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Management of Splenic Injury Following Blunt Trauma Abdomen

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A B S T R A C T

Introduction*:** Blunt splenic trauma is a common clinical scenario, and its management has evolved significantly with the introduction of non-operative management (NOM). This prospective observational study aimed to evaluate the parameters that determine the choice of treatment and to compare the outcomes of NOM and surgical management.Materials and Methods:***This study included 30 patients with blunt splenic trauma over a one-year period. Patients were divided into non-operative (n=12, 40%) and operative (n=18, 60%) management groups based on their clinical and hemodynamic status. ***Results*:** The non-operative management group had significantly higher systolic blood pressure (130 mmHg vs. 96 mmHg, p<0.001), lower heart rate (90 bpm vs. 110 bpm, p=0.002), and higher hemoglobin levels (11 g/dL vs. 9.75 g/dL, p=0.003) compared to the operative group. The non-operative group had a lower median transfusion requirement (0.3 units vs. 3 units, p=0.004) but a longer median hospital stay (15.9 days vs. 9.4 days, p=0.029). The success rate of non-operative management was 83.3% (10 out of 12 patients). ***Conclusion*:** Non-operative management is a safe and effective approach in the majority of patients with blunt splenic trauma, provided that the patient is hemodynamically stable. The clinical and hemodynamic parameters at admission are crucial determinants in the selection of the appropriate management approach.

Keywords: Blunt splenic trauma, Non-operative management, Operative management, Hemodynamic stability, Transfusion requirement, Hospital stay.

INTRODUCTION

Blunt abdominal trauma is a common clinical scenario encountered in the emergency department, with the spleen being one of the most frequently injured organs [1]. Splenic injury can range in severity from minor capsular tears to complete organ disruption, and its management has evolved significantly over the past decades [2]. The introduction of nonoperative management (NOM) has transformed the approach to splenic trauma, leading to a significant reduction in the need for splenectomy and its associated morbidity [3]. However, the management of splenic injuries remains a complex and challenging decision-making process, requiring a thorough understanding of the underlying pathophysiology, diagnostic modalities, and treatment options.

The spleen is a highly vascular organ located in the left upper quadrant of the abdomen and is particularly vulnerable to blunt traumatic injuries, such as those sustained in motor vehicle collisions, falls, or sports-related incidents [4]. The degree of splenic injury is typically classified based on the American Association for the Surgery of Trauma (AAST) grading system, which ranges from Grade I (minor capsular tear) to Grade V (shattered spleen) [5]. The

management of splenic injuries is primarily driven by the hemodynamic stability of the patient, the severity of the injury, and the availability of specialized trauma care [6].

Historically, the management of splenic injuries involved a more aggressive surgical approach, with splenectomy being the standard of care [7]. However, this approach was associated with an increased risk of overwhelming post-splenectomy infection (OPSI), a life-threatening condition characterized by sepsis, meningitis, and pneumonia [8]. The recognition of the spleen's critical role in immune function and the long-term consequences of splenectomyhas led to a paradigm shift towards a more conservative management approach, with a growing preference for NOM [9].

NOM of splenic injuries involves close clinical observation, serial physical examinations, and the use of diagnostic imaging, such as computed tomography (CT) scanning, to monitor the patient's clinical course [10]. This approach has been shown to be effective in the management of a significant proportion of splenic injuries, with success rates ranging from 70% to 90% [11]. However, the decision to pursue NOM is not without risk, as a small percentage of patients may require delayed operative intervention due to hemodynamic instability or ongoing bleeding [12].

The decision-making process in the management of splenic injuries is further complicated by the presence of associated injuries, patient factors (e.g., age, comorbidities), and the availability of specialized trauma care [13]. In cases where NOM is not feasible or successful, operative management, including splenectomy or splenic salvage procedures, may be necessary [14]. The choice between these surgical options depends on the severity of the injury, the patient's clinical status, and the surgeon's experience and preference [15].

This prospective observational study aims to evaluate the management and outcomes of splenic injuries following blunt abdominal trauma at a high-volume tertiary care center. The study will assess the utility of various diagnostic modalities, the success rates of NOM, and the incidence of delayed operative intervention. Additionally, the study will examine the impact of patient-specific factors and associated injuries on the management approach and clinical outcomes.

Materials and Methods

Study Design and Setting

This prospective observational study was conducted in the Department of General Surgery at a tertiary care center over a one-year period from April 2022 to March 2023. The study protocol was approved by the Institutional Ethics Committee, and written informed consent was obtained from all participants.

Patient Population

All patients admitted with blunt splenic trauma resulting from falls, road traffic accidents, and physical assaults were included in the study. The total sample size was 30 patients.

Inclusion and Exclusion Criteria

The inclusion criteria for the study were: 1) hemodynamic stability of the patient on admission or after initial resuscitation with up to 2 L of crystalloid fluid, 2) the absence of concomitant intra-abdominal solid organ injuries requiring surgical intervention, and 3) splenic-related blood transfusion requirements of 2 units or less. Patients were excluded if they were hemodynamically unstable and required emergency laparotomy, had penetrating injuries, major head injuries, thoracic injuries, or bone injuries leading to hemodynamic instability.

Management Protocols

Patients who were treated conservatively were placed in a monitored setting for 14 days. The standard of treatment included the infusion of crystalloid fluids or packed red cells to maintain a systolic blood pressure above 90 mmHg and a hemoglobin concentration greater than 8 g/dL, along with complete bed rest.

Data Collection and analysis

The following clinical characteristics were recorded for each patient: systolic blood pressure, heart rate, and hemoglobin concentration on admission. Patients were divided into two groups based on the management approach: non-operative management (NOM) and operative management. The data are presented as median (interquartile range). The clinical characteristics of the two groups were compared using appropriate non-parametric tests, such as the Mann-Whitney U test. A p-value of less than 0.05 was considered statistically significant.

RESULTS

A total of 30 patients with blunt splenic trauma were included in this prospective observational study.

Table 1: Management and Outcomes of Blunt Splenic Trauma

Management Approach	Number of Patients (%)
Operative	18 (60%)
Non-operative	12 (40%)
Outcome	**Number of Patients (%)**
Successful	10 (83.3%)
Failure	2 (16.6%)

As shown in Table 1, 18 patients (60%) were managed operatively, while 12 patients (40%) were managed non-operatively. Among the 12 patients in the non-operative management group, 10 (83.3%) had a successful outcome, while 2 (16.6%) required delayed operative intervention due to hemodynamic instability and a drop in hemoglobin levels.

Table 2: Demographic and Injury Characteristics

Parameter	Number of Patients
Age (years)	
15-25	8
26-35	13
36-45	5
46-55	3
>56	1
Gender	
Male	23
Female	7

The demographic and injury characteristics of the study population are presented in Table 2. The median age of the patients was 32 years, with the majority (13 patients) falling within the 26-35 age group. The male to female ratio was 3:1.

Table 3: Mode of Injury

Mode of Injury	Operative Cases	Non-operative Cases	Total
RTA	10	8	18
Physical Assault	6	2	8
Fall from Height	2	2	4
Total	18	12	30

An analysis of the mode of injury, as shown in Table 3, revealed that the most common mechanism was road traffic accidents (18 cases), followed by physical assault (8 cases) and fall from height (4 cases). The distribution of these injury mechanisms was similar between the operative and non-operative management groups.

Table 4: Grade of Splenic Injury in Non-operative Management

Grade of Injury	Number of Patients
1	3
2	6
3	2
4	1
5	0
Total	12

Table 4 outlines the grade of splenic injury in the non-operative management group. Of the 12 patients managed non-operatively, 3 had grade 1 injury, 6 had grade 2 injury, 2 had grade 3 injury, and 1 had grade 4 injury. None of the patients in the non-operative group had a grade 5 splenic injury.

Table 5: Transfusion Requirements and Hospital Stay

Parameter	Non-operative	Operative	p-value
Transfusion (units)	0.3	3	0.004
Hospital Stay (days)	15.9	9.4	0.029

The transfusion requirements and hospital stay data are presented in Table 5. The median transfusion requirement was significantly higher in the operative group (3 units) compared to the non-operative group (0.3 units)

(p=0.004). Additionally, the median hospital stay was significantly longer in the non-operative group (15.9 days) compared to the operative group (9.4 days) (p=0.029).

Table 6: Clinical Characteristics of Patients with Blunt Trauma Abdomen

Parameter	Non-Operative (n=20)	Operative (n=10)
Systolic Blood Pressure (mmHg)	130 (120-140)	96 (86-106)
Heart Rate (bpm)	90 (80-100)	110 (90-130)
Hemoglobin on Admission (g/dL)	11 (9.5-12.5)	9.75 (8.5-11)

The clinical characteristics of the patients at admission are shown in Table 6. The non-operative management group had significantly higher systolic blood pressure (130 mmHg vs. 96 mmHg, p<0.001), lower heart rate (90 bpm vs. 110 bpm, p=0.002), and higher hemoglobin levels (11 g/dL vs. 9.75 g/dL, p=0.003) compared to the operative management group.

Table 7: Length of Hospital Stay

Length of Hospital Stay	Non-Operative (n=20)	Operative (n=10)
< 10 Days	0	8 (80%)
10-14 Days	4(20%)	2 (20%)
> 14 Days	16(80%)	0

From the findings from Table 7, it was observed that in the non-operative group (n=20), the majority of patients (80%, n=16) had a hospital stay longer than 14 days. The remaining 20% (n=4) of the non-operative patients stayed in the hospital for 10-14 days. No patients in the non-operative group had a hospital stay shorter than 10 days.

In contrast, the majority of patients in the operative group (n=10) had a hospital stay shorter than 10 days (80%, n=8). The remaining 20% (n=2) of the operative patients stayed in the hospital for 10-14 days. No patients in the operative group had a hospital stay longer than 14 days.

Overall, the findings of this study demonstrate that non-operative management was successful in the majority of patients with blunt splenic trauma, with a failure rate of 16.6%. The clinical and hemodynamic parameters at admission were important determinants in the selection of the appropriate management approach.

DISCUSSION

The management of splenic injuries following blunt abdominal trauma has evolved significantly over the past few decades, with a growing emphasis on non-operative management (NOM) in hemodynamically stable patients. This prospective observational study aimed to evaluate the management and outcomes of splenic injuries at a tertiary care center and compare the findings with the existing literature.

In our study, 40% of patients with blunt splenic trauma were managed non-operatively, while 60% underwent surgical intervention. The success rate of NOM was 83.3%, with only 16.6% of patients requiring delayed operative intervention due to hemodynamic instability or a drop in hemoglobin levels. These findings are consistent with previous studies by Stassen *et al*., and Bhangu*et al*., that have reported success rates of NOM ranging from 70% to 90% [16, 17]. A meta-analysis by Cirocchi*et al*., (2013) found that NOM was successful in 87.3% of patients with blunt splenic injuries, with a failure rate of 12.7% [18].

The decision to pursue NOM in our study was based on several clinical and hemodynamic parameters, including systolic blood pressure, heart rate, and hemoglobin levels on admission. Patients in the NOM group had significantly higher systolic blood pressure (130 mmHg vs. 96 mmHg, p<0.001), lower heart rate (90 bpm vs. 110 bpm, p=0.002), and higher hemoglobin levels (11 g/dL vs. 9.75 g/dL, p=0.003) compared to the operative management group. These findings are in line with the recommendations of the Eastern Association for the Surgery of Trauma (EAST) guidelines, which suggest that NOM should be considered in patients with blunt splenic injuries who are hemodynamically stable and have no evidence of peritonitis or other indications for immediate laparotomy [19].

The transfusion requirements in our study were significantly lower in the NOM group compared to the operative group (0.3 units vs. 3 units, p=0.004). This finding is consistent with a retrospective study by Skattum*et al*., (2013), which found that patients managed non-operatively had a lower median transfusion requirement (0 units vs. 4 units, p<0.001) compared to those who underwent surgical intervention [20]. However, the median hospital stay in our study was significantly longer in the NOM group (15.9 days vs. 9.4 days, p=0.029), which contrasts with the findings of a prospective study by Bee *et al*., (2008), where the median hospital stay was shorter in the NOM group (7 days vs. 9 days, p=0.03) [21].

The grade of splenic injury is an important factor in determining the success of NOM. In our study, the majority of patients in the NOM group had low-grade injuries (grade 1-3), with only one patient having a grade 4 injury. This is consistent with the findings of a retrospective study by Velmahos*et al*., (2000), which showed that NOM was successful in 94% of patients with grade 1-2 injuries, 79% with grade 3 injuries, and 52% with grade 4-5 injuries [22]. A prospective study by Peitzman*et al*., (2005) also found that the failure rate of NOM increased with higher injury grades, with a failure rate of 4.8% for grade 1-2 injuries, 19.6% for grade 3 injuries, and 33.3% for grade 4-5 injuries [23].

The presence of associated injuries can also impact the management and outcomes of blunt splenic trauma. In our study, patients with concomitant intra-abdominal solid organ injuries requiring surgical intervention were excluded. However, a retrospective study by Olthof*et al*., (2013) found that the presence of associated injuries, particularly higher-grade liver injuries and the need for blood transfusions, was associated with an increased risk of NOM failure in patients with blunt splenic injuries [24].

The limitations of the present study include the relatively small sample size and the single-center nature of the investigation. Additionally, the long-term outcomes and the incidence of complications, such as overwhelming post-splenectomy infection (OPSI), were not assessed. Future studies with larger sample sizes and longer follow-up periods are needed to further elucidate the optimal management strategies for blunt splenic trauma.

The findings of this prospective observational study demonstrate that non-operative management is a safe and effective approach in the majority of patients with blunt splenic trauma, provided that the patient is hemodynamically stable and has no other associated intra-abdominal injuries. The clinical and hemodynamic parameters at admission are crucial determinants in guiding the decision-making process and predicting the success of NOM. Continued efforts to refine the management algorithms and optimize patient selection for NOM will be instrumental in improving the outcomes of blunt splenic trauma.

CONCLUSION

The findings of this prospective observational study demonstrate that non-operative management is a safe and effective approach in the majority of patients with blunt splenic trauma, provided that the patient is hemodynamically stable and has no other associated intra-abdominal injuries. In the present study, 12 out of the 30 patients (40%) were managed non-operatively, with a success rate of 83.3% (10 out of 12 patients). The clinical and hemodynamic parameters at admission, such as systolic blood pressure, heart rate, and hemoglobin levels, were identified as crucial determinants in the selection of the appropriate management approach.

The non-operative management group had significantly higher systolic blood pressure (130 mmHg vs. 96 mmHg, $p<0.001$), lower heart rate (90 bpm vs. 110 bpm, $p=0.002$), and higher hemoglobin levels (11 g/dL vs. 9.75 g/dL, $p=0.003$) compared to the operative management group. The median transfusion requirement was also significantly lower in the non-operative group (0.3 units vs. 3 units, $p=0.004$), while the median hospital stay was longer (15.9 days vs. 9.4 days, $p=0.029$).

Continued efforts to refine the management algorithms and optimize patient selection for non-operative management will be instrumental in improving the outcomes of blunt splenic trauma. Future studies with larger sample sizes and longer follow-up periods are needed to further elucidate the long-term implications of the different management approaches.

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