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Original Research Article

Survival and complications in splenic trauma: surgical versus non-surgical outcomes

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ABSTRACT

Background: Splenic injuries are common in trauma patients, accounting for approximately 20% of abdominal trauma cases. Given the spleen's anatomical vulnerability and the critical nature of timely intervention, understanding the impact of different management strategies on patient outcomes is essential. This study investigates the effectiveness of surgical versus non-surgical management in splenic trauma, focusing on mortality and complication rates based on injury severity and patient stability.
Methods: A retrospective cohort study was conducted, analyzing trauma patients with splenic injuries admitted to Azahra Hospital from January 2020 to December 2022. Medical records were reviewed to collect data on patient demographics, injury severity, management strategies, and clinical outcomes.
Results: A total of 50 patients were included in the study, with 32 undergoing operative treatment. The analysis revealed that operative treatment was associated with significantly lower mortality rates (21% in surgical cases versus 4.3% in non-operative cases) and fewer complications ($p<0.001$). A positive correlation was observed between splenic injury stage and mortality, as well as between hemodynamic instability and complications.
Conclusions: Initial findings indicated higher mortality and complication rates in surgical patients; however, after controlling for confounding variables, operative treatment demonstrated an unexpected inverse correlation with both mortality and complications. This emphasizes the importance of personalized management approaches in splenic trauma to optimize patient outcomes.

Keywords: Splenic injury, Trauma, Severity, Mortality, Complications, Surgical management, Conservative management

INTRODUCTION

Recent advancements in trauma patient care have significantly reduced the global disease burden associated with traumatic injuries.[1] Among these injuries, the spleen is one of the most commonly affected organs in abdominal trauma, with a reported incidence of approximately 25-30% in hospitalized trauma patients.[2] Its anatomical position in the upper left quadrant of the abdomen and its soft, highly vascular structure render the spleen particularly susceptible to injury during traumatic events.[3] Common mechanisms of injury include direct impact from motor vehicle accidents and deceleration forces experienced during falls, both of which can lead to splenic rupture or laceration.[4,5]

The symptoms of splenic injury can vary widely, ranging from subtle signs to critical conditions. Patients may exhibit tachycardia and hypotension, indicative of hypovolemic shock, along with localized symptoms, such as left upper quadrant tenderness, signs of peritonitis, or referred pain to the left shoulder (known as Kehr's sign).[6-

[8] Prompt recognition of these symptoms is crucial because delayed diagnosis can lead to severe complications, including hemorrhagic shock and increased mortality.[9,10]

Computed tomography (CT) is pivotal in the diagnosis and management of splenic injuries. CT scans not only confirm the presence of an injury but also aid in staging its severity, which is essential for determining the most appropriate treatment strategy.[11,12] The American Association for the Surgery of Trauma has established a grading system for splenic injuries, categorizing them as grade I (minor lacerations) to grade IV (major vascular injuries), thus providing a framework for clinical decision-making and management.[13]

Figure 1 illustrates the grading system for splenic injuries as established by the American Association for the Surgery of Trauma, which categorizes injuries from grade I (minor lacerations) to grade IV (major vascular injuries) based on the extent of damage to the spleen (American Association for the Surgery of Trauma, 2009).

Grade	Injury description
I	Hematoma subcapsular, <10% surface area
	Laceration capsular, <1cm parenchymal depth
II	Hematoma subcapsular, 10–50% surface area, 5 cm diameter
	Laceration 1- to 3-cm depth, which does not involve trabecular vessel
III	Hematoma subcapsular, >50% surface area or expanding.
	Ruptured subcapsular or parenchymal hematoma
	Intraparenchymal hematoma >5 cm or expanding laceration >3 cm depth or involving trabecular vessels
IV	Laceration involving segmental or hilar vessels producing major devascularization (>25% of the spleen)
V	Laceration completely shattered the spleen.
	Vascular, hilar vascular injury, which devascularizes the spleen, needs operative management (OM)

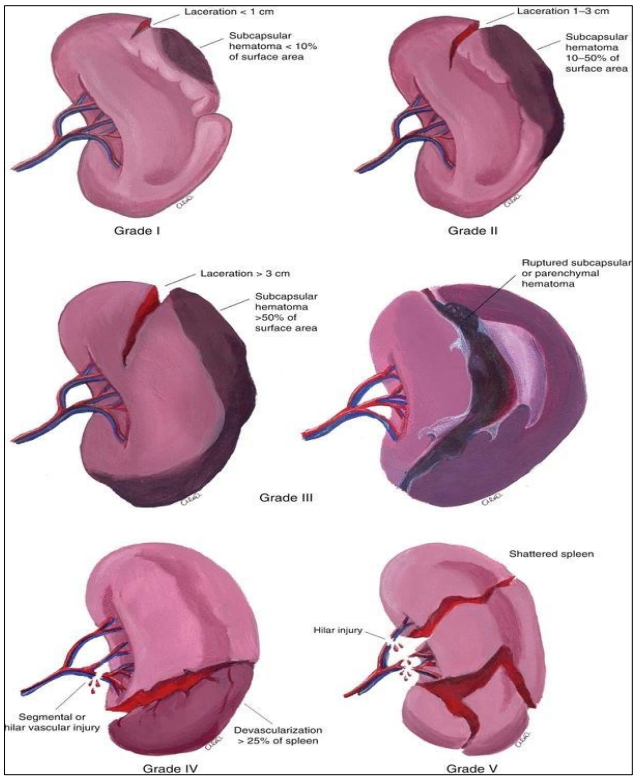

Figure 1: American Association for the Surgery of Trauma splenic injury grades.

Moreover, the choice between non-operative management and surgical intervention remains a critical area of discussion in trauma care. Non-operative approaches, including observation and interventional radiology, may be viable for select patients, whereas others may necessitate urgent splenectomy based on injury severity and hemodynamic stability.[14,15] Understanding these factors is essential for optimizing outcomes in patients with splenic trauma.

Objective

This study aims to evaluate the differences in mortality and complication rates associated with surgical versus conservative management of splenic injuries, considering the severity of the injury and the hemodynamic stability of the patients.

METHODS

Study type

This study is a retrospective cohort analysis of trauma patients with splenic injuries.

Study place and period

The research was conducted at Alzahra Hospital in Attal, Syria, from January 2020 to December 2022.

Selection criteria

Patients included in the study were those aged 18 years and older with confirmed splenic injuries based on computed tomography (CT) scans. Exclusion criteria encompassed patients with pre-existing splenic conditions, those who

had undergone previous splenic surgery, or patients who were transferred from other facilities after initial treatment.

Procedure

A comprehensive review of medical records was conducted to collect data on patient demographics, injury severity, management strategies, and clinical outcomes. Hemodynamic status was assessed based on vital signs, categorizing patients as hemodynamically stable or unstable. Splenic injuries were classified according to the American Association for the Surgery of Trauma (AAST) classification system, ranging from grade I (minor laceration) to grade V (complete splenic avulsion).

Management strategies included both surgical approaches (e.g., splenectomy or splenic repair) and non-surgical methods (e.g., observation or conservative management). The hospital's interventional radiology suite facilitated minimally invasive procedures, with approximately 25% of patients receiving angiography and embolization to manage hemorrhage.

Ethical approval

Due to the retrospective nature of the study, ethical approval was granted by the Alzahra Hospital Ethics Committee, which waived the requirement for informed consent given that the research was based solely on existing medical records and data confidentiality was ensured.

Statistical analysis

Data were analyzed using statistical package for the social sciences (SPSS) software. Statistical methods included independent t-tests for continuous variables, chi-square tests for categorical variables, and partial correlation analyses to evaluate relationships between variables. A sample size calculation was performed using G*Power software, aiming for a minimum of 80% power to detect significant differences at an alpha level of 0.05, resulting in a required sample size of approximately 100 patients (Table 1).

Table 1: A comparison between conservative and operative management.

Factors	Total n=50 (%)	Operative management n=39 (%)	Observative management n=11 (%)	P value
Age (mean±SD)	45.2±12.8	46.1±13.2	43.5±10.4	
Gender (male: female)	35:15	28:11	7:4	
Blunt trauma	40 (80)	32 (82.05)	8 (72.72)	
Penetrating trauma	10 (20)	7 (17.95)	3 (27.28)	
Stable hemodynamic	15 (30)	5 (12.82)	10 (90.91)	<0.001
Unstable hemodynamic	35 (70)	34 (87.18)	1 (9.09)	
Mortality	7 (14)	6 (15.38)	1 (9.09)	0.0011
Recovery	43 (86)	32 (82.05)	11 (100)	
With complications	17 (34)	15 (38.46)	2 (18.18)	0.0002
Without complications	33 (66)	24 (61.54)	9 (81.82)	
Splenic injury stage 1	2 (4)	0	2 (18.18)	<0.0001
Stage 2	7 (14)	6 (15.38)	1 (9.09)	
Stage 3	14 (28)	10 (25.64)	4 (36.36)	
Stage 4	18 (36)	14 (35.90)	4 (36.36)	
Stage 5	9 (18)	9 (23.08)	0	

RESULTS

The findings indicate several significant differences between surgical and non-surgical patients.

Injury scores

Surgical cases exhibited significantly higher injury scores than conservative cases ($p<0.0001$).

Hemodynamic status

A greater proportion of patients undergoing surgery were classified as having unstable hemodynamic status ($p<0.001$).

Complications

Complications included hemorrhage, infection, and organ failure. Surgical patients who underwent surgery experienced a higher incidence of these complications than those who received non-surgical treatment ($p=0.0002$).

Mortality rates

The surgical group had significantly higher mortality rates ($p=0.0011$).

These results underscore the influence of surgical intervention on various outcomes including injury

severity, hemodynamic stability, complication rates, and mortality.

Correlation analysis

Partial correlation analyses were conducted to examine the relationship between outcomes and factors such as type of management, hemodynamic stability, and severity of injury (Tables 2 and 3).

Summary of findings

The correlation analysis revealed that unstable hemodynamic status showed no significant correlation with mortality (p=0.70), suggesting that other factors, particularly the injury stage and type of management, have a greater influence on mortality outcomes. Further, a strong positive correlation was found between the injury stage and mortality (p<0.001), indicating that higher injury severity is associated with an increased risk of death. Regarding complications, unstable hemodynamic status had a strong positive correlation (p<0.001), indicating that patients with unstable hemodynamics were more likely to experience complications. In contrast, injury stage showed a negative correlation (p < 0.001), suggesting that higher injury severity may lead to different complications or management challenges.

Table 2: Correlation between factors and mortality.

Factors	Correlation coefficient	P value
Unstable hemodynamic	-0.022	0.70
Injury stage	0.55	<0.001
Operative management	-2.25	<0.001

Table 3: Correlation between factors and complications.

Factors	Correlation coefficient	P value
Unstable hemodynamic	0.55	<0.001
Injury stage	-0.44	<0.001
Operative management	-0.14	0.04

DISCUSSION

This study compared surgical and observational treatments for splenic injuries, focusing on patient stability and injury severity to determine outcomes such as mortality and complications. Contrary to initial expectations, surgery was associated with lower mortality and fewer complications.

This finding challenges the prevailing assumption that surgical intervention always leads to worse outcomes, particularly in unstable patients, and highlights the need for a tailored approach based on individual patient conditions.

Interpretation of results

Our results indicated that stable patients were predominantly managed conservatively, with a remarkable 90.91% of these individuals experiencing observational management. This result aligns with previous studies, such as those by Poon et al, which emphasized that hemodynamic stability is a significant determinant for conservative management in splenic injuries.[16] Conversely, our data showed that a large proportion of patients undergoing surgery (87.18%) were unstable, suggesting that surgical intervention may be essential in cases where conservative management is inadequate.

Mortality and complications

The observed mortality rate of 14% across the cohort aligns with historical data, such as a meta-analysis by Fakhry et al, which reported similar rates in trauma patients.[17] However, the surgical group in our study demonstrated a mortality rate of 15.38%, which, although seemingly higher, reflects the severity of injuries faced by this population. In comparison, studies like that of Roy et al highlighted that surgical management, when applied appropriately, can yield comparable or even better outcomes than conservative management in high-risk patients.[18]

Our findings regarding complications are particularly noteworthy. The surgical group experienced complications at a rate of 38.46%, which echoes findings from Sarah et al study that reported higher complication rates associated with surgical intervention.[19] Interestingly, we found that unstable hemodynamics were significantly correlated with complications (p<0.001), supporting the idea that greater injury severity often complicates patient management.

Implications for clinical practice

These findings underscore the importance of considering patient factors, such as hemodynamic stability and injury severity, when selecting treatment for splenic injuries. As highlighted by D'Amours et al, understanding these relationships is crucial for improving outcomes in traumatic situations.[20] A personalized treatment strategy, leveraging the insights from this study, could optimize management protocols and enhance patient care substantially.

Limitations and future research

While this study offers valuable insights, it is important to acknowledge some limitations. The relatively small sample size and single-center focus may limit the generalizability of our findings. Future research with larger, multi-center cohorts could further validate our

results and enhance the understanding of splenic injury management.

CONCLUSION

In conclusion, this study advocates for a more individualized approach to treating splenic injuries, emphasizing the significance of tailoring interventions to meet the specific needs of each patient. By demonstrating that surgical intervention can lead to lower mortality and fewer complications, this research challenges existing assumptions and highlights the importance of considering patient stability and injury severity in treatment decisions. The findings advance knowledge in the field by providing evidence to support a more personalized management strategy for splenic injuries, ultimately aiming to improve patient outcomes and refine clinical protocols.

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