

Short-term outcomes of non-operative management of blunt splenic injury: a retrospective study

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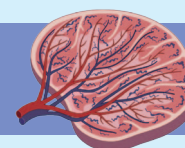
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GRAPHICAL ABSTRACT



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Summary

Non-operative treatment is the first-line therapy for hemodynamically stable patients with mild grade blunt trauma to the spleen, while severe grade injuries more often require surgical intervention.

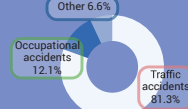


Materials and methods

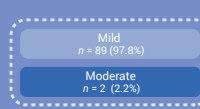
Tertiary hospital



N = 91
M : F = 6 : 1
Age 34 (25; 47)



Causes of blunt splenic trauma



Injury Severity Score



Length of hospital stay:
5 (4; 6) days

Outcomes

Non-operative treatment:

Medical treatment alone
n = 74

Medical treatment + transcatheter
arterial embolization
n = 14

Splenectomy
n = 3

Factors associated with the success of nonoperative treatment:

AAST^a grading of splenic injury

	Successful	Failed
Grade I	3 (100%)	0
Grade II	28 (100%)	0
Grade III	34 (97.1%)	1 (2.9%)
Grade IV	20 (100%)	0
Grade V	3 (60%)	2 (40%)

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^aAAST American Association for the Surgery of Trauma

Abstract

Aim. To evaluate the short-term outcomes of non-operative management (NOM) for blunt splenic trauma and to identify prognostic factors for its success at a tertiary hospital.

Methods. The study cohort comprised 136 patients with blunt splenic rupture treated at People's Hospital 115, Ho Chi Minh City, Vietnam, between January 2021 and December 2023. Non-operative management was implemented in 91 cases (66.9%). Collected data included demographics, injury characteristics, therapeutic interventions, complications and NOM outcomes.

Results. Among the 91 patients who received NOM, the median age was 34 (25; 47) years with male-to-female ratio of 6:1. Traffic accidents accounted for most splenic ruptures (81.3%). Clinical symptoms included abdominal pain (98.9%) and distension (27.5%). Abdominal computed tomography findings according to the American Association for the Surgery of Trauma (AAST) classification revealed predominantly Grade II (30.8%) and Grade III (38.5%) splenic injuries. The hemoperitoneum volume correlated significantly with injury severity ($p = 0.029$). NOM was successful in 88 patients (96.7%), whereas three patients (3.3%) required splenectomy. The median hospital stay was 5 (4; 6) days. The median amount of blood transfusion was 937.5 ± 340.9 ml. No mortality was reported.

Conclusions. Our findings confirm that NOM should be considered as a first-line therapy for hemodynamically stable patients with blunt splenic injury, as it safely obviates the need for surgery while avoiding operation-associated morbidity.

Keywords: blunt splenic injury; non-operative treatment; transcatheter arterial embolization; splenic salvage; outcomes of splenic rupture

MeSH terms:

WOUNDS, NONPENETRATING – COMPLICATIONS

WOUNDS, NONPENETRATING – THERAPY

ABDOMINAL INJURIES – COMPLICATIONS

ABDOMINAL INJURIES – SURGERY

SPLEEN – INJURIES

EMBOLIZATION, THERAPEUTIC – METHODS

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Ethics statements. This study was conducted in accordance with the ethical standards set out in the Helsinki Declaration, version 2024. The study protocol was reviewed and approved by People's Hospital 115's local ethics committee on 10 October 2024 (approval number 2395/QD-BVND115). Obtaining informed consent from patients and their legal representatives was waived due to the retrospective nature of the study and analysis of anonymous clinical data.

Data access. The data that support the findings of this study have been published and available via <https://doi.org/10.47093/2218-7332.2025.16.2.30-38-annex>. The data and statistical methods presented in the article have been statistically reviewed by the journal editor, a certified biostatistician.

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Краткосрочные результаты неоперативного лечения тупой травмы селезенки: ретроспективное исследование

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Аннотация

Цель. Оценить краткосрочные результаты неоперативного лечения (НОЛ) тупой травмы селезенки и прогностические факторы эффективности НОЛ в больнице третьего уровня.

Материалы и методы. Исследуемая когорта включала 136 пациентов с разрывом селезенки в результате тупой травмы живота, проходивших лечение в Народной больнице 115, Хошимин, Вьетнам, в период с января 2021 по декабрь 2023 года. НОЛ было применено в 91 случае (66,9%). Для анализа собирались

демографические данные пациентов, характеристики травмы, вид терапевтических вмешательств, характер осложнений и результаты лечения.

Результаты. Средний возраст среди 91 пациента, получавшего НОЛ, составил 34 (25; 47) года, соотношение мужчин и женщин – 6:1. Большинство разрывов селезенки (81,3%) произошло в результате дорожно-транспортных происшествий. Клинические симптомы включали: боль в животе (98,9%) и вздутие (27,5%). Результаты компьютерной томографии брюшной полости в соответствии с классификацией Американской ассоциации хирургии травм (American Association for the Surgery of Trauma, AAST) выявили преимущественно повреждения селезенки II и III степени (30,8 и 38,5% соответственно). Объем гемоперитонеума статистически значимо коррелировал с тяжестью травмы ($p = 0,029$). НОЛ было эффективно у 88 пациентов (96,7%), тогда как трем пациентам (3,3%) потребовалась спленэктомия. Медиана пребывания в больнице составила 5 (4; 6) дней. Медиана объема переливания крови – $937,5 \pm 340,9$ мл. Летальных исходов не наблюдалось.

Заключение. Наши результаты подтверждают, что НОЛ следует рассматривать как терапию первой линии для гемодинамически стабильных пациентов с тупой травмой селезенки, поскольку оно безопасно устраняет необходимость хирургического вмешательства и ассоциированных с ним осложнений.

Ключевые слова: тупая травма селезенки; неоперативное лечение; транскатетерная артериальная эмболизация; сохранение селезенки; исходы разрыва селезенки

Рубрики MeSH:

РАНЫ НЕПРОНИКАЮЩИЕ – ОСЛОЖНЕНИЯ
РАНЫ НЕПРОНИКАЮЩИЕ – ТЕРАПИЯ
БРЮШНОЙ ПОЛОСТИ ТРАВМЫ – ОСЛОЖНЕНИЯ
БРЮШНОЙ ПОЛОСТИ ТРАВМЫ – ХИРУРГИЯ
СЕЛЕЗЕНКА – ПОВРЕЖДЕНИЯ
ЭМБОЛИЗАЦИЯ ТЕРАПЕВТИЧЕСКАЯ – МЕТОДЫ

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КОНТАКТНАЯ ИНФОРМАЦИЯ:

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Соблюдение этических норм. Данное исследование проведено в соответствии с этическими стандартами Хельсинкской декларации версии 2024 года. Протокол исследования рассмотрен и одобрен 10.10.2024 локальным этическим комитетом Народной больницы 115 (номер одобрения 2395/QD-BVND115). Получение информированных согласий пациентов и их законных представителей не требовалось из-за ретроспективного характера исследования и анализа анонимных клинических данных.

Доступ к данным. Данные, подтверждающие выводы этого исследования, опубликованы и доступны по ссылке: <https://doi.org/10.47093/2218-7332.2025.16.2.30-38-annex>. Данные и статистические методы, представленные в статье, были проверены редактором журнала, сертифицированным биостатистиком.

Конфликт интересов. Авторы заявляют об отсутствии конфликта интересов.

Финансирование. Исследование не имело спонсорской поддержки (собственные ресурсы).

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Abbreviations:

AAST – American Association for the Surgery of Trauma
ASA – American Society of Anesthesiologists
CT – computed tomography

DSA – digital subtraction angiography
NOM – non-operative management
TAE – transcatheter arterial embolization

HIGHLIGHTS	КЛЮЧЕВЫЕ ПОЛОЖЕНИЯ
In blunt splenic trauma, non-operative management has become the gold standard for hemodynamically stable patients without signs of peritonitis, ahead of splenectomy and splenorrhaphy.	При тупой травме селезенки неоперативное лечение стало золотым стандартом для гемодинамически стабильных пациентов без признаков перитонита, превосходя спленэктомию и спленорафию.
Non-operative management is feasible in 74–88% of blunt splenic injury cases, representing the safest and most effective treatment approach.	Неоперативное лечение возможно в 74–88% случаев тупой травмы селезенки и считается самым безопасным и эффективным методом терапии.
The failure rate of non-operative management increases progressively with higher injury grades, with most failures occurring within the first 48 hours.	Частота неудачного неоперативного лечения увеличивается по мере повышения тяжести травмы, при этом большинство неудач происходит в первые 48 часов.

The spleen is one of the most frequently vulnerable organs, accounting for about 32% of patients with blunt abdominal trauma [1, 2]. This injury can lead to severe internal bleeding and hemorrhagic shock with a mortality rate of 7–18% if diagnosis and treatment are delayed [3]. Motor vehicle accidents and falls are the most prevalent causes of splenic injury in blunt abdominal trauma [1, 4].

Treatment modalities for blunt splenic injury include surgical interventions (splenorrhaphy and splenectomy) and non-operative management (NOM). Laparotomy is a recommended therapeutic option for blunt splenic injury and splenectomy is often unavoidable in hemodynamically unstable patients [1, 5, 6]. However, the spleen plays a critical role in the immune defense response, including filtration, blood storage and phagocytosis [3]. Therefore, organ-preserving strategies were proposed with initial studies focusing on pediatric cases [6].

Over the past few decades, because of advances in modern diagnostic tools and medical interventions, the management of splenic trauma has shifted significantly in favor of NOM. For hemodynamically stable patients, NOM may require close monitoring with or without digital subtraction angiography (DSA) or DSA with selective splenic embolization [1, 3, 6].

The aim of the study is to evaluate the short-term outcomes of NOM for blunt splenic trauma and to identify prognostic factors for its success at a tertiary hospital.

MATERIALS AND METHODS

The retrospective study included patients admitted to People's Hospital 115 (a tertiary hospital) with a diagnosis of blunt splenic injury according to the classification codes of the International Classification of Disease 10th revision (ICD-10) between January 2021 and December 2023.

Inclusion criteria were as follows:

- age 16 or older;
 - isolated or combined splenic injury due to blunt abdominal trauma;
 - conservative therapy or NOM.
- Non-inclusion criteria were:
- penetrating injury;

- death before admission to the hospital;
- the need for emergency surgery due to instability or other diagnoses.

Data were collected on demographics, clinical symptoms, trauma causes, radiological injury characteristics, and medical interventions.

The study flowchart is illustrated in Figure. A total of 136 patients with blunt splenic injury were assessed, of whom 91 (66.9%) were included in the study.

All patients admitted for blunt splenic trauma were managed according to the Advanced Trauma Life Support (ATLS®) guidelines by the American College of Surgeons Committee on Trauma (Chicago, USA) [7]. Fluid resuscitation and blood replacement were administered to maintain hemodynamic stable.

Contrast-enhanced computed tomography (CT) was performed to assess the grade of splenic injury, the extent of haemoperitoneum, presence of peritonitis and other associated injuries. If active splenic arterial bleeding or a pseudoaneurysm was identified using CT, transcatheter arterial embolization (TAE) was performed by interventional radiologists.

When DSA of the celiac artery and splenic artery identified the bleeding site, superselective embolization was performed using embolic materials such as gelatin sponge, Lipiodol, Histoacryl or fibered coil (Boston Scientific, USA).

The primary endpoint was the success of NOM during the current hospitalization.

Statistical data analysis

Data distribution was assessed using the Kolmogorov-Smirnov test. Categorical variables are presented as frequencies (%), continuous variables as mean values \pm standard deviation or median (interquartile range) depending on the distribution. For categorical variables, the chi-square test was used. A p -value < 0.05 was considered statistically significant. Statistical analyses were performed using SPSS version 26.0 (IBM Corp., USA).

RESULTS

The median age was 34 (25; 47) years, and the male-to-female ratio was 6:1. Traffic accidents were

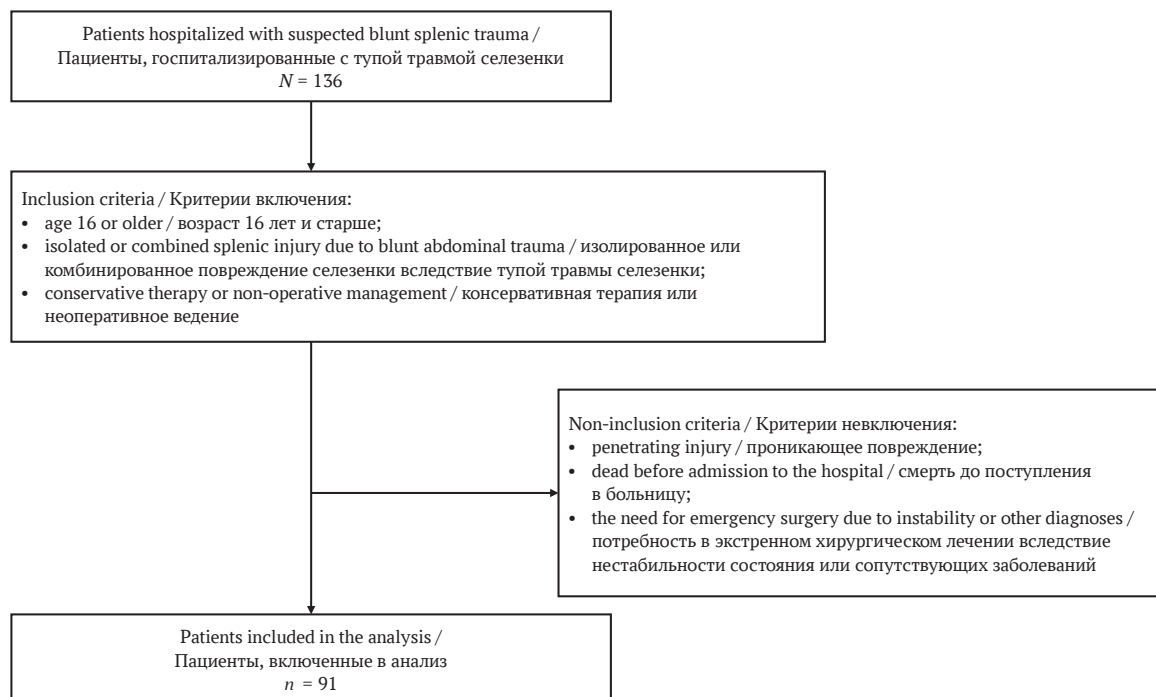


FIG. The study flowchart

РИС. Поток-диаграмма исследования

the leading cause (81.3%), followed by occupational accidents (12.1%). Moreover, 73.6% of patients arrived within 12 hours of trauma. Also, 50 patients (54.9%) received first aid at the healthcare facilities, and 41 patients (45.1%) did not receive first aid or went to the hospital directly. The clinical symptoms, laboratory tests, and diagnostic imaging results are summarized in Table 1.

The severity of the hemoperitoneum correlated with increasing the grade of splenic injury ($p = 0.029$) (Table 2).

The length of hospital stay ranged from 1 to 26 days, with a median of 5 (4; 6) days. The median blood transfusion volume was 937.5 ± 340.9 mL.

Concerning the interim treatment outcomes, 88 patients (96.7%) were stable and discharged from the hospital following NOM. Of these patients, 74 received medical treatment alone while 14 received a combination of medical therapy and TAE. The distribution of successful NOM rates following Grades I–V of blunt splenic injury was 100%, 100%, 97.1%, 100%, and 60%, respectively (Table 3).

Only three patients experienced persistent intra-abdominal bleeding and hemodynamic instability despite NOM, necessitating urgent open total splenectomy (the characteristics of these cases are summarized in Table 4). As a result, all three patients achieved postoperative progress and were successfully discharged. There were no mortalities in the study cohort.

DISCUSSION

In cases of splenic injury due to blunt abdominal trauma, NOM has emerged as the gold standard for hemodynamically stable patients without signs of peritonitis [2, 3, 5]. B. Garber et al. reported in a multicentric retrospective analysis that NOM became the preferred therapeutic strategy, followed by splenectomy and splenorrhaphy. The rate of NOM increased from 59% in 1991 to 75% in 1994, while splenectomy rates declined from 35% to 24% during the same period [8].

Recent studies indicate that NOM of blunt splenic injury is feasible in 74–88% of cases [9, 10]. Among patients with blunt splenic injury in this study, NOM was possible in 66.9%. There is a male predominance in blunt splenic injury (85%), with motor vehicle and motorbike accidents being the primary cause of such injuries. As reported in other studies, the prevalence among men was about 70–80% [6, 11, 12]. Since the most common vehicle in Vietnam is the motorcycle, motorcycle accidents are the leading cause of blunt abdominal trauma, especially splenic injury [13].

Abdominal ultrasound and contrast-enhanced CT could allow for assessing hemoperitoneum volume, injury severity, and associated abdominal organ damage. In this study, imaging findings revealed splenic injuries predominantly classified as Grades II–III according to AAST scale, accompanied by mild-to-moderate hemoperitoneum. A. Yildiz et al. reported Grades

Table 1. The baseline characteristics of patients with blunt splenic trauma
Таблица 1. Исходные характеристики пациентов с тупой травмой селезенки

Variables / Параметры	No. of patients / Количество пациентов (n = 91)	%
Sex / Пол		
male / муж	78	85.7
female / жен	13	14.3
Clinical symptoms / Клинические симптомы		
splenic pain / боль в области селезенки	83	91.2
peritoneal reaction / симптомы раздражения брюшины	4	4.4
abdominal distention / вздутие живота	25	27.5
Anemia / Анемия		
none (Hb > 12 g/dl) / нет (Hb > 12 г/дл)	54	59.3
mild (Hb = 10–12 g/dl) / легкая (Hb = 10–12 г/дл)	27	29.7
moderate (Hb = 8–10 g/dl) / умеренная (Hb = 8–10 г/дл)	7	7.7
severe (Hb < 8 g/dl) / тяжелая (Hb < 8 г/дл)	3	3.3
The amount of hemoperitoneum on computed tomography findings / Объем гемоперитонеума по данным компьютерной томографии		
none / отсутствует	10	11.0
mild / минимальный	43	47.2
moderate / умеренный	30	33.0
severe / выраженный	8	8.8
AAST grading of splenic injury / Классификация травмы селезенки по AAST		
grade I / I степень	3	3.3
grade II / II степень	28	30.8
grade III / III степень	35	38.5
grade IV / IV степень	20	22.0
grade V / V степень	5	5.5
Associated injuries / Сопутствующие повреждения		
chest / грудная клетка	21	23.1
face / лицо	8	8.8
brain / головной мозг	2	2.2
bones / костные структуры	10	11.0
abdomen and visceral pelvis (other than spleen) / брюшная полость и органы малого таза (кроме селезенки)	11	12.1
liver / печень	1	1.1
kidneys / почки	10	11.0
DSA (n = 17) / ЦСА (n = 17)		
splenic artery pseudoaneurysm / псевдоаневризма селезеночной артерии	1	1.1 ^a
contrast extravasation from the splenic artery / экстравазация контрастного вещества из селезеночной артерии	15	16.5 ^a
no lesion / нет повреждения	1	1.1 ^a
ISS scores / Показатель ISS		
mild (<9) / легкая степень (<9)	89	97.8
moderate (9–15) / умеренная степень (9–15)	2	2.2

Notes: ^a The percentage of patients who underwent DSA.

AAST – American Association for the Surgery of Trauma; DSA – digital subtraction angiography; ISS – Injury Severity Score.

Примечания: ^a Доля от пациентов, которым проведена ЦСА.

AAST – American Association for the Surgery of Trauma (Американская ассоциация хирургии травмы); ISS – Injury Severity Score (шкала тяжести травмы); ЦСА – цифровая субтракционная ангиография.

II and III injuries as the most common (34.1% and 35.4%, respectively). The extent of hemoperitoneum correlated positively with the severity of splenic injury [14]. In the present study, NOM of blunt splenic injury demonstrated a high success rate of 96.7%, and in

only three patients (3.3%) did it prove not successful. Currently, NOM has become the primary treatment strategy for splenic injuries, with success rates ranging from 80% to 100% [10, 15–18]. A. Brillantino et al. reported a comparable failure rate of 4.6% [18].

Table 2. Distribution of severity of hemoperitoneum following the grade of splenic injury
Таблица 2. Распределение степени выраженности гемоперитонеума в зависимости от степени повреждения селезенки

Hemoperitoneum volume / Объем гемоперитонеума	AAST grading of splenic injury / Классификация травмы селезенки по AAST					Total / Всего	p-value / p-значение
	Grade I / I степень	Grade II / II степень	Grade III / III степень	Grade IV / IV степень	Grade V / V степень		
None / Нет	0	2	0	0	0	2	0.029
Mild (100–200 ml) / Легкий (100–200 мл)	2	10	6	1	0	19	
Moderate (200–500 ml) / Умеренный (200–500 мл)	0	15	24	15	3	57	
Large (>500 ml) / Большой (>500 мл)	1	1	5	4	2	13	
Total / Всего	3	28	35	20	5	91	

Note: AAST – American Association for the Surgery of Trauma.
 Примечание: AAST – American Association for the Surgery of Trauma (Американская ассоциация хирургии травмы).

Table 3. The distribution of successful and failed non-operative management patients following the grade of splenic injury
Таблица 3. Распределение успешных и неудачных случаев неоперативного лечения в зависимости от степени повреждения селезенки

AAST grading of splenic injury / Классификация травмы селезенки по AAST	Successful NOM / Успех НОЛ	Failed NOM / Неудача НОЛ	p-value / p-значение
Grade I / I степень, n (%)	3 (100)	0	0.0001
Grade II / II степень, n (%)	28 (100)	0	
Grade III / III степень, n (%)	34 (97.1)	1 (2.9)	
Grade IV / IV степень, n (%)	20 (100)	0	
Grade V / V степень, n (%)	3 (60)	2 (40)	
Total / Всего	88 (96.7)	3 (3.3)	

Note: AAST – American Association for the Surgery of Trauma; NOM – non-operative management.
 Примечание: AAST – Американская ассоциация хирургии травмы (American Association for the Surgery of Trauma); НОЛ – неоперативное лечение.

Table 4. Characteristics of the admission and postoperative features on patients with non-operative management failure
Таблица 4. Показатели при поступлении и послеоперационные данные у пациентов с неэффективным неоперативным лечением

Sex, age / Пол, возраст	Systolic BP mmHg) / Систолическое АД (мм рт. ст.)	Hct (%)	AAST	ISS	Hemoperitoneum (mL) / Гемоперитонеум (мл)	DSA / ЦСА	Treatment / Лечение	Fluid transfusion (mL) / Объем инфузионной терапии (мл)
Female, 85 ^a / Женщина, 85 ^a	70	26.5	III	Mild / Легкая	500–1000	Contrast extravasation / Экстравазация КВ	Medical + angiography / Медикаментозное + ангиография	2000
Male, 29 / Мужчина, 29	110	29.9	V	Mild / Легкая	1000–1500	Contrast extravasation / Экстравазация КВ	Medical + angiography / Медикаментозное + ангиография	400
Male, 21 / Мужчина, 21	100	37.6	V	Mild / Легкая	1500–2000	Contrast extravasation / Экстравазация КВ	Medical + angiography / Медикаментозное + ангиография	3500

Notes: ^a Concomitant Grade III lateral kidney injury.
 AAST – American Association for the Surgery of Trauma; BP – Blood pressure; DSA – digital subtraction angiography; Hct – Hematocrit; ISS – Injury Severity Score.
 Примечания: ^a Сопутствующее повреждение боковой поверхности почки III степени.
 AAST – American Association for the Surgery of Trauma (Американская ассоциация хирургии травмы); Hct – Hematocrit (гематокрит); ISS – Injury Severity Score (шкала тяжести травмы); АД – артериальное давление; КВ – контрастное вещество; ЦСА – цифровая субтракционная ангиография.

The severity of the splenic injury is a critical predictor of NOM failure. Previous studies have classified Grade I-III spleen injuries as low grade, whereas Grade IV-V is considered high grade. If Grade III spleen damage is accompanied by concomitant solid organ injury, it may be reclassified as a high-grade. The incidence of NOM failure increased progressively with the increasing grade of splenic injury.

In this study, the Grade I-V spleen injuries were successfully treated with NOM in 100%, 100%, 97.1%, 100%, and 60% ($p = 0.0001$), respectively. A. Yildiz et al. demonstrated that the success rates in Grade I-V spleen injuries were 100%, 96.3%, 92.8%, 57.7%, and 0% [14]. In three patients with NOM failure, two patients had Grade V splenic injury and one patient had Grade III splenic injury with an older age (85 years). Moreover, this patient had concomitant Grade III lateral kidney injury. All three patients had contrast extravasation on angiography and required more than three units of blood transfusion.

A. Yildiz et al. suggested that the grade of splenic injury, hemoperitoneum volume, the age being over 55 years old, the presence of contrast extravasation or pseudoaneurysm on CT, and requiring a transfusion of more than four units of blood within the first 24 h were considered risk factors for NOM failure. Additionally, other factors including ASA (American Society of Anesthesiologists) physical status classification, GCS (Glasgow Coma Scale), ISS (Injury Severity Score), and RTS (Revised Trauma Score), comorbidities, and abdominal and extra-abdominal organ injuries, have impacted NOM success [18–21].

NOM failure typically occurs within four days following trauma, with a maximum reported delay

of 26 days [11]. A. Peitzman et al. found that 78.9% of failures happened within 48 hours of admission, with the remainder failing between days 7 and 12 [4]. In this study, three cases experienced NOM failure on day 2. CT scanning was frequently performed to monitor hospitalized or discharged patients, but this is controversial. Repeat imaging of low-grade splenic injuries is not necessary unless there is evidence of intra-abdominal hemorrhage. Nonetheless, repeat CT scans in hospitalized patients may detect vascular anomalies such as splenic artery pseudoaneurysms [14].

In the present study, we indicated TAE in patients who had contrast extravasation or artery pseudoaneurysm on CT immediately after admission. In three cases with NOM failure, TAE could enhance the outcomes of blunt splenic injuries and increase the splenic salvage rates. Most studies suggested using TAE only for patients with a contrast hemorrhage or posttraumatic pseudoaneurysm of the splenic artery on CT [11, 21].

The limitations of this study are as follows: 1) this is a retrospective study; 2) sample size was limited; 3) this was a single-center study. The failure rate of NOM in the study was low. Therefore, no predictive variables could be provided.

CONCLUSION

Out of all the solid organs, the spleen is one of the most vulnerable to blunt abdominal trauma. NOM is preferred for managing hemodynamically stable patients, demonstrating a relatively high success rate, especially in patients with mild to moderate splenic rupture severity. TAE in combination with medical treatment enhances the rate of splenic salvage.

ВКЛАД АВТОРОВ

К.Х. Нгуен, Т.К. Данг разработали концепцию и дизайн исследования, написали статью. Ш.С. Хоанг осуществил сбор и анализ данных, участвовал в написании статьи. К.Х. Нгуен проанализировал и интерпретировал данные. Все авторы одобрили окончательную версию публикации.

AUTHORS CONTRIBUTIONS


Quang H. Nguyen and Toan K. Dang conceived and designed the study. They also wrote the article. Song X. Hoang collected and analyzed the data, as well as participated in the drafting of the article. Quang H. Nguyen analyzed and interpreted the data. All of the authors approved the final version of the publication.

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