ORIGINAL ARTICLE

Blunt splenic trauma: Analysis of predictors and risk factors affecting the non-operative management failure rate

Abdullah Yıldız, M.D.,[1] Adnan Özpek, M.D.,[1] Ahmet Topçu, M.D.,[2] Metin Yücel, M.D.,[1] Fikret Ezberci, M.D.[1]

[1]Department of General Surgery, Health Sciences University Ümraniye Training and Research Hospital, İstanbul-*Türkiye*
[2]Department of General Surgery, Tokat State Hospital, Tokat-*Türkiye*

ABSTRACT

BACKGROUND: Non-operative management (NOM) has become a standard treatment in hemodynamically stable patients with blunt splenic trauma. Studies have identified numerous predictors and risk factors for NOM. However, these factors' role in NOM failure continues to be debated. This study aimed to reveal the role of these factors in NOM failure through retrospective analysis of data from patients who underwent non-operative treatment.

METHODS: After the initial evaluation of 189 patients brought to the emergency department between March 2009 and June 2021 and diagnosed with blunt splenic trauma, 13 patients underwent emergency surgery due to hemodynamic instability (immediate splenectomy), and 18 patients who died were excluded from the study. NOM was planned for the remaining 158 patients (stable or stabilized). Patients scheduled for NOM were grouped as either successful NOM (s-NOM; n=139) or failure NOM (f-NOM; n=19) and analyzed the results, retrospectively.

RESULTS: Of the 158 patients scheduled for the NOM, 115 were male. The mean age in s-NOM and f-NOM was 32.2±14.5 versus 36.1±16.1. The mean hospital stay was 8 (4–21) days. The mean follow-up period was 12 (6–18) months. Used USG for 60 (43.2%) patients and CT for 137 (98.6%) in the NOM. The number of Grades I-V in the NOM planned patients (n=158) was 20 (12.6%), 54 (34.1%) 56 (35.4%), 26 (16.4%), and 2 (1.3%), respectively. The success rates according to the Grades I-V were 20 (100%), 52 (96.3%), 52 (92.8%), 15 (57.7%), and 0 (0.0%), respectively. There were 102 units of red cell transfusions administered (mean, 2.46 units) to 41 patients in the s-NOM group, while 81 units (mean, 4.26 units) were administered to 19 patients in the f-NOM group (p=0.001). ISS score >15 was 57.5% (mean score, 22.8) and those in the f-NOM group were 78.9% (mean score, 34.8), respectively (p<0.001). Overall NOM success was 88.0%, total complications were 10.1%, and mortality was 1.2% in this study.

CONCLUSION: Grades I-III blunt splenic trauma patients were successfully treated using the NOM protocol in this study. However, more than half of Grade IV (57.7%) splenic injuries were successfully treated using NOM. Identifying predictors and risk factors based on a standardized plan will likely increase this success.

Keywords: Blunt splenic trauma; non-operative management; splenectomy; splenic injury.

INTRODUCTION

The spleen is the most frequently injured organ (approximately 46%) in blunt abdominal trauma due to its anatomical location and highly vascularized parenchyma structure.[1] Splenectomy was previously the only option for spleen trauma. However, the spleen has an essential role in the body's immunological defense mechanism and functions, such as filtration, blood storage, and phagocytosis. In recent years, spleen protective methods have begun to gain importance. Therefore, the emergency team's support provided according to the Advanced Trauma Life Support (ATLS) in blunt abdominal trauma patients has been an important step.[2,3]

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Address for correspondence: Abdullah Yıldız, M.D.
Sağlık Bilimleri Üniversitesi Ümraniye Eğitim Araştırma Hastanesi, Genel Cerrahi Kliniği, İstanbul, Türkiye
Tel: +90 216 - 632 18 18 E-mail: abdullah4772@msn.com

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Non-operative management (NOM) has been successfully applied to Grades I-III blunt spleen traumas. Significant successful results have been reported in Grade IV injuries in some studies. However, the overall success rates are variable and reported to be 60–98%.[4] The most critical causes of failure NOM (f-NOM) are hemodynamic instability and peritonitis. Studies have reported 14–25 predictors and risk factors for f-NOM. Although the role of some of them in f-NOM has become clear, the part of others remains controversial. In general, the aim of NOM is less blood transfusion, shorter hospital stays, long-term protection from infectious complications (preserving the spleen), and lower surgical costs.[4–6]

There are some significant consequences and a high success rate achieved with NOM. These include the delayed risk of splenic rupture, the possibility of rebleeding, delayed diagnosis of another abdominal organ injury, pseudoaneurysm, and arteriovenous fistula. Thus, determining possible predictors and risk factors, including the hospitalization and discharge times from admission to the emergency department, using a standardized plan, and keeping these patients' follow-up and treatment consistent with this plan will increase the successful NOM (s-NOM). The overall incidence of f-NOM ranged from 8% to 18%.[4–6]

Today, many scoring systems are recommended for spleen trauma. However, none of these scoring systems alone is a sufficient predictor for splenectomy. The American Association for the Surgery of Trauma (AAST) is currently the most widely used scoring system. Although the AAST has been revised, it only evaluates the anatomical structure of the wounds, and it does not evaluate the vascular injury and active bleeding.

Blunt spleen injuries generally are evaluated as Grades I-V, but in some studies, these injuries are graded as low (I-III) and high (IV, V).[7] The revised AAST scale indicates that for Grade III injuries, the presence of additional abdominal solid organ injuries accompanying the spleen trauma should classify the injury as a higher grade.[8]

In this study, the first aim was to select patients diagnosed with blunt splenic trauma who were suitable for NOM after the initial evaluation by the emergency service team. The second aim was to determine the predictors and risk factors for selecting NOM and analyze their effects on failure NOM.

MATERIALS AND METHODS

Between March 2009 and June 2021, 189 patients with blunt spleen trauma were included in the study among all the patients with blunt abdominal trauma who were brought to the SBU Ümraniye Training and Research Hospital trauma center.

After admission to the emergency department, 13 patients underwent emergency surgery (immediate splenectomy) for hemodynamic instability, and 18 died. NOM was planned for the remaining 158 patients (stable or stabilized). Patients scheduled for NOM were grouped as s-NOM (n=139) and f-NOM (n=19) and retrospectively analyzed their results.

We obtained ethics committee approval for the clinical research study (March 11, 2021/79). This study was performed according to the principles of the Declaration of Helsinki and, before surgery, informed the patients and first-degree relatives about the procedure and possible complications. Written informed consent was waived because the study was retrospective.

Patients' demographic data, AAST spleen injury grading scale, injury scores (Injury Severity Score [ISS], Revised Trauma Score [RTS], and Glasgow Coma Score [GCS]), injury mechanism, hemodynamic parameters at presentation, laboratory data, imaging studies, interventions, blood transfusions, associated abdominal organ injuries, and other extra-abdominal injuries, morbidity, and mortality data were recorded prospectively.

Hemodynamically stable or stabilized patients over 17 years of age with blunt splenic trauma were included in the study. Patients who underwent emergency surgery due to instability, peritonitis, or other diagnoses were excluded from the study.

Statistical Analysis

The data were analyzed using the SPSS version 25.0 statistical program (IBM Corp., Armonk, NY, USA). The expected data distribution was determined using the Kolmogorov-Smirnov test. The Student's t-test and Chi-square test were used for parametric data and descriptive statistical methods (mean, standard deviation, and frequency) while evaluating study data, and $p<0.05$ was considered statistically significant.

NOM-Overview

Initial Evaluation

Patients admitted to the emergency trauma unit were managed according to the ATLS algorithms. According to these criteria, the study strategy for patients is determined by classifying the patients as hemodynamically stable, hemodynamically stabilized, and unstable. Hemodynamically unstable patients were defined as having a systolic blood pressure (SBP) <90 mmHg despite intense fluid and blood supplementation. These patients were taken directly into the surgery during the initial evaluation. At admission, patients who were hemodynamically stable or stabilized (SBP >90 mmHg with adequate fluid replacement) were followed up with NOM.

Emergency Department Management

Focused Assessment with Sonography for Trauma (FAST) for unstable patients was requested on admission to the emergency department. FAST-positive patients underwent emergency surgery.

Patients who were FAST positive but stable or stabilizing should be treated with contrast-enhanced abdominal computed tomography (CT) to assess the location and extent of parenchymal lesions, accompanying extra-abdominal injuries, and the size of the hemoperitoneum.

In FAST-negative patients, the intraperitoneal bleeding in hemodynamically unstable patients was not excluded and repeated the FAST procedure after a short resuscitation. Performed spleen salvage (splenorrhaphy and partial splenectomy) in stable perioperative patients who underwent laparotomy for an unstable indication or other reasons and splenectomy was performed in unstable patients.

Intensive Care Unit (ICU) Management

Patients scheduled for NOM were monitored in the ICU. Standard care consisted of infusion of crystalloid fluids or packed red blood cells, which were necessary to maintain SBU >90 mmHg and hemoglobin >8 g/L, and controlled fluid resuscitation instead of aggressive fluid resuscitation. A massive transfusion protocol was applied when necessary.

The patients were on bed rest for the first 72 h. They received serial blood tests every 6 h in addition to blood gas testing and clinical observation (GCS, SpO2, heart rate, blood pressure, and urinary output) for 12 h. Both mobilization and oral diet were allowed when two consecutive hemoglobin measurements were stable.

Immediate Surgery

It was defined as the patients brought to the emergency department that required immediate surgery (splenectomy or laparotomy) due to instability or peritonitis after initial evaluation.

Delayed Surgery

After the initial evaluation, defined as the patients who were unstable but stabilized with ATLS, and underwent surgery because of instability or complications within 6 months after discharge.

s-NOM

Among the planned NOM patients, those who did not undergo splenectomy and had no concomitant accompanying abdominal organ injuries or who did not undergo surgery due to complications during hospitalization before discharge or 6 months after discharge were identified as s-NOM patients.

F-NOM

After NOM was planned, the f-NOM was defined as patients who underwent surgery for hemodynamic instability, peritonitis, and diagnostic purposes or due to complications.

Trauma Scoring Systems

The grading defined by the AAST is the most used organ injury scale for spleen trauma. This classification is based on the lesion anatomy in the spleen.

The ISS summarizes the severity of the injury in a patient with multiple traumas. It is calculated as the sum of the squares of the highest Abbreviated Injury Scale ratings in the three most severely injured body regions. ISS ranges from 1 to 75.[8]

RTS

The RTS is based on three specific physiological parameters, each of which is scored from 0 (severe impairment) to 4 (mild impairment). It is achieved from the initial dataset obtained from the patient, consisting of GCS, SBP, and respiratory rate. RTS values range from 0 to 7.84. RTS has been shown to correlate well with the probability of survival.

To describe the extent of the injury, we used the AAST organ injury scale, which represents five degrees of injury to the spleen (Fig. 1).

RESULTS

After the initial evaluation of 189 patients with blunt splenic injury (BSI) who was brought to the emergency department, 13 (6.9%) patients underwent emergency surgery due to instability, and 18 (9.5%) patients died. NOM was planned for the remaining 158 patients, among whom 115 (72.8%) were men and 43 (27.2%) were women. The mean hospital stay was 8 (4–21) days. The mean follow-up period was 12 (6–18) months. USG and CT were applied in s-NOM patients 60 (43.2%) versus 137 (98.6%) and in f-NOM 10 (52.6%) versus 19 (100%), respectively. There was no statistically significant difference between the groups for age or gender (Table 1).

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. The American Association for the Surgery of Trauma Splenic Injury Scale (1994 revision), Moore et al.[7]

Table 1. Demographic data and characteristics on the admission of the patients (s-NOM and f-NOM)

	s-NOM (n=139/%)	f-NOM (n=19/%)	p-value
Age (years)	32.2±14.5	36.1±16.1	0.265
Age >55	8 (5.7)	3 (15.8)	0.146
Male	100 (72.0)	15 (79.0)	0.520
Femele	39 (28.0)	4 (21.1)	
Mechanisms of accident			
Motor vehicle	70 (50.3)	13 (68.4)	0.155
Motorcycle/bike	20 (14.4)	3 (15.8)	
Falling	37 (26.6)	3 (15.8)	
Others	12 (8.6)	–	
	Mean±SD	**Mean±SD**	
Max_leukocyte (×10^3/L)	17.740±6.2	24.636±5.5	0.001
Min_htc level (%)	31.9±5.9	26.7±6.8	0.001
Min_Hb (gr/dL)	11.5±1.9	8.8±2.2	0.001
Hearth rate/min	92.9±12.3	104.9±18.7	0.001
Systolic blood pressure (mmHg)	114.9±13.4	101.1±15.6	0.001
Glasgow coma score	14.8±1.4	13.05±3.8	0.001
Revised trauma score	7.8±1.0	6.9±1.3	0.001
Injury severity score	13.9±9.4	27.5±12.4	0.001
Red cell transfusion/IU	2.46±0.8	4.26±2.2	0.001
Blunt abdominal trauma			
Solitary splenic injury	98 (70.5)	9 (47.4)	0.043
Multiple abdominal solid organ injury	41 (29.5)	10 (52.6)	

NOM: Non-operative management; SD: Standard deviation; IU: International unit; htc: Hematocrit; Hb: Hemoglobin.

The number of Grades I-V in the NOM planned patients (n=158) was 20 (12.6%), 54 (34.1%) 56 (35.4%), 26 (16.4%), and 2 (1.3%), respectively, shown the number of patients with Grades I-V in the s-NOM and f-NOM groups in Figure 2.

The success or failure of NOM significantly correlates with the degree of spleen injury. Overall, the success was 88.0%, and the failure was 12.0 for NOM patients. According to these results, while the success of NOM was primarily seen in Grades I, II, and III, success and failure rates in Grade IV were close to each other (57.7% vs. 42.3%). Two patients with Grade V spleen injury in the planned NOM died postoperatively. However, there was multiple solid organ trauma other than the spleen in two patients who performed liver packing and distal pancreatectomy in one patient and nephrectomy in the other.

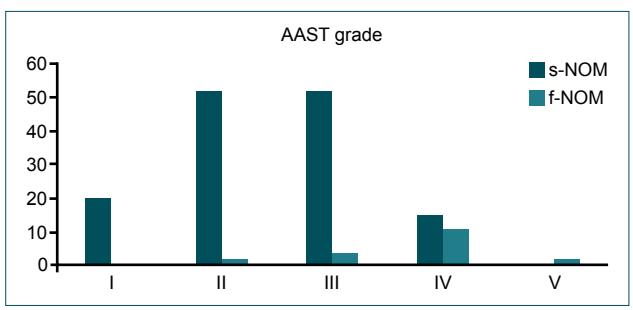

Figure 2. Performed scoring organ injury according to the AAST organ injury scale.

The success rates of s-NOM patients according to the Grades I-V were 20 (100%), 52 (96.3%), 52 (92.8%), 15 (57.7%), and 0 (0.0%), respectively.

There were 102 units of red cell transfusions (RCTs; mean, 2.46 units) that were given to 41 patients in the s-NOM group, and 81 units of RCTs (mean, 4.26 units) were given to 19 patients in the f-NOM (p<0.001).

Factors determining organ injury severity and the patient's general condition, such as hemoglobin, hematocrit, RCT, SBP, GCS, ISS, RTS, and associated abdominal organ injury, were evaluated as significant predictors of f-NOM (p<0.001). ISS scores >15 and<15 in s-NOM were 57.5% (mean score, 22.8) versus 42.4% (mean, 7.6), and those in the f-NOM group were 78.9% (mean score, 34.8) versus 21% (mean score,

11.7), respectively (p<0.001). When S-NOM and f-NOM patients were analyzed by age, patients over 55 years of age were 5.7% and 15.8%, respectively (p>0.05).

In the f-NOM (n=19) group, 17 (89.5%) patients underwent surgery with the diagnosis of hemodynamic instability and/or acute abdomen. Total splenectomy was performed in 15 (78.9%) patients and splenic salvage (splenorrhaphy and partial splenectomy) in 2 (10.5%) patients. Two patients died due to reasons unrelated to the spleen in the NOM group. One of these patients had Grade III spleen trauma, aorta dissection, and hemopneumothorax, and the other had Grade III spleen trauma and pelvic fracture. Ninety-five percent of total or partial splenectomy cases occurred within the first 72 h in patients planned for NOM. Additional extra-abdominal organ injuries were observed in 141 patients in the s-NOM group and 37 in the f-NOM group (Fig. 3).

In the s-NOM group, the liver, kidney, and pancreas were the most injured organs (17.9%, 7.9%, and 2.1%, respectively). Isolated splenic trauma was observed in 70.5% of the s-NOM group and 47.4% of the f-NOM group (p<0.05); however, multiple abdominal solid organ injuries were observed in 29.5% of the s-NOM, 52.6% in the f-NOM group (p<0.05). The overall complication rate was 10.1%, and the mortality rate was 1.2% in the f-NOM group.

Forty-six surgical procedures were performed (including thoracic tube drainage). The most frequently performed procedures in the f-NOM group were liver packing (3), nephrectomy (2), nephropathy and renal vein repair (1), left diaphragm rupture (1), pancreatic rupture and postoperative fistula (1), adrenalectomy (1), and distal pancreatectomy (1).

Among the complications associated with a chest injury, atelectasis, pneumonia, pleural effusion, rebleeding, sub-diaphragmatic collection, wound infection, wound dehiscence, and evisceration were the most common challenges and complications. In our study, cerebral edema, frontal sac, and pneumocephalus were observed in one patient in each group. Two patients with chest injury (hemopneumothorax) due to trauma and thoracic tube drainage underwent retube drainage due to pleurisy on days 15 and 30 of follow-up.

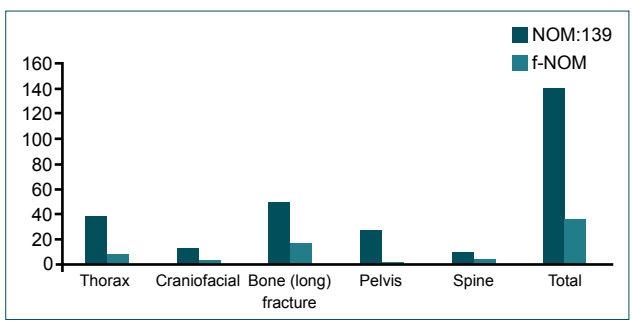

Figure 3. The types and number of associated extra-abdominal organ injuries.

Prophylactic triple vaccine (pneumococcal, influenza, and meningitis) was recommended for patients who underwent splenectomy after discharge. No patient developed sepsis, AV fistula, or pseudoaneurysm.

DISCUSSION

Blunt splenic trauma cases without hemodynamic instability and peritonitis are successfully managed without surgery. NOM aims to reduce blood transfusion, morbidity, mortality, and unnecessary laparotomy. Patients with multiple blunt abdominal organ injuries can be successfully treated with NOM.[9]

In the present study, s-NOM was 88.0, and f-NOM was 12.0%. Brillantino et al.[3] showed an f-NOM of 4.6%. In similar studies, f-NOM rates of 8–46.5% were reported.[9,10]

The degree of spleen injury is considered one of the most important predictors of NOM failure. In some studies, Grades I-III spleen injuries are reported as low grade, and Grades IV-V injuries are reported as high grade. According to the revised scale, if a Grade III spleen injury accompanies an additional solid organ injury, it is recommended to be defined as a higher grade.[11]

Peitzman et al.[4] showed that the Grades I-V spleen traumas were successfully treated with NOM in 75%, 70%, 49.3%, 16.9%, and 1.3% of patients.

In the present study, the success rates in Grades I-V spleen injuries were 100%, 96.3%, 92.8%, 57.7%, and 0%, respectively. In similar studies, f-NOM increased as the grade increased.[4,12]

Isolated spleen injury was higher in the s-NOM group than in the f-NOM group in the present study (70.5% vs. 47.4%). However, failure was higher in patients with multiple abdominal solid organ injuries (29.5% vs. 52%, p<0.05). Reported similar results in other studies.[13,14]

The degree of splenic injury, amount of hemoperitoneum, patients over 55 years of age, presence of contrast extravasation or pseudoaneurysm on CT scan, and required more than 4 units of blood transfusion in the first 24 h are essential predictors and risks for NOM failure.

However, none of these factors are sufficient to demonstrate the success or failure of NOM. Because they include effects of other factors such as ASA, GCS, ISS, and RTS, the scores, comorbidities, and abdominal and extra-abdominal organ injuries are risk factors for NOM failure.[15–17]

Olthof et al.[16] reported a systematic review of ten cohort studies investigating prognostic factors for disability in NOM. The number of predictors reported in these studies ranged

from 14 to 25. They observed that hemodynamic instability and peritonitis were the most important predictors. However, they declared over 80% consensus among experts in the Delphi study that hemodynamic stability is necessary for s-NOM.

In the present study, minimum hematocrit level (%), minimum hemoglobin (g/dL), heart rate (beats/min), SBP (mmHg), GCS, RTS, ISS, and units of RCT were predictors with statistically significant results ($p<0.001$). Different opinions have about whether age alone is an essential determinant of failure in managing blunt splenic trauma. The most used limit among young and old adults is 55 years.[15]

Olthof et al.[16] reported that age was a significant prognostic factor for f-NOM in four systematic reviews, including age >40 years in one study and age >55 years in two studies. Another study reported higher failure rates (11%) in patients older than 55, whereas only 7% in patients younger than 55.[18] All patients over 55 years of age with f-NOM were Grade IV spleen injuries in this study. Patients >55 years of age were 5.7% in the s-NOM and 15.8% in the f-NOM group in the present study. However, this result was not statistically significant ($p>0.05$).

The blood transfusion rate is one of the most important predictors. Some studies reported that the risk of splenectomy increased in patients who received four units or more blood transfusions for hemodynamic stability.[17] The present study showed the mean number of RCT units per person in the s-NOM and f-NOM groups (2.46±0.8 vs. 4.26±2.2, $p<0.001$). There was an over 80% consensus in the Delphi study that surgical management is indicated for patients requiring five or more units of packed red blood cells.[16]

ISS and other trauma scores are often used to analyze outcomes and prognoses of trauma patients. Some studies state that they have little effect on trauma scores on initial patient evaluation and NOM planning. Most of these studies reported an ISS over 25 in NOM deficiency.[19–21]

In this study, the mean ISS score >15 in the s-NOM and f-NOM groups was 34.8 and 22.8, respectively ($p<0.001$). Peitzman et al.[4] reported an ISS score of >15 in 46.6% of patients and <15 in 82.1% in their study.

Bala et al.[22] defined risk factors and highlighted the number of injured areas, which is different from other studies. They reported that injuries that did not require blood transfusion and had <3 anatomical region injuries were successfully treated with NOM. We did not differentiate between the isolated spleen and other anatomical region injuries in our study because we predicted that the severity of the organ injury score was more important than the number of concomitant injuries in a spleen trauma.

In this study, multiple abdominal solid organ injuries associated with spleen trauma were proportionally higher. s-NOM and f-NOM were 29.5% versus 52.6% ($p<0.001$), respectively. This result is like that of other studies, including Malhotra et al.[23] In their study, patients with multiple organ injuries had a higher rate of f-NOM than s-NOM (11.6% vs. 5.8%).

A multicenter study identified a significant relationship between the effect of traumatic brain injury and NOM failure ($p<0.05$).[24]

Cerebral trauma is not considered an indication for splenectomy in cases with BSI. However, cognitive impairment associated with a head injury was suggested to complicate the diagnosis of intra-abdominal injury, especially intestinal damage (peritonitis).[25]

A clear evaluation could not be made of the effect of severe brain trauma cases on NOM deficiency in our study. Studies of traumatic cerebral injury were limited to f-NOM. Some authors have suggested that splenectomy is independently associated with increased mortality in moderate or severe brain trauma patients.[26,27]

Peitzman et al.[4] reported that 60.9% of f-NOM occurred in the first 24 h after admission, 13.8% occurred on the 2nd day, 6.9% on the 3rd day, and 4.6% on the 4th day. Similarly, another study showed that 65% of the patients underwent surgery in the first 24 h.[28] In addition, 78.9% of the NOM failure occurred in the first 48 h, and the rest of the failures occurred between days 7 and 12 in this study.[29]

The frequency of CT assessment in hospitalized or discharged patients with splenic trauma is controversial. In low-grade splenic injuries, repeat imaging is not recommended unless the patient has signs and symptoms of intra-abdominal bleeding. Repeated CT in hospitalized patients aims to diagnose specific vascular abnormalities, particularly splenic artery pseudoaneurysms. One of the largest series examined the role of CT scans in the follow-up of discharged spleen trauma patients. In patients who want to return to their daily activities, repeat CT may be helpful to learn the status of spleen healing.

Cerebral trauma is not considered an indication for splenectomy in patients with BSI. However, cognitive impairment associated with a head injury was suggested to complicate the diagnosis of intra-abdominal injury, especially intestinal damage (peritonitis).[25]

Robinson et al.[14] suggested a restricted return to daily activities in patients with Grades III-V injuries for 8 weeks or until imaging studies noted complete recovery. Although there was no consensus on this issue in the Delphi study, most participants agreed that a 3-month rest period is required before patients return to close contact sports activities.[16]

This period was determined (approximately 6–8 weeks in high-grade patients) according to additional abdominal organ injuries, complications, laboratory and radiological findings, and the patient's compliance status in the present study.

Thrombocytosis occurs in approximately 50% of patients 2–10 days after splenectomy. Although the data are insufficient, there is no need for antiplatelet use until a level greater than 1,000,000 cells/mm3 is reached.[27,30,31] Eberle et al.[31] reported that early (<3 days) use of low-molecular-weight heparin in pharmaceutical deep vein thrombosis (DVT) prophylaxis did not increase the failure rates or blood transfusion requirements in patients with a splenic injury. Alejandro et al.[32] showed that DVT prophylaxis did not affect the f-NOM.

Late splenic rupture, early or late splenic hemorrhages, infection, splenic infarction, abscess, sepsis, AV fistulas, and pseudoaneurysm are observed in patients with planned NOM for spleen trauma.

Splenectomy is accepted as the first-choice intervention in spleen abscesses. However, percutaneous drainage can be performed in suitable patients according to the trauma location.[33,34] Percutaneous drainage was performed for the subdiaphragmatic collection in two patients in weeks 3 and 5 after splenectomy.

In the present study, the post-operative follow-up period was 18 months. Total complications were 10.1% with NOM. There were no deaths among patients who underwent laparotomy or splenectomy; However, 2 patients (1.3%) died due to another reason (pulmonary embolism and aortic dissection) in the planned NOM. Developed a pancreatic fistula in one patient in this study (0.6%). Mohren et al.[30] showed a 1.5% pancreatic fistula rate. Koca et al.[35] reported a complication rate of 6.45% in NOM patients.

The limitations of this study are its retrospective design, conducted in a single center, and the small sample size. The multivariate analysis could not be performed in the f-NOM due to the small sample sizes of the f-NOM group. However, the predictors, risk factors, and other data were prospectively recorded.

Conclusion

NOM of blunt splenic injuries has been preferred in hemodynamically stable patients, regardless of the grade of injury. While the role of some of the predictors and risk factors causing failure in NOM has been revealed, some remain controversial. This study showed that grade of injury, Hb, red blood cell transfusion, GCS, ISS, SBP, and multiple abdominal solid organ injuries were important predictors for NOM failure. The Grades I-III blunt splenic trauma patients and more than half of Grade IV spleen injuries were successfully treated using NOM. However, NOM was insufficient in all Grade V patients.

In addition to the high success rate achieved with NOM, some critical consequences can be seen, such as the delayed risk of splenic rupture, the possibility of rebleeding, and delayed diagnosis of other abdominal organ injuries.

Therefore, we predict that standardized and careful patient selection, categorization of the cases planned for NOM according to their clinical and radiological conditions, and timely determination of predictors and risk factors will increase the success rate of NOM by reducing possible morbidity and mortality.

Ethics Committee Approval: This study was approved by the Ümraniye Training and Research Hospital Clinical Research Ethics Committee (Date: 11.03.2021, Decision No: B.10.1.TKH.4.34.H.GP.0.01/79).

Peer-review: Internally peer-reviewed.

Authorship Contributions: Concept: A.Y., A.Ö.; Design: A.Y., M.Y.; Supervision: F.E.; Materials: M.Y.; Data: A.T.; Analysis: A.Y., A.Ö.; Literature search: A.Y.; Writing: A.Y., A.Ö.; Critical revision: F.E.

Conflict of Interest: None declared.

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ORİJİNAL ÇALIŞMA - *ÖZ*

Künt dalak travma: Nonoperatif başarısızlık oranını etkileyen prediktör ve risk faktörlerin analizi

Dr. Abdullah Yıldız,[1] Dr. Adnan Özpek,[1] Dr. Ahmet Topçu,[2] Dr. Metin Yücel,[1] Dr. Fikret Ezberci[1]

[1]Sağlık Bilimleri Üniversitesi Ümraniye Eğitim Araştırma Hastanesi, Genel Cerrahi Kliniği, İstanbul
[2]Tokat Devlet Hastanesi, Genel Cerrahi Kliniği, Tokat

AMAÇ: Non-operative management (NOM), künt dalak travması olan hemodinamik olarak stabil hastalarda standart bir tedavi haline gelmiştir. Çalışmalarda, NOM için çok sayıda prediktör ve risk faktörü tanımlanmaktadır. Ancak, bu faktörlerin NOM başarısızlığındaki rolleri tartışılmaya devam etmektedir. Bu çalışma, NOM uygulanan hastalardan elde edilen verilerin geriye dönük analiziyle, bu faktörlerin NOM başarısızlığındaki rolünü sunmayı amaçladı.

GEREÇ VE YÖNTEM: Mart 2009–Haziran 2021 tarihleri arasında künt karın travması ile getirilen ve künt dalak travması tanısı alan 189 hastanın ilk değerlendirmesi yapıldı. Hemodinamik instabilite nedeniyle acil ameliyata (immediate splenektomi) alınan 13 ve hayatını kaybeden 18 hasta çalışmaya alınmadı. Geri kalan 158 hastaya (stabil veya stabilleşen) NOM planlandı. NOM planlanan hastalar başarılı (s-NOM; n=139) veya başarısız (f-NOM; n=19) olarak gruplandırılarak, sonuçlar geriye dönük olarak analiz edildi.

BULGULAR: NOM için planlanan 158 hastanın 115'i erkekti. Ortalama yaş; s-NOM 32.2±14.5 ve f-NOM'da 36.1±16.1) idi. Ortalama hastanede kalış süresi 8 (4–21) gün, takip süresi ise 12 (6–18) aydı. Planlanan NOM grubunda 60 (%43.2) hastaya USG ve 137 (%98.6) hastaya BT yapıldı. NOM planlanan hastalarda (n=158) grade I-V sırasıyla 20 (%12.6), 54 (34.1) 56 (%35.4), 26 (%16.4) ve 2 (%1.3) idi. Grade I-V başarı oranları sırasıyla 20 (%100), 52 (%96.3), 52 (%92.8), 15 (%57.7), 0 (%0.0) idi. s-NOM grubundaki 41 hastaya 102 ünite eritrosit transfüzyonu (ortalama 2.46 ünite) uygulanırken, f-NOM grubundaki 19 hastaya 81 ünite (ortalama 4.26 ünite) uygulandı (p<0.001). ISS skoru >15 hastalar %57.5 (ortalama skor, 22.8) ve f-NOM grubunda %78.9 (ortalama skor, 34.8) idi (p<0.001). Bu çalışmada genel NOM başarısı %88.0, toplam komplikasyon %10.1 ve mortalite %1.2 idi.

TARTIŞMA: Bu çalışmada grade I-III künt dalak travmalı hastalara NOM protokolü uygulanarak başarıyla tedavi edildi. Ancak, grade IV dalak yaralanmalarının sadece %57.7'si NOM ile başarılı bir şekilde yönetildi. Standart bir plan dahilinde prediktör ve risk faktörleri belirlenmesi ve bu plan dahilinde takip ve tedavilerinin yapılması NOM başarısını artıracağını öngörüyoruz.

Anahtar sözcükler: Dalak yaralanması; künt dalak trauma; non-operatif yönetim; splenektomi; splenic trauma.

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