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Clinical study of stab wounds and other penetrating injuries to the abdomen

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Abstract

Background and Objectives: Penetrating injury abdomen is most common in young males in the age group of 20-30 years. These injuries usually affect young healthy individuals in the society. Abdomen is the most commonly involved part in penetrating injuries. Its anatomical location makes it unprotected and most susceptible for penetrating injuries either homicidal or accidental. Penetrating injuries can be homicidal, accidental or rarely suicidal for which exploratory laparotomy is done. Abdominal stab injuries mostly homicidal are common in India.

Methods: This Study is a prospective study of one hundred cases of penetrating injury to the abdomen admitted at Shadan Institute of Medical Sciences from January 2015 to December 2015. All patients with history of penetrating injury to the abdomen during the period, admitted are included in the study. By clinical and radiological criteria, all cases were evaluated for abdominal injury due to penetration. All patients with peritoneal breach, evisceration, signs of peritonitis and shock underwent laparotomy.

Result and Discussion: 180 cases (90%) had significant abdominal injury requiring laparotomy. Criteria for laparotomy were evisceration (24%), shock (36%) and peritonitis (32%). Mere peritoneal penetration is a poor indicator of emergency laparotomy in stab wounds. Erect X-ray abdomen is unreliable criteria for laparotomy in presence of other signs.

Conclusions: Majority of patients require operative intervention particularly those with haemodynamic instability, generalized peritonitis, evisceration of omentum and bowel and continuing haemorrhage. Peritoneal penetration as such is a poor indicator of significant organ injury and requires direct organ specific evaluation such as, computed tomography or laparoscopy to identify patients who can be safely treated without operations.

Keywords: Shock, evisceration, peritonitis, erect X-ray

Introduction

The type of injuries caused by sharp pointed objects depends on the nature and shape of the weapon, the amount of energy in the weapon or implement when it strikes the body, whether it is inflicted upon a moving or a still body, and the nature of the tissue injured^[1]. Failure of USG to detect clinically significant pathologies, particularly in intestinal injuries in the early period, is well-known^[2, 3]. Focused Assessment with Sonography for Trauma (FAST) can be a useful initial diagnostic study after penetrating abdominal trauma. A positive FAST is a strong predictor of injury, and patients should proceed directly to laparotomy^[4]. The anterior abdominal wall is defined as the area between xiphoid and pubic symphysis and both post axillary lines. This area consists from skin, subcutaneous tissue, the three muscles of the anterior abdominal wall. (External oblique muscle, internal oblique muscle and transversus abdominis muscle)^[5, 6]. These muscles are separated in the flanks and fused in the ventral midline to overlap the rectus abdominis muscle and forming anterior and posterior rectus sheaths. Parietal peritoneum covers the anterior and posterior walls, the undersurface of diaphragm and the cavity of the pelvis. Stab wounds are produced from penetration with long narrow instruments having pointed.

By the year 2020 death from all forms of injury are predicted to rise by 63% by which time accidents will be the third most common cause of death worldwide and second most in developing nations.

The incidence of penetrating injury is difficult to estimate, but it is believe to rise² no data can determine exact number of penetrating abdominal injuries.

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In country like India where majority of population reside in rural areas and trauma centers available in cities, the care of injured is far from satisfactory.

Penetrating injury being the commonest surgical emergency with an associated high risk of morbidity and mortality, has influenced me to undertake this surgical problem with special reference to the clinical study of stab wounds and other penetrating wounds to abdomen.

Objectives

- To study the etiology, extent of organ involvement in the penetrating injury and organ most involved.
- To assess patient, for surgical intervention and avoid negative laparotomy.
- To know the morbidity rate, due to different organs involved.
- To evaluate modalities of treatment, complications and prognosis.
- To know the cause of death and evolve better management.

Thus, the study aims at analysing the incidents, clinical characteristics, the diagnosis, the indications for laparotomy, the therapeutic methods and the morbidity and mortality rates.

Methodology

This study is a prospective study of 200 patients with stab wounds and other penetrating injuries to abdomen, admitted Shadan Institute of Medical Sciences, Hyderabad for a period between January 2015 to December 2015. All patients with history of penetrating abdominal trauma, admitted as inpatients, during study period, are included in this study.

Documentation of patients, which included identification history, clinical findings, diagnostic test, operative findings, operative procedure, complications during the stay in the hospital and during subsequent follow-up period were all recorded on proforma prepared. The demographic data collected included age, sex, occupation and nature and time of event leading to the injury.

After initial resuscitation and achieving haemodynamic stability, all patients were subjected to careful clinical examination. Depending on the clinical findings, decision for further investigations as four-quadrant aspiration, local wound exploration, X-ray, chest and abdomen erect view and abdominal ultrasound were taken.

The decision to operate or non-operative management depended on the outcome of clinical examination and results of diagnostic tests. Patients selected for non-operative or conservative management were placed on strict bed rest, subjected to serial clinical examination, which included hourly pulse rate, blood pressure, respiratory rate and repeated examination of abdomen and other systems. Appropriate diagnostic tests, were repeated as and when required. Apart from routine investigations, abdomen X-ray was done in most cases. Patients also underwent four-quadrant aspiration. Aspiration of blood, which did not clot, was taken as positive. When the aspirate clotted, the test was taken as negative.

On laparotomy, the examination of hollow viscus was seen for starting from stomach, duodenum, small intestine and large intestine with both exit and entry wound searched for. In small intestine, starting from duodenojejunal junction to

ileocaecal junction, both at mesenteric and antimesenteric border were seen. The extent of solid organ injuries were graded according to the organ injury scaling.

In most of the cases, long midline incision was made for laparotomy. Also left paramedian and right paramedian, right subcostal incision was used, according to site of injury and suspected organ injury. Whenever necessary, right and left lateral extensions was used. Associated injuries which were recognized were managed appropriately on priority basis. Also its impact on morbidity was analysed.

Statistics on postoperative complications was seen and cause for it was analysed, the impact of delay in surgery on it was also noted.

The number of mortality and cause for it was analysed for and thus consensus for a overall better management is depicted.

The series included all civilians and there were no patients from armed forces.

Statistical Methods

Percentages, Arithmetic mean and Standard Deviation were calculated.

Statistical Software

Statistical software mainly SPSS 11.00 and Systat 8.00 was used for the analysis of the data and Microsoft Word and Excel have been used to generate graphs, tables etc.

Results

From January 2015 to December 2015, 200 cases of stab wounds and other penetrating injuries to abdomen, were managed at Shadan Institute of Medical Sciences, Hyderabad, Telangana, India.

Out of 200 patients, 170 patients underwent emergency laparotomy. 4 patients died after surgery. 30 patients were managed conservatively, of which 10 patients died even before they could be taken for surgery.

The following is the Analysis Data.

1. Age incidence

The age of patients ranged from 18-80 years. The maximum incidence was found in age group of 21-30 years, being 52%, seconded by 31-40 years group constituting 20%.

Age in Years	No. of Patients	Percentage
10-20	28	14
21-30	104	52
31-40	40	20
41-50	8	4
51-60	6	3
>61 years	14	7
Total	200	100

2. Sex incidence

Among 200 cases, there were 178 males and 22 females. Thus, male to female percentage being 89% and 11%. Thus male to female ratio being 8.9:1.1 i.e., 9:1.

Table 2: Sex Incidence

Gender	No. of Patients	Percentage
Male	178	89
Female	22	11
Total	200	100

3. Mode of penetrating injury

The commonest mode of injury being stab wounds (93%), of which majority (82%) were homicidal in nature, seconded by bull gore injury (3%) and injury following self-fall (3%).

Table 3: Mode of penetrating injury

	No. of Patients	Percentage
Homicidal Stab Injury	164	82
Self-inflicted stab	22	11
Bull gore Injury	6	3
Self-fall injury	6	3
GSW	2	1
Total	200	100

This is the time of injury to time of surgery. Majority of patients i.e., 85% were take up for laparotomy of these 86 cases i.e., 50.5% were taken up within 5 hours from time of injury, seconded by 62 cases within 10 hours (36.5%).

Table 4: Latent Period

Latent Period	No. of Patients	Percentage
< 1 hour	-	-
1-5 hours	86	50.5
5-10 hours	62	36.5
10-15 hours	16	9.5
15-20 hours	4	2.3
20-24 hours	2	1.2
> 24 hours	-	-
Total	170	100

Associated injury is seen in 40 out of 200 patients. Chest and Head injury amounts to highest being 40% each.

Table 5: Associated Injuries

Associated Injury	No. of Patients	Percentage
Chest	16	40
Head	16	40
Neck	4	10
Extremities	4	10
Total	40	100

All the patients with penetrating abdominal injuries underwent LWE for detection of peritoneal penetration. Wounds with evisceration of omentum and/or bowel were considered as positive peritoneal penetration and explored. Further during laparotomy, out of 200 patients i.e. (90%) had peritoneal penetration and 10% no peritoneal penetration occurred.

Table 6: Local Wound Exploration

Peritoneal penetration	No. of Patients	Percentage
Present	180	90
Absent	20	10
Total	200	100

Indications for Laparotomy in penetrating abdominal trauma

Out of 200 patients, 180 patients (90%) presented with peritoneal penetration. 85 patients underwent laparotomy and 10 patients died even before they could be taken up for surgery. Omental evisceration with or without bowel evisceration was present in 24% of cases. Generalised peritonitis was present in 32% cases. Haemodynamic

instability was present in 36% cases, which was stabilized prior to laparotomy.

Table 7: Indications for Laparotomy in penetrating abdominal trauma

Indications	No. of Patients	Percentage
Peritoneal penetration of LWE	180	90
Generalised tenderness	64	32
Omental and/or bowel evisceration	48	24
Haemodynamic instability	72	36

After a detailed clinical evaluation and suitable investigation, 170 out of 180 patients with peritoneal penetration, with haemodynamic instability and with peritoneal signs and evisceration underwent exploratory laparotomy. 10 of 180 patients with peritoneal penetration died during resuscitation, even before surgery could be performed.

Rest of 20 patients were selected for non-operative management because they had no signs of peritoneal penetration or peritoneal signs. None of these patients required delayed laparotomy after being subjected to serial clinical examination.

Table 8: Ratio of operative to conservative treatment

	No. of Patients	Percentage
Operated	170	85
Conservative	30	15
Total	200	100

Out of 170 patients who underwent exploratory laparotomy, 132 patients (77.6%) patients had therapeutic laparotomy. Laparotomy was negative in 38 patients i.e. (22.4%). All of them were stable injuries to anterior abdomen.

Table 9: Role of Laparotomy in operated patients

Laparotomy	No. of Patients	Percentage
Therapeutic	132	77.6
Negative	38	22.4
Total	170	100

Post-operative complications

Following table shows the postoperative complication in patients who underwent exploratory laparotomy.

Table 10: Post-operative complications

Complications	No. of Patients	Percentage
Respiratory complications	20	55.5
Surgical Site infections	10	27.8
Intra-abdominal sepsis	6	16.7
Total	36	100

Morbidity & Mortality

The duration of stay of patients in the hospital ranged from 1-31 days with an average of 10 days. The following table shows the duration of hospital stay of patients with penetrating trauma.

Table 11: Morbidity & Mortality

No. of Days	No. of Patients
1-10	94
11-20	92
21-30	12
> 31	2
Total	200

Discussion

1. Age Incidence

Incidence of penetrating stab wound to abdomen in various age group are as follows:

Table 12: Age incidence

Age in Years	Present Study	Nance FC <i>et al.</i> ⁷ (1974)
10-20	28	5
21-30	104	45
31-40	40	19
41-50	8	15
51-60	6	8
> 61 years	14	8
Total	200	100

In the present study (2007-2009) majority of patients belonged to age group 21-30 years i.e. 52% followed by age group of 31-40 with 20%.

In Nance FC *et al.* ^[7]. (1974) study, people in age group of 21-30 years were commonly affected. (45%).

In Nagy K *et al.* ^[8]. (1999) study, majority of patients with penetrating trauma were in 20-35 years age group.

Therefore young and productive age group persons are the usual victims.

Sex incidence

Incidence of penetrating abdominal trauma in male and female sexes are:

Table 13: Sex Incidence

Gender	Present study	Nance FC <i>et al.</i> (1974)	Leppaniemi AK <i>et al.</i> ^[9] (1999)
Male	170	85	87
Female	22	15	13

In present study of the 200 cases, 89% were males and 11% were female. In Nagy K *et al.* (1999) 88% cases were males and 12% were females. In Nance FC *et al.* (1974) males comprised 85% cases and females 15% of cases. In Leppaniemi AK *et al.* ^[9]. (1999) 87% were males and 13% were females.

Table 14: Modes of Penetrating abdominal injuries

	Present Study	Nance FC <i>et al.</i> (1974) ^[7]
Homicidal Stab Injuries	164	53
Self-Inflicted Stab Injuries	22	
Bullgore Injury	6	-
Fall over sharp objects	6	-
GSW	2	47
Total	200	100

Table-32

The commonest mode of penetrating abdominal injury in our study was stabs, of which homicidal stabs was 82% and suicidal stab was 11%, totalling to incidence of 93%. This is followed by bullgore injury and self-fall on penetrating object (3%).

In Nance FC *et al.* (1974) study, stabs to abdomen accounted to 53% of all penetrating injuries while GSW accounting to remaining 47%.

The difference is because the reference study was carried out in an urban center and possession of guns and fire arms was

common in the study population.

Most of the cases coming to our hospitals are from low socio economic background and from rural areas, where weapons like knife, sickle and axe are commonly used for house hold activities and are easily available. Also cattle are part of livelihood used for ploughing the fields and for transportation and accounts for bullgore injury.

Table 15: Latent Period

No. of Hours	Present Study (%)
< 1 Hr	-
1-5 Hrs	50.5
5-10 Hrs	36.5
10-15 Hrs	9.5
15-20 Hrs	2.3
20-24 Hrs	1.2
> 24 Hrs	-
Total	100

Most of the patients, 50.5% in our series were operated within 1-5 hours of injury, which correlates well with Allen B.R. series ^[10]. Injuries managed soon after the insult have less morbidity than when treatment is postponed. In our study, those who were treated within 5 hours, the complication rate was 33.3% and that treated after 5 hours was 66.7%.

Nance FC *et al.* ^[52], in a study of selective management of abdominal stab wounds reported 49% complication rate in those operated less than 6 hours and 50% complicate in those with a delay exceeding 6 hours.

Table 16: Associated Injuries

Associated Injury	No. of Patients
Chest	40%
Head	40%
Neck	10%
Extremities	10%
Total	100%

In our series, the extra abdominal injuries were present in 20 cases, accounting to 20%, in which chest and head injury was commonest involving 40% each comparable with that of Nance *et al.* studies, 42% and 32%. Extra abdominal injuries are also to be given equal importance and should be managed along with the abdominal injuries on priority basis.

Table 17: Site of Injury

Site	Present Study (%)
Epigastric region	12
Left hypochondrium	17
Right hypochondrium	14
Umbilical	33
Left lumbar	9
Right lumbar	2
Left iliac region	12
Right iliac region	0
Hypogastrium	1
Total	100

Table-35

In our series, 43% injuries were inflicted in upper abdomen compared to 75% of penetrating wounds occur in the upper abdomen (Moss LK *et al.* 1962) ^[11].

Table 18: Local Wound Exploration

Peritoneal penetration	Present study	Nance FC <i>et al.</i> (1974) ^[7]
Present	180	82
Absent	20	18

In present study, peritoneal penetration was noted in 90% cases. In contrast with Nance FC *et al.* (1974) where peritoneal penetration was noted in 82% of stab wounds to abdomen.

95% of GSW to abdomen cause significant intra-abdominal injuries. Hence LWE is not indicated in such studies.

Table 19: Indication for Laparotomy in Penetrating abdominal trauma

Indication	Present Study
Peritoneal Penetration on LWE	90%
Omentum and bowel evisceration	24%
Generalised peritonitis	32%
Hemodynamic instability	36%
TOTAL	100

In present study, peritoneal penetration, haemodynamic instability, generalized peritonitis and evisceration were prime indicators for exploratory laparotomy. In 90% cases, peritoneal penetration was noted. In Leppaniemi A.K. *et al.* (1999) peritoneal penetration was present in 72% cases. The difference can be explained by fact that in 6% cases in reference study, the peritoneal penetration was undetermined.

In another study (Nagy K. *et al.* 1999) evisceration constituted 73% of cases and was the indication for laparotomy. In our study omentum and bowel evisceration occurred in 24% cases.

32% cases presented with generalized peritonitis. In a study by Nagy K. *et al.* (1999) generalized peritonitis was present in 12% cases. In present study, haemodynamic instability was present in 36% cases. In Nagy K. *et al.* (1999), 9% patients were in shock. The difference is because of more number of injuries to the abdomen in our study.

Table 20: Ratio-operative to conservative treatment

	Present Study	Leppaniemi AK <i>et al.</i> ^[10] (1999)
Operated	170	68
Conservative	30	32
Total	200	100

In present study, 85% cases of penetrating abdominal injury underwent exploratory laparotomy.

In Leppaniemi AK *et al.* (1999), the number of operated cases constituted 68%.

Similarly in Nance FC *et al.* (1974) 75% of cases underwent laparotomy.

Table 21: Role of Laparotomy in Penetrating Trauma

Laparotomy	Present Study	Nance FC <i>et al.</i> (1974) ^[7]
Therapeutic	132	78
Negative	38	22
Total	170	100

In present study, laparotomy was therapeutic in 66% cases and in 19% was negative.

In Nance FC *et al.* (1974), in 78% of all cases of stab wounds to abdomen, laparotomy was therapeutic.

Even in Nagy K *et al.* (1999), 78% of all cases required laparotomy for repair of an intraabdominal injury. Incidence of evisceration in penetrating abdominal trauma.

In present study, omental evisceration was present in 41.7% patients, while with Nagy K *et al.* (1999) 75% cases had omental protrusion. Omental evisceration is probably related more to size and location of penetrating wound and the omental anatomy in all individual patients than to the presence of significant internal injury.

Evisceration of bowel are commonly associated with internal injuries than those with omental protrusion alone.

As per the above data, the positive predictive value of peritoneal penetration is 0.73, in the present study which correlates well with Leppaniemi AK *et al.*^[9].

(1999) where the positive predictive value was 0.6. Negative predictive value in both studies is 1. The difference in PPV is probably due to difference in size of study population.

Conclusion

Following the prospective study of 200 cases of stab wounds and other penetrating injuries to abdomen in the present study, the following conclusion can be made.

- Penetrating abdominal trauma is a common type of surgical emergency.
- Stab wound are most common cause of penetrating abdominal injury. Establishing a trauma centre, a well-equipped one with ventilator support, at every major city will go a long way in preventing morbidity and mortality in victims.
- Young males in the productive age group of 20-30 years are predominantly affected.
- Careful and repeated clinical examination and appropriate diagnostic investigations lead to successful treatment.
- Majority of the patients require operative intervention particularly those with haemodynamic instability, generalized peritonitis, evisceration of omentum and bowel and continuing haemorrhage. Peritoneal penetration as such, is a poor indicator of significant organ injury and requires direct organ specific evaluation, such as computed tomography or laparoscopy to identify patients who can be safely treated without operations.
- Abdominal roentgenograms are unreliable to predict the intestinal perforation or add to the management in patients with positive peritoneal signs. Majority of patients who present with evisceration after penetrating wound require a laparotomy. This is true regardless of what has eviscerated or the presence of other clinical indications to operate. Evisceration continues to prompt operative intervention.
- The most commonly involved organ is small bowel, then followed by liver and stomach. Thus hollow viscus predominates over solid organ injury. Thus the operating surgeon should be well versed with technique of managing hollow viscus injury.
- Post-operative complications is minimal even though it is an emergency operation. The postoperative complications in hollow viscus injury is more compared to solid organ injury, hinting that a better technique of management and broader antibiotics in hollow viscus injury should be advocated. Respiratory infection and intra-abdominal sepsis were the frequent post-operative

complication in the present study followed by wound infection.

- Mortality rate can be reduced by proper management of shock and use of advanced resuscitatory measure and proper post-operative care and systemic approach of management. Simultaneous treatment of associated injuries to other systems also reduce morbidity and mortality rates.

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