



ORIGINAL RESEARCH PAPER

Surgery

SOLID ORGAN INJURIES IN BLUNT ABDOMINAL TRAUMA IN CHILDREN

KEY WORDS:

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ABSTRACT

INTRODUCTION: Trauma has come to occupy a prominent position as one of the preventable cause of death children. In developed countries trauma to the abdomen is mainly due to road traffic accidents. Abdomen is the third most commonly injured part of the body next to injuries to extremities and head injuries in children. Blunt injury to the abdomen causes single organ injury or multiple organ injury according to the severity of the accident.

AIM OF THE STUDY: To evaluate the impact of blunt abdominal trauma on various intra abdominal solid organs such as liver, spleen, pancreas and kidney with regard to age, sex and various modes of blunt injuries. To evaluate various associated injuries occurring in blunt abdominal trauma. To evaluate the value of various available investigations employed for the diagnosis of the solid organ injuries in blunt abdominal trauma. To analyse the various modalities of treatment available for solid organ injuries. To compare the incidence and mode of injuries due to agricultural and agricultural related activities with that of road traffic accidents.

MATERIAL AND METHODS: Forty five children of blunt abdominal trauma with solid organ injuries admitted in our hospital during the period of July 2015 to June 2019 were taken for this study. The clinical features were studied in detail with special note to any associated injuries like head injury, chest injury and fracture limbs. Plain X-Ray of the abdomen, Ultra sonogram of abdomen, intravenous urogram and CAT scan abdomen were done in relevant cases. Laparotomy was done except when conservative management was planned.

OBSERVATION: In our study of forty five patients, solid organ injuries confirmed clinically in thirty four patients, by ultrasonogram in nine patients and by postmortem finding in two patients. In this study, the number of splenic injuries was twenty, liver injuries were fourteen, pancreatic injuries were eight and renal injuries were three. Injury due to road traffic accidents was the cause in twenty five cases, injury during agricultural activities was seventeen and injury due to fall from height was the cause in three cases.

CONCLUSION: The commonest intra abdominal organ injured was spleen followed by liver pancreas and kidney. The commonest associated injury was chest injury followed by injury to the extremities. Biochemical investigations are not very useful in the diagnosis of specific intra abdominal organ injury. Imaging studies like x- ray, ultrasonogram and CT scan are only complimentary to clinical diagnosis. In the management, conservation procedures are better advocated for minor injuries. Injury occurring during agricultural and related activities is more in this region due to agricultural nature of this part of Tamilnadu.

INTRODUCTION:

Although intra abdominal injuries account for a small percentage of total paediatric trauma deaths, failure to diagnose promptly and manage successfully these injuries account for the majority of preventable deaths following multiple trauma. In developed countries trauma to the abdomen is mainly due to road traffic accidents. In our country also it is a major health problem. Abdomen is the third most commonly injured part of the body next to injuries to extremities and head injuries. Blunt injury to the abdomen causes single organ injury or multiple organ injury according to the severity of the accident. Our Thanjavur District being the Granary of south India, the injury sustained during agricultural work more or less equals to that of road traffic accidents. Hence, the pattern of injury of to the solid organ was also taken as a comparative study of road traffic accidents and agricultural related injuries.

AIM OF THE STUDY:

The aim of our study is

1. To evaluate the impact of blunt abdominal trauma on various intra abdominal solid organs such as liver, spleen, pancreas and kidney with regard to age, sex and various modes of blunt injuries.
2. To evaluate various associated injuries occurring in blunt abdominal trauma.
3. To evaluate the value of various available investigations employed for the diagnosis of the solid organ injuries in blunt abdominal trauma.
4. To analyse various modalities of treatment available for solid organ injuries with the aim to reduce the postoperative morbidity and mortality.
5. To compare the incidence and mode of injuries due to agricultural and agricultural related activities with that of road traffic accidents.

MATERIAL AND METHODS:

Forty five cases of blunt abdominal trauma with solid organ injuries admitted in Raja Mirasdhar hospital and Thanjavur Medical College Hospital, Thanjavur during the period of July 2015 to June 2019 were chosen retrospectively for this study. The cases were selected in such a way that only those patients with definitive history and clinical findings suggestive of injury to organs which were later confirmed by investigations and/or Laparotomy /autopsy. Details history regarding the mode and nature of injury were taken, time elapsed between the time of injury to the time of admission in the hospital and the time of injury to the time of operation were analysed. The clinical features were studied in detail with special note to any associated injuries like head injury, chest injury and fracture limbs. Basic investigations viz. Complete blood count, blood urea, blood sugar, serum creatinine and blood grouping were done in all cases. Plain X-Ray of the abdomen was taken in most of the cases except in those who were admitted in a critically ill condition. Radiographs of other parts were also taken to find out associated injuries. Under aseptic precaution using sterile 18 G needle peritoneal tapping done in all the four quadrants, in selected patients with the history of blunt abdominal trauma. Ultrasonogram of abdomen, intravenous urogram and CAT scan abdomen were done in relevant cases. Serum amylase was taken in a selected group of patients. Only indicated cases were taken up for laparotomy. At laparotomy a systematic approach with examination of all intra abdominal organs were made and are dealt with appropriate management. Postoperative complications were specifically looked for, if present were treated appropriately.

OBSERVATION:

In our study of forty five patients, solid organ injuries were confirmed clinically in thirty four patients, by ultrasonogram

in nine patients and by postmortem finding in two patients. In this study the following injuries were noted. Total number of splenic injuries was twenty. Isolated splenic injury was twelve and associated with other organ injury was eight. Total number of liver injury was fourteen. Isolated liver injuries and associated with other injuries was seven each. Total number of pancreatic injuries was eight. Isolated pancreatic injury was five and associated with other organ injuries was three. Among the eight cases pancreatic body was involved in five cases and tail was involved in three cases. The number of isolated renal injuries was two and associated with other organ injuries was one. Among the three cases left kidney was involved in one case and right kidney was involved in two cases.

Injury due to road traffic accidents was the cause in twenty five cases, injury during agricultural activities was seventeen and injury due to fall from height was the cause in three cases. The nature of injury in agricultural activity is fall in the paddy fields, bull gore injuries and fall from tractor and bullock cart. Among the twenty five road traffic accidents, sixteen patients sustained injury due to direct hit, four patients due to run over by vehicles, another three was thrown out of the vehicles which caused blunt injury and the rest two due to vehicles capsized over the patients.

SPLenic INJURIES:

Spleen is the commonest organ injured following blunt abdominal injury. Our study showed a total of twenty cases of splenic injuries. Among these isolated splenic injury was twelve and associated with other organ injury was eight. Twelve patients got injured in road traffic accidents. Seven of these were injured during agricultural work. One patient was injured due to fall from height. Among the twelve road traffic accidents, direct hit was the commonest mode of injury accounted for nine cases.

Seventeen cases underwent laparotomy after resuscitation and three children were treated conservatively. The procedures include fourteen splenectomies and three splenorrhaphies. The mortality was two cases, one after laparotomy and another one before surgery. The time interval from injury to the admission in hospital was varying from one hour to thirty hours. The injury operation interval ranges from four hours to thirty six hours. The delay in surgery was due to non-specific presentation on admission. At the time of admission twenty patients were suspected to have splenic injury with history of injury over left hypochondrium. Seventeen patients were haemodynamically unstable and they were resuscitated with IV fluids and blood and then taken up for surgery.

Plain X-ray abdomen and X-ray chest were taken in all patients. Two patients X-ray showed fracture 7th to 9th ribs on the left side. In three patients there was a fracture in the 9th rib on the left side. Three patients X-ray showed air under right dome of diaphragm. Fracture left clavicle was found in one patient. Four patients X-rays were suggestive of peritonitis. Ultrasonogram was done in thirteen patients it revealed splenic haematoma. One child with paracentesis positive expired within one hour of admission due to associated head injury. The postmortem findings showed Grade III injury spleen with retroperitoneal haematoma.

The diagnosis of splenic injury was confirmed by clinical examination. The presence of haemoperitoneum was confirmed by ultrasonogram and paracentesis in doubtful cases. Seventeen patients underwent laparotomy. Two patients had Grade II injury, seven patients had Grade III injury, five patients had Grade IV injury and three patients had Grade V injury. Two patients with grade I injury treated non operatively by conservative management. Both recovered well.

Laparotomy showed twelve isolated splenic injuries and eight

with associated other organ injuries. Retroperitoneal haematoma were found in eleven patients. Post operative period was uneventful in twelve patients and three patients developed postoperative fever. One patient developed wound gaping. One patient expired postoperatively due to associated chest and head injury. All the patients were advised to have pneumococcal vaccine.

LIVER INJURIES:

Liver is the next commonest organ to get injured in blunt abdominal trauma. In our study the incidence of liver injury is fourteen. Isolated liver injury was found in seven patients and associated with other organ injury was seven. Among the fourteen patients, eight patients were injured in road traffic accidents and direct hit was the mode of injury in seven cases. Bullock cart is responsible for injury in three cases and two patients were injured due to fall which occurred during agricultural work. One patient sustained injury due to fall from height. The injury admission interval varies from two hour to thirty eight hours. The injury operation interval ranges from four hours to forty hours. The delay in operation was due to delay in the admission of the patient. At the time of admission patients were in shock were resuscitated with IV fluids and compatible blood except for two patients who died within an hour of admission. The post-mortem showed Grade III lacerations in the right lobe of liver with associated head injury in one and the other with grade IV isolated liver injury. Plain X-ray abdomen was taken in all patients. Seven patients showed fracture ribs on the right side. Three patients showed air under right dome of diaphragm suggestive of associated hollow viscus injury. Features of peritonitis were present in seven patients. Ten patients were haemodynamically unstable and all these ten patients were taken up for surgery. On laparotomy four patients were found to have Grade II injuries, three patients with Grade III injuries and Grade IV injuries each. Postoperatively one patient with Grade II injury developed post operative adhesive obstruction and another patient developed abscess in the right sub diaphragmatic space. Postoperative fever was present in six cases. Two patients developed pleural effusion.

PANCREATIC INJURIES:

Pancreatic injuries occurred in eight cases, three cases were associated with other intra-abdominal organ injuries and five with isolated pancreatic injury. Peritoneal signs were present in six cases. Elevation of serum amylase was found in five cases. Road traffic accident was the cause in four cases and four cases sustained injury during agricultural related work. In our study five cases with injury to the body of the pancreas and three cases with tail of pancreas occurred. Distal Pancreatectomy was done in three cases. Simple repair with non absorbable suture material was done in two cases with injury to the body of pancreas. Combined pancreaticoduodenal injury occurred in one case in which pyloric exclusion with gastrojejunostomy was done. Two children with haematoma of pancreas without ductal injury were treated conservatively. Pancreatic fistula is the commonest complication following pancreatic trauma. In our study, three patients developed pancreatic fistula. Next common complication is formation of pseudocyst followed by subphrenic abscess.

RENAL INJURIES:

Among the three cases of renal injuries studied, two cases were with isolated renal injuries and one cases with other associated organ injuries. All the three cases were treated conservatively. Among the three patients with renal injuries one sustained injury following road traffic accident, one patient sustained injury during agricultural work and one patient sustained injury due to fall from height. The injury admission interval varies from two hour to thirty two hours. In our study of three cases of renal injury, the mortality was nil. All the patients are treated conservatively.

DISCUSSION:

The present study includes observation made in forty five cases admitted with the history of blunt abdominal trauma with solid organ injuries. This constitutes 0.058% of total hospital admission. Thirty six cases were in the age group of 5 to 12 years which accounts for 80% of cases. Six cases were between 2 to 5 years age group and three cases were less than two years of age. S.C.Dwivedi et al and B.C.jain et al (1993) reported similar results. The increased incidence in male children is probably due to more active and aggressive nature of male children. The age incidence in our study is shown in fig. 1.

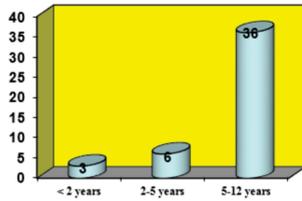


Fig.1 Age incidence

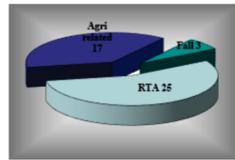


Fig.2 Mode of injury

In our study the commonest mode of injury was the road traffic accidents which occurred in twenty five cases accounting for 55.5% followed by injuries due to agricultural and agricultural related works in seventeen cases accounting for 37.7%. This higher incidence is due to the more agricultural activities in this region of Tamilnadu. The other modes of injuries were due to fall from height in three cases and accounting for 6.6% of cases. The relative occurrence of mode of blunt injuries is shown in fig.2. S.C.Dwivedi et al reported 57% incidence of motor vehicular accidents in blunt abdominal trauma. Solid organs are injured by a direct violence or deceleration injury because of the protected position and ligament attachments. Injuries to the kidney may occur by contrecoup mechanism or direct trauma. Pancreas is usually injured by direct trauma. In our study direct hit was the commonest mode of injury occurred during road traffic accidents. But the mortality is more in run over accidents when compared to direct hit.

In our study thirty four patients were admitted in this hospital within 10 hours after injury. The mortality in this group was six accounting for 17.6% and eleven patients were admitted after ten hours of which mortality occurred in three patients and accounts for 27% mortality. This is because delay in admission with massive haemorrhage leading to irreversible shock and peritonitis. This is similar to study by S.C.Dwivedi et al. The commonest associated injury in our study is chest injury which accounted for ten cases followed by injury to extremities and head injury. Laboratory investigations are of limited value immediately following blunt trauma. Evidence of intra abdominal injury in plain X-ray was present in twenty three patients in the form of fracture ribs in seventeen patients and air under diaphragm in six patients. There is a 20% chance of splenic injury and 10% chance of liver injury with fracture ribs on the left or right lower six ribs (Griffin W.O et al 1978, Moore E.E. 1985).

Abdominal paracentesis when positive is highly predictive of significant intra abdominal injuries but the accuracy varies from 50% to 90% in various studies. Autony et al (1966) showed 90% accuracy. The false negative rate is very high ranging up to 36% to 40% (Powel 1982, Root et al 1965). In our study abdominal paracentesis was done in seventeen cases, positive in twelve patients accounting for 70% and negative in five patients constituting false negative in 29% of cases.

Ultrasonography can be used routinely in emergency department and it can demonstrate the presence of free fluids and solid organ injuries (Furtschegger et al 1988). In our study ultrasonogram was done in thirty two haemodynamically stable patients. In thirty cases it clearly demonstrated the injury. Stritmatter B .1988 showed a

sensitivity of 95.5% and specificity of 97.5%, hence ultrasonogram can be used as an initial imaging procedure for screening.

Erik Kisa M.D. et al in 1986 reported that emergency IVP is useful in patients with specific indication and gross haematuria and patients with microscopic haematuria alone may be safely followed by observation. In our study three patients with macroscopic haematuria were submitted for IVP. In three patients IVP showed evidence of renal injury. IVP was also useful to confirm the presence of other normally functioning Kidney.

Computerized tomography is the best investigation for both solid and hollow abdominal viscera. With careful interpretation even subtle visceral, bowel and mesenteric injuries can be detected (department of radiology, virginia, health science.) CAT scan has specificity and sensitivity of more than 95%. Intra peritoneal fluid tends to accumulate in the pouch of douglas (67%) and morrison's pouch (30%). In our study two cases of renal injuries were submitted for contrast CAT scan.

The greatest problem in dealing with management of blunt abdominal trauma in children is early diagnosis. This is usually due to masking of abdominal findings by associated injuries and also because of the apprehensive and crying nature of the children. When the diagnosis is in doubt especially in a hospital where sophisticated investigations are lacking, one must often depend upon repeated physical examination done at frequent intervals to decide whether the patient requires laparotomy or not (P. Sivalingam et al 1982). At laparotomy the commonest organ injured in most of the series is spleen (Denver Hospital Study, Herman Hospital 1983). In our study also the commonest organ involved is spleen followed by liver. The organs involved in our study are shown in Table 1. In cases of injuries due to fall from height, the number of organs involved increases the height increases. In our study of three cases of fall from height in one case the height was below ten feet and this caused single organ injury. Where as in two cases the height of fall was more than ten feet and this caused multiple organ injuries. But no mortality was noted in all those three patients.

Table 1. Associated other organ injuries

S. No.	Organs	Total No. Of Cases	Isolated Injury	Asso. With Other Organs Number	Organs Involved
1	Spleen	20	12	8	Liver 3 Pancreas 3 Intestine 3
2	Liver	14	7	7	Spleen 3 Intestine 3 Duodenum 1
3	Pancreas	8	5	3	Duodenum 1 Intestine 1 Spleen 3
4	Kidney	3	2	1	Liver 1

MORTALITY:

Mortality occurred in nine cases and accounting for 20%. Herman Hospital study a mortality of 24% of which 38.8% was due to other intra-abdominal organ and 34.3% was due to head injuries. This shows that mortality increase as the number of organs involved increases. This is similar to the study conducted by Feliciano D.V. et 1988. Road traffic accidents accounts for eight cases of death which shows that road traffic accidents produces multiple associated injuries. Out of eight cases of death two cases were due to associated head injuries. Two cases were due to associated chest injuries and one case was due to associated head and chest injuries. Three cases were admitted more than ten hours after injury.

CONCLUSION:

From our study the following conclusions were made.

1. The commonest intra abdominal organ injured was spleen followed by liver pancreas and kidney.
2. The commonest associated injury was chest injury followed by injury to the extremities.
3. Biochemical investigations are not very useful in the diagnosis of specific intra abdominal organ injury. Imaging studies like x- ray, ultrasonogram and CAT scan are only complimentary to clinical diagnosis.
4. In the management of solid organ injuries, splenic conservation procedures are better advocated for minor injuries and splenectomy in major injuries. Non operative approach to the minor liver injuries may be a better policy in a haemodynamically stable patient. Pancreatic injuries are usually associated with other organ injuries and are managed by minimal salvage procedures. Most of the renal injuries can be managed conservatively.
5. Injury occurring during agricultural and related activities is more in this region due to agricultural nature of this part of Tamilnadu. The mortality is more in patient with other associated injuries especially head injuries and in patient who were admitted delayed in the hospital.

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