest erect versus exploratory laparotomy		
Positive findings on X-ray	2	0
Negative findings on X-ray	11	14
FAST examination versus exploratory laparotomy		
Positive findings on FAST	4	0
Negative findings on FAST	2	10
CT abdomen versus exploratory laparotomy		
Positive findings on CT scan	3	0
Negative findings on CT scan	0	6
Local wound exploration versus exploratory laparotomy		
Peritoneal breach present	35	16
Peritoneal breach absent	0	3

Table 9 explores the contingency values of patients undergoing chest X-ray, FAST, CT scan and peritoneal breach v/s patients undergoing exploratory laparotomy. Out of the 54 patients, 31 (57.4%) patients got X-ray chest in erect position and 23 patients did not undergo X-ray chest (42.6%). 2 patients (3.7%) had X-ray findings suggestive of gas under diaphragm for which they underwent immediate exploratory laparotomy. 25 patients (46.29%) had no abnormality detected in X-ray, of which 11 patients (20.37%) had positive findings on exploratory laparotomy on X-ray. 10 patients (18.5%) did not undergo surgery and 4 patients (7.4%) underwent negative exploratory laparotomy. positive predictive value of X-ray in predicting positive findings on exploration was 100% whereas the negative predictive value was 56%. The sensitivity of X-rays was 15.38% and specificity was 100%. The accuracy was 59.25%.

Sixteen patients (29.6%) underwent FAST examination on admission. 38 patients did not undergo FAST examination (70.4%). 12 out of 16 patients had no abnormality detected on FAST examination (22.22%), whereas 4 patients had positive findings on FAST (7.4%). All 4 patients with positive findings on FAST underwent exploratory laparotomy and had positive findings on exploration. 2 patients (3.7%) out of the 12 patients with no abnormality detected on FAST underwent exploratory laparotomy with positive findings on exploration. The rest of the 10 patients (18.5%) with no abnormality detected on FAST did not undergo exploration. The positive predictive value of FAST was 100% and negative predictive value was 83.33%. The sensitivity was 66.67% whereas specificity was 100%. The accuracy was 87.5%.

Nine patients (16.67%) had CT scan of the abdomen done, of which 3 patients had positive findings on CT scan (5.55%). 45 patients did not undergo CT abdomen (83.33%). 6 patients had no abnormality detected on CT (11.11%). These 6 patients did not undergo exploratory laparotomy and were discharged after observation. 3 patients had positive findings on CT for which they underwent exploratory laparotomy and were found to

have positive findings on exploration. In our study, the sensitivity, specificity, positive predictive value, negative predictive value and accuracy of CT abdomen was 100%.

All patients with penetrating wounds to the abdomen underwent local wound exploration. Out of 54 patients, 38 had only peritoneal breach on LWE. All cases with omental pouting or bowel pouting were considered to have positive peritoneal breach. 12 patients were found to have omental pouting and 1 patient was found to have bowel pouting. Hence, the total number of patients with peritoneal breach were found to be 51 (94.44%). 3 patients (5.55%) did not have peritoneal breach on LWE and were managed conservatively, after investigations. Out of 51 patients with peritoneal breach, 8 patients were managed conservatively of which 7 patients were observed and discharged and 1 patient died pre-operatively. 43 patients underwent exploratory laparotomy of which 35 had positive findings and 8 were negative explorations. The sensitivity of local wound exploration with peritoneal breach is 100%, specificity is 18.75%, positive predictive value is 68.6%, and negative predictive value is 100%. The accuracy of local wound exploration with peritoneal breach is 70.3%.

Table 10: Different operative procedures done on patients undergoing exploratory laparotomy.

Procedures done	Parts involved	Frequency (%)
Primary closure	Diaphragm	4 (8.33)
	Gastric perforation	6 (12.5)
	Duodenal perforation	2 (4.16)
	Jejunal perforation	6 (12.5)
	Ileal perforation	2 (4.16)
	Colonic perforation	5 (10.41)
	Mesenteric rent	4 (8.33)
Resection anastomosis	Jejunum	5 (10.41)
	Ileum	0 (0)
Stoma creation	Jejunostomy	2 (4.16)
	Ileostomy	1 (2.08)
	Colostomy	3 (6.25)
Splenectomy		1 (2.08)
Splenorrhaphy		1 (2.08)
Liver packing		5 (10.41)
Cholecystectomy		1 (2.08)
Total		**48 (100)**

In this study 28 patients (51.85%) went to the operation theatre within 1 hour of admission. 8 patients (14.8%) received blood within 1 hour of admission. 0.22 were the average number of blood units received in 1 hour of admission, the maximum being 2 and the minimum being 1. The average numbers of blood units received in 24 hours were 0.907. The maximum units of blood received in 24 hours were 6, minimum being 1.

Various operative procedures done on exploratory laparotomy of patients with penetrating trauma to the abdomen. Primary closure of jejunal perforation (12.5%) and gastric perforation (12.5%) were the most common operative procedures done. 6 patients (11.11%) underwent creation of a stoma, of which colostomy (6.25%) was the most common stoma created of the patients as shown in Table 10.

Table 11: Details of the organs involved due to penetrating trauma.

Organ involved	Frequency (%)
Diaphragm	4 (7.4)
Liver	6 (11.11)
Gall bladder	2 (3.7)
Spleen	3 (5.55)
Stomach	7 (12.96)
Small intestine	
Duodenum	2 (3.7)
Jejunum	11 (2.03)
Ileum	5 (9.25)
Colon	6 (11.11)
Kidney	1 (1.85)
Retro peritoneal vessels	2 (3.7)
Mesentery	10 (18.5)

In the present study intraoperative findings observed were active bleeding/ perforation/ haematoma in a solid organ/s, hollow viscus or the mesentery. Jejunum was the most frequently involved organ followed by mesenteric injuries and injuries to the stomach. The least frequently involved organ was the kidney as shown in Table 11.

Table 12: The PATI of patients who were operated and those managed conservatively.

	Patients taken up for exploratory laparotomy	Patients managed conservatively
Mean	8.56	0
Standard deviation	7.33	0
Standard error of mean	1.12	0
n	43	10

In the present study the average penetrating abdominal trauma index (PATI) of the patients was 6.77. The highest PATI score was 27, whereas the lowest was 0 as shown in Table 12. The difference between PATI of patients operated and those managed conservatively was statistically significant ($p < 0.0003$).

Table 13 explains the operative time and time spent on ventilator by the patients with abdominal trauma. The average operative time taken was 1.4 hours. Out of 54 patients, 44 patients were on ventilator support, which included the operation time. 10 patients were not on ventilator anytime during their course of stay in the ward.

Table 13: Operation time and time spent on ventilator support by patients of penetrating trauma to the abdomen.

	Average time	Minimum time	Maximum time	Mode	Standard deviation
Operation time (in hours)	1.4	1	3.5	1	0.95
Time spent on ventilator (in hours)	8.15	0.15	96	0	16.14

Table 14: The frequency of each day of ICU stay.

Days of ICU stay	Frequency	Percent	Valid Percent	Cumulative Percent
0.01	1	1.9	1.9	1.9
0.02	1	1.9	1.9	3.7
0.17	2	3.7	3.7	7.4
0.25	7	13.0	13.0	20.4
0.50	3	5.6	5.6	25.9
1.00	26	48.1	48.1	74.1
2.00	7	13.0	13.0	87.0
3.00	5	9.3	9.3	96.3
10.0	1	1.9	1.9	98.1
12.0	1	1.9	1.9	100.0
Total	**54**	**100.0**	**100.0**	

Table 15: Time taken by the patients to be ambulatory and started on sips.

	Average time	Minimum time	Maximum time	Mode	Standard deviation
Time taken to be ambulatory (in days)	2.75	1	9	2	1.97
Time taken to start on sips (in days)	3.92	1	28	2	4.22

Table 16: Time days to remove drains postoperatively and to get discharge.

	Average time	Minimum time	Maximum time	Mode	Standard deviation
Time taken to remove drains (in days)	6.53	3	32	4	4.2
Time taken to get discharge (in days)	6.85	2	36	4	5.94

Table 14 describes the number of days stayed in ICU by the patients. The average number of days spent in the emergency ward were 1.5 days, the maximum being 12 days and the minimum being 20 minutes. Most patients (26) spent 1 day in the emergency ward. Table 15 explains the time taken for the patients in days to to get up and walk out of their bed and to be started on sips.

Table 16 describes the number of days taken for drains to be removed postoperatively and the average number of days after which the patients were discharged. In this study various complications were faced by 24 patients (44.44%) of penetrating trauma during their course of stay in the ward. Some patients faced multiple complications. Wound infection was the commonest complication faced by patients followed by urinary tract infection. Patients discharged with a stoma faced prolonged morbidity till stoma closure. 1 patient had anastomotic leak for which he was re-explored as given in Table 17.

Table 18 illustrates time taken for midline suture removal. Out of the 51 patients discharged, 42 patients were operated and underwent midline suture removal. The average time taken for midline suture removal was 12.83

days. One patient having wound gape underwent suture removal after 30 days after secondary suturing of the midline wound. Wound infection led to prolonged time for suture removal.

Table 17: Complications faced by patients with penetrating abdominal trauma.

Complications	Frequency (%)
Wound infection	7 (12.96)
Wound gape	2 (3.7)
Post-op fever	2 (3.7)
Paralytic ileus	2 (3.7)
Urinary tract infection	5 (9.25)
Chest infection	5 (9.25)
Stoma prolapse	1 (1.85)
Peristomal excoriation	1 (1.85)
Anastomotic leak	1 (1.85)

Table 18: Time taken for midline suture removal of patients with penetrating abdominal trauma.

Ave. time (days)	Min. time (days)	Max. time (days)	Mode (days)	SD (days)
12.83	7	30	10	4.68

Table 19: Morbidity score based on various parameters.

Score	Frequency	Percent	Valid Percent	Cumulative Percent
Length of ventilator support (hours)				
up to 1 day (1)	21	38.9	38.9	38.9
1 - 5 day (2)	20	37.0	37.0	75.9
3 > 5 day (3)	13	24.1	24.1	100.0
Total	**54**	**100.0**	**100.0**	
Length of stay in the ICU (in days)				
<1(1)	14	25.9	25.9	25.9
1 day (2)	26	48.1	48.1	74.1
2 and more day (3)	14	25.9	25.9	100.0
Total	**54**	**100.0**	**100.0**	
Length of time by which patient is ambulatory (days)				
up to 1 (1)	16	29.6	29.6	29.6
2 and 3 (2)	21	38.9	38.9	68.5
> 4 (3)	17	31.5	31.5	100.0
Total	**54**	**100.0**	**100.0**	
Length of time by which patient is started on sips/ orals (days)				
up to 2 days(1)	23	42.6	42.6	42.6
> 2 days (2)	31	57.4	57.4	100.0
Total	**54**	**100.0**	**100.0**	
Length of time by which all drains were removed				
up to 3 days (1)	13	24.1	24.1	24.1
> 3 days (2)	41	75.9	75.9	100.0
Total	**54**	**100.0**	**100.0**	
Duration for which patient was admitted				
up to 5 days (1)	29	53.7	53.7	53.7
> 5 days (2)	25	46.3	46.3	100.0
Total	**54**	**100.0**	**100.0**	
Whether patient was discharged/ died				
Discharge (1)	51	94.4	94.4	94.4
Death (2)	3	5.6	5.6	100.0
Total	**54**	**100.0**	**100.0**	
Whether patient faced any complication				
Absent (1)	30	55.6	55.6	55.6
Present (2)	24	44.4	44.4	100.0
Total	**54**	**100.0**	**100.0**	

Table 19 describes the morbidity score after 30 days of penetrating injury to the abdomen based on the following parameters. Table 20 describes the outcome scores of the frequency of value of each outcome obtained after summation of all scores given in the above table.

Morbidity score values of patients managed conservatively, undergoing negative exploration and patients with positive findings was given in Table 21. Using unpaired t-test, the difference in the morbidity scores between patients managed conservatively and undergoing negative exploration is statistically significant ($p < 0.0001$) and the difference in the morbidity scores between patients managed conservatively and having positive findings intraoperatively is statistically significant ($p = 0.0056$).

Table 20: Outcome morbidity scores.

Score	Frequency	Percent	Valid Percent	Cumulative Percent
8.00	6	11.1	11.1	11.1
9.00	7	13.0	13.0	24.1
10.00	2	3.7	3.7	27.8
11.00	4	7.4	7.4	35.2
12.00	3	5.6	5.6	40.7
13.00	4	7.4	7.4	48.1
14.00	4	7.4	7.4	55.6
15.00	8	14.8	14.8	70.4
16.00	4	7.4	7.4	77.8
17.00	8	14.8	14.8	92.6
18.00	4	7.4	7.4	100.0
Total	**54**	**100.0**	**100.0**	

Table 21: Morbidity score values of patients managed conservatively, undergoing negative exploration and patients with positive findings.

	Patients managed conservatively	Patients undergoing negative exploration	Patients with positive findings
Mean	8.5	12.13	14.89
Standard deviation	0.53	1.96	2.49
Standard error of mean	0.17	0.69	0.42
N	10	8	35

DISCUSSION

In this present study, penetrating trauma to the abdomen was most commonly observed in age groups 16-30 (68.5%). This is similar to the study conducted by Nance et al in which the age ranged from 2 months to 77 years. Most cases occurred between 18-30 age group.[7] In a study by Nagy et al most cases occurred on the 20 to 35 age group.[8]

In this study, 85.2% of the patients were males and 14.8% of our patients were females. The male to female ratio was 5.75:1. This corroborates with the study made by Nance et al where 80% of the patients of stab wounds were males and 20% were female.[7] In contrast study conducted by Asuquo et al majority of the patients having penetrating wounds were males (96.6%).[9]

Homicidal stab wounds (83.3%) were the most frequent mode of injury in our study followed by accidental stab wounds (9.26%) and accidental stab wounds (7.41%). We did not have any cases of gunshot wounds to the abdomen. This is in accordance with the study of James et al in which 70% of injuries were stab wounds, the majority inflicted by knives; 30 per cent were gunshot wounds, either pistol or rifle, frequently with multiple bullets.[10] This difference in the observations exist because our group consists people living around our hospital which belong to a low socio-economic strata of society. Weapons used for stab injuries are easily available, making it more common than gunshot wounds.

In this study, the most common object causing penetrating injury to the abdomen was knife (81.5%). Unknown objects caused injury in 5.5% patients whereas miscellaneous objects such as scissors, glass objects, construction rods and fence caused injury in 13% of the patients. This is comparable with the study of Aswad in which the weapons caused abdominal injury were with knife (87.5%).[11]

In this study 24 patients (59%) had associated injuries. The most common associated injury was limb injury. This is similar with the findings of Njile in which associated extra-abdominal injuries were found in 34 patients out of 92 patients (37%). Skeletal injuries (upper and lower limbs, pelvis and spine) were the most common associated injuries that occurred in 73.5% of cases with associated injuries.[12]

In this study, out of the nine regions of the abdomen, the site most commonly involved was the umbilical (21.9%), followed by the left hypochondrium (20.3%) and the epigastrium (18.75%). This is in consistent with studies of Asad that the most commonly involved quadrant of the abdomen was the left upper quadrant (32.3%).[11]

In this study 11 of our patients were under influence of alcohol/ illicit drugs. Similar observations were made in the study of Njile.[12] Substance abuse on the day of accident was reported by 38 patients out of 92. Twenty seven patients (29.3%) reported to have taken alcohol and 11 patients (12%) reported use of cannabis.

In this study 32 patients (57.4%) were first seen and then discharged, referred or transferred from another private/ public hospital whereas 22 (42.6%) patients came directly to hospital. 36 patients (66.67%) arrived to the hospital by an ambulance and the rest 18 (33.33%) patients arrived by a private vehicle. In a similar study by Kumar et al prehospital delay and outcome were studied in a trauma centre in Mumbai.[13] According to the study, taxicab was the most common mode of transport. The study by Gad et al observed that the interval between injury and care in the emergency department may be an important risk factor for fatalities.[3] 81.8% of fatal penetration cases waited 60 to 90 minutes for emergency care, whereas 75% of surviving penetration cases waited less than 60 minutes ($P < 0.001$). Thus prehospital delay can contribute to the morbidity of the patient with penetrating abdominal injury and an improvement in referral systems and mode of transport could reduce the prehospital delay.

In this study, the average heart rate of patients presenting with penetrating trauma to the abdomen was 100.44, which ranged from 56 to 140, the average systolic blood pressure was 106.29, ranging from 60 to130. The average respiratory rate was 22.79 and average GCS of patients presenting to our centre with penetrating abdominal trauma was 14.64, ranging from 6 to 15. These observations were in agreement with the statements of Omer et al.[14]

In our study, the mean revised trauma score of all patients was 7.66. The difference between RTS of patients who were discharged and patients who died was statistically significant. This is in concordance with the study by Gad et al mortality was significantly higher with penetrating trauma patients than with blunt trauma (57.9% vs 11.6% respectively, P value <0.05).[3] Penetrating trauma patients had a higher RTS and patients with penetrating abdominal trauma had a higher mortality.

In this study, average haemoglobin of patients presenting to the emergency ward was 12.71 and the average haemoglobin of the 12 hypotensive patients was 10.61. A similar values were observed in the study of Gad et al.[3]

In this study, out of the 54 patients, 31 (57.4%) patients got X-ray chest in erect position and 23 patients did not undergo X-ray chest (42.6%). The study by Kester et al demonstrates that the overwhelming majority of patients with injury requiring repair have normal roentgenograms.[15] They also found that even when abnormal, abdominal roentgenograms make a negligible contribution to the evaluation in these patients. Sixteen patients (29.6%) underwent FAST examination on admission. 12 out of 16 patients had no abnormality detected on FAST examination (22.22%), whereas 4 patients had positive findings on FAST (7.4%) and nine patients (16.67%) had CT scan of the abdomen done, of which 3 patients had positive findings on CT scan (5.55%). In this study, out of 51 patients with peritoneal breach, 8 patients were managed conservatively of which 7 patients were observed and discharged and 1 patient died pre-operatively. 43 patients underwent exploratory laparotomy of which 35 had positive findings and 8 were negative explorations. These results are similar with the findings of Yucel et al.[16]

In this study, forty three patients (79.6%) out of all the patients with penetrating trauma to the abdomen underwent exploratory laparotomy. Two patients taken up for exploratory laparotomy expired, intraoperatively and postoperatively, respectively. 10 patients (20.37%) were managed conservatively and discharged. One patient died within 15 minutes of arrival. These results were similar with the findings of Sanei et al report.[17]

In this study primary closure of jejunal perforation and gastric perforation were the most common operative procedures done. These procedures are in correspondence with study of Omer et al.[14] In this study jejunum was the most frequently involved organ followed by mesenteric injuries and injuries to the stomach. The least frequently involved organ was the kidney. Similar observations were made in the study of Asuquo et al and Leppaniemi et al.[18,19]

The average PATI of patients in our study was 6.77. The highest PATI score was 27, whereas the lowest was 0. This score was similar with the results of Moore et al.[20]

Complications contribute to the morbidity of the outcome of penetrating abdominal injuries and can prolong the duration of stay in the hospital. The average number of days after which the patients were discharged was 6.85±5.94 days. Similar number of stays were observed in the study of Omer et al, (8.5±10.6 days).[14] 44.44% of

the patients were faced with complications, which were due to operative procedure. This observation was similar with the study conducted by Omer et al.[14]

CONCLUSION

The 30 day outcome of a patient with penetrating trauma to the abdomen is influenced by the demography, clinical presentations, management and morbidity caused to the patient by the injury. Selective non operative management can be practised in tertiary care centres but its benefits must be weighed against the risk of missed injuries. A large prospective study can be carried out to further elucidate the various parameters.

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