CLINICAL STUDY OF PENETRATING INJURIES OF ABDOMEN

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ABSTRACT

Penetrating trauma forms an important component of surgical emergencies. The importance of this category becomes further apparent when one realises that most of such trauma victims are essentially healthy people and in the prime of their life. Over the past century, great advances were made in the management of such wounds. The operative management replaced the expectant therapy and reduced mortality rates. So this study is being done to evaluate the various indications for early mandatory laparotomy in penetrating abdominal injuries.

AIM

Aim of the study is to study various modes of injuries of penetrating injuries of abdomen, clinical presentation and their management.

MATERIALS AND METHODS

The study includes 60 cases of penetrating injury to abdomen admitted to our hospital during the period August 2013 to August 2015. After initial resuscitation and achieving haemodynamic stability, all patients were subjected to careful clinical examination. Depending on the clinical findings decision for further investigations such as local wound exploration, X-ray abdomen and ultrasound abdomen taken. The resuscitation begins in the causality and based on the vitals, patients were submitted to immediate laparotomy or shifted to T.M.T ward for further evaluation. The decision for operative or nonoperative depends on the clinical examination and results of diagnostic tests. They were subsequently investigated and managed according to the standard protocol.

RESULTS

81.67% of cases of penetrating abdominal trauma underwent exploratory laparotomy. Laparotomy was therapeutic in 79.59% of cases. Commonest organ injured in the descending order of frequency: Small bowel, liver, stomach, mesentery, large bowel, spleen, gall bladder and diaphragm. Average duration of hospital stay was 7 days. Mortality rate was 3.3%.

CONCLUSION

Penetrating abdominal trauma is one of the surgical emergencies. 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. Small bowel and liver are the commonest organs injured in the present study. Stomach is the next common organ injured in the present study. It can also be managed by simple suturing. Wound infection and intra-abdominal sepsis was the frequent postoperative complication in the present study.

KEYWORDS

Intestinal fistulas, Hepatic lobectomy, Evisceration.

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INTRODUCTION: Penetrating trauma forms an important component of surgical emergencies. The importance of this category becomes further apparent when one realises that most of such trauma victims are essentially healthy people and in the prime of their life.

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Abdomen occupies a vulnerable position in human anatomy and it is least protected and most susceptible part for accidental or homicidal injuries. Major improvement in the management of abdominal wounds occurred with the introduction of blood transfusion and liberal use of antibiotics.

In a country like India where more than 70% of population dwells in villages and a very few trauma centres are located in large cities, the care of a penetrating injury patient is far from satisfactory. So this study is being done to evaluate the various indications for early mandatory laparotomy in penetrating abdominal injuries.

AIM OF THE STUDY: To study various modes of injuries of penetrating injuries of abdomen, clinical presentation and their management.

Management of operative treatment of injuries of specific organs:

Liver: The aim of management of liver trauma is:

- To arrest the bleeding.
- Removal of devitalised liver tissue.
- Provision of adequate drainage.

Grading of Liver Injuries:

Grade	Injury	Description
I	Haematoma	Subcapsular, non-expanding<10% surface area.
	laceration	Capsular tear, non-bleeding with <1 cm deep parenchymal disruption
II	Haematoma	Subcapsular, non-expanding haematoma 20%-50%, intraparenchymal, nonexpanding 2 cm diameter
	laceration	<3 cm parenchymal depth, <10 cm in length
III	Haematoma	Subcapsular, >50% of surface area expanding; ruptured subcapsular haematoma with active bleeding; intraparenchymal haematoma 2 cm
	laceration	>3 cm parenchymal depth
IV	Haematoma	Ruptured central haematoma
	laceration	Parenchymal destruction involving 25% to 75% hepatic lobe
V	laceration	Parenchymal destruction involving 75% of hepatic lobe
	Vascular disruption	Juxtahepatic venous injuries
VI	Vascular disruption	Hepatic avulsion

In 60 – 70% of liver trauma the bleeding stops spontaneously. In these cases, suture of the lacerated liver which is not bleeding is unnecessary. All that needed is adequate drainage.

In 30-40% of liver injuries, the bleeding may not stop. In addition to packing the wound which stops bleeding temporarily, Pringle's manoeuvre i.e, and occlusion of the portal triad in the lesser omentum with fingers or with soft clamps can be used in severe bleeding from the liver. The period of occlusion should not exceed 15 minutes. The lacerated liver can be sutured with 2-0 or 1-0 chromic catgut.

In gunshot wounds, debridement or segmentectomy should be done. If bleeding is not controlled by the above methods, the following procedures are adopted.

Extensive packing and re-exploration after 24 hours.
Corresponding branch of hepatic artery ligation.
Hepatic lobectomy or segmentectomy.
Hepatic vein exclusion by balloon shunts.

GALLBLADDER AND BILIARY TRACT INJURIES: Penetrating injury to extra hepatic biliary tract is rare with an incidence of 1.4%.[1] Gall bladder is the most commonly injured part of extrahepatic biliary tract. It is attributed to its superficial location, size.

For gall bladder injuries cholecystectomy is the treatment.

For extrahepatic biliary ducts injuries like partial tear, repair of the tear and insertion of T tube is the treatment. For complete transaction of CBD treatment is choledochoduodenostomy or choledochojejunostomy.

The mortality rate for injuries to extrahepatic biliary tract varies between 4% and 11% and depends on associated injuries. Mortality rate can be 50% when biliary injury associated with vascular injury.

SPLEEN:

Splenic Injury Scale:

Grade	Injury	Description
I	Haematoma	Sub capsular, non-expanding<10% surface area.
	laceration	Capsular tear, <1 cm deep parenchymal disruption
II	Haematoma	Subcapsular, non-expanding haematoma 20%-50%, intraparenchymal, < 2 cm diameter
	laceration	Capsular tear 1-3 cm not involving trabecular vessels
III	Haematoma	Subcapsular, >50% of surface area expanding; ruptured sub capsular haematoma with active bleeding; intraparenchymal haematoma> 2 cm or expanding
	laceration	>3 cm parenchymal depth or involving trabecular vessels
IV	Haematoma	Ruptured intra parenchymal haematoma
	laceration	Parenchymal laceration involving segmental hilar vessels producing major devascularisation (>25% of spleen)
V	laceration	Completely shattered spleen
	Vascular disruption	Hilar vascular injury which devascularises spleen

Spleen is most commonly injured in blunt trauma and only rarely in stab injury. The accepted treatment of splenic injury is splenectomy.

The conservative treatment of splenic trauma is coming into vogue especially in children.

The conservative treatment is indicated in stable patient and where spleen is amendable for repair.

Preoperatively, patient is subjected to resuscitative measures. If remains unstable after two fluid infusions, he should be taken to operating room. A nasogastric tube should be positioned to decompress the stomach. Adequate blood should be arranged. Prophylactic antibiotics should be given as there is high frequency of associated hollow viscous injury.[2]

Laceration of spleen which is not amendable for repair, splenectomy is the treatment.

The problem of over whelming bacterial infection after splenectomy is quite considerable. Overwhelming post-splenectomy infection is a fulminant bacterial illness that progresses to death within 24 hours of recognition and does not always exhibit the usual prodromal signs of infection.[3] Young children are particularly at high risk to develop infection due to Streptococcus pneumonia, Haemophilus influenzae and Neisseria meningitidis. All patients should be given polyvalent pneumococcal vaccine following splenectomy. Children in addition should receive Haemophilus influenzae type B vaccine.

The segmental resection of spleen is a recent trend in cases of stab injuries especially in children to save the spleen. The anatomical structure of the spleen shows numerous septae dividing the organ into numerous sectors. Each sector has got its own blood supply.

Overall, mortality following splenic injury is 10%.[4] Mortality correlated well with degree of associated injury.

Pancreas: Penetrating injuries of pancreas are very rare. Blunt trauma is more common. The associated injuries to stomach, duodenum and transverse colon are invariably there. If there is no laceration, only haematoma, drainage is provided through lateral stab wound.

CT-scan may provide direct information about location of pancreatic injury as well as three dimensional picture of wound tract.[5]

Serum amylase has repeatedly been shown to be neither sensitive nor specific of pancreatic injury.

If the tail of the pancreas is cut, immediate distal pancreatectomy with splenectomy should be carried out with lesser sac drainage.

If the duct is served, repair of the duct over the T tube which is brought outside and approximation of the ends of the gland with 5-0 silk is done. The T tube can be pulled out when it has served its purpose.

Kidney: Kidney is also exposed to penetrating trauma especially when attack is from the back. Knife and gunshot injuries are common.

Emergency IVP and arteriogram will give the extent of damage to the kidney. If the kidney is bleeding for more than 24 hours, it needs immediate surgical intervention. If the other kidney is normal, nephrectomy or partial nephrectomy is done.

INJURIES TO HOLLOW VISCERA:

Stomach: When compared to blunt injuries penetrating injuries of the stomach are common. The associated injuries are common. The perforation of stomach should be closed in layers after existing the edges. Drainage should be provided. When an anterior hole is detected, second hole on the posterior wall should be searched. If not located lower oesophagus and duodenum must be explored.

Duodenum: Penetrating wounds of duodenum are infrequent. These are frequently associated with other visceral injuries. Its retroperitoneal location accounts for high incidence or misdiagnosed injuries that carry very serious consequences.

General incidence of duodenal injuries following penetrating abdominal trauma varies from 3 to 5%.[6]

Small tears can be closed in two layers. If the laceration is present in the second part of the duodenum, choledochotomy and T tube insertion for 2 weeks is mandatory. A complete transaction of duodenum can be managed by end-to-end anastomosis. If that is not possible, closure of both ends and gastrojejunostomy can be done.

Duodenal injuries carry significant mortality rate. It ranges from 5.3% to 30%. Mortality due to penetrating trauma is less than blunt trauma.

Morbidity rates for duodenal injuries range from 38% to 100%. Most important cause for morbidity is duodenal fistula which results from suture line dehiscence.[7]

Small Intestine: Mortality from small bowel penetrating injury reduced from 70% in 19th century, to 14% at the end of World War II. In penetrating abdominal injuries, the organ most frequently involved is small bowel. It accounts for 49% to 60% of all injuries.[8]

Small bowel holes are closed in transverse fashion to avoid postoperative stenosis. Multiple wounds in close proximity of devascularised segment are best managed by segmental resection and end–to-end anastomosis. Intestinal non-crushing clamps should be used for a clean surgical area. Before closing abdominal cavity, it is irrigated with warm saline until effluent is clear.[9]

Most important technical point is that blood supply is maintained at the anastomotic line. Because the antimesenteric border has lesser blood supply than the mesenteric border resection should be made at an angle and vasa recti should be ligated close to border resection. Haemostasis must be secure as haematoma formation impairs proper healing and reduces blood supply by compression leading to dehiscence.[10] Small non-expanding haematomas can be observed. If superior mesenteric vessel injury is suspected proximal vascular control must be obtained through lesser sac.

Most frequent complications after small bowel penetrating trauma are:

1. Abdominal sepsis.
2. Dehiscence and evisceration.
3. Intestinal fistulas.
4. Haemorrhage.

Abdominal Sepsis: Intra–abdominal infection after penetrating gastric or small bowel injury is 5% to 20%. Fifty percent of patients will have fever, haematological changes or physical signs, remaining 50% will present with multiorgan dysfunction syndrome with no conclusive physical findings.

Prevention of septic complications is by initial management, adequate intra-operative treatment and optimal postoperative support. Early detection is crucial. Laboratory and radiologic studies are important adjunctive. However, daily examination and looking for distant organ dysfunction is the best single method for diagnosis.

Intestinal Fistula: Fistulation from intestinal or gastric suture after trauma has been reported in the range of 0 to 1%. Fistulas can flow into the abdominal cavity or drain outside through the traumatic wound or surgical incision.

The basic management is:

1. Sepsis control: Laparotomy is done for peritonitis, drainage, fistula exteriorisation, debridement and suture.
2. Fluid and electrolyte management.
3. Nutritional support.
4. Cases with spontaneous leak without sepsis can be successfully managed conservatively.

Colon and Rectum: Penetrating injuries are about 10% and blunt injuries of colon are less than 10% of abdominal injuries. The gun shot injuries produce multiple perforations of colon and rectum.

Flint[11] grading of colon injuries:

Grade I: Minimal contamination, no associated injuries, minimal shock, and no delay before operation.

Grade II: Through and through perforation, laceration, associated injuries.

Grade III: Severe tissue loss, heavy contamination, deep shock.

There are number of operative procedures developed in the management of injuries of colon and rectum. Primary repair can be performed in colon perforation with minimal spillage and minimum tissue damage.

All gunshot wounds of colon are preferably treated with exteriorisation of colon as loop colostomy. If exteriorisation is not possible the following procedures are adopted.

Suture repair and decompression with tube caecostomy in rectal and colon injuries.

If caecal and ascending colon injury is extensive, resection with primary anastomosis or ileostomy and mucus fistula.

Proximal loop colostomy and suture repair of distal perforations.

Resection of the colon and construction of proximal end colostomy and distal mucus fistula.

Rectal injury above the peritoneal reflection, the management is same as colon injuries. The injury below the peritoneal reflection needs following principles.

Complete diverting colostomy preferably in transverse colon away from the colon where additional surgery is needed.

Adequate drainage of presacral area.

Wash out of faecal matter in the distal segment.

Repair of extra peritoneal wound if there is less contamination and small perforation.

Bladder and Ureter: Incidence of bladder injuries is 2-4%. Treatment is by suturing of the rent and suprapubic cystostomy. In extraperitoneal tears and tears at the base, suturing is difficult. Suturing with 2-0 catgut is done.
Ureteric injuries are frequently missed.

MATERIALS AND METHODS:

Study Population: This study is a prospective study of 60 cases of penetrating injury to abdomen admitted to our hospital during the period August 2013 to August 2015.

Inclusion Criteria: All the patients with history of penetrating abdominal trauma requiring admission during the study period are included in this study.

Exclusion Criteria:

1. Age group less than 11 years.
2. Patients with significant extra abdominal injuries
3. Insignificant minor incised wounds of abdomen.

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

All these cases were received alive at the causality of hospital.

Treatment Protocol: After initial resuscitation and achieving haemodynamic stability, all patients were subjected to careful clinical examination. Depending on the clinical findings decision for further investigations such as local wound exploration, X-ray abdomen and ultrasound abdomen taken.

The resuscitation begins in the causality and based on the vitals, patients were submitted to immediate laparotomy or shifted to T.M.T ward for further evaluation. The decision for operative or non-operative depends on the clinical examination and results of diagnostic tests.

Patients selected for nonoperative or conservative management were placed on strict bed rest were subjected to serial clinical examination which included hourly pulse rate, BP, RR and repeated examination of abdomen and other systems. Appropriate diagnostic test especially ultrasound of abdomen was repeated as and when required.

Subsequent to laparotomy, they are placed in the post-operative ward after stabilisation are shifted to the wards. Any complication in the post-operative ward are dealt with and sutures are removed on the day 7.

All the cases have been attended to by the general surgeon in the casualty. A tetanus toxoid injection [0.5 cc] was administered routinely. An intravenous line is established usually with a 16G or 18G catheter. Ringer lactate is the initial crystalloid of choice for administration. If the vitals are unstable, then Haemaccel is also given through a second line. Simultaneously, blood is tested for the group and matched for compatibility and depending on the blood loss, it is replaced. Prophylactic antibiotics were administered to all cases.

The antibiotics commonly administrated are ciprofloxacin [200 mg IV 12 hourly], gentamicin [80 mg IV 12 hourly] and Metrogyl [500 mg IV 12 hourly]. When septicaemia is suspected, higher antibiotics are preferred.

Thus, the patient is assessed in the casualty and when the presentation is with shock or unstable vitals, major extra abdominal vascular injuries or other extra abdominal causes of shock have been excluded, a laparotomy is the immediate treatment. If on the other hand the shock is due to extra abdominal stab wounds, the primary cause is treated and the abdomen reassessed, as in a stable patient with an abdominal stab. When the patient is stable, a clinical assessment is initially made and is followed by bed side clinical tests. Any investigations which are deemed necessary are also simultaneously carried out.

At laparotomy details of injury and the repair performed were noted. Any associated hemothorax and pneumothorax was drained with an intercostal tube. Any significant complication in the postoperative period was noted and dealt with.

Outcome Measures: Patients were analysed according to the age group, sex, clinical presentation, operative procedure and post-operative complications.

OBSERVATIONS:

Age Group Effected: Incidence of penetrating abdominal trauma in various groups was:

Age in years	Number of cases	Percentage
11-20	2	3.33%
21-30	25	41.67%
31-40	14	23.33%
41-50	12	20%
51-60	3	5%
61-70	3	5%
>71	1	1.67%
Total	**60**	**100**

Table 1: Age group effected

Maximum number of cases was [41.67%] in the age group of 21-30 years.

Sex Incidence:

Sex	Number	Percentage
Male	49	81.67%
Female	11	18.33%

Table 2: Sex incidence

Male comprised of 81.67% of cases.

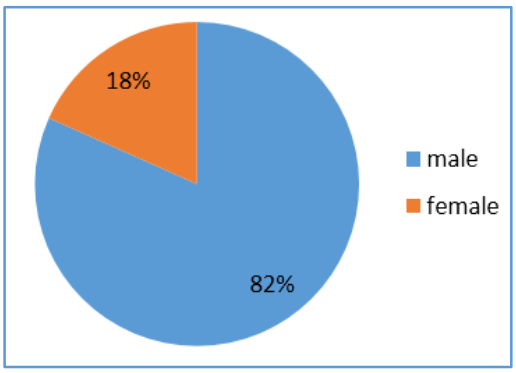

Fig. 1: Sex incidence

Mode of Penetrating Injury:

Mode of injury	Number of patients	Percentage
Homicidal stab injuries	32	53.33%
Self-inflicted stab injuries	11	18.33%
Road traffic accidents	8	13.33%
Fall over sharp objects	6	10%
Bull gore injury	2	3.33%
Gunshot injury	1	1.67%
Total	**60**	**100%**

Table 3: Mode of penetrating injury

Homicidal stab injury was the commonest mode of penetrating injury followed by self-inflicted stab injury.

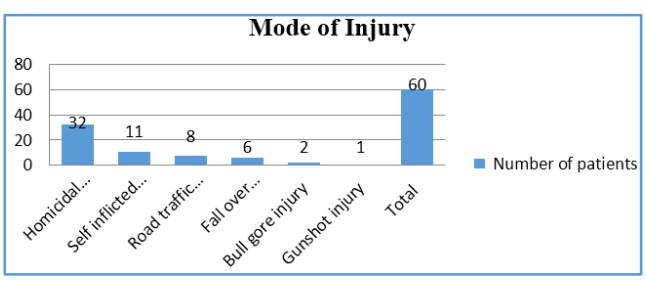

Fig. 2: Mode of injury

Peritoneal penetration during local wound exploration:

Peritoneal penetration	Number of patients	Percentage
Present	49	81.67%
Absent	11	18.33%
Total	**60**	**100%**

Table 4: Peritoneal penetration during local wound exploration

All the patients with penetrating abdominal injury underwent local wound exploration for the detection of peritoneal penetration. Wounds with evisceration of omentum and or bowel were considered as positive peritoneal penetration and explored further during laparotomy.

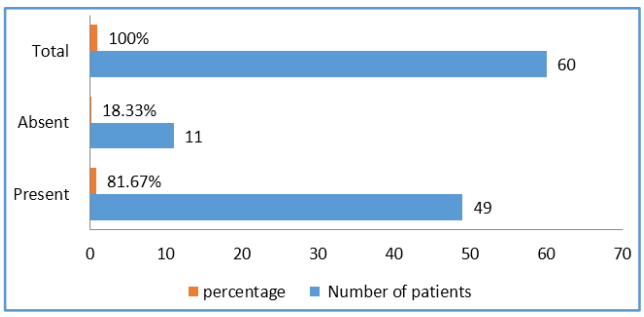

Fig. 3: Peritoneal penetration during local wound exploration

Indication for laparotomy in penetrating abdominal trauma:

Indication	Number of patients	Percentage
Peritoneal penetration on LWE	49	81.67%
Generalised tenderness	38	63.33%
Omental and bowel evisceration	16	26.67%
Haemodynamic instability	6	10%

Table 5: Indication for laparotomy in penetrating abdominal trauma

All the 49 patients with peritoneal penetration underwent exploratory laparotomy.

Plain abdominal roentgenogram findings:

X-ray	Number of patients	Percentage
Normal	21	35%
Abnormal	39	65%
Total	**60**	**100%**

Table 6: Plain abdominal roentgenogram findings

In all the cases of penetrating abdominal injuries, plain X-ray abdomen was taken erect posture. Gas under diaphragm was present in 39 cases. In remaining 21 cases X-ray findings were normal.

Ratio of operative to conservative treatment:

	Number of patients	Percentage
Operated	49	81.67%
Conservative	11	18.33%
Total	**60**	**100%**

Table 7: Ratio of operative to conservative treatment

After a detailed clinical evaluation and suitable investigation, 49 patients with peritoneal penetration on local wound exploration, evisceration, those with haemodynamic instability, with peritoneal signs underwent exploratory laparotomy. About 11 patients selected for non-operative management because they had no signs of peritoneal penetration or peritoneal signs. None of these required delayed laparotomy after being subjected to serial clinical examination.

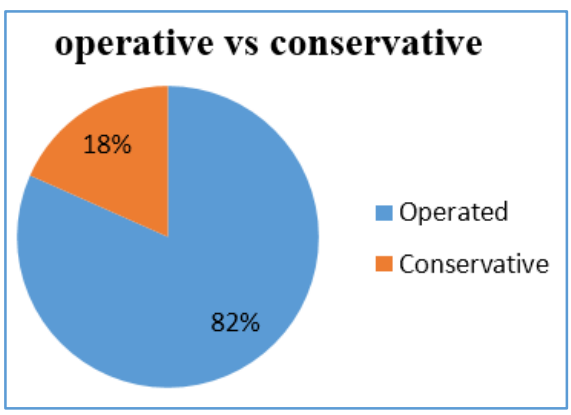

Fig. 4: Operated versus conservative treatment group

Role of laparotomy in operated patients:

Laparotomy	Number of patients	Percentage
Therapeutic	39	79.59%
Negative	10	20.41%
Total	**49**	**100%**

Table 8: Role of laparotomy in operated patients

Of the 49 patients who underwent exploratory laparotomy, 39 had therapeutic laparotomy. It was negative in 10 cases.

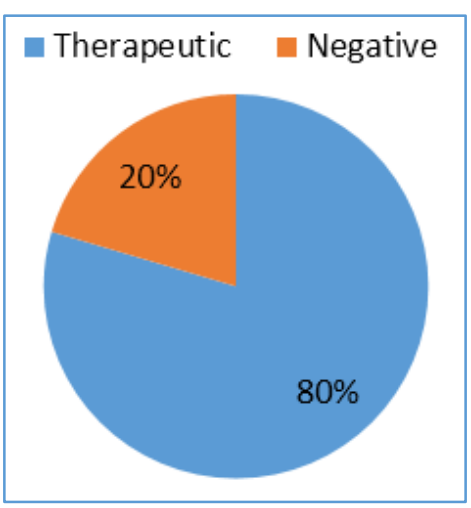

Fig. 5: Role of laparotomy in operated patients

Role of evisceration of omentum and bowel in penetrating abdominal trauma:

	Number of patients
evisceration of omentum	12
evisceration of bowel with or without omentum	4
Total	16

Table 9: Role of evisceration of omentum and bowel in penetrating abdominal trauma

Organs affected in penetrating injuries:
Therapeutic laparotomy group:

Organs affected	Number of cases	Percentage
Liver	12	24.45%
Spleen	1	2.04%
Stomach	10	20.41%
Duodenum	2	4.08%
Jejunum	10	20.41%
Ileum	22	44.9%
Large bowel	2	4.08%
Pancreas	1	2.04%
Gall bladder	1	2.04%
Mesentery	10	20.41%
Diaphragm	1	2.04%
Kidneys	Nil	-
Bladder	Nil	-

Table 10: Organs affected in penetrating injuries

Operative Procedure:

Procedure	Number of patients
Closure of bowel perforation	28
Resection and anastomosis of bowel	6
Repair of mesentery	10
Splenectomy	1
Cholecystectomy	1
Diaphragmatic repair	1
Gastric perforation closure	10
AbGel application to liver serration	12

Table 11: Operative procedure done

Post-operative Complications:

Complication	Number of patients	Percentage
Wound dehiscence	2	10.52
Wound infection	6	31.58
Respiratory complication	4	21.05
Intra-abdominal sepsis	6	31.58
Faecal fistula	1	5.27
Total	**19**	**100**

Table 12: Post-operative complications

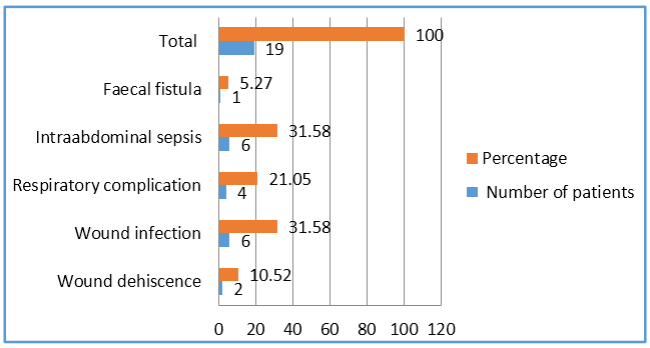

Fig. 6: Post-operative complications

Morbidity and Mortality: The duration of stay of patients in the hospital ranged from 3 – 40 with an average of 7 days. The following table shows the duration of hospital stay of patients with penetrating injury:

Number of days	Number of patients
3 – 10	32
11 – 20	19
21 – 30	7
31 – 40	2
Total	**60**

Table 13: Duration of hospital stay

There were two deaths in the present study.
Mortality rate 3.33%.

DISCUSSION:

Age Incidence: Incidence of penetrating abdominal trauma in various age groups as follows:

Present Study	Age in years	Nance FC et al.[12] [1974]
3.33%	11- 20	5%
41.67%	21 – 30	45%
23.33%	31 – 40	19%
20%	41 – 50	15%
5%	51 – 60	8%
5%	61 – 70	5%
1.67%	>71	3%

Table 14: Age incidence (Comparison)

In the present study [2007 – 09] majority of patients belonged to 21-30 years' age group followed by those in 31-40 years' age group.

In Nance FC et al[12] [1974] study people in the 21 – 30 years' age group are commonly affected.

In Nagy K et al[13] [1999] study majority of patients with penetrating trauma were 20 – 35 years' age group.

In H.Baradaran et al[14] [1995] study majority of patients with penetrating trauma were 15 – 29 age group (62.3%). Therefore, young and productive age group persons are the usual victims of penetrating trauma.

Sex Incidence: Incidence of penetrating abdominal trauma in male and female sexes was:

Gender	Present study	Nance FC et al[12] [1974]	Leppaniemi AK et al[15] [1999]	Navsaria PH et al[16] [2005]
Male	81.67%	85%	87%	91.9%
Female	18.33%	15%	13%	8.1%

Table 15: Sex incidence (Comparison)

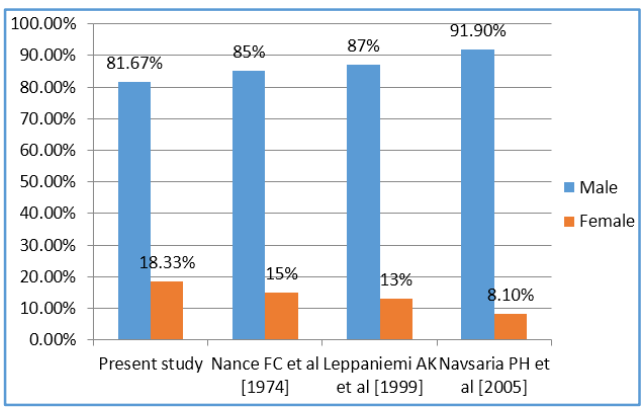

Fig. 7: Sex incidence (Comparison)

In the present study of 60 cases of penetrating abdominal trauma 81.67 were males and 18.33 were females.

In Nance FC et al[12] [1974] study males comprise 85% of cases and females comprised 15% of cases.

In Leppaniemi AK et al [15] [1999] study 87% were males and 13% were females.

In Nagy K et al [13] [1992] study 88% were males and 12% were females.

In Navsaria PH et al[16] [2005] study 91.9% were males and 8.1% were females.

Modes of Penetrating Abdominal Injuries:

Mode of injury	Present study	Nance FC et al[12] [1974]	H.Baradaran et al[14] [1995]
Homicidal stab injuries	53.33%	53%	89.9%
Self- inflicted stab injuries	18.33%		
Road traffic accidents	13.33%		
Fall over sharp objects	10%		
Bull gore injury	3.33%		
Gunshot injury	1.67%	47%	10.1%

Table 16: Modes of penetrating abdominal injuries (comparison)

In the present study, stab injuries constituted the most common cause for penetrating injuries to abdomen accounting nearly 72%. Homicidal stab injuries were the most common cause followed by self-inflicted stab injuries. This is followed by penetrating injuries because of road traffic accidents.

In H.Baradaran et al[14] [1995] study stab injuries accounted 89.9% of penetrating injuries while firearms accounted for 10.1% of cases.

In Maurice E.Asuquo et al[17] study stab wound [46.1%] was the commonest injury, while gunshot ranked second.

In Nance FC et al[12] [1974] study stab injuries accounted 53% of all penetrating injuries while gunshot wounds accounted for remaining 47%.

This difference was because the reference study was carried out in an urban centre and possession of guns and firearms was common in their study population.

Most of the cases referred to our hospital were from rural areas. The weapons like sickle, knife and axe are common to the population of present study as these are used for agricultural purposes.

Local Wound Exploration:

Peritoneal penetration	Present study	Nance FC et al[12] [1974]
Present	81.67%	82%
Absent	18.33%	18%

Table 17: Local wound exploration (comparison)

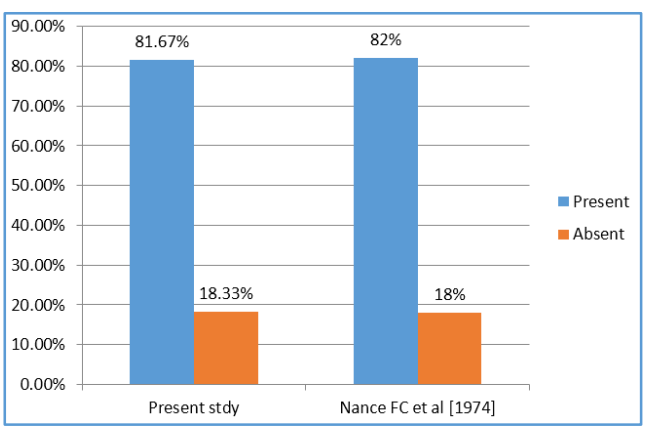

Fig. 8: Local wound exploration (Comparison)

In the present study peritoneal penetration was noted in 81.67% of stab injuries to abdomen. This correlates well with the Nance FC et al[12] [1974] where peritoneal violation was noted in 82% of stab wounds to abdomen.

Ninety-five percent of cases of gunshot wounds to abdomen cause significant intra-abdominal injuries. Hence local wound exploration is not indicated in such cases.

Indication for Laparotomy in Penetrating Abdominal Trauma:

Indication	Percentage
Peritoneal penetration on LWE	81.67%
Generalised tenderness	63.33%
Omental and bowel evisceration	26.67%
Haemodynamic instability	10%

Table 18: Indication for laparotomy in penetrating abdominal trauma

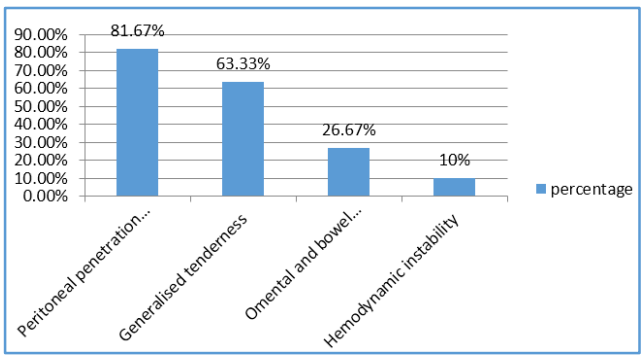

Fig. 9: Indication for laparotomy

In the present study peritoneal penetration, haemodynamic instability, generalised peritonitis and evisceration were the prime indicators of exploratory laparotomy.

Peritoneal penetration was present in 81.67% of cases. In Leppaniemi AK et al[15] [1999] study peritoneal penetration was present in 72% of cases.

In the present study omentum and bowel evisceration was present in 26.67% of cases.

In Nagy K et al[13] [1999] study this was 76%.

Generalised peritonitis was present in 63.33% of cases in the present study. In a study by Nagy K et al[13] [1999] generalised peritonitis was present in 12% of cases. This difference can be explained by delayed presentation of patients to the hospital in the present study.

In the present study, haemodynamic instability was present in 10% of cases. This correlates well with Nagy K et al[13] [1999] in which 9% cases was in shock.

Ratio of Operative to Conservative Treatment:

	Present study	Leppaniemi AK et al[15] [1999]
Operated	81.67%	68%
Conservative	18.33%	32%

Table 19: Ratio of operative to conservative treatment (comparison)

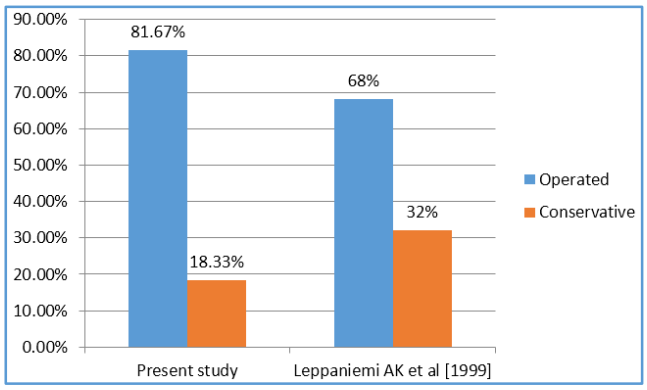

Fig. 10: Operative vs. conservative (comparison)

In the present study 81.67% of cases of penetrating abdominal trauma underwent exploratory laparotomy.

In Leppaniemi AK et al [15] [1999] study the number of operated constituted 68%.

Similarly, in Nance FC et al[12] [1974] 75% of cases underwent laparotomy.

Role of Laparotomy in Operated Patients:

Laparotomy	Percentage	Nance FC et al[12] [1974]
Therapeutic	79.59%	78%
Negative	20.41%	22%

Table 20: Role of laparotomy in operated patients (comparison)

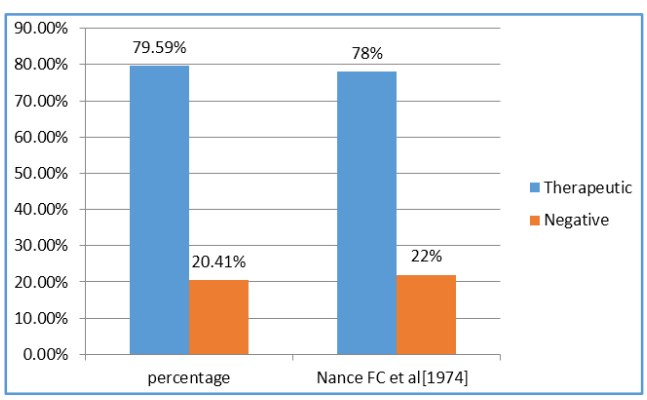

Fig. 11: Role of laparotomy (comparison)

In the present study the laparotomy was therapeutic in 79.59% of cases and in remaining 20.41% of cases it was negative.

In Nance FC et al[12] [1974] in 78% of stab injury abdomen the laparotomy was therapeutic.

Even in Nagy K et al [13] [1999], 78% of all cases required laparotomy for repair of an intra-abdominal injury.

Value of Abdominal Roentgenogram in the Evaluation of Penetrating Abdominal Injuries:

X-ray	Present study	Kester et al[18] [1986]
Normal	35%	92%
Abnormal	65%	8%

Table 21: Value of abdominal roentgenogram in the evaluation of penetrating abdominal injuries (comparison)

In the present study roentgenogram finding were abnormal in 65% of cases

In Kester et al[18] [1986] study findings were abnormal in only 8% of cases.

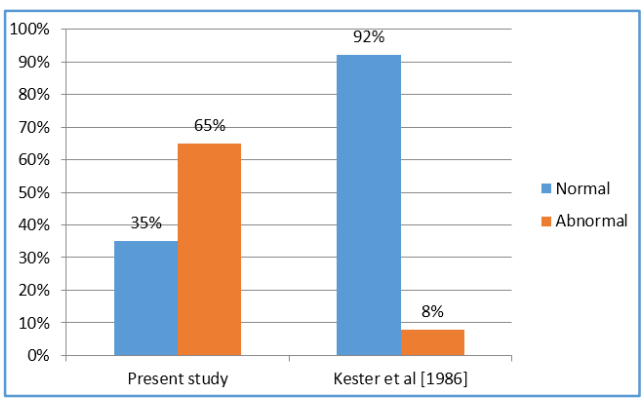

Fig. 12: X-ray findings (Comparison)

Incidence of Evisceration in Penetrating Abdominal Trauma:

	Present study	Nagy K et al [1999]
Evisceration of omentum	20%	75%
Evisceration of bowel with or without omentum	6.67%	25%

Table 22: Incidence of evisceration in penetrating abdominal trauma (comparison)

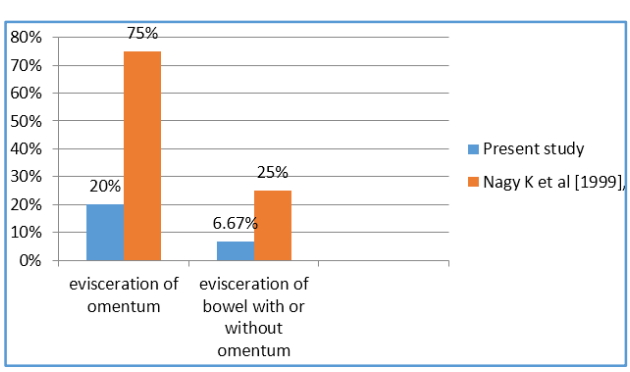

Fig. 13: Incidence of evisceration in penetrating abdominal trauma (comparison)

Organs Injured in Penetrating Abdominal Trauma:

Organ	Present study	Leppaniemi AK et al [1999]	Nance FC et al[12] [1974]
Liver	24.45%	22	30
Spleen	2.04%	4	4
Stomach	20.41%	8	13
Duodenum	4.08%		
Jejunum	20.41%	15	29
Ileum	44.9%		
Large bowel	4.08%	9	6
Pancreas	2.04%	-	-
Gall bladder	2.04%	2	2
Mesentery	20.41%	14	8
Diaphragm	2.04%	11	-

Table 23: Organs injured in penetrating abdominal trauma (comparison)

Hollow viscus injuries are frequent in patients with penetrating abdominal trauma. In Nance FC et al[12] [1974] study liver and small bowels are the commonest organs to be injured.

In the present study also small bowel was the commonest to injure.

Post-operative complications:

Complication	Percentage
Wound dehiscence	10.52
Wound infection	31.58
Respiratory complication	21.05
Intra-abdominal sepsis	31.58
Faecal fistula	5.27

Table 24: Post-operative complications

In the present study, wound infection and intra-abdominal sepsis were the most frequent complications postoperatively accounting up to 63%.

In Croce MA et al[19] (1992) Intra-abdominal sepsis developed in 5 to 20% of cases after penetrating stomach and small bowel injury.

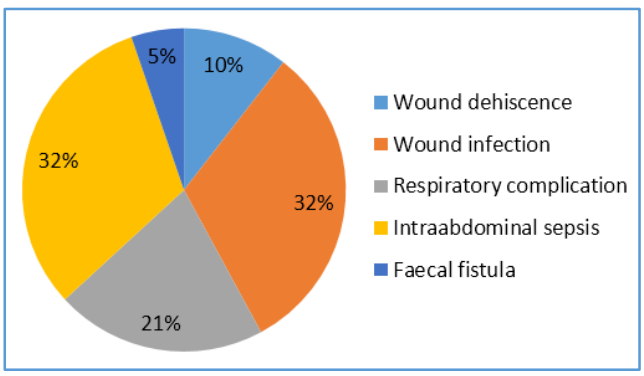

Fig. 14: Post-operative complications

Morbidity and Mortality:

- In the present study the duration of hospital stay ranged from 3- 40 days with an average of 7 days.
- In Leppaniemi AK et al [1999] the duration of hospital stay ranged from 1- 38 days with an average of 6 days.
- Mortality rate in present study was 3.3%.
- In Nance FC et al[12] [1974] study mortality rate was 1.4%.
- Maynard and oropeza[20] reported a mortality of 6.3%.
- Lowe et al[21] reported a mortality rate of 1.6%.
- Mourice E. Asuquo et al[17] reported a mortality rate of 5%.

SUMMARY:

1. Maximum number of cases was [41.67%] were in the age group of 21-30 years.
2. Males comprised 81.67% of cases.
3. Stab injury to abdomen accounted for 71.66% of cases of penetrating abdominal trauma.
4. Peritoneal violation was present in 81.67% of cases.
5. Plain x-ray of abdomen in erect posture was abnormal in 65% of cases.
6. 81.67% of cases of penetrating abdominal trauma underwent exploratory laparotomy.
7. Laparotomy was therapeutic in 79.59% of cases.
8. None of the conservative group needed delayed laparotomy.
9. Accurate and repeated vigilant examination of patient is most valuable.
10. Commonest organ injured in the descending order of frequency: small bowel, liver, stomach, mesentery, large bowel, spleen, gall bladder and diaphragm.
11. 38.77% of patients developed postoperative complications.
12. Wound infection and intra-abdominal sepsis were the most frequent postoperative complications accounting up to 63% of all complications.
13. Average duration of hospital stay was 7 days.
14. Mortality rate was 3.3%.

CONCLUSIONS:

1. Penetrating abdominal trauma is one of the surgical emergencies.
2. Young males in the productive age group of 20-30 years predominantly affected. The patients affected are usually from lower socio-economic group.
3. The commonest mode of penetrating injury by stab wounds to abdomen. Hence measures taken for the care of patients at trauma site and establishing well equipped trauma care centres at least at every district hospital will go a long way in preventing morbidity and mortality of these unfortunate victims.
4. Careful and repeated clinical examination and appropriate diagnostic tests leads to successful treatment in these patients.
5. Majority of patients require operative intervention particularly those with haemodynamic instability, generalised peritonitis, evisceration of omentum and bowel and continuing haemorrhage. Peritoneal penetration as such is a poor indication of significant organ injury and requires direct organ specific evaluation, such as computed tomography or laparoscopy to identify patients who can safely treated without operation.
6. 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.
7. Small bowel and liver are the commonest organs injured in the present study.
8. Stomach is the next common organ injured in the present study. It can also be managed by simple suturing.
9. Wound infection and intra-abdominal sepsis was the frequent post-operative complication in the present study.

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