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PEDIATRIC BLUNT ABDOMINAL ISOLATED LIVER TRAUMA-OUTCOMES & MANAGEMENT AT ICH-A COMPREHENSIVE REVIEW

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ABSTRACT **Background:** Blunt abdominal trauma is a significant cause of morbidity in the Pediatric population, with the liver being one of the most commonly injured solid organs. Pediatric patients have a unique physiological response to trauma and often require individualised management strategies. This study aims to analyse the clinical presentation, management, and outcomes of Pediatric patients with isolated blunt liver trauma at our tertiary care centre. **Method:** A retrospective observational study was conducted over 5 years, including Pediatric patients (<12 years) with BAT involving only the liver. Data were collected on demographics, mechanism of injury, imaging findings, AAST liver injury grading, management (operative vs. non-operative), hospital stay, and outcomes. **Result:** A total of 30 children with isolated blunt liver trauma were included. The majority sustained injury from road traffic accidents (66.7%) and falls (33.3%). Most cases were managed non-operatively(93.3%). Surgical intervention was indicated in two patients (6.67%) due to associated biliary injury. The mean hospital stay was 7.1 days. Mortality was (3.33%) **Conclusion:** Non-operative management is safe and effective for most Pediatric liver injuries. Early identification, grading, and close monitoring are crucial in optimising outcomes in these patients.

KEYWORDS : liver injury, blunt abdominal trauma, non-operative management

INTRODUCTION

The liver is the largest intra-abdominal solid organ and is enclosed in its anterior and lateral aspect within the ribcage[1]. The large size of the liver, its friable parenchyma, thin capsule, and its relatively fixed position in relation to the spine make it prone to blunt injury[2]. Segments VI, VII, and VIII of the right lobe are involved in 85% of cases[3]. Blunt abdominal trauma (BAT) accounts for 80-90% of trauma in children[4]. Liver trauma comes second in blunt abdominal trauma frequency[5]. Evidence suggests that most patients with blunt liver injury never bleed intraperitoneally[6]. Contrast-enhanced CT is the imaging modality of choice in evaluating hemodynamically stable patients with suspected hepatic injury[1]. CT findings of perihilar injuries, major hepatic vein or bile duct injury, progression of injury on follow-up, or persistent hemoperitoneum need aggressive management[2].

Management strategies in blunt solid organ injuries have evolved over the last two decades, with non-operative management (NOM) being the hallmark of treatment for the vast majority of children[4]. Present American Pediatric Surgical Association (APSA) guidelines recommend non-operative management with length of stay and activity restrictions based on the grade of injury[7][8]. Indications for procedural intervention in a patient with blunt hepatic injury include hemodynamic instability or generalised peritonitis, no response to an initial resuscitation effort, or a continued transfusion requirement[5].

AIMS AND OBJECTIVES

This study aims to determine the incidence, aetiology, grade of injuries, management and outcome of blunt abdominal trauma in children at our tertiary care centre.

MATERIALS AND METHODS

It is a Retrospective study on a series of 30 patients admitted with isolated blunt liver injury, recorded over a period of 5 years from January 2020 to April 2025 at the Department of Pediatric Surgery, Institute Of Child Health, Madras Medical College, Chennai.

Several parameters were studied, including age, sex, mode of injury, presenting complaints, radiological findings, injury assessment, associated injuries, and management.

RESULTS

In 5 years, we had 30 cases of isolated blunt liver injury representing a frequency of 6/year and 18.9% of all abdominal trauma cases admitted during the study period. Ages varied between 1 to 12 years, with a mean of 6.5 years (Figure 1). Children between 5 and 10 years of age were the majority (50 %). The Male/Female ratio was 2:1. Road traffic accidents (RTA) were the most frequent cause (66.7%), followed by fall from height (20%) (Figure 2). In children >10 years, falling from height or bicycles was the most common cause of trauma (33.7%).

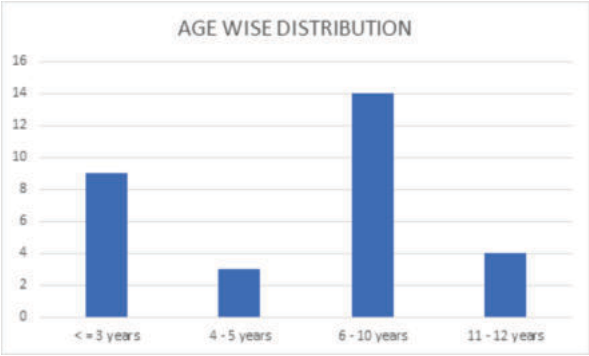

Figure 1: Age-wise Distribution of Cases

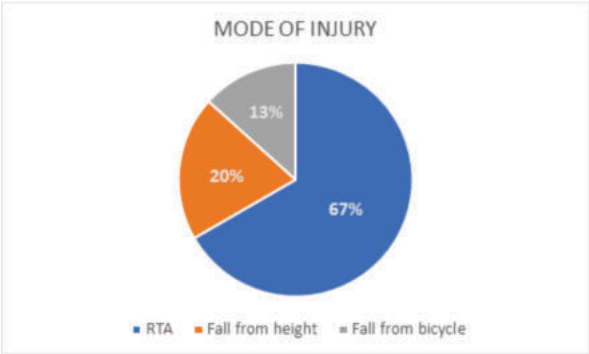

Figure 2: Distribution of Cases According to Mode of Injury

Admission time was within 24 hrs in 76.6% of cases, with an average admission time since injury being 5.5 hrs. Abdominal pain was the presenting complaint in all cases. Out of 30 cases, 93.3% were managed non operatively. CECT was done in all cases. On CECT abdomen & pelvis, 3.33% had grade I/II liver injury, 50% had grade III, and 43.3% had Grade IV liver injury (Table 1). The most dominant injury type was laceration (83.3%), followed by contusion in 16.6% (Figure 3). These injuries involved the right lobe in all cases, and segment VIII was the most commonly involved (83.3%).

Table 1 – Grade-specific Injuries as Per the American Association of Surgery for Trauma (AAST)

GRADE	INJURY TYPE	n
1	Small subcapsular hematoma or superficial laceration	-
2	Subcapsular hematoma covering 10-50% of surface area or 1-3cm depth laceration,<10cm length	1

3	Large(>50%) ruptured subcapsular hematoma, intraparenchymal hematoma>10cm or laceration >3cm depth	15
4	Ruptured intraparenchymal hematoma or lobar parenchymal disruption involving 25-505 of the lobe	13
5	Lobar parenchymal disruption >50% or juxta hepatic venous injuries	1
6	Hepatic avulsion	-

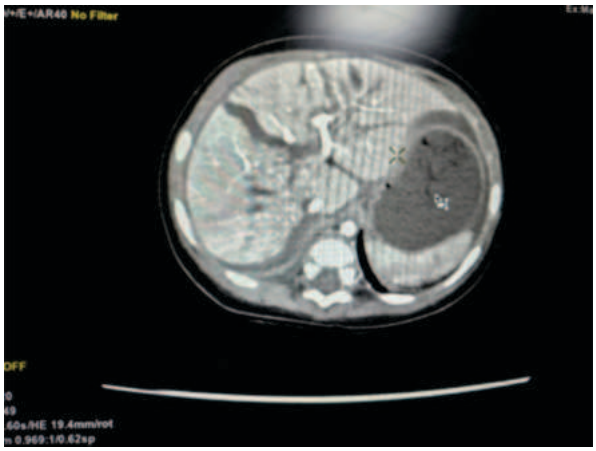

Figure 3 - CECT Abdomen and Pelvis Showing Laceration in Segment VIII of the Right Lobe of the Liver.

Operative treatment was indicated in two patients(6.67%). The indication of surgery was biliary leak in both cases, one from the central and the other from the sectoral bile duct. The child with central duct injury had an intraperitoneal drain inserted on day 3 of trauma that became bilious on day 5, with the child passing acholic stools. CECT showed multiple lacerations in the right lobe with right portal vein injury (Figure 4). Intraoperatively, there was a rent in the anterior wall of the right hepatic duct (Figure 5) with a devascularized right lobe of the liver; hence, a Right Hemihepatectomy was performed. The child passed cholic stools from POD 5 and was discharged home on POD 9. The child passed cholic stools from POD5 and was discharged home on POD 9.

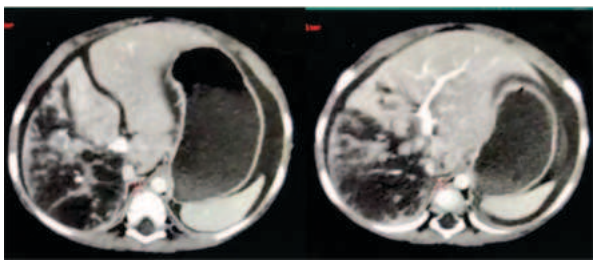

Figure 4 - CECT Abdomen and Pelvis With Multiple Linear Lacerations (Grade V), Right Portal Vein Injury and Devascularisation of the Right Lobe of the Liver

Figure 5 - Rent in the Anterior Wall of the Right Hepatic Duct

A child with sectoral duct injury presented 48 hours after a bicycle fall. He had grade III liver injury involving segments V and VIII of the right lobe. Initially managed non-operatively, he developed abdominal distension and acholic stools on day 5. A pigtail catheter was inserted under ultrasound guidance and drained bile. An MRCP showed a biliary leak from the sectoral duct to segment VIII. He was planned for surgical exploration due to high output from the catheter but developed MODS and expired on day 8.

DISCUSSION

Blunt abdominal trauma accounts for 80-90% of abdominal trauma in children. Most of the liver injuries are due to motor vehicle accidents followed by falls from heights. Penetrative injuries are rare in children. Around 90% of liver injury cases can be managed non-operatively[1].

Physical examination is an important step in the evaluation of abdominal trauma. Abdominal tenderness is the most common finding, with a prevalence of 67-75% in the literature[2]. Focused assessment with sonography for trauma (FAST) helps in the prompt identification of hemoperitoneum in blunt abdominal trauma (BAT) with a high sensitivity and specificity of 95-100%[3]. In hemodynamically stable patients, contrast-enhanced abdominal CT is the imaging modality of choice. It accurately defines the morphology and extent of injury[4]. The AAST grading system is used to define the severity of injury[5].

According to the ATOMAC group consensus version 11.0 published in 2015[8], several new concepts on solid organ injury (SOI) have been introduced: 1) Most patients with blunt SOI never bleed intraperitoneally; 2) Management decisions can be made based on clinical signs of recent or ongoing bleeding; 3) A patient who bled to the point of shock may not still be bleeding; 4) The best way to determine if a child is still bleeding is to transfuse blood and evaluate the hemodynamic response; 5) Avoid crystalloids; 6) Admission to ICU should be based on hemodynamic status and not on the grade of injury; 7) Safe transfusion threshold of 7 g/dL; 8) No role for vasopressors; 9) Routine follow-up imaging is not required; 10) Serial hemoglobin measurement lacks utility[6].

Non-operative management is the "gold standard" in the majority of children with blunt parenchymal liver injury who are hemodynamically stable and without peritonitis. Children have smaller vessels with a more prominent vasomotor response, hence have a higher success rate with non-operative management[7][10]. Our results support the principle of conservative treatment in all hemodynamically stable patients.

Failure of non-operative management (NOM) has previously been reported in up to 25% of cases in the literature, mostly owing to poor patient selection, liver necrosis, sepsis, and biliary leak [9]. Failure of NOM in our study was in two cases (6.66%).

Previously, NOM was limited to low-grade liver injury less than grade III, but NOM is now the protocol of management in hemodynamically stable patients irrespective of AAST grade or amount of hemoperitoneum on CT.

The mean length of hospital stay in different series is 5-7 days, with ours being 7.6 days, and the mean stay in the ICU was 4 days. Mortality in literature is on average 5%, with our mortality rate (3.33%), which was the child with biliary leak expired due to Multiple Organ Dysfunction Syndrome (MODS).

CONCLUSION

It is safe to treat most children with isolated blunt liver trauma non-operatively, irrespective of the grade of injury, provided the child is hemodynamically stable. The success of NOM depends upon proper patient selection. eFAST is an excellent screening tool for accurate triage of unstable children that require laparotomy. Surgical interventions are needed only in cases of hemodynamic instability or those with peritonitis. Assessment of hemodynamic status is crucial in managing children rather than serial unnecessary imaging or hemoglobin monitoring.

Declarations

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Conflict of Interest: The authors declare no conflict of interest regarding this manuscript.

Ethical Approval: Consent obtained before this publication.

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