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Original Research Article

A study of role of non-operative management in blunt abdominal trauma with solid organ injury

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ABSTRACT

Background: The present study of role of non-operative management in blunt abdominal trauma with solid organ injury was done to assess the feasibility and safety of non-operative management in hemodynamically stable patients and identify the causes, predictive factors to delineate the rate of non-operative management failure.
Methods: A longitudinal observational study was carried out from September 2013 to November 2015. All cases of blunt trauma abdomen with ultrasonological e/o solid organ injury and were hemodynamically stable were included in study.
Results: Total 138 cases presented with a history of blunt trauma abdomen of which 56 cases had ultrasonological evidence of solid organ injury. 8 cases were excluded as 6 of these were hemodynamically unstable at presentation while 1 had bowel perforation and another had severe head injury all requiring operative management. Maximum cases were of age group 21-30 years (41.66%) and 31-40 years (31.25%). 42 (87.5%) cases were male and 6 (12.5%) cases of 48 were females. 28 (66.67%) cases presented as Road Traffic Accident. 28 (66.67%) cases had abdominal pain as the commonest symptom while tenderness in 38 (79.17%) cases and tachycardia in 30 (75%) cases was the predominant sign. Most injuries were seen in spleen 23 (47.92%) cases f/b Liver with 14 (29.12%). Conservative management was successful in 40 (83.33%) cases and failed in 8 (16.67%) cases. Mortality of the study was 1 (2.08%) case.
Conclusions: Non-operative strategy is a successful approach in patients who are hemodynamically stable and authors strongly recommend it.

Keywords: Blunt trauma abdomen, Hemodynamically stable, Non-operative management

INTRODUCTION

Trauma is one of the leading preventable causes of death in developing countries and is a major health and social problem.[1] Trauma affects generally the young people and accounts for loss of more years of life than lost due to cancer and heart diseases put together. Our country is not an exception to this universal trend and has witnessed a steady increase in accidental trauma and at present ranks fourth among chief causes of death. Abdomen is the third common organ system of the body that is injured in civilian trauma after extremity and head injury. Blunt abdominal trauma is a leading cause of morbidity and mortality among all age groups. It is the main cause of death in people under 35 years of age worldwide.

Blunt abdominal trauma usually results from; motor-vehicle collisions (most common 50-75%), assault, recreational accidents and accidental falls.

Management of blunt abdominal trauma has evolved from operative to a non-operative approach. Non-

operative management in blunt abdominal trauma patients with liver, spleen and kidneys injury has become the standard of care in the present era. The availability of various sophisticated and highly accurate noninvasive imaging tools as well as interventional radiology techniques to selectively control bleeding has made this shift from operative to non-operative management possible. Thus, the present study of was done to assess the feasibility and safety of non-operative management in blunt abdominal trauma with solid organ injury in haemodynamically stable patients.

METHODS

Study design

A longitudinal observational study was carried out from September 2013 to November 2015.

Source of data

All patients giving consent and admitted in surgery wards with history of blunt trauma abdomen.

Inclusion criteria

- All patients with blunt abdominal trauma with solid organ injury who are hemodynamically stable and are explained about this study and are willing to give free consent to be included in this study.
- Patient's having blunt abdominal trauma with solid organ injury with polytrauma who do not require any operative management urgently for other organ systems involvement were included in this study.

Exclusion criteria

- Patients with blunt trauma abdomen with solid organ injury with hemodynamic instability defined as
  Tachycardia >130/min,
  Hypotension systolic BP <90 mm of hg [after initial fluid loading (< 2 liter)].
- Patients with severe pre- existing co morbidities: cardiovascular, respiratory and hematological disorders.
- Patient's with blunt trauma abdomen with solid organ injury with associated hollow viscus injury.
- Radiological evidence of ongoing bleed with combined hemodynamic instability.
- All ANC (antenatal care) and Pediatric age group patients (less than 18 years of age).

Methods

Once the patient is admitted with blunt trauma abdomen, after initial assessment, two wide bore IV access is taken, and IV fluids started. Blood sample is removed for grouping, cross-matching and other haematological investigations. Patient's history is reassessed, and his general examination and systemic examination is done.

After primary survey and stabilisation, radiological examination like ultrasound abdomen scan, radiograph of chest PA view, radiograph of pelvis with both hips and radiograph of cervical spine are done. Other radiographs are done depending on the extent of patient's injury.

Patient's hemodynamic instability grade is calculated as per Western Trauma Association hemodynamic instability scores.[2]

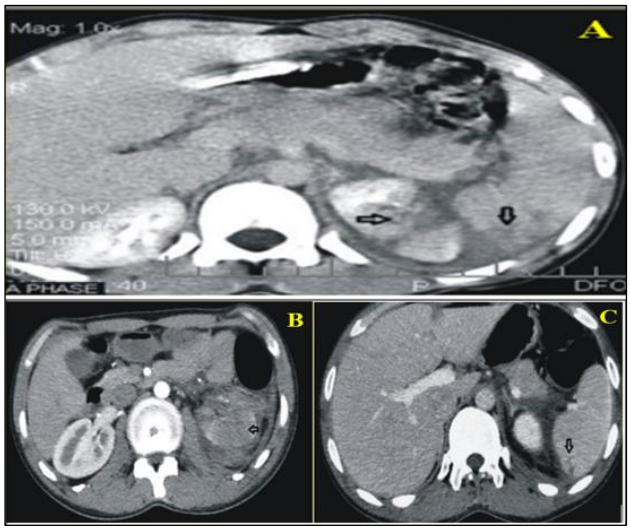

Figure 1: CT images showing multiple solid organ injuries; A: Grade III left kidney with grade II splenic injury; B: Grade IV left kidney with grade I splenic injury (A); C: Grade IV left kidney with grade I splenic injury (B).

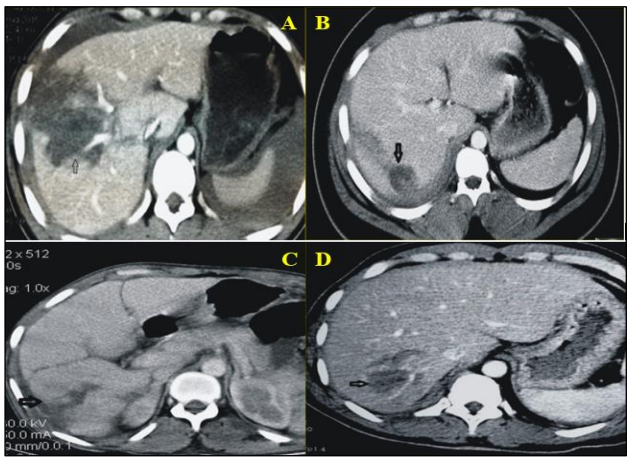

Figure 2: CT images showing hepatic injuries A: Grade IV liver injury; B: Grade III liver injury; C: Grade II liver injury; D: Grade I liver injury.

CECT abdomen is done if ultrasound reveals hemoperitoneum. CT grading of solid organ injury is done by American Association for Surgery of Trauma (AAST) grading system.[3] Despite conservative management and all supportive treatment if there is evidence of clinico-haemato-radiological deterioration

then non-operative management is discontinued and patient is explored.

Failure of non-operative management defined as a laparotomy performed more than 6 hours4 after admission after patient was initially considered for non-operative management was noted.

Patients were divided into two groups depending on the outcome of non-operative management: non-operative management-successful (NOM-S) and non-operative management-failure (NOM-F).

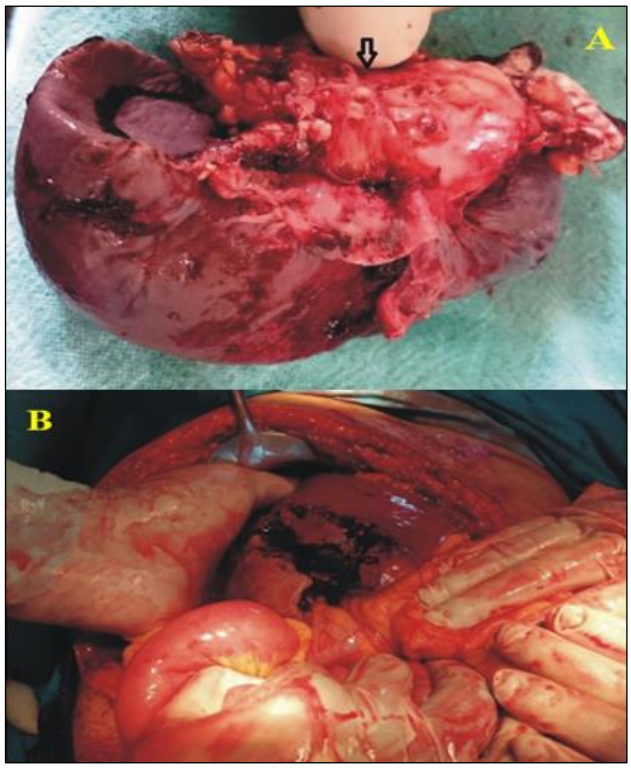

Figure 3: Intra-operative images of organ injuries A: Specimen of distal pancreatectomy with splenectomy; B: Grade IV hepatic injury.

Demographic and clinical profiles of patients in NOM-S and NOM-F groups will be studied and compared by applying tests for significance. Factors having statistically significant differences in between the two groups and more associated with the non-operative management failure group can be used to predict failure of non-operative management. Consent was obtained in written form by all patients and their relatives.

RESULTS

A total number of 138 patients presented with a history of blunt trauma abdomen. After initial evaluation and resuscitation as per ATLS protocols all 138 patients were investigated and out of these 138 patients, 56 patients had sonological evidence of solid organ injury.

Out of these 56 patients who had blunt trauma of the abdomen with solid organ injury, 8 patients required immediate operative intervention and were shifted to operation theatre for exploration after initial resuscitation and necessary and permissible investigations. These 8 patients were excluded from the study. 6 out of these 8 patients were hemodynamically unstable at presentation while 1 patient had bowel perforation associated with it and another had severe head injury that required operative management.

After early resuscitation and appropriate investigation 48 cases were considered for non-operative management and were included in this study after taking appropriate consent. All the patients that were included in this study were investigated by Contrast Enhanced Computed Tomography (CECT) of abdomen, pelvis and lower thorax and other required investigations and were kept under close observation in Surgical intensive care unit (SICU) initially and later on in surgical wards. Supportive treatment by intravenous fluids, analgesics, immobilisation and blood transfusions were given as required. Those patients who showed deterioration on any of these parameters were immediately taken for exploration and intraoperative findings noted. Patients were discharged with an advice to attend surgery outpatient department for follow up.

Age distribution

In this study 48 patients of blunt abdominal trauma with solid organ injuries who were started on non-operative management most of the patients were in the age group of 21 to 30 years which accounted for 20 out of 48 cases (41.66%). 15 patients out of 48 were in age group of 31 to 40 years (31.25%). There were 5 cases (10.42%) below 21 years of age and 5 cases (10.42%) out of 48 were in age group 41-50 years. 2 patients were in the elderly age group 51-60 years (4.17%) and 1 patient was of the age group of 61-70 years (2.08%) which represented the oldest patient in this study of 65 years. Mean age was 32.17 years (Table 1).

Table 1: Age group wise distribution of cases.

Age group	Male	Female	Total	Percentage
18-20 years	5	0	5	10.42
21-30 years	17	3	20	41.67
31-40 years	13	2	15	31.25
41-50 years	5	0	5	10.42
51-60 years	2	0	2	4.17
61-70 years	0	1	1	2.08

Sex distribution

42 (87.5%) patients were male and 6 (12.5%) patients of 48 were females. Male to Female ratio of patients with blunt abdominal trauma with solid organ injury was found to be 7: 1.

Mode of injury

The most common mode of injury in this study of 48 patients to cause solid organ injury via blunt abdominal trauma is Road Traffic Accident (RTA) which alone accounted for 32 out of 48 cases (66.67 %). 8(16.47%) patients out of 48 suffered from abdominal solid organ injury due to fall from height Injuries due to assault and railway accidents contribute 5 and 3 cases respectively, accounting for 10.42 % and 6.24 % of cases respectively (Table 2).

Table 2: Mode of injury causing solid abdominal organ injury by blunt trauma.

Mode of injury	Male	Female	Total	Percentage
Road traffic accidents	28	4	32	66.67
Fall from height	7	1	8	16.67
Assault	5	0	5	10.42
Railway accident	2	1	3	6.24

Clinical profile

Presenting symptoms

Out of 48 patients included in this study, all presented with history of trauma and following complaints: Pain in abdomen was the most common complaint in this study which was present in 32 out of 48 patients making 66.67 % of cases.

Vomiting was present in 11 patients (22.92%) out of 48 as one of their presenting complaint. Breathlessness was one of the chief complaints in 6 patients (12.5%) out of 48 patients presented to us.

History of loss of consciousness was present in 10 patients (20.83%) out of 48 out of which 3 had loss of consciousness as their only presenting complaints without any abdominal symptoms and 1 patient was brought in unconscious state with Glassgow Coma Scale of 6/15 (Table 3).

Table 3: Clinical symptoms of blunt trauma.

Symptoms	Total no. of cases	Percentage
Pain in abdomen	32	66.67
Vomiting	11	22.92
Loss of consciousness	10	20.83
Breathlessness	6	12.50

Clinical signs: General examination

Tachycardia was found in 30 out of 48 patients at presentation which accounted for 62.5 % of all cases. Hypotension was detected in 13 (27.08%) patients of these 48 patients which was treated immediately by intravenous fluids and whole blood transfusions as per situations demand. Pallor was seen in 16 (33.33%) patients out of 48 patients at presentation and these patients were given immediate blood transfusions.

Normal general examination was found in 18 (37.5%) patients out of 48 who were diagnosed to have blunt abdominal solid organ injury on further examination and subsequent investigations (Table 4).

Table 4: Clinical profile of blunt trauma abdomen general examination.

Signs on general examination	Total no. of cases	Percentage
Tachycardia	30	75
Hypotension	13	27.08
Normal general examination	18	37.5
Pallor	16	33.33

Clinical profile signs: Per abdominal examination

Localised tenderness was present in 38 out of 48 patients in this study accounting for 79.17% of total cases. Guarding was present in 13 (28.08%) patients Distension of abdomen was seen in 2 (4.17%) patients.

Normal per abdominal examination was found in 10 patients (20.83%) (Table 5).

Table 5: Signs on per abdominal examination.

Signs on per abdominal examination	No. of patients	Percentage of patients
Per abdominal tenderness	38	79.17
Per abdominal localized guarding	13	27.08
Normal per abdomen finding	10	20.83
Distension of abdomen	2	4.17

Severity of isolated solid organ injuries (grades of injuries)

Isolated splenic injuries

23 patients had isolated splenic injuries. Most common splenic injury in this study as per AAST grading was patients with grade III splenic injury which included 17 out of 23 cases of isolated splenic injury 73.91 % of splenic injury patients. Grade IV splenic injury was seen in 3 patients (13.04 %) of isolated splenic injuries while 3 other patients (13.04 %) had grade II splenic injury.

Isolated liver injuries

Fourteen patients out of 48 included in this study had isolated hepatic injuries. As per AAST grade in this study 4 patients had grade III (28.57 %) injury of liver while another 4 patients (28.57 %) had grade IV liver injury. Grade I injuries of liver were present in 3 21.43 %)

patients. Similarly grade II liver injuries were present in 3 patients (21.43 %) having isolated hepatic injury.

Isolated pancreatic injuries

Two patients out of 48 in this study had grade III pancreatic injury with complete pancreatic transection at distal pancreas and cut of main pancreatic duct (Table 6).

Severity of multiple solid organ injuries (grades of injuries)

Out of 48 patients included in this study 9 patients (18.75%) had multiple abdominal solid organ injury.

Multiple solid organ injuries involving spleen and left kidney

Four patients out of 48 (8.33 %) patients in this study had combined injuries of left kidney and spleen. 2 patients out of 48 in this study (4.17 %) had a combination of grade III left renal injuries with grade III splenic injuries. One patient out of 48 (2.08 %) had grade III renal injury of left side with grade II splenic injury.

One patient out of 48 in this study (2.08 %) had grade IV real injury with grade I splenic injury as per AAST grading scale.

Multiple solid organ injuries involving spleen and liver

Four patients out of 48 (8.33 %) patients in this study had combined injuries of spleen and liver.1 patient out of 48 (2.08 %) had grade I splenic injury with grade II liver injury. 1 other patient out of 48 patients in this study (2.08 %) had grade II splenic injury with grade III liver injury combined. While 1 patient out of 48 (2.08 %) in this study had grade III splenic injury with grade II liver injury and 1 patient out of 48 (2.08 %) in this study had grade V splenic injury with grade I liver injury.

Multiple solid organ injuries involving spleen and pancreas

One patient out of 48 in this study (2.08 %) had multiple solid injuries with grade I splenic injury with grade III pancreatic injury.

Outcome of non-operative management: Failure and Success of non-operative management (NOM-S and NOM-F)

Eight patients deteriorated and had to be converted to exploratory laparotomy which indicated Non-Operative Management-Failure (NOM-F; n=8) cases. 40 patients out of 48 started initially on non-operative management were treated successfully by non-Operative Management indicating Non-Operative Management-Successful cases (NOM-S; n= 40).

Table 6: Grades of isolated solid organ injuries.

Grades of injury (AAST)	No. of cases with isolated splenic injuries (%)	No. of cases with isolated hepatic injuries (%)	No. of cases with isolated pancreatic injuries (%)
Grade I	0 (0 %)	3 (6.25 %)	0 (0 %)
Grade II	3 (6.25 %)	3 (6.25 %)	0 (0 %)
Grade III	17 (35.42 %)	4 (8.33 %)	2 (4.17 %)
Grade IV	3 (6.25 %)	4 (8.33 %)	0 (0 %)
Total	23 (47.92 %)	14 (29.17 %)	2 (4.17 %)

Mortality

One patient out of 48 died. This patient who had grade III splenic injury with right middle and lower lobe lung contusion failed non-operative management due to on-going bleeding from the splenic injuries and splenectomy was done. Patient's hemodynamics and vitals had settled post-op, but he succumbed to ARDS that developed secondary to chest injuries on post op day 3.

Predictive factors for failure of non-operative management in blunt solid abdominal organ injuries

Forty patients were treated successfully by non-operative management (83.33 %) and were considered in non-operative management-successful group (NOM-S) and 8 patients (16.67) failed on non-operative management and were taken for exploratory laparotomy and were considered in non-operative management failure group (NOM-F). All the parameters described above of both these groups were compared and tests for statistical significance tests were applied for each of the parameters. t-test was applied in cases where variables for each individual (quantitative data) were present (for example: age) after calculating mean and standard deviation. Other test used in this study was Chi-square test which was used to calculate p value for factors which represents qualitative data (for example: sex).

P values of <0.01 were considered to be statistically significant. The parameters those were statistically significantly different in these two groups and were associated with non-operative management-failure group (NOM-F) were considered to have significant association with failure of non-operative management and thus could help in predicting failure of non-operative management. Various parameters in both groups of non-operative management failure and non-operative management successful were as follows (Table 7).

Table 7: Comparison between non-operative successful and failure groups.

Factor	Non-operative management-successful (n=40)	Non-operative management-failure (n=8)	P value
Age mean±SD	32.55±11.397	30.25±9.347	0.6115
Male sex	36 (90 %)	6 (75 %)	0.2415
Mode of injuries			0.6149
Road traffic accidents	26 (65 %)	6 (75 %)	0.5838
Fall from heights	7 (17.5 %)	1 (12.5 %)	0.7290
Assault	5 (12.5 %)	0	0.2907
Railway accidents	2 (5 %)	1 (12.5 %)	0.4237
Systolic blood pressure at presentation	107.55±14.333	97.5±14.373	0.0779
Diastolic blood pressure at presentation	71.1±8.387	64.25±12.937	0.0596
Hemodynamic instability grades at presentation			
Grade 0	6 (15 %)	2 (25 %)	0.4884
Grade 1	17 (42.5 %)	1 (12.5 %)	0.1095
Grade 2	17 (42.5 %)	3 (37.5 %)	0.7934
Grade 3		2 (25 %)	0.001*
Organs involved			
Liver	13 (32.5 %)	1 (12.5 %)	0.2559
Spleen	21 (52.5 %)	2 (25 %)	0.1556
Pancreas	0	2 (25 %)	0.001
Multiple solid organ	6 (15 %)	3 (37.5 %)	0.1366
Extra abdominal injuries	20 (50 %)	3 (37.5 %)	
Chest injuries	14 (35 %)	3 (37.5 %)	0.8926
Rib fracture	14 (35 %)	3 (37.5 %)	
Lung contusion	1 (2.5 %)	1 (12.5 %)	0.2013
Hemothorax	5 (12.5 %)	1 (12.5 %)	0.9375
Pneumothorax	2 (5 %)	1 (12.5 %)	0.4322
Bony injuries	11 (27.5 %)	0	0.0911
Head injuries	3 (7.5 %)	0	0.4237
Injury grade >III			
Liver	7 (17.5 %)	1 (12.5 %)	0.7290
Spleen	18 (45 %)	2 (25 %)	0.7505
Pancreas	0	2 (25 %)	0.0012

DISCUSSION

Blunt abdominal trauma (BAT) is one of the leading causes of mortality among trauma victims[5]. Ong et al from Singapore described trauma as the leading cause of death in those aged 1-44 years.[6] Blunt abdominal trauma accounted for 79% of cases. Most studies indicate that the peak incidence is in persons aged 14-30 years According to international data, globally blunt abdominal trauma is more common in men. The male-to-female ratio is 1.5:1.[7] Solid organs, especially spleen and liver, are most frequently injured following blunt trauma (Table 8).

Peitzman et al studied 1,488 adults (>15 years of age) with blunt splenic injury from 27 trauma centres were studied through the Multi-institutional Trials Committee of the Eastern Association for the Surgery of Trauma.[8] 61.5% of patients were admitted with planned non-operative management out of which the success rate was 89.2%. The failure rate increased significantly by AAST grade of splenic injury as follows: grade I (4.8%), grade II (9.5%), grade III (19.6%), grade IV (33.3%) and grade V (75.0%). Successful non-operative management was associated with higher blood pressure and hematocrit, and less severe injury based on injury severity score (ISS),

Table 8: Frequency of organ injury in blunt abdominal trauma.

Organ injured	Blunt trauma
Liver	30 %
Spleen	25 %
Retroperitoneal hematoma	13 %
Kidney	7 %
Urinary bladder	6 %
Mesentery and omentum	5 %
Pancreas	3 %
Stomach, small bowel and colon	3 %
Diaphragm	2 %
Urethra	2 %
Vascular injuries	2 %
Duodenum and biliary system	2 %

Glasgow Coma Scale, grade of splenic injury, and quantity of hemoperitoneum.

Based on numerous such studies with highly successful rates of non-operative management, in 2008, western trauma association formulated guidelines for management of adult blunt splenic injuries.[2] Non-operative management of liver trauma was first reported in 1972 and has been one of the most significant changes in the treatment of liver trauma over the past three decades.[9] Ongoing bleeding, infections, and the high mortality rate after operative treatment, stimulated the search for alternative treatments and, in 1990 non-operative management was introduced as a treatment for liver injury. The high success rate (approximately 90%) combined with the lower mortality and complication rates, in comparison to surgical treatment, makes non-operative management the treatment of choice for the majority of liver injuries, including high grade liver injury.[8] In 2009, based on high success rates of non-operative management in cases of blunt hepatic injuries Western Trauma Association released guidelines for management of blunt hepatic injuries.[10]

Li et al reported that 70 out of 72 patients with blunt liver trauma were managed successfully without operation, including 5 patients with grade V, 17 with grade IV and 48 with grade I-III liver trauma.[11] The overall success rate of non-operative management was 97.2%. The success rates of non-operative management in the patients with grade I-III, IV and V liver trauma were 100%, 94.4% and 83.3%, respectively. Bergen et al noticed that patients who underwent a laparotomy had a significantly higher risk of nephrectomy than the patients who were treated non-operatively; it therefore seemed that maximal renal preservation, with a minimum of subsequent complications, could be better achieved with non-operative management.[12] The switch from operative to non-operative management for the treatment of renal injuries occurred as a result of critical perceptions.

In 2004, the Renal Trauma Committee and in 2005, the European Association of Urology drew up guidelines for the optimum evaluation of patients with urological trauma.[13,14] In 2015 European Association of Urology updated these guidelines and stated that in haemodynamically stable patients, non-operative management is recommended for the management of all renal injuries including grade IV and grade V.[15]

Maaroufet al studied 206 patients with renal injuries on non-operative management with successful outcome in 189 cases (92.75%).[16] Eight cases out of these 189 required angioembolisation while 181 cases were managed without any intervention. Wood et al reported that after operative management, 21% had pancreatic complications, 57% had non-pancreatic complications, and 11% were readmitted.[17] In contrast, in the group undergoing non-operative management, 73% had pancreatic complications, 20% had non-pancreatic complications, and 40% were readmitted. Complication rates were higher among those with endoscopic retrograde cholangiopancreatography (ERCP) proven duct injuries.

In the multicenter experience reported by Paul and Mooney length of stay was not different between operative management and non-operative management.[18] Morbidity was 45% after operative management and 35% with non-operative management. Among the patients in the operative group, 15% developed pseudocysts, 10% developed fistulae, and 15% developed reoperations. In the non-operative group, 35% developed pseudocysts. The interpretation of the data is confounded by selection bias, whereby the less severely injured were more likely to undergo non-operative management, and thus, prospective studies with long-term outcomes are warranted. Cuenca and Islam reported 79 cases of pancreatic trauma of which operations were performed in 32 patients, whereas nonoperative management was noted in 47 cases.[19] They noted no differences in length of stay, age, injury severity score (ISS) and initial blood pressure in operative versus non-operatively managed cases. They concluded that non-operative management appeared to be safe for pancreatic injuries and was more commonly successful in treatment of low-grade injuries.

CONCLUSION

Therefore, authors concluded that blunt abdominal trauma with solid organ injuries is more common in young adults with male preponderance. Road traffic accident is the most common mode of injury. Most common solid organ injured in blunt abdominal trauma is spleen followed by liver. Multiple solid organ involvement may be present sometimes. Non-operative management of blunt abdominal trauma with solid organ injuries have very high success rate. Most common cause of failure of non-operative management is ongoing bleeding. Considering the above findings authors strongly recommend non-operative management in selected haemodynamically stable patients.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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