

**A comparative study to evaluate outcome of surgical versus conservative management in a case of solid organ injury following blunt trauma abdomen**

**Outcome of surgical versus conservative management in a case of solid organ injury**

**Dr. Chandranath Banerjee<sup>1</sup>, Dr. Bikramjit Maity<sup>2</sup>, Dr. Rhitarashmi Nath<sup>3</sup>, Dr. Kajal Kumar Patra<sup>4\*</sup>, Dr. Jyotirmoy Bhattacharya<sup>5</sup>**

1. Associate Professor, Dept of General Surgery, Burdwan Medical College and Hospital, Burdwan, West Bengal, [ddchandranath@rediffmail.com](mailto:ddchandranath@rediffmail.com)
2. Assistant Professor, Dept of General Surgery, Burdwan Medical College and Hospital, Burdwan, West Bengal,
3. PGT, Dept of General Surgery, Burdwan Medical College and Hospital, Burdwan, West Bengal, [rhitarashmmh@gmail.com](mailto:rhitarashmmh@gmail.com),
4. Professor and Head, Dept of Gynae and Obstetrics, Gouri Devi Institute of Medical Science, Durgapur, West Bengal, [drmch2000@gmail.com](mailto:drmch2000@gmail.com),
5. Associate Professor, Dept of General Surgery, Burdwan Medical College and Hospital, Burdwan, West Bengal,

**Author for correspondence and reprint request:: DrKajal Kumar Patra**

Professor and Head, Dept of Gynae and Obstetrics, Gouri Devi Institute of Medical Science  
GT Road, National Highway 2, Rajbandh, Durgapur, West Bengal 713212

**Mobile : +91 9830212433**

**Email: [patrakajal8@gmail.com](mailto:patrakajal8@gmail.com), [drmch2000@gmail.com](mailto:drmch2000@gmail.com)**

**ABSTRACT**

**Background:** Blunt abdominal trauma (BAT) presently is the third most common form of trauma worldwide. The management of blunt abdominal trauma (BAT) is challenging. Management may involve non-operative measures or surgical treatment, as appropriate. Recently there has been increasing trend towards non operative management (NOM) of blunt trauma amounting to 80% of the cases with failure rates of 2-3%. NOM is a standard protocol for hemodynamically stable solid organ injuries. Present research was conducted to study the cause of blunt abdominal trauma, its different modes of presentation and to study and compare the different modalities of management. Thorough history taking and clinical examination was done. Template was generated in MS excel sheet and analysis was done on SPSS software.

**Results:** In the present study 59% patients are conservatively managed where mortality is 3.38%. 32% patients are surgically managed where mortality is 25%. 9 patients are died during resuscitation. Total 20 persons had been died among all patients. So, overall mortality rate was 20%. Total 42 patients have been diagnosed with morbidity. Among them, 21 patients of conservatively treated found with morbidity. 21 surgically managed patients got morbidity. Almost 100% of surgically treated survived patient had got morbid condition. 17 out of 21 (80.95%) conservatively treated patients with morbidity have longer hospital stay.

**Conclusions:** In this study liver is the most commonly involved organ followed by spleen. A thorough and repeated clinical examination and appropriate diagnostic investigations lead to successful treatment in blunt abdominal trauma patient with solid organ injury.

**Keywords:** Blunt abdominal trauma, solid organ injury, road traffic accident, Surgery

### **INTRODUCTION:**

Blunt abdominal trauma is a leading cause of morbidity and mortality among all age groups. The abdomen is a diagnostic black box.<sup>[1]</sup> It is most commonly involved following blunt trauma. The trauma can be either from road traffic accidents, accidental fall from height, sports injury or violence.<sup>[2]</sup> Motor vehicle accidents account for 75-80% of blunt trauma of abdomen.<sup>[3]</sup> Assault with blunt objects, sports injuries, industrial mishaps, bomb blast injuries and falls are responsible for 15 and 6-9 percent respectively. Child abuse and domestic violence can also cause blunt abdominal trauma. Road traffic crashes kill 1.2 million people annually around the world (3242 people in a day). Road traffic accident is predicted to become third largest contributor to the global burden of disease by 2020.

Blunt abdominal trauma is usually not obvious clinically and frequently unreliable.<sup>[4]</sup> Identification of serious intra abdominal pathology is often challenging. Missed intra-abdominal injuries and concealed hemorrhage are frequent causes of increased morbidity and mortality, especially in patients who survive the initial phase after an injury. These injuries are not initially diagnosed in a substantial proportion of patients. Delayed diagnosis can have serious consequences and may even lead to “preventable” deaths. Therefore, several diagnostic modalities have evolved in the past three decades: diagnostic peritoneal lavage, ultrasound, computed tomography (CT) and videolaparoscopy, each having inherent advantages, disadvantages and complications.<sup>[5]</sup> In recent years, focused assessment with sonography for trauma (FAST) has emerged as a useful tool in the evaluation of blunt abdominal trauma. The advantage of FAST is that it is non-invasive, portable; may be easily performed, and can be performed concurrently with resuscitation. Some authors in fact argue that FAST is more sensitive than CT for free fluid. Routine use of CT scanning for the evaluation of blunt abdominal trauma was not initially viewed with overwhelming enthusiasm. CT scanning requires a hemodynamically stable patient. In developing countries, late arrival to hospital, poor diagnostic facilities as well as late intervention continue to adversely affect the outcome.<sup>[6]</sup> In spite of the best techniques and advances in diagnostic and supportive care, morbidity and mortality remains at large. The reason for this could be due to the interval between trauma and hospitalization, delay in diagnosis, inadequate and lack of appropriate surgical management, postoperative complications and associated specially to head, thorax, and extremities. In view of increasing number of increased blunt trauma incident nowadays this dissertation for thesis has been chosen to study the cause of blunt abdominal trauma, its different modes of presentation and to study and compare the different modalities of management.

### **Objectives:**

The objectives of the study are

1. To establish diagnosis in solid organ injury without any hollow viscous injury following blunt trauma.
2. To evaluate various modalities of treatment to reduce morbidity and mortality.

3. To determine the outcome of surgical and conservative treatment in case of solid organ injury.

**Materials and Method:**

**Study design:** Prospective Cohort Study

**Study setting:** All surgical units at Burdwan Medical College and Hospital, Burdwan, West Bengal, India.

**Study period:** 1st September,2017 to 31st August,2019

**Definition of Population:** All Blunt Abdominal Trauma Cases in the given time period admitted in all surgical units will be considered.\ Sample size: 100

**Inclusion Criteria:** The patients presenting with history of recent assault by blunt and heavy object over abdomen.

- i. Road traffic accident with suspected blunt abdominal injury
- ii. History of fall from height.
- iii. Injuries occurring during natural calamities like earth quakes and land slides.
- iv. Patients on whom there is clinical suspension of blunt trauma to abdomen.
- v. Blunt trauma abdomen in sports injury.

**Exclusion Criteria:**

- i. Patients with penetrating and stab and gunshot injuries.
- ii. Patients with traumatic hollow viscous perforation with or without solid organ injury
- iii. Patients of blunt abdominal trauma with severe head injuries.
- iv. The patients who do not give consent for study

**Parameters to be used:**

**Age and gender distribution:** Any patients of blunt trauma solid organ injury

**Types of Organ Injury:** Liver, spleen, kidney, pancreas isolated injury (injury of one solid organ) or combined injury.

**Grading of injury:** grading of solid organ injury has also been noted.

**Mortality:** Mortality with respect to type of management.

**Morbidity:** Morbidity with respect to type of management.

**Post-Operative Complication:** Any immediate or delayed postoperative complication and temporary or permanent handicapped after surgical management.

**Hospital Stay:** Number of days in hospital staying

**i. Study Tools:**

- ii. Indoor Bed Head Tickets
- iii. Data sheet of interview
- iv. History and Clinical Examination Notes
- v. Blood parameters
- vi. Imaging investigation (st. x-ray abdomen in erect posture, FAST, Contrast enhanced computed tomography of whole abdomen)
- vii. Operation Theatre Records

**Methods data collection:** Data will be collected from indoor patient records, operation theatre records and outpatient records of the study cases in a preformed proforma.

**Ethical clearance:** Ethical clearance and approval for conducting this study was obtained from the ethical committee of Burdwan Medical College and Hospital, Burdwan. Informed verbal consent was obtained from the patients participating in this study after full explanation of the study objectives.

**Method of Study:**

The patients were classified according to best possible treatment: surgical or conservative. They were informed about the study and they were assured that best possible treatment will be given to them. Although some patients were died during resuscitation. Some patients had unstable vitals and the imaging could not be performed before urgent laparotomy. Hence intraoperative diagnosis could be done. Duration of hospital stay, morbidity, post operative complication in case of surgically treated patients, grading of injury, any complication will be noted. Depending on the outcome conclusion were made.

**Statistical analysis:** Standard statistical methods for data compilation and analysis. Software package SPSS is applied for statistical analysis.

**Results :**

A hospital based Prospective Cohort Study was undertaken with 100 patients of blunt trauma solid organ injury to study the cause of blunt abdominal trauma, its different modes of presentation and to study and compare the different modalities of management.

During the study 59% patients are conservatively managed where mortality is 3.38%.32% patients are surgically managed where mortality is 25%.9 patients are died during resuscitation. Total 20 persons had been died among all patients. So, overall mortality rate was 20%.

**Table 1 : Distribution according to intra-abdominal solid organ injury.**

Type of intra-abdominal solid organ injury	No. of patients	%	Mortality
Liver	27	29.7	3
Spleen	25	27.4	2
Kidney	13	14.3	--
Pancreas	12	13.2	5
Liver with spleen injury	6	6.5	1
Liver with kidney injury	5	5.5	--
Spleen with kidney injury	2	2.2	--
Spleen with pancreas injury	1	1.1	--

Table 1 shows that 9 Patients were died during resuscitation. Those are not included in the table. In this series liver (29.7 %) is the most common organ involved followed by spleen (27.4%).

**Table 2 : Morbidity & mortality in every grade of liver trauma**

<b>Grade of liver trauma</b>	<b>Conservative approach in no. of patients</b>	<b>Surgical approach in no. patients</b>	<b>Morbidity in no. of patients</b>	<b>Mortality in no. of patients</b>
Grade 1	4	0	0	0
Grade 2	5	0	0	0
Grade 3	8	0	1	0
Grade 4	4	4	2	1
Grade 5	0	2	--	2
<b>Total</b>	<b>21</b>	<b>6</b>	<b>3</b>	<b>3</b>

Table 2 shows that 21 Patients among 27 patients are managed conservatively. Overall mortality is 3 out of 27 patients (11.11%). While morbidity rate is 11.11%. All grade 3 patients were conservatively managed with the mortality rate 0%. 50% of grade 4 patients were managed surgically. 1 out of 4 surgically treated grade 4 liver injury had died; so the mortality rate 25% among surgically treated patients. Grade 5 liver injury has a high 100% mortality.

**Table 3 :Morbidity & mortality in grade 3 and grade 4 liver injury patients.**

<b>Grade 3 liver Injury (in no. of patients)</b>	<b>Morbidity (in no. of patients)</b>	<b>Mortality (in no. of patients)</b>
Conservative-8	1	0
Surgical-0	--	--
<b>Total -8</b>	<b>1</b>	<b>0</b>
<b>Grade 4 liver injury</b>		
Conservative-4	2	0
Surgical- 4	0	1
<b>Total -8</b>	<b>2</b>	<b>1</b>

Table 3 shows that in grade 3, there is no surgical approach considered in grade 3 liver injury. Mortality rate is zero and morbidity is 1 out of 8 (12.5%). In grade 4, overall mortality is 1 out of 8 (12.5%). Mortality is zero in conservative approach. Morbidity is 50% in conservative approach. While no morbidity in surgical approach. Leading to 25% of overall morbidity.

**Table 4 :Morbidity & mortality in every grade of splenic trauma.**

<b>Grade of splenic trauma</b>	<b>Conservative approach</b>	<b>Surgical approach</b>	<b>Morbidity</b>		<b>Mortality</b>	
			<b>Conservative approach</b>	<b>Surgical approach</b>	<b>Conservative approach</b>	<b>Surgical approach</b>
Grade 1	1	0	0	0	0	0
Grade 2	8	1	1	0	0	0
Grade3	5	1	0	0	1	0
Grade 4	1	3	0	0	0	0
Grade5	0	5	0	3	0	1
<b>total</b>	<b>15</b>	<b>10</b>	<b>1</b>	<b>3</b>	<b>1</b>	<b>1</b>

Table 4 shows that Total 15 patients (60%) out of 25 cases of solid organ injury to spleen were managed conservatively and the mortality rate is 6.67% and morbidity rate was 6.67%. There is no mortality in grade 1 and grade 2 splenic injury. 1 Out of 10 patients are expired during surgical treatment showing mortality rate 10%. Morbidity rate in surgically managed patient is 33.3%. 3 Out of 5 patients of grade 5 injury there is morbidity. Morbidity rate is 60%.

**Table 5 :Morbidity & mortality in grade 3 and grade 4 splenic trauma**

<b>Grade 3 splenic trauma</b>	<b>Morbidity (inno. of patients)</b>	<b>Mortality (in no. of patients)</b>
Conservative- 5	0	1
Surgical- 1	0	0
<b>Total- 6</b>	<b>0</b>	<b>1</b>
<b>Grade 4 splenic trauma</b>		
Conservative- 1	0	0
Surgical- 3	0	0
<b>Total- 4</b>	<b>0</b>	<b>0</b>

Table 5 shows that in grade 3 splenic trauma zero mortality and zero morbidity in surgically treated patients. Mortality is 1 out of 5 (20%) in conservatively treated patients. Morbidity is zero. In grade 4 splenic trauma 3 patients have been managed surgically and 1 patient has been managed conservatively. There is no morbidity and mortality among grade 4 splenic trauma patients.

**Table 6 :Conservative and surgical treatment in isolated kidney and pancreatic trauma patients.**

<b>Isolated kidney trauma</b>	<b>Conservative Approach</b>	<b>Surgical Approach</b>
Grade 1	0	0
Grade 2	4	0
Grade 3	1	0
Grade 4	4	1
Grade 5	0	2
<b>Total</b>	<b>10</b>	<b>3</b>
<b>Pancreatic trauma</b>	<b>Trauma without ductal involvement(no. of patients)-3</b>	<b>trauma causing duct of disruption(no. of patients)- 9</b>
Conservative-5	3	2
Surgical-7	0	7

Table 6 shows that from grade 1 to grade 3 all renal trauma patients were conservatively managed. Among all grade 4 renal trauma patients 4 out of 5 (80%) patients were conservatively managed. There is zero mortality in renal trauma patients irrespective of their grade of injury.Morbidity rate is 10% among conservatively managed patients; 2 out of 3 patients got morbidity after surgical procedure. In pancreatic trauma patients 7 out of 9 pancreatic ductal

injury patients have been surgically managed. Among the 2 ductal injury patients who have been conservatively managed, found expired after conservative treatment and one presented with pseudocyst of pancreas.

**Table 7 :Conservative and surgical treatment in combined liver and splenic trauma.**

<b>Approach to the patients</b>	<b>Total no. of patients</b>	<b>Morbidity (no. of patients)</b>	<b>Mortality (no. of patients)</b>
Conservative	3	1	0
Surgical	3	1	1
P value 0.008			

Table 7 shows that combined liver and splenic trauma has zero mortality and 33.3% morbidity in conservative approach. Combined liver and splenic trauma has 33.3% mortality as well as morbidity in surgically managed patients. The p-value is 0.008. As per my study non operative management is a safe and effective method in the treatment.

**Table 8 :Conservative & surgical approach in liver and kidney combined trauma, combined spleen and kidney trauma and combined splenic and pancreatic trauma with respect to morbidity**

<b>Liver and kidney combined trauma</b>	<b>Morbidity</b>	<b>Mortality</b>
Conservative- 2	0	0
Surgical-3	0	0
Total-5	0	0
<b>Combined spleen and kidney trauma</b>		
Conservative- 2	0	0
Surgical-0	--	--
Total- 2	0	0
<b>combined splenic and pancreatic trauma</b>		
Conservative- 1	1	0
Surgical-0	--	--
Total- 1	1	0

Table 8 shows that There is zero morbidity as well as mortality in combined liver and kidney injury. 2 out of 5 patients (40%) have been conservatively managed and 3 out of 5 patients (60%) have been surgically managed without any complication. In combined spleen and kidney trauma 2 patients with combined spleen and kidney trauma. The two patients are conservatively managed without any mortality and morbidity. In combined splenic and pancreatic trauma one patient of combined splenic and pancreatic trauma has been conservatively managed but has come with sepsis and pancreatic pseudocyst formation. Here mortality rate is zero but morbidity is 100%.

**Table 9 : Relationship of morbidity with respect to mean hospital stay**

Morbidity in no. of patients	≤ to mean hospital stay	> mean hospital stay	total
Conservative approach	4	17	21
Surgical approach	13	8	21
<b>Total</b>	<b>17</b>	<b>25</b>	<b>42</b>

Table 9 reveal that Total 42 patients have been diagnosed with morbidity. Among them, 21 patients of conservatively treated found with morbidity. 21 surgically managed patients got morbidity. Almost 100% of surgically treated survived patient had got morbid condition. The above table shows that 17 out of 21 (80.95%) conservatively treated patients with morbidity have longer hospital stay. This result is same in surgically treated patients. A large no. of patients with morbidity 25 out of 42 (59.52%) have longer mean hospital stay.

**Discussion**

**Ratio of conservative to surgical treatment:**

Treatment Approach	Present Study	Davis et al <sup>7</sup>	Khanna et al <sup>8</sup>
Conservative	59 out of 91=64.83%	23%	42%
Surgical	32 out of 91=35.16%	77%	58%

The above table shows that there is an increasing trend towards conservative treatment. In present study around 65 % patients are subjected for conservative management. Davis et al<sup>7</sup> showed 23% and Khanna et al<sup>8</sup> showed 42% non-operative management. Conservative management is gaining increasing acceptance mainly because of easy availability of FAST (Focussed Assesment Sonography for Trauma) and CT scan. With the aid of CT scan it is possible to accurately grade the extent of injury to solid organs like spleen, liver, kidney, pancreas. Minor lacerations and capsular tear, difficult to diagnose clinically can be demonstrated by CT scan and selected for conservative treatment. The disadvantages of conservative treatment are those of missed injuries and delayed treatment resulting in increasing mortality.

**Intra-abdominal organ injury:**

Table 1 shows the incidence of solid organs involved in blunt trauma to abdomen. In our study liver is the most common organ involved while the next most common organ involved is the spleen. Mortality is highest in pancreatic trauma patients. Blunt injury of abdomen as one of the most common injuries caused by road traffic accidents has been reported by many studies.<sup>[9]</sup>

John S et al<sup>[10]</sup> also reported most common mode of injury was due to Road traffic accidents in their study from Chennai. Maurice A et al.<sup>[11]</sup> in Nigeria also observed Road traffic accidents were the commonest cause of abdominal injury. Tiwari C et al.<sup>[12]</sup> in a study from Mumbai, India also observed that the Road traffic accident was the most common mode of injury seen in 14 patients (58.33%).

Multiple organ injury was seen in 8% cases. Anuradha G et al.<sup>[13]</sup> reported pain, localised

tenderness, abdominal distention and guarding among abdominal trauma patients, Spleen was the most common organ (66%) involved followed by liver (38%).

**Discussion about surgical or conservative treatment:**

In table 2 we can see that upto grade 3 liver injury can be managed conservatively with least morbidity and mortality. Grade 4 liver injury can also be managed conservatively if clinical profile is favourable. Similar management scenario has been observed in a study by Tripathi MD et al.<sup>[14]</sup>. Varied management decisions have been observed, Norman et al.<sup>[15]</sup> reported that 55% were managed conservatively.

Grade 5 liver trauma presents with high mortality. Overall mortality and morbidity increases with increasing the grade of liver injury inspite of best possible approach.

From table 4, it has been observed that upto grade 3 injury conservative treatment is the ideal one if clinical profile is favourable.

In grade 4 & grade 5 trauma splenectomy is the best possible treatment. These surgical procedures have less mortality. Although there are some instances of post operative morbidity in splenectomy patients.

Table 6, shows upto grade 4 renal trauma can be managed conservatively. Urinoma is an morbid condition which is associated with conservative treatment can be reduced by drainage of the urine radiologically. Grade 5 renal trauma may need nephrectomy after initial resuscitation of the patients. Renal trauma has no mortality.

Table 6, 7 show pancreatic trauma results with increase in mortality (41.66%) and morbidity rate 50%. Pancreatic ductal injury requires surgical management. In our study we have seen that ductal injury with conservative management comes with 100% mortality. There is delay in diagnosing pancreatic injury and this delay is probably responsible for high mortality and morbidity. Combined solid organs injury are with single incident of mortality. That occurred in combined liver and splenic injury. Cox et al.<sup>[16]</sup> reported a mortality of 16.6% in their study, whereas Allen and Curry et al.<sup>[17]</sup> reported a mortality of 10.8% in their study. Mortality was also higher in the converted group in study done in Oman by Raza M.<sup>[18]</sup>

Table 9 show after conservative treatment 56.14% of survived patients had short mean hospital stay. Higher the morbidity longer the hospital stay. Almost all surgically treated survived trauma patients got morbidity. This states surgical treatment has higher morbidity compared to conservative treatment. John S et al.<sup>[10]</sup> reported that mortality was also higher in the operative group. Malhotra et al.<sup>[19]</sup> and Schroepel and Croce<sup>[20]</sup> reported that non-operative management significantly improved outcomes over operative managements in terms of decreased abdominal infections, decreased transfusions and decreased lengths of stay.

We had the hypothesis that in conservative treatment the mortality is low and the alternative hypothesis is that for surgical resection the mortality is high. The P value of that study comes with

0.067 i.e. slightly better than 0.05. So that hypothesis was not statistically significant. But in the other tables and their statistical analysis showed that P value < 0.05. But the data in rest of the tables are statistically significant.

**Conclusion and Recommendations :**

A through and repeated clinical examination and appropriate diagnostic investigations lead to successful treatment in blunt abdominal trauma patient with solid organ injury. FAST is a very important investigation which gives a very clear picture of solid organ injury and hemoperitoneum. Around 9 patients were died during resuscitation. That makes overall mortality

20% in BAT solid organ injury patients. Liver injury has been surgically managed by hepatorrhaphy and absorbable gelatin sponge packing while splenic trauma can be surgically managed by splenorrhaphy and splenectomy. Grade 4,5 splenic injury are to be managed by surgical approach most of the time. Grade 4 liver injury can be managed conservatively in 50% of instances if there is hemodynamic stability. Pancreatic injury comes with high morbidity and mortality in both conservative and surgical treatment. Renal trauma patients had zero mortality in both surgical and conservative management. Some patients had mortality inspite of surgical treatment as they were hemodynamically unstable and in irreversible shock. Probably this is the main reason why surgically treated patient had comparatively high mortality. Higher the morbidity longer the hospital stay; Surgical patient had higher morbidity. Almost every surgically treated patients had morbidity.

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### **References :**

1. Hamilton Bailey's Emergency Surgery. 13th edition p 446-471
2. J. David Richardson, Martha Brewer. Management of upper abdominal solid organ injuries. AORN Journal may 1996
3. Maingot 's abdominal operations 11th edition p 772-784
4. Sabiston Text Book of Surgery. Feliciano DV. Diagnostic modalities in abdominal trauma. 17th edition p 483 -53 5
5. Peritoneal Lavage, ultrasonography computed tomography scanning, and arteriography. Surg Clin North Am 1991; 72:241-56.
6. Mirvis SE, Whitley NO, Valnwrsght JR, Gens OR. Blunt hepatic trauma in adults: CT-based classification and correlation with prognosis and treatment. Radiology 1989; 171:27-32.
7. Davis AR, Rosenthal P, Newman TB. Nontransplant surgical interventions in progressive familial intrahepatic cholestasis. Journal of Pediatric Surgery 2009; 44(4): 821-827.
8. J.N. Khanna, N.N. Andrade, Oral submucous fibrosis: a new concept in surgical management: Report of 100 cases, International Journal of Oral and Maxillofacial Surgery, 1995; 24(6):433-439
9. George C. Velmahos. Nonoperative treatment of Blunt injury abdomen. Arch Surg. 2003; 138:844-51
10. John S, Ravindrakumar C, Ramakrishnan R. Evaluation of the outcome of non-operative management in blunt abdominal solid organ injury. International Surgery Journal. 2016; 3(2):626-32
11. Maurice A, Okon B, Anietimfon E, Ogbu N, Gabriel U, Ikpeme A. Non Operative Management of Blunt Solid Abdominal Organ Injury in Calabar, Nigeria. International Journal of Clinical Medicine. 2010; 1(01):31

12. Tiwari C et al. Conservative Management of Blunt Abdominal Trauma with Solid Organ Injury in the Paediatric Age Group: Our Experience. *Indian Journal of Trauma &Emergency Pediatrics*. 2016; 8(3):215-219
13. Anuradha G, Kumar GA, Rao SA. An Audit of Management of Cases of Blunt Trauma Abdomen Resulting in Solid Organ Injury in a Tertiary Hospital Mumbai.
14. Tripathi MD, Shrivastava RD. Blunt abdominal trauma with special reference to early detection of visceral injuries. *US*. 1991; 53(5):179-84
15. Norman G, Tingstedt B, Ekelund M, Andersson R. “Nonoperative Management of Blunt Splenic Trauma: Also Feasible and Safe in Centres with Low Trauma Incidence and in the Presence of Established Risk Factors,” *European Journal of Trauma and Emergency Surgery*. 2009;35(2):102-107
16. Cox EF: Blunt abdominal trauma: A 5 year analysis of 870 patients requiring celiotomy *Ann Surg*. 1984; 199:467.
17. Rober B Allen, Georg J Curry. Abdominal trauma a study of 297 consecutive cases. *American journal of Surgery*. 1957; 93:398-402
18. Raza M, Abbas Y, Devi V, Prasad KV, Rizk KN, Nair PP. Non operative management of abdominal trauma—a 10 years review. *World Journal of Emergency Surgery*.2013;8(1):14
19. Malhotra AK, Fabian TC, Croce MA, Gavin TJ, Kudsk KA, Minard G, Pritchard FE. “Blunt Hepatic Injury: Paradigm Shift from Operative to Nonoperative Management in the 1990s,” *Annals of Surgery*. 2000; 231(6):804-813.
20. Schroepfel TJ, Croce MA. Diagnosis and Management of Blunt Abdominal Solid Organ Injury, *Current Opinion in Critical Care*. 2007; 13(4):399-404