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RESEARCH ARTICLE
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'' ROLE OF RADIOLOGY IN MANAGEMENT OF BLUNT TRAUMA ABDOMEN IN PEDIATRIC PATIENTS''

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ABSTRACT

Background - Blunt trauma accounts for more than 90% of traumatic mechanisms of injury in children. Blunt abdominal trauma accounts for between 10 and 15% of all blunt mechanisms. Children and young people are most often killed and disabled by accidents. The establishment of the present non- operative treatment for the majority of blunt solid organ injuries in the pediatric age group was prompted by observations that most blunt solid organ injuries will heal on their own and that surgical intervention would thwart this mechanism

Aim: this is a prospective observational study done in department of pediatrics surgery and radiology department in MGM Medical college and MY hospital Indore institute from January 2022 to July 2023**.** The aim of this study is 'Role of Radiology in management of blunt trauma abdomen in pediatric patients' whether to conserve or operate at tertiary health care center in high patient load hospital in India.

Methodology: 116 patients with blunt abdominal trauma due to any cause, the medical records of all patients with trauma of any kind age up to 13 years were carefully reviewed. The injured organ, patient age, sex, injury grade, imaging findings, intervention, length of hospital stay, and complications were prospectively reviewed using medical records. Initial resuscitation was done according to ATLS protocol. Ultimate management decision was based on stability of patients after resuscitation. Data was entered and analyzed through SPSS-26. Chi- square test and student's t-test were applied and P value <0.05 was considered statistically significant.

Results: There are 116 patients included, mean age was 5.34 years. Most of the patients suffered from road traffic accident, 50(86.2%). 104 (89.65%) patients showed free fluid in the abdomen. Sonography picked organ injury in 104 (89.65 %) patients. Out of 108, 32 patients had spleen laceration, 56 liver and 20 renal injuries. 16 patients were having splenic as well as renal laceration. Only 2 patient (1.3%) showed isolated renal injury. Two patients also have pancreatic injury. CT abdomen with intravenous contrast confirmed findings of ultra sonography. Despite resuscitation, 12 (10.6%) patients remained unstable and were operated. 104 [89.4%] patients were kept on conservative treatment. Hospital stays ranged from 5-19 days. Pancreatic injury patient has more hospital stay.

Conclusion: BTA is common in boys under age of 10 years**.** Although non-operative management is the treatment of choice in blunt trauma abdomen with solid organ injury but stability of the injured

child is the central pivot around which the whole management revolves. Delay in presentation and failure of timely resuscitation results into high operative intervention.

Keywords: Blunt trauma, non-operative management, road traffic accident.

INTRODUCTION

Children and young people are most often killed and disabled by accidents[1]. Blunt trauma accounts for more than 90% of traumatic mechanisms of injury in children. Blunt abdominal trauma accounts for between 10 and 15% of all blunt mechanisms[2,3]. Due to a combination of anatomical factors, including proportionately greater solid organs, comparatively taller, less ossified ribs, and a lack of sufficient fat to deflect impact of energy, the paediatric abdomen is particularly vulnerable to injury[4]. The vascularity of solid organs when injured can contribute significantly to significant hemorrhage, which can result in serious consequences and even death. The solid organ that sustains forceful damage most frequently is the spleen. It is more important to preserve the spleenin youngsters because of its immunological functions[5].

Abdominal trauma occurs in approximately 25% of children with major trauma, and it is caused by blunt forces in most cases. Blunt abdominal trauma often leads to solid organ injury. The spleen is the most commonly injured organ, followed by the liver. Pancreatic injury is less common, but must not be overlooked due to its relatively high morbidity and mortality.

The treatment of paediatric abdominal trauma has evolved during the past 40 years. The establishment of the present non- operative treatment for the majority of blunt solid organ injuries in the paediatric age group was prompted by observations that most blunt solid organ injuries will heal on their own and that surgical intervention would thwart this mechanism[6,7].

Spleen, liver, kidney, and pancreas are among the solidorgans that are frequently injured as a result of forceful abdominal trauma. The patients who were hurt by blunt methods are the subject of this study. The vast majority of patients with acute abdominal injuries react effectively to conservative treatment, but in the event of potentially deadly hemodynamic instability, onemust continue to take care of unstable patients with caution. Although the stability of the patient determines whether to save or operate rather than the severity of the injury, some patients requireprompt operation. Finding these patients as soon as feasible is the challenging aspect[8,9]. Delayed presentation, delayed resuscitation, lack of relevant investigations and absence of paediatric intensive care monitoring result into high rate of operative intervention and decreases the rate of non-operative management.

Over the past few decades, non-operative management has evolved into the industry standard for managing children with BTA who are experiencing clinical stability[13]. Due to their anatomically smaller blood vessels, children's blood vessels have a very strong vasoconstrictive reaction[13]. Because of this, the capsule and the damaged blood vessels stop bleeding on their own, regardless of the degree of the injury. Conservative management has an overall success rate of more than 91%, according to recent literature[14,15].

In this study, we attempt to clarify the current status of care for severe pediatrics trauma patients at our paediatrics trauma Centre hospitals while also identifying the issues that need to be addressed in order to consolidate the care for these patients. The purpose of this study is to provide a reference material for improving the system of paediatrics trauma care and to also consider some of the common problems when compared with other regions.

Aims and objectives-

this is a prospective observational study done in department of pediatrics surgery and radiology department in MGM Medical college and MY hospital Indore institute from January 2022 to July 2023**.** The aim of this study is Role of Radiology in management of blunt trauma abdomen in pediatric patients'' whether to conserve or operate at tertiary health care center in high patient load hospital in India.

Methods and materials-

A total of 116 children with abdominal blunt trauma up to the age of 13 years were enrolled. Patients who had penetrating abdominal injuries, examination-detected peritonitis, pneumoperitoneum on an abdominal X-ray, and who left against medical advice or referred to other hospitals were excluded from study. Age, gender, injury localization, mechanism, and areas of injury were all noted, as were the vital signs at the time of admission, the results of the abdominal exam, the CBC, blood chemistry, and the abdominal US and CT findings.

Initial clinical evaluations following admission are typically conducted using Advanced Trauma Life Support (ATLS) protocols, with clinical endpoints assessed in relation to age- appropriate heart rate and blood pressure ranges, as well as the observation of urine output as a stand-in for end-organ perfusion at the bedside.

Regardless of the injury's mechanism, resuscitation was initiated in accordance with ATLS in all trauma patients. Vital indicators were closely watched and monitored. Blood transfusions and intravenous fluids were given as necessary. After a preliminary examination and any necessary bedside investigations, such as X-rays of the chest, pelvis, and C-spine and Extended FAST, it was only then decided to perform a CT abdomen with IV contrast on stable patients.

Patients who required surgery following fluid resuscitation and 20ml/kg packed RBCs were unable to stabilize despite all conservative measures. Children with hemodynamic instability do not exhibit typical adult clinical findings due to their different physiological responses to hypovolemia, and tachycardia may be the only clinical symptom of class III shock in the context of normal blood pressure. Only when the amount of blood in circulation has decreased by up to 25% does hypotension become apparent. As a result, isolated tachycardia should raise an alarm and be treated surgically.

Data was entered and analyzed through SPSS-26. Chi- square test and student's t-test were applied and P value <0.05 was considered statistically significant.

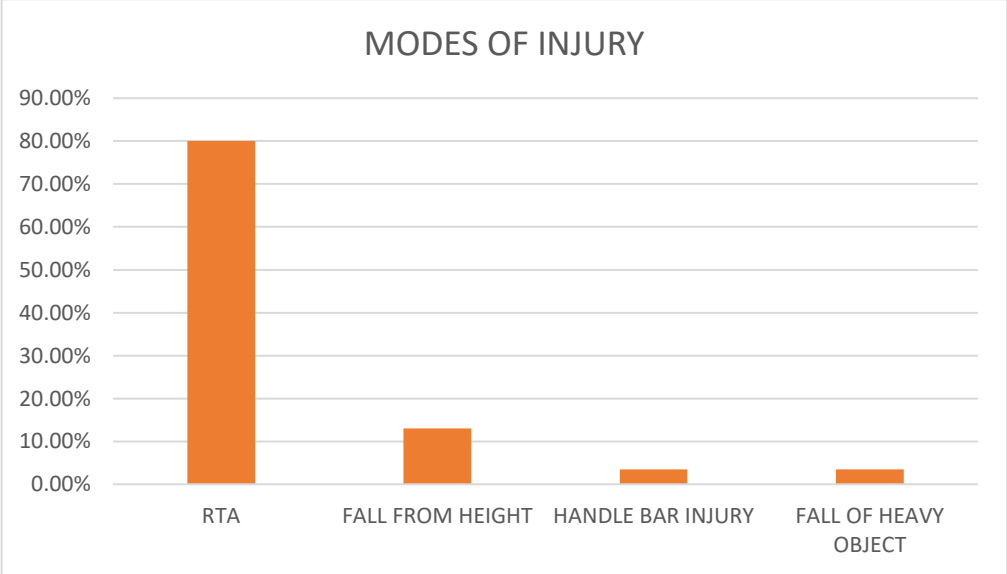
RESULTS-

-The mean age was 5.34 years with range was 1 year to 13 years.

-76 (63.52%) were males while 40 females.

-Most of the patients suffered from road traffic accident, 93 (80%). Fall from height 15 (13%), handle bar injury 4 (3.4%) and fall of heavy object 4 (3.4%) were other modes of injury.

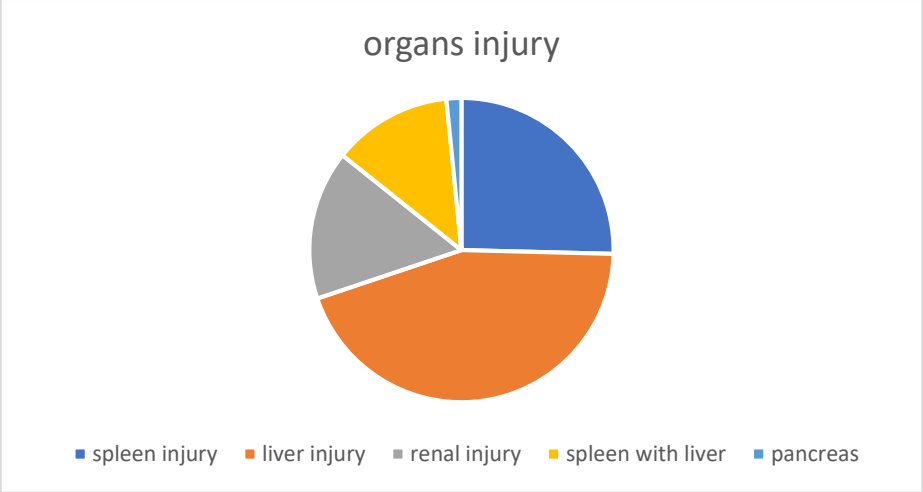
Graph no-1



-42 (36.2%) patients presented within 6 hours while 48 (41.37%) after 24 hours of injury, range 1-15 days from injury. Due to lack of emergency medical services and illiteracy, usually patients reach hospital with delay which increases morbidity and mortality.
-Most of the patients presented with complaint of pain abdomen, distension and vomiting. Nearly (95 %) presented with abdominal tenderness. Heart rate ranged from 92-156 beats per minute while mean was 128, so (94%) presented with tachycardia.

-The mean systolic blood pressure was 85mmHg (range 70-125mmHg).
-All patients were resuscitated, X-Ray chest, c-spine and pelvis were carriedout and bed side FAST scan was done. 104 (89.65%) patients showed free fluid in the abdomen.
-Sonography picked organ injury in 104 (89.65 %) patients. Out of 108, 32 patients had spleen laceration, 56 liver and 20 renal injuries. 16 patients were having splenic as well as renal laceration. Only 2 patient (1.3%) showed isolated renal injury. Two patients also have pancreatic injury.

Graph no-2



-CT abdomen and pelvis with IV contrast was done in 104 (89.6 %) of patients. Computed Tomography proved findings of ultrasonography.
-16 patients had spleen laceration grade 2, 12 patients grade 3 and 4 patient grade 4 splenic trauma. Likewise, 20 patients had liver trauma grade 1, 16 patients grade 2, 16 patients grade 3 and 4 patients grade 4. Among patients with splenic trauma, 16 patients had renal injury simultaneously and only 4 patients had isolated renal trauma, out of 10 patients with renal injury grade of injury ranged from grade 1 to 3.

Table -1 Ultrasonography findings

Findings of US	Findings of US	Findings of US
Free fluid	104	89.65
Spleen injury	32	29.62
Liver injury	56	51.85
Renal injury	20	18.51
Pancreatic injury	2	1.66
Spleen with renal	16	13.8

-Despite resuscitation with IV fluids and blood transfusion, 10 (8.6%) patients remained unstable and were operated. 106 [91.37%] patients were kept on conservative treatment.
-8 [6.89%] patients were operated within twenty-four hours while 4 [3.44%] patients after 24 hours

underwent surgery. Remaining 104 [89.65%] patients managed by non-operative management.
-As a whole on admission haemoglobine was less than eight grams/dl in 14 patients, 8-9gm/dl in 20 and more than 9 in 82 patients. Two patients underwent multiple transfusions.
-Splenectomy was done in 2 patients while two underwent splenorrhaphy. Renal laceration was repaired in one patient. Liver lacerations were repaired in 2 patients.
-Hospital stay ranged from 7-19 days, mean 5.89 days. 32 patients stayed more than 10 days in the hospital while 50 patients 5-10 days and 34 less than 5 days. Pancreatic injury patients have more hospital stay.

Table 2: Demographic and other variables of patients

Variables	Mean±SD	Range
Age (years)	5.34±2.61	1-12
GCS	13.9±1.8	12 -15
Systolic blood pressure (mmHg)	89.1±16.5	45-130
Pulse (beats/min)	94.0±8.05	2-161
Respiratory rate (beats/min)	27.6±4.0	20-40
Hb (g/dL)	10.0±1.3	5-13.9
Hematocrit (%)	35±4.9	20.5-37.3
AST (UI/L)	139.4±251.8	16-2016
ALT (UI/L)	147.9±281.1	31-2269
Duration between admission and injury (hours)	18.0±4.2	1-40
Duration between admission and surgery (hours)	10±4.7	6-36
Hospital stays (days)	7.89±4.2	4-19

-complications of post-operative wound infection 2 cases, paralytic ileus two cases and urinoma formation in one case.
The wound infection treated successfully with daily dressing and antibiotics.
-no any mortality was observed in our study.

DISCUSSION

this is a prospective observational study done in department of pediatrics surgery and radiology department in MGM Medical college and MY hospital Indore institute from January 2022 to July 2023. The aim of this study is Role of Radiology in management of blunt trauma abdomen in pediatric patients'' *whether to conserve or operate at tertiary health care center in high patient load hospital in India.* Particularly in the paediatric age range, blunt trauma abdomen (BTA) is a significant cause of torso trauma.[10] It is one of the main factors contributing to morbidity and mortality in children. The most common causes of blunt abdominal trauma are car accidents, falls from great heights, bicycle handlebar injuries, pedestrian trauma, sports injuries, and child abuse[11,12]. Traffic collisions are the main causes of BTA, which mostly affects the spleen, liver, and kidney

-The range of presentation according to ages in our study was 1 year to 13 years, with a mean of 5.34 years. 40 females and 76 males were part of our study. Our research is partially comparable to that of Ameh et al[16], who studied 57 individuals with a mean age of 9 years, 45 males, and 12 females.
-According to Baiomy et al[17], polytrauma accounted for 22.1% of cases, road traffic accidents (RTAs) for 30.7% of cases, falls from heights for 21.4% of cases, and crush injuries for 10.7% of cases. Most of the patients suffered from road traffic accident, 93 (80%). Fall from height 15 (13%), handle bar injury 4 (3.4%) and fall of heavy object 4 (3.4%) were other modes of injury. Our study's high rate of traffic accidents is caused by drivers' negligence and poor road conditions, as well as unattended kids riding motorcycles aimlessly.
-Wisner et al[18] looked at a total of 605 children who had solid organ injuries and discovered that 49% of them had spleen injuries, 47% had liver injuries, and 24% had kidney injuries. Sonography picked organ injury in 104 (89.65 %) patients. Out of 108, 32 patients had spleen laceration, 56 liver and 20 renal injuries. 16 patients were having splenic as well as renal laceration. Only 2 patient (1.3%) showed isolated renal injury. Two patients also have pancreatic injury. According to another study by Coley et al[19], only 32 of the 107 patients with abdominal trauma had CT-documented injuries, and FAST only found free fluid in 12 of the patients.

-Ten cases were missed by FAST because they had solid organ damage but no free fluid. In our study, all patients underwent FAST testing, which identified free fluid collection in 104 (89.65%) of the cases Sonography picked organ injury in 104 (89.65 %) patients. Out of 108, 32 patients had spleen laceration, 56 liver and 20 renal injuries. 16 patients were having splenic as well as renal laceration. Only 2 patient (1.3%) showed isolated renal injury. Two patients also have pancreatic injury. The US is 56-97% sensitive in detecting hemoperitoneum[20]. The US imaging value for determining damage to other organs and the retroperitoneum is lower. Focused assessment using sonography in trauma (FAST) was determined by Er et al. to have a sensitivity of 50% and a specificity of 85% for identifying solid organ injury or free fluid[21].
According to the literature, the prevalence of surgical therapy ranges from 8 to 31% and the prevalence of conservative treatment is from 70 to 92%[22]. Recent investigations have found that the surgery ratio is frequently low. Surgery was found to be 8.7% prevalent in Henderson et al study.[18] In the Rogers et al. trial, only 10% of patients with Grade IV injuries underwent surgery, while the other 80% received conservative care.[23]
12 (10.34%) of the patients in our research continued to be unstable and required surgery. 104 [89.4%] patients were continued on conservative care. Nine patients underwent surgery after 24 hours, while three patients had operations within 24 hours. The percentage of operated patients was very high in our study, and only 89.6% of patients received non-operative care. This is the result of delayed presentation and a lack of paediatric critical care monitoring and availability. The hospital stay duration in our study ranged from 5 to 19 days, with a mean of 7.89 days. Research by Fodor et al[24] found that the mean hospital stay was 14 days, with a range of 0 to 38.

Although the literature is full of favors in respect of non-operative management of blunt trauma abdomen with solid organ injury but timely presentation, prompt resuscitation, CT with intravenous contrast and intensive care monitoring are the mandatory prerequisites of such a management. If such facilities are insufficient, patients should be shifted to other centers with high care environment. The high rate of operative cases in our study is due to delayed presentation, inadequate investigations and lack of intensive care monitoring.

CONCLUSION

BTA is common in boys under age of 10 years**.** Although non-operative management is the treatment of choice in blunt trauma abdomen with solid organ injury but stability of the injured child is the central pivot around which the whole management revolves. Delay in presentation and failure of timely resuscitation results into high operative intervention. Paediatric blunt abdominal injuries are still quite common in our neighborhoods and much work needs to be done to reduce this prevalence.

Initial care should focus on oxygenating and perfusing essential organs in accordance with ATLS principles. Since children's physiological needs differ from adults, aggressive fluid resuscitation should commence as early as possible. An inadequate response to fluid resuscitation is a sign that bloodtransfusion is mandatory and determining the source of the bleeding is necessary. It is necessary to measure serum lactate, base excess, and hemoglobin. A laparotomy will eventually be performed on all unstable patients. CT abdomen with IV contrast and intensive care unit for close monitoring are essential prerequisites for conservative management of solid organ injury in blunt trauma abdomen.

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