International Journal of Science and Research (IJSR)
ISSN: 2319-7064
SJIF (2022): 7.942

A Prospective Observational Study in CT Evaluation of Solid Organs in Blunt Abdominal Trauma

Dr. Megha Dilip[1], Dr. Pratibha Nayak[2], Dr. Rajan B[3]

[1]Third Year Resident, Dep of Radio Diagnosis, Dr. B. R. Ambedkar Medical College, Kadugondanahalli, Bangalore

[2]Third Year Resident, Dept. of Radio Diagnosis, Dr. B. R. Ambedkar Medical College, Kadugondanahalli , Bangalore

[3]Head of the Department, Dept. of Radio Diagnosis, Dr. B. R. Ambedkar Medical College, Kadugondanahalli, Bangalore

Abstract: ***Introduction: A prospective study was conducted at Dr. B.R. Ambedkar Medical College and Hospital on 40 patients with blunt abdominal trauma from July 2022 to January 2024. After obtaining informed consent, patient histories and clinical examinations were recorded. Inclusion criteria included all ages with blunt trauma due to accidents, falls, and other blunt injuries, excluding unstable patients, pregnant patients, and those previously evaluated. Methodology: The study assessed the effectiveness of CT in diagnosing solid organ injuries. CT scans of the abdomen and pelvis were conducted using TOSHIBA ACTIVION 16, with patients scanned in helical mode. Imaging parameters were 120 kV, 150 mAs, and 0.7–1.5 mm section thickness. Scans were analysed for solid organ injuries to help guide management decisions. Results and Discussion: The majority of cases involved individuals aged 21–30 years. Men (85%) were more affected than women (15%), with road accidents (47.5%) and falls (37.5%) being common causes. Liver injuries were most frequent (42.5%), followed by spleen (32%), kidney (15%), adrenal (7.5%), and pancreas (2.5%) injuries, aligning with existing studies. CT grading correlated with intra-operative findings in 94.73% of cases, with significant agreement (kappa = 0.831, p < 0.01). Single organ injuries (87.5%) were more common than multiple injuries (12.5%). n the present study, the spleen was commonly affected, with 77% of splenic injuries presenting as lacerations, 30% as hematomas, and 15% as contusions. Liver injuries were also significant, with lacerations observed in all cases (100%), followed by hematomas in 59% and contusions in 35% of cases. For kidney injuries, 50% were lacerations, 33% were hematomas, and 17% were contusions. These findings suggest that lacerations and hematomas are the most frequent types of injuries for the spleen, liver, and kidneys, while contusions are less common. Most cases (52.5%) were managed conservatively, supporting CT's role in guiding treatment. Rib fractures and hemothorax were noted in 32.5% and 37.5% of patients, respectively. Recovery was achieved in 96% of cases, with a 4% mortality rate. Conclusion: CT grading strongly correlated with surgical findings, validating its reliability for pre-operative evaluation of intra-abdominal injuries.***

Keywords: CT imaging, blunt abdominal trauma, solid organ injuries, liver and spleen injuries, injury management

1. Introduction

Abdominal injuries account for approximately 10% of all trauma-related deaths. Traffic accidents are the leading cause, with other sources including falls (often work-related), recreational accidents, and violent events. Common abdominal injuries include lacerations to the liver, spleen, and kidneys, as well as urological and bowel injuries[1,2]. CT scans are extensively used in the early treatment of acute abdominal trauma and have become invaluable in this area. CT has proven to be highly specific and sensitive for detecting abdominal injuries, making it the preferred initial assessment tool for patients with both stable and unstable trauma[3]. Studies suggest that CT can accurately diagnose blunt abdominal injuries with up to 97% precision[4,5,6]. Moreover, CT scans can also identify coexisting extra-abdominal injuries, such as pneumothorax, and undetected pelvic and spinal fractures[5,6]. The introduction of MDCT technology has further enhanced CT's role in assessing blunt abdominal trauma[7,8]. With faster scan times and narrow collimation, MDCT improves contrast in blood vessels and organs, allowing for full scans in a single breath-hold[8,9]. This technique aids in pinpointing active arterial bleeding and organ injuries, with multislice scanning reducing breathing artifacts in cases where breath-holding is difficult[9,10]. The use of CT in trauma assessments has increased the effectiveness of conservative, non-surgical treatment for abdominal injuries and significantly reduced the number of unnecessary exploratory surgeries[11,12].

2. Aims and Objectives

Aim: To study the pattern of solid organ injuries with blunt abdominal trauma using computed tomography.

Objective: To study the grades of abdominal solid organ injuries and prompt diagnosis, which is essential for early management and preventing complications due to trauma

3. Materials and Methods

Patients with blunt abdominal trauma who had been referred to the department of Radiodiagnosis from the casualty of Dr. B.R. Ambedkar Medical College and Hospital, Bengaluru.

Study Size: 40 cases

Study Design: Prospective observational study

Study Duration: July 2022 to January 2024

Inclusion criteria

All patients, irrespective of age and gender, who are hemodynamically stable with a history of blunt abdominal

trauma due to car accidents, falls, pedestrian strikes, motorcycle accidents, and direct, blunt traumas such as animal kicks were included in the study.

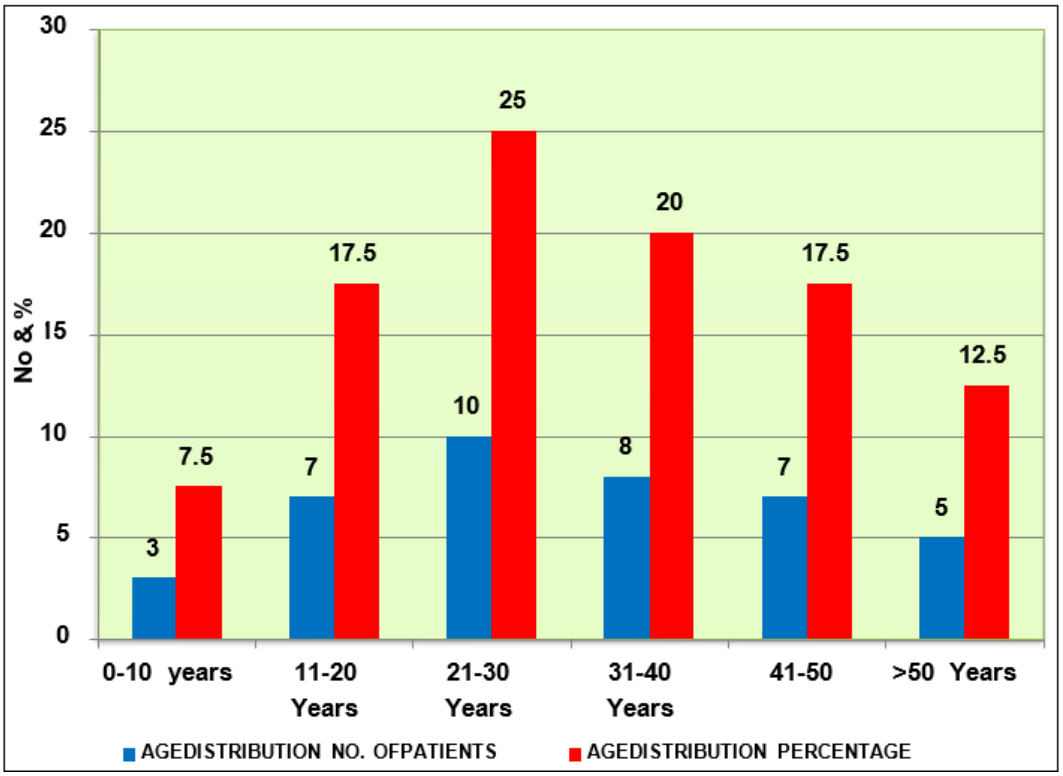
Exclusion criteria

Patients were excluded if they had prior radiological imaging elsewhere, were hemodynamically unstable with peritoneal signs or abdominal distention requiring immediate surgery, were pregnant, had penetrating trauma, or did not consent to participate.

4. Observation and Results

a) Age-wise distribution of cases

A total of 40 cases were included in the study. Most cases were in the 21-30 years age group, with 10 cases (25.0%), followed by the 31-40 years group with 8 cases (20%). The 41-50 years and 11-20 years age groups each had 7 cases (17.5%), while the least represented group was under 10 years, with only 3 cases (7.5%).

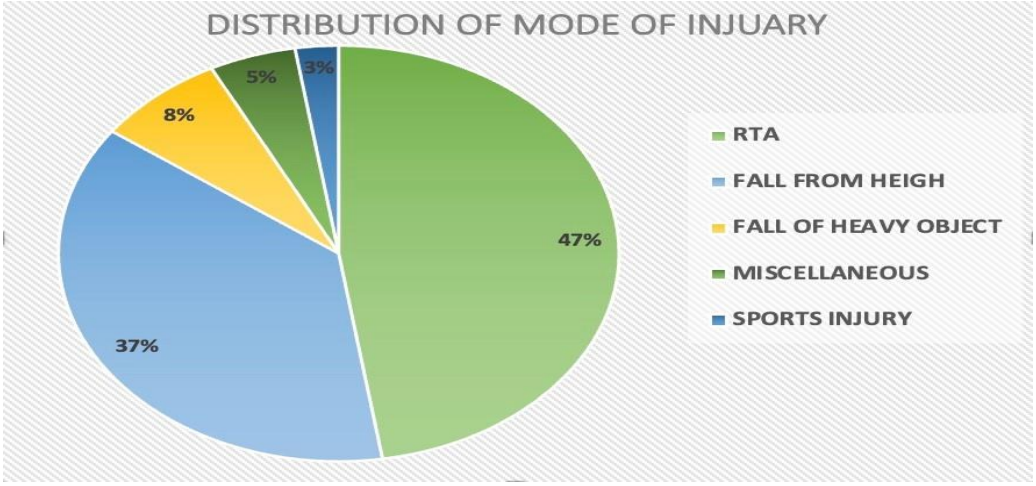


Gender-wise distribution of patients with abdominal trauma

Shows the gender-wise distribution involved in abdominal trauma. As per the present study, 40 cases were included, of which males and females were 34 (85%) and 6 (15%), respectively. Males are more predominant as compared with females.

Distribution of mode of injury

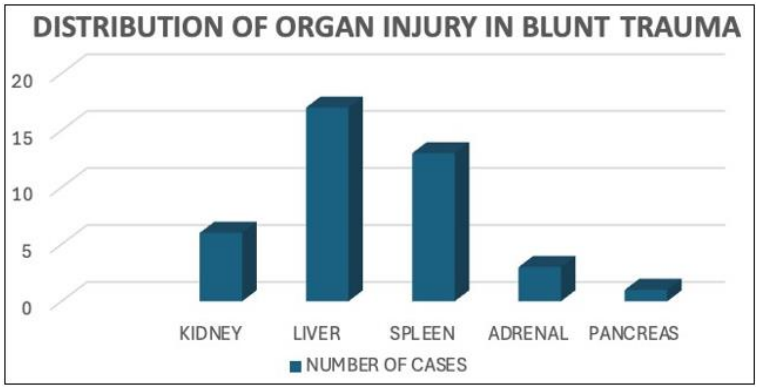
Most cases were due to road accidents (47.5%), followed by falls from heights (37.5%), heavy object falls (7.5%), miscellaneous injuries (5%), and sports injuries (2.5%). Logistic regression testing showed all parameters were statistically significant ($p<0.01$), with an odds ratio of 2.1.



Distribution of organ involvement

The study found that the liver was the most commonly injured organ in abdominal trauma, involved in 17 cases (42.5%), followed by the spleen (13 cases, 32%) and kidney (6 cases, 15%, $p<0.01$). Adrenal involvement occurred in 3 cases (7.5%), and the pancreas was least affected with 1 case

(2.5%). The liver, spleen, and kidney were statistically significant ($p<0.01$). Our findings align with existing literature, confirming that the liver, spleen, and kidney are the most commonly injured organs in abdominal trauma.



Distribution of intra-operative correlation of grade of injury

In the present study, among the 17 patients who got operated on, intra-operative grading correlated with computed tomography grading in 17 cases, constituting 83.50 % with Unpaired t-test value 3.74, $p< 0.01$, which is highly significant. Hence, the present study suggests that computed tomography grading correlates well with intra-operative grading and is a good and reliable modality to grade intraabdominal organ injury grading pre-operatively.

Comparison of intraoperative and perioperative grading

The study examined intra-operative and pre-operative grading, finding the following distribution across grades: Grade I (4.2%), Grade II (25.0%), Grade III (45.0%), Grade IV (35.0%), and Grade V (8.6%). Kappa statistics were applied to test the hypothesis, revealing a statistically significant agreement both between and within grades ($p < 0.001$) with a high Kappa value of 0.831(Table 1).

Number of organs involved (cases with single/multiple organ involvement)

In our study, of a total of 40 patients with abdominal injuries, multiple injuries were present in 5 patients (10 %), and isolated organ injury was present in 35 patients (90 %). In our study single organ injury was seen to be more common than multiple-organ injury in abdominal trauma.

Patterns and Prevalence of Organ Injuries in Splenic, Liver, and Renal Trauma

The study examined cases of splenic, liver, and renal injuries. Among 13 splenic injury cases, 10 were lacerations, 4 were hematomas, and 2 were contusions, with laceration and hematoma being the most common injuries (85%). In 17 liver injury cases, all exhibited laceration (100%), 10 had hematomas (58.8%), and 6 had contusions, indicating laceration as the most frequent liver injury. For renal trauma, out of 6 cases, 3 were lacerations, 2 were hematomas, and 1 was a contusion, with laceration and hematoma collectively comprising 83.3% of renal injuries.

Distribution of mode of treatment

Out of a total of 40 patients with abdominal injuries, 21 patients were treated conservatively, and 19 patients underwent surgery. Thus, operative and conservative management were undertaken in 47.50 % and 52.50 % of cases, respectively. This could be because most patients in our study had lower grades of injury which did not require surgery.

Outcome in patients

Of the 40 patients included in our study, 38 patients (96 %) were successfully treated, and their condition improved after treatment with follow-up advice. Mortality in the present study was in 2 patients (4 %).

5. Discussion

The study focused on 40 cases of abdominal trauma, emphasising the effectiveness of CT imaging in detecting and grading organ injuries. CT scans successfully identified the injured organs in all patients and accurately matched intra-operative grading in 83.5% of cases, highlighting its reliability as a diagnostic tool ($p<0.01$). The liver and spleen emerged as the most frequently injured organs, with incidences of 42% and 32%, respectively. This was followed by kidney injuries, which accounted for 15% of cases, then the adrenal gland (7.5%) and the pancreas (2.5%). Every patient exhibited hemoperitoneum, reinforcing the prevalence of internal bleeding in abdominal trauma cases.

CT imaging revealed typical injury patterns, with liver and spleen injuries commonly involving hematomas and lacerations, while the kidney injuries included hematomas, lacerations, and contusions. These findings underscored CT's role in providing a detailed understanding of injury types and severities. Among the patients, 21 (52.5%) were managed conservatively, particularly those with lower-grade injuries, avoiding the need for surgery. This reflects a growing trend towards non-operative management (NOM) in stable patients, aligning with the study's conclusion that CT scans play a key role in directing appropriate treatment strategies.

Age-wise, trauma was most prevalent among individuals aged 21-30, and road traffic accidents were the primary cause of abdominal injuries, accounting for 47.5% of cases. Other causes included falls from heights (37.5%), impacts from heavy objects (7.5%), and sports injuries (2.5%). The male-to-female ratio in the study was significantly skewed at 5:1, suggesting a higher risk among males.

Of the 40 cases studied, only 2 patients (4%) did not survive, which highlights the relatively low mortality rate in this cohort. The study concluded that solid organ injuries,

particularly to the liver and spleen, are major contributors to morbidity in blunt abdominal trauma. Notably, computed tomography was essential in accurately grading injuries, which helped guide effective management and improve patient outcomes. The research findings align with previous studies, confirming CT's effectiveness in abdominal trauma assessment. Additionally, non-operative management proved to be a viable treatment approach for most cases, as long as close monitoring was maintained. This research reinforces the importance of CT imaging in assessing abdominal injuries, accurately grading trauma, and informing treatment decisions, particularly in non-operative management strategies for stable patients.

This study had several limitations that impacted its ability to comprehensively evaluate the role of CT in detecting and grading abdominal injuries. The small sample size of 40 cases limited the robustness of findings, and all injuries were assessed by a single radiologist, preventing evaluation of interobserver variability. Only 19 patients underwent surgery, allowing correlation of CT findings with intra-operative results in these cases; however, there was no definitive way to confirm CT grading for the 21 patients managed conservatively. Additionally, the study followed patients only until discharge, without long-term follow-up to assess clinical outcomes. The lack of a control group without abdominal injuries also meant that sensitivity, specificity, and accuracy of CT in diagnosing abdominal trauma could not be calculated.

6. Conclusion

From the study, we concluded that computed tomography (CT) grading demonstrated a robust correlation with intra-operative grading ($p < 0.01$, $\kappa = 0.831$), underscoring CT as a highly reliable modality for pre-operative assessment of intra-abdominal organ injuries. CT exhibited excellent diagnostic performance in detecting hematoma, contusion, and laceration, making it a valuable tool for precise identification and characterization of these trauma-induced abnormalities.

References

[1] Novelline RA, Rhea JT, Bell T. Helical CT of abdominal trauma. *Radiol Clin North Am* 1999;37:591-612, vi-vii.
[2] Wolfman NT, Bechtold RE, Scharling ES, et al. Blunt upper abdominal trauma:evaluation by CT. *AJR Am J Roentgenol* 1992;158:493-501
[3] Linsenmaier U, Krotz M, Hauser H, et al. Whole-body computed tomography in polytrauma: techniques and management. *Eur Radiol* 2002; 12:1728-1740.
[4] Udekwu PO, Gurkin B, Oller DW. The use of computed tomography in blunt abdominal injuries. *Am Surg* 1996;62:56-59
[5] Dondelinger RF, Trotteur G, Ghaye B, et al. Traumatic injuries: radiological hemostatic intervention at admission. *Eur Radiol* 2002; 12:979-993
[6] Novelline RA, Rhea JT, Rao PM, et al. Helical CT in emergency radiology.*Radiology* 1999;213:321-339
[7] Wing VW, Federle MP, Morris JA, et al. The clinical impact of CT for blunt abdominal trauma. *AJR Am J Roentgenol* 1985; 145:1191-1194
[8] Weishaupt D, Grozaj AM, Willmann JK, et al. Traumatic injuries: imaging of abdominal and pelvic injuries. *Eur Radiol* 2002; 12:1295-1311
[9] Cogbill TH, Moore EE, Jurkovich GJ, et al. Nonoperative management of blunt splenic trauma: a multicenter experience. *J Trauma* 1989; 29:1312-1317
[10] Shuman WP. CT of blunt abdominal trauma in adults. *Radiology* 1997;205:297-306.
[11] Foley WD, Cates JD, Kellman GM, et al. Treatment of blunt hepatic injuries: role of CT. *Radiology* 1987;164:635-638
[12] Shanmuganathan K, Mirvis SE. CT scan evaluation of blunt hepatic trauma. *RadiolClin*

Table 1: Showing intra-op correlation with grade of injury

Injury Grade		Intra-Operative Grading					Total
		Grade I	Grade II	Grade III	Grade IV	Grade V	
Grade I	Frequency	1	0	0	0	0	1
	% within grade of injury	100.00%	0.00%	0.00%	0.00%	0.00%	100.00%
	% within intra op grading	100.00%	0.00%	0.00%	0.00%	0.00%	4.20%
	P-value	1	-	-	-	-	0.001
Grade II	Frequency	0	4	2	0	0	6
	% within grade of injury	0.00%	66.70%	33.30%	0.00%	0.00%	100.00%
	% within intra op grading	0.00%	100.00%	25.00%	0.00%	0.00%	25.00%
	P-value		0.001	0.025	-	-	
Grade III	Frequency	0	0	6	0	0	6
	% within grade of injury	0.00%	0.00%	100.00%	0.00%	0.00%	100.00%
	% within intraop grading	0.00%	0.00%	85.00%	0.00%	0.00%	45.00%
	P-value	-	-	0.001	-	-	0.001
Grade IV	Frequency	0	0	0	8	1	9
	% within grade of injury	0.00%	0.00%	0.00%	83.60%	13.44%	100.00%
	% within intraop grading	0.00%	0.00%	0.00%	100.00%	35.00%	35.00%
	P-value	-	-	-	0	0.007	0.003
Grade V	Frequency	0	0	0	0	2	2
	% within grade of injury	0.00%	0.00%	0.00%	0.00%	100.00%	100.00%
	% within intraop grading	0.00%	0.00%	0.00%	0.00%	68.00%	8.60%
	P- value	-	-	-	-	-	0.001
Total	Frequency	1	4	8	8	3	24
	% within grade of injury	4.80%	17.55%	35.00%	36.00%	13.87%	100.00%
	% within intraop grading	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
	P-value	0	0.001	0	0.008	0	1