

Clinical Study of Pediatric Abdominal Trauma

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ABSTRACT

Introduction: Blunt trauma accounts for approximately 90% of all pediatric injuries, with falls and motor vehicle collisions representing the most common mechanism of injury. Head and extremity injuries occur most frequently; however, injury to the abdomen occurs in up to 8% of children and abdominal injury is responsible for 9% of all trauma deaths. Study aimed to know the Nature of trauma, Mode of injury, Associated injuries, Investigative modalities and their relative accuracy in diagnosing blunt abdominal trauma.

Material and methods: Analysis of 98 children admitted with blunt abdominal trauma, from sep-2013 to jan-2016 were included in this study and results were analyzed.

Results: More than 40% of children are in 6 to 10 years. 2/3rd of children are males. Blunt trauma is the commonest cause of trauma. Accidental fall and RTA constituted 75.42% of cases. Polytrauma was seen in 41.8% of cases, head injury is the commonest association. Out of 98 abdominal trauma cases, 68 were managed conservatively and 23 underwent operative intervention. Total 35 cases had injury to solid organ. On laparotomy bowel injury was found in 17 cases, solid organ injury was found in 27 cases. Bowel perforations were found in 13 cases, most of them required simple closure in two layers, 4 cases of ileum perforations with gangrene due to mesenteric tear required resection and end to end anastomosis. There were 3 deaths all of them had polytrauma with all the 3 cases died during initial emergency resuscitation.

Conclusion: Effective strategies, coupled with aggressive management can reduce the mortality and morbidity. Now is the time has to establish separate pediatric trauma units in all pediatric hospitals for effective management of injured children.

Keywords: Pediatric Abdominal Trauma

INTRODUCTION

Traumatic injuries have been reported since the advent of medical literature, but the recognition of the importance of injury as a public health issue is a relatively recent phenomenon. Trauma is a major health problem in the developed as well as developing countries. Injury is the leading cause of death in children and adolescents all over the world and probably ranks next only to infectious disease in countries India.

Traumatic injury is the damage to the body caused by an exchange energy that is beyond the body resilience. Injury is a word seen in the nonclinical; public health literature. Trauma describes bodily damage. Trauma is the leading cause of morbidity and mortality in children. Trauma Statistics include nearly 1.5 million injuries 500,000 hospitalizations. 20,000 deaths and over 120,000 permanently disabled

victims annually.¹ Blunt trauma accounts for approximately 90% of all pediatric injuries, with falls and motor vehicle collisions representing the most common mechanism of injury.² Head and extremity injuries occur most frequently; however, injury to the abdomen occurs in up to 8% of children and abdominal injury is responsible for 9% of all trauma deaths. Significant abdominal trauma occurs in 25% of children sustaining multisystem injuries.³

There is a worldwide increase in the incidence of trauma in children. With ever expanding population, modernization and industrialization there is an increase in the vehicular traffic, riots, terrorist activities, use of fire arms freely by different sectors of society, which has contributed to the rise in no small way. Trauma affects the most productive segment of our society, which has been ignored by too many and to long of accepting kneads. Hence it continues to remain a major health and social problem. As per National crime records bureau (NCRB) report of 2006, there were 22,766 deaths (<14 years) due to injuries among children. There are very few studies developing countries discussing the epidemiology of pediatric trauma. Aim of our study is to determine the various types of childhood injuries, their modes of occurrence, place of occurrence and their distribution according to age and sex.

Study aimed at analysis of all children admitted with abdominal trauma, Nature of trauma - blunt trauma/ penetrating trauma, mode of injury and associated injuries.

Investigative modalities and their relative accuracy in diagnosing particular trauma condition

Differences between the natures of trauma in our study compared to west-reasons.

MATERIAL AND METHODS

All children admitted to pediatric surgical unit at Niloufer Hospital, from sep-2013 to jan-2016 were included in this study and results were analyzed.

Inclusion Criteria: All cases of polytrauma with associated

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abdominal injuries were included irrespective of the mode of injury. (1 year to 12 years)

Exclusion Criteria: All case of polytrauma where there were no abdominal injuries was excluded.

After admission routine investigations like CBP, Blood grouping was done. Relevant investigation like chest X-ray, erect abdomen X-ray, ultrasound were done in most of the cases and CT scan was done in the above cases as and hence required.

Explorative laparotomy was done as and when required depending on the extent of intra-abdominal injury and hemodynamic status of child. Remaining children were managed conservatively. Complication if any were noted and managed accordingly.

RESULTS

More than 40% of children are in 6 to 10 years. 2/3rd of children are males. Blunt trauma is the commonest cause of

Age group	Total No.	Percentage
<2 years	5	5
2-5 years	35	35.75
6-10 years	40	50.8
>10 years	18	18.2
Sex		
Male	76	77.5%
Female	22	22.5%
Nature of trauma		
Blunt	94	95.91%
Penetrating	4	4.01%

Table-1: Demographic distribution

Nature of Accident	Total No.	Percentage
Fall	28	28.05%
RTA	46	46.92%
Bullgore injury	1	1.02%
Assault	4	4.08%
Child Abuse	1	1.02%
Bicycle	12	12.2%
Bullock cart	3	3.06%
Buffalo stampede	3	3.06%
polytrauma associated		
Total abdominal trauma	98	
Polytrauma	41	41.8%
Head injury	20	20.4%
Fracture ribs and Chest injury	17	17.2%
Fracture Extremities and Pelvis	5	5.1%

Table-2: Nature of accident and polytrauma associated

Management	Total No.	Percentage
Laparotomy	23	23.47%
Conservative Management	68	69.38%
SPC	2	
ICD	5	
Local wound exploration	4	4.08%
Expired during resuscitation	3	3.07%
Total Number	98	

Table-3: Management of patients in study

Organ	Total Number	Non-Operative	Operative
Liver	21	16	2
Spleen	8	6	2
Kidney	3	3	None
Pancreas	3	2	1

Table-4: Solid organ injury of patients in study

Visceral Injuries	Total No.	Percentage
Bowel Injury	17	17.3%
Liver laceration	10	10.2%
Splenic injury	14	14.2%
Renal injuries	1	1.02%
Retroperitoneal hematoma	4	4.02%
Gallbladder perforation	1	1.02%
Pancreatic Injury	2	1.02%
Diaphragmatic injury	1	1.02%
Bladder Injury	1	1.02%

Table-5: Operative findings

Bowel injuries	Total No.
Perforations	
Stomach	2
Duodenal laceration	4
Jejunum	6
Ileum	5
Large bowel	0
Contusions	
Small Bowel	1
Large bowel	0

Table-6: Bowel injuries of patients in study

Operative Procedures	Total No.
Closure of perforation	13
Resection and EEA	4
Suturing of liver laceration	1
Packing the liver laceration	1
Splenectomy	1
Splenorrhaphy	1
Laparotomy and peritoneal lavage	3

Table-7: Operative Procedures

abdominal trauma among children (table-1).

Accidental fall and RTA constituted 75.42% of cases, whereas child abuse was seen in only one case. Polytrauma was seen in 41.8% of cases, head injury is the commonest association (table-2).

Investigations performed

Apart from the initial resuscitation and thorough physical examination the following investigations were done.

Blood grouping and Hematocrit

Plain X-Ray- Abdomen Pneumoperitoneum was diagnosed by x-ray abdomen (erect) in 9 of the 19 cases of bowel perforation, findings suggestive of localized ileus were noted in 13 cases. Therest of the firms were reported to be normal.

Ultra Sound Abdomen (FAST)

This investigation was done in almost all cases. This is the

initial investigation of choice to detect solid organ injury. As it can be done in emergency room, we have done this investigation in all cases. This helps in detection of intra-abdominal and retroperitoneal injury.

Peritoneal tap was performed in 12 cases of which 8 were positive for hemoperitoneum.

CT Scan

A Total of 58 cases underwent CT Scan examination was done. Head and brain was done in 5 cases with clinical signs of head injury. CT Scan brain and abdomen was done in 3 cases who had head injury with solid organ injury detected on ultra sound. CT Scan abdomen was done in 48 cases. Emergency IVP was done in 1 case of suspected renal trauma. IVP showed normal renal excretion on right side and no excretion on left side.

Out of 98 abdominal trauma cases, 68 were managed conservatively and 23 underwent laparotomy, 4 cases underwent local wound exploration as there was no peritoneal breach, 3 patients expired during resuscitation (table-3). Total 35 cases had injury to solid organ (table-4). Penetrating injury of the abdomen was the indication for laparotomy in 4 cases, haemoperitoneum in 10 cases, pneumoperitoneum in 8 cases, clinical signs of peritonitis in 4 cases.

On laparotomy bowel injury was found in 17 cases, solid organ injury was found in 27 cases, retroperitoneal hematoma was found in 4 cases, gallbladder perforation 1 and pancreatic contusion was found in 2, bladder 1, diaphragmatic injury 1 (table-5).

Bowel perforations were found in 13 cases, most of them required simple closure in two layers, 4 cases of ileum perforations with gangrene due to mesenteric tear required resection and end to end anastomosis. All 4 cases of duodenal laceration underwent primary closure. 2 cases presented with complication leaks in which one required redo laparotomy with gastro- jejunostomy and the other managed conservatively this two required prolong hospital stay 62 to 53 days (table 6,7).

Suturing of liver laceration was done in 1 case, one case required packing the liver laceration with gel foam. Abdomen was closed over a Bilateral flank drain. Liver laceration associated with haematoma was found in two cases, who underwent laparotomy for hollow viscous injury. Bleeding was controlled with gel foam without disturbing the haematoma, peritoneal toilet was done and abdomen was closed with adequate drainage. Out of 5 cases who had splenic injury, splenectomy was done in 1 case and 1 case splenorrhaphy both children received pneumococcal vaccine post operatively. Laparotomy was performed for the other 3 cases who had Gr 1 and Gr 2 laceration and were managed conservatively. One of the above three had associated gastric perforation which was managed accordingly. Laparotomy and peritoneal lavage was done in 11 cases.

There were 3 deaths in this study; all of them had polytrauma with all the 3 cases died during emergency resuscitation. 1 child who expired in 2 hours after admission had travelled 300 km over 8hrs from a referral center while being resuscitated in

the ambulance. CT scan showed non enhancing right portion of liver, complete occlusion or laceration of right hepatic artery. One case expired in the emergency ward within one hour of presentation. He was brought unconscious, with pallor and shock. He had suspected intracranial injury and distension of abdomen. Diagnostic peritoneal tap revealed frank blood. The third child had a fall from height, 3rd floor, and had travelled 150 km over 5 hours to reach our hospital. He had suffered a scalp laceration at right temporoparietal area with right ear bleed and abdominal distension and blood in Ryle's tube. Pallor was present. The patient expired during resuscitation.

DISCUSSION

Most serious abdominal injuries in children are the result of blunt trauma. Repeated clinical examination and evaluation is essential for early diagnosis and correct management of abdominal injuries approximately 90% of all pediatric injuries. In our study 95.91% of the children (94 out of 98 cases) sustained blunt abdominal trauma. The initial examination of the injured child may be quite misleading. Majority of the children with insignificant injuries show considerable improvement within 24 hours of observation. In our present study 68 children (69.4%) improved with observation where more than 25% of children with abdominal trauma underwent operative intervention. These children were admitted to pediatric surgical unit with external injuries and their general condition was stable. They showed no signs of peritonitis or intraperitoneal bleed. Even though external injuries appear to be trivial, a child with non-tender abdomen may still have ruptured liver on spleen. The injured child may be so apprehensive and irritable that immediate clinical evaluation may be difficult or impossible. Hence every child with suspected blunt abdominal trauma should be admitted and kept under observation till the clinical picture becomes clear. It is rarely necessary to rush a child directly to operating room for abdominal trauma. Repeated clinical evaluations are essential to determine the necessity for surgical intervention.

Increasing tenderness of abdomen with signs of peritonitis, increasing pulse rate fall in the blood pressure with falling hematocrit inspite of resuscitative measures are the indication for surgical correction.

Penetrating trauma is less frequent in children when compared to adults. In the present study there were 4 cases of penetrating abdominal trauma. Children underwent laparotomy as there was peritoneal breach. In this part of the country penetrating injuries due to animal assault (bull gore injury) accounted for 1.02% of the total cases (1 out of 4 cases), of penetrating abdominal trauma. In developed countries penetrating injuries due to social violence (fire arm related injuries) was common, reported incidence being 20%. In the present study there was no case of fire arm injury. In our study bullock cart and buffalo causing injury was found, which was rare in developed countries.

In our study there were 40 cases of trauma to fall (28 cases of trauma due to accidental fall (28.5%) and bicycle fall

12(12.24%) accounting 40(40.81%) cases. 46 cases were due to road traffic accident (RTA) (46.92%). RTA accounted for majority of cases of abdominal trauma (46.92%) as compared to 32-66% incidence reported in American literature, 58.1% from California and 20.7% from Granada. The reported incidence of abdominal trauma due to road traffic accidents is 60%, which is higher when compared to that of our study (46.92%) which is in between other study.

The male to female ratio is approximately 3:1 as compared to other studies. Children in the age group of 6-10 were most commonly affected (40 out of 98 cases 40.8%). In our study two patients presented with delayed signs of peritonitis did not show pneumoperitoneum on initial erect abdomen X-ray. These patients underwent laparotomy and were found to have perforations of small bowel. In Mukesh Sharma, study Male to female ratio was 1.9:1 in and similar to the 1.5:1 to 3:1 ratio reported in the above studies.^{5,6} School-going children (6-12 years) were the most common age group found to be affected study, which is also similar to that reported in other previous studies.^{7,8}

Bowel perforation were seen in 17 children 17.34% (17 out of 98 cases). 8(47.05%) of these cases were diagnosed radio logically on the basis of free air under the diaphragm. The other half were operated on the basis of clinical signs of peritonitis or exploration for penetrating injury abdomen. Stomach perforation was seen in 2 cases, jejuna perforation in 6, ilea perforation in 2 cases and perforation secondary to devascularisation of a segment of ileum 3 cases Duodenal laceration with haematoma was found in one case along with all bladder small bowel/mesentery injury. Most of the bowel injuries were due to blunt abdominal trauma. 12 cases of bowel injury were seen out of which 5 were due to bicycle (jejunum 4, duodenum 1), 6 cases were due to fall, and 1 case was because of buffalo stampede. Only 3 resulted from penetrating injury trauma. In the present study small bowel injury was found to be more common (15 out of 17) as compared to other reports.

2 children had gastric perforations. A 4 year old child inadvertently sustained a penetrating injury to the anterior upper part of the greater curvature of stomach by a knife caused by the child's mentally deranged mother. This child presented with stab wound at right epigastric area with omental prolapse. On investigation the child was found to have gross pneumoperitoneum. The child underwent exploratory laparotomy. On laparotomy, the findings were gastric perforation, another perforation at ileum, soiling of peritoneal cavity with food, fecopurulent material. closure of stomach perforation and ilea perforation closure was done and bilateral flank drains were placed. Another 6 year old female child sustained a bull gore injury. On examination, there was an open penetrating wound over left lower part of chest and the child had shortness of breath. On investigation, she was found to have gross pneumoperitoneum and underwent emergency laparotomy. On laparotomy there was gross peritoneal contamination with food and perforation was found on greater curvature of stomach 3x3 cm rent in the diaphragm with herniation of stomach. Stomach perforation

was repaired in 2 layers and diaphragm repaired with prolene horizontal mattress sutures, thorough peritoneal ravage was given post op period was uneventful. Chest wound closed after placing the intercostal drainage tube through the same wound.

Duodenal hematoma is relatively rare occurrence in children. A 11-year-old boy sustained an injury to the upper abdomen when he fell over a bench while playing. He presented 3 days after the injury with pain abdomen. On examination there was tenderness and generalized guarding over the abdomen. X-ray erect abdomen revealed pneumoperitoneum. The child was taken up for laparotomy. Intra operative findings included a rent in the first part of duodenum measuring 2x1 cm in diameter. The rent was closed primarily over a transanastomotic stent. Peritoneal ravage was done and right flank drain was placed. Patient developed a leak on post-operative day 6 for which the child was managed conservatively with nil per oral and total parental nutrition for a month. As the leak was not subsiding redo laparotomy with closure of rent and gastrojejunostomy was performed. The leak subsided and the child improved after the second injury.

A 10 year old male child presented with history of injury to upper abdomen caused by handle bar of a bicycle. His symptoms included pain abdomen and vomiting. On examination he had tenderness and guarding over the abdomen. X-ray erect abdomen revealed pneumoperitoneum. He underwent exploratory laparotomy. Intra operative findings included 2 perforations at D2, Part of duodenum one on anterior wall and the other on the posterior wall, each measuring approximately 1 cm in diameter. Primary closure of the perforations and feeding jejunostomy was done. The patient developed a leak on 7th post-operative day. He was managed conservatively with FJ feeds and TPN. The leak subsided and the patient was discharged.

2 cases of duodenal perforation underwent primary closures. One of these cases which were caused by a penetrating injury had an associated gall bladder injury for which cholecystectomy was done. Both the cases had uneventful post-operative periods.

Total 35 cases had injury to solid organs (35.7%) (21 livers, 8 spleens, 3 kidneys, 3 pancreas). These cases were diagnosed by ultrasound abdomen or CT scan in stable case. 4 cases of solid organ injury underwent laparotomy. 2 cases on splenic injury underwent laparotomy and the procedures done included splenectomy in one case which had shattered spleen and splenorraphy in the other case. 2 cases of liver injury underwent laparotomy. Packing with gelfoam was done in one case and suturing of the liver laceration was done in other case. Remaining cases of splenic and liver injures were managed conservatively.

All 3 renal injuries and 3 pancreatic injuries were managed conservatively. Out of 3 pancreatic injuries, 1 case was 11 year male child with bicycle handlebar injury managed conservatively and readmitted after 8 weeks with lump abdomen. On evaluation he was found to have pseudopancreaticyst. He has undergone

laparotomy+cystogastrostomy with flank drain, post-operative period uneventful

There was bladder injury 1 case, out of 98 cases. A 3 year old female child presented with history of RTA. She had suprapubic tenderness and abdominal distension. The distension subsided after catheterization. CT scan of abdomen revealed free fluid in the abdomen. On laparotomy there was a rent in the posterior wall of the bladder measuring approximately 5 cm. The bladder was repaired in 2 layers. Post-operative period was uneventful.

In the present study we came across only 1 case of child abuse [battered baby syndrome]. A 3 year old male child presented with history of parental discord and drunken father intentionally falling on child. He had multiple fractures at various stages of healing and left rib fracture, abrasions over the abdomen and abdominal distension. Ultrasound abdomen revealed free fluid and no solid organ injury. The child improved with conservative treatment.

In our study of 98 cases there were 3 deaths (3.06%). The incidence of mortality due to abdominal trauma in children varied from 2.2% to 14% in various studies. Bener *et al.* also reported the same result in his study.⁹ Mortality was higher in males. RTA was most common cause of death, followed by burn and fall from height. These results are similar to those of the studies done in developing countries,^{10,8} whereas studies from developed countries reveal RTA to be the most common cause of death, followed by gunshot injuries.^{11,12} All of the patients who expired had polytrauma, with a history of RTA. All the 3 cases died during initial emergency resuscitation. 1 child who expired in 2 hours after admission had travelled 300km over 8 hours from a referral center while being resuscitated in the ambulance. CT scan showed non enhancing Right portion of liver, complete occlusion or laceration of Right Hepatic artery. One case expired in the emergency ward within one hour of presentation. He was brought unconscious, with pallor and shock. He had suspected intracranial injury and distension of abdomen. Diagnostic peritoneal tap revealed frank blood. The third had a fall from height 3 floor, and had travelled 150km over 5 hrs. to reach our hospital. He had suffered a scalp laceration at Right temporoparietal area with Right ear bleed and abdominal distension and blood in riles tube. Pallor was present. The patient expired during resuscitation.

Henderson, et al, from Children's National Medical Center retrospectively reviewed 164 children with blunt renal trauma and found a non-operative rate of 70%. For high-grade renal injuries specifically (grades IV and V), the non-operative rate was only 56%. However, these numbers do not exclude patients who underwent non-kidney related surgeries and the authors mentioned that if this is taken into account that the non-operative rate overall is mid 90%.¹³

CONCLUSION

Children are the future of the nation. Injury is the most important threat to the health of the children and leading cause of death after the first year of life. Injuries must be viewed as diseases that can be prevented by using principles

of Epidemiology, engineering, biomechanics and health education. A critically injured child has a tremendous potential for recovery if timely intervention is initiated. Effective strategies, coupled with aggressive management can reduce the mortality and morbidity. Now the time has to establish separate pediatric trauma units in all pediatric hospitals and at secondary centers (district hospital) with all availability of USG and CT Scan) for effective management of injured children.

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