Incidence of splenic abscess after conservative management of blunt splenic injury: a cross-sectional study

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Background
The spleen and liver are the most frequently injured solid organs in blunt trauma of the abdomen. Motor car accidents are the leading cause of injury. Splenic abscess is one of the delayed complications after splenic trauma. It is not a common clinical problem. However, if not diagnosed, splenic abscess has a very high mortality rate.
Methods
This observational cross-sectional study was conducted at our Hospital Emergency Department. All patients with isolated blunt splenic trauma who were hemodynamically stable and managed conservatively were included in the study. This study was applied on 74 patients; four patients were dropped out during follow-up and two patients were operated upon and excluded from the study. Sixty-eight patients were included in this study and were managed conservatively after splenic injury.
Results
Follow-up computed tomography (CT) with intravenous contrast was performed to all included 68 patients 1 month after initial admission date, aiming to detect splenic abscess. In the presence of warning symptoms like persistent left hypochondrial pain and fever, follow-up CT was done earlier after proper clinical evaluation. Two (2.9%) cases out of 68 patients had splenic abscess. Their initial CT abdomen showed grade III splenic injury according to the American Association for Surgery of Trauma.
Conclusions
Follow-up CT abdomen with intravenous contrast is recommended for all patients with grade III or more splenic injury who underwent conservative management of splenic trauma, especially who had persistent fever and left hypochondrial pain.

Keywords:
conservative management of splenic injury, splenic abscess, splenic trauma

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Introduction

Injuries to the spleen are one of the most common injuries in abdominal trauma [1]. Since the 1970s, management of blunt splenic trauma has changed from almost exclusive surgical management to nonoperative management (NOM) in hemodynamically stable patients without any signs of peritonitis. Understanding of the spleen's immunologic value in protection against overwhelming postsplenectomy infection led to the development first of surgical techniques for splenic salvage and then protocols for nonsurgical management of adults and children with blunt splenic injury [2]. The evolution of nonsurgical management has resulted in new patterns of after splenic trauma complications like splenic artery pseudoaneurysm, splenic pseudocyst, and splenic abscesses. Splenic abscess is not a common complication following conservative management of splenic injury [3].

Splenic abscess is a rare condition, with a reported frequency of 0.05–0.7%. Its reported mortality rate is high, up to 70%. Proper management can lower the mortality rate to less than 10% [4,5].

History and clinical examination are not reliable to make the diagnosis of splenic abscess. However, information obtained from the history and clinical examination can help in the diagnosis. Widespread use of imaging modalities [e.g. computed tomography (CT) and ultrasonography (US)] facilitates early diagnosis and directs treatment, thus improving prognosis.

Keeping this in mind, the current work aimed to detect the incidence of splenic abscess after conservative management of splenic injury, in addition to identification of the possible risk factors (on admission and during follow-up) for the development of this complication.

Patients and methods

This observational cross-sectional study was conducted from November 2020 to April 2021 at our Hospital

Emergency Department. The study protocol was reviewed and permitted by the Institutional Research and Ethics Committee. Verbal informal consent was taken from all patients included in our study. All patients with splenic trauma who were admitted were included in the study.

Inclusion criteria

(1) Blunt abdominal trauma with isolated splenic injury managed conservatively including all age groups and sexes.
(2) Hemodynamically stable patients regarding pulse, blood pressure, and respiratory rate.

Exclusion criteria

(1) Hemodynamic instability.
(2) Penetrating abdominal trauma.
(3) Blunt trauma with air under diaphragm.
(4) Pregnant women and handicapped persons.
(5) Blunt abdominal trauma with other intra-abdominal organs.
(6) Associated other system injuries, for example, brain and cardiothoracic injuries.

All patients with splenic trauma were evaluated at the time of presentation using the Advanced Life Trauma Support protocol regarding mode of trauma, time of presentation related to trauma, hemodynamic parameters (pulse, blood pressure, respiratory rate and temperature), and laboratory data on admission.

Patients underwent imaging protocols as the following:

(1) FAST that was performed for all patients, to detect intra-abdominal free-fluid collection.
(2) CT with intravenous contrast on admission to detect the degree of splenic injury according to Organ Injury Scale of the American Association for the Surgery of Trauma (AAST).

Hemodynamic stability was monitored by pulse, blood pressure, respiratory rate, urine output, and ongoing blood loss as reflected on patient follow-up hemoglobin, hematocrit values, and FAST. Patients were admitted under conservative management for 3–7 days according to our hospital protocol in conservative management of splenic injury. The stable patients were managed nonoperatively with bed rest, intravenous fluid, and blood transfusion when indicated.

Conservatively managed patients were informed about warning signs before discharge like fever and left hypochondrial pain and to avoid any strenuous activity in the first month.

After 1 month, all patients were re-evaluated at the outpatient clinic regarding hemodynamic parameters (especially temperature), history of left hypochondrial pain, and new total leukocytic count (TLC). Another follow-up CT with intravenous contrast was done to detect the formation of splenic abscess.

Statistical methods

Data were coded and entered using the Statistical Package for the Social Sciences (SPSS), version 26 (IBM Corp., Armonk, New York, USA). Data was summarized using mean, SD, median, minimum, and maximum in quantitative data and using frequency (count) and relative frequency (percentage) for categorical data. Comparisons between quantitative variables were done using the nonparametric Mann–Whitney test [6]. For comparing categorical data, χ^2 test was performed. Exact test was used instead when the expected frequency is less than 5 [7]. *P* values less than 0.05 were considered statistically significant.

Results

This observational cross-sectional study was conducted at our hospital emergency department from November 2020 to April 2021. The study was applied on 74 patients; four patients were dropped out during the follow-up and two patients were operated upon and excluded from the study. Sixty-eight patients were included in this study and were managed conservatively after splenic injury.

Baseline data

Demographic data of the 68 patients revealed a mean age of 18.74 ± 16.03 years (range from 3 months to 78 years), with male sex being 73.5% of the studied group.

Comorbidities

In all, 61 cases did not have comorbidities, four cases were diabetic, one case was hypertensive, one case was hypertensive and diabetic, and one case had a history of epilepsy (Table 1).

Follow-up TLC after 1 month:

The mean follow-up TLC after 1 month is 6.39×10^9 (range from 4000 to 20 000 white blood cells per microliter)

Table 1 Descriptive statistics of comorbidities collected on the studied patients

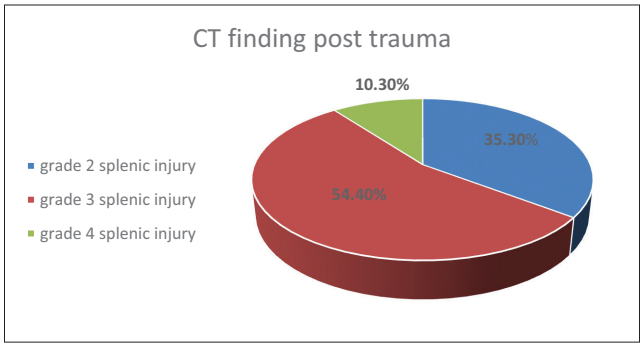
	Count	%
Comorbidities		
Diabetic	4	5.9
Diabetic, HTN	1	1.5
Epileptic	1	1.5
HTN	1	1.5
None	61	89.7

HTN, hypertension.

CT finding posttrauma (Fig. 1):

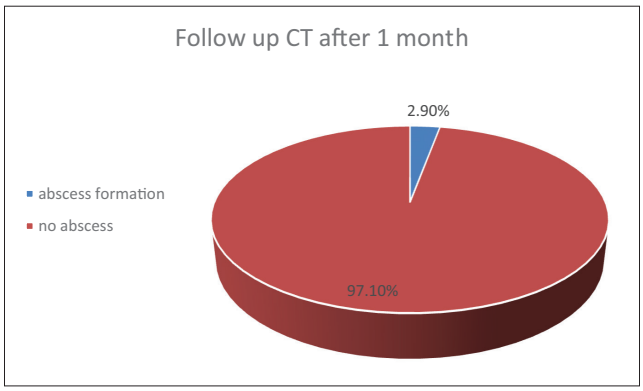
24 (35.3%) out of 68 patients revealed grade II splenic injury.

Figure 1



Pie chart presenting CT finding after trauma. CT, computed tomography.

Figure 2



Incidence of splenic abscess in follow-up CT after 1 month. CT, computed tomography.

37 (54.4%) out of 68 patients revealed grade III splenic injury.

Seven (10.3%) out of 68 patients revealed grade IV splenic injury.

Follow-up CT after 1 month:

Two (2.9%) cases out of 68 patients had splenic abscess formation.

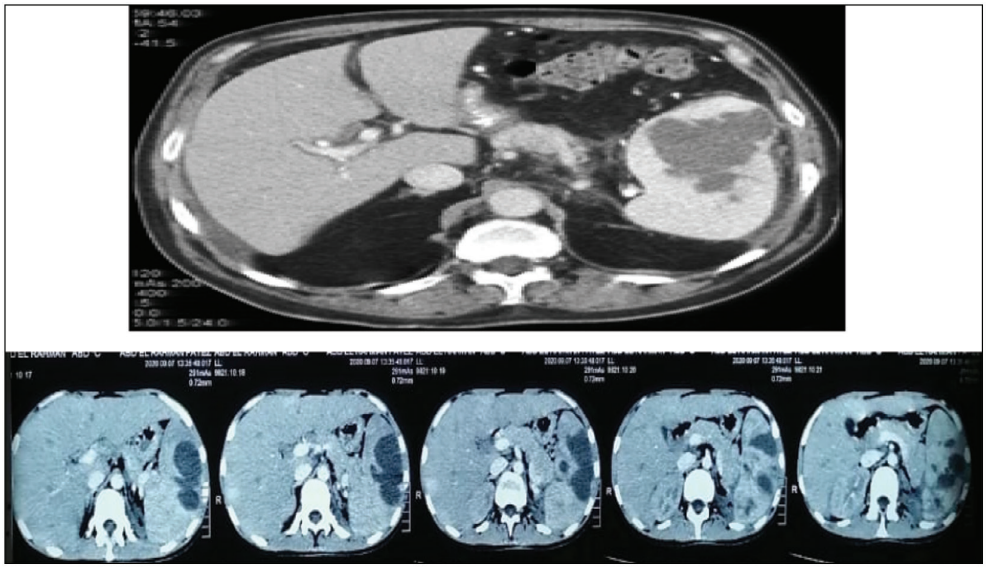
Seven (10.3%) cases out of 68 patients had splenic residual hematoma (Figs 2, 3). Clinical and radiological follow-up (by abdominal US or CT if needed) of these patients were done to confirm complete resolution of the hematoma in addition to exclude splenic abscess formation.

Fever and left hypochondrial pain:

The two cases of splenic abscess developed fever and left hypochondrial pain (Table 2). It is worth reporting that one case was managed by open splenectomy because the patient had multiple abscesses and the other case by splenectomy after failed US-guided aspiration because the abscess was multiloculated.

Our patients were divided into two groups. Group A included patients who developed splenic abscess and group B included patients with no splenic abscess detected in CT. A detailed comparison between the two groups is shown in Tables 3 and 4 with statistically significant increase in TLC, left hypochondrial pain, and fever in group A (P<0.001).

Figure 3



Two cases of splenic abscess formation.

Discussion

Trauma is a major cause of morbidity and mortality; in the developed world, road traffic accidents are one of the leading causes. Up to 45% of patients with blunt abdominal trauma usually have a splenic injury, which may require urgent operative management or NOM in the form of active observation [8].

The risk of overwhelming postsplenectomy infection prompted the evolution toward preservation of the injured spleen. NOM of blunt injury to the spleen in adults has become the standard of care in hemodynamically stable patients.

Table 2 Descriptive statistics of fever and left hypochondrial pain after 1 month

	Count	%
Fever		
Yes	2	2.9
No	66	97.1
Left hypochondrial pain		
Yes	2	2.9
No	66	97.1

Splenic abscess is an uncommon complication following NOM of splenic trauma. In about 2–4 weeks' posttrauma, an abscess could appear [9].

Since there are no guidelines regarding its diagnosis and management, the best therapeutic approach for splenic abscess is still a matter of debate. Patients with splenic abscesses receiving antimicrobial therapy alone were in a relatively high proportion and got a good prognosis especially in patients with small and multiple abscesses. Also, mortality may be more related to patients with underlying immunodeficiency. Due to fewer cases collected in our study, further research will be needed to support our study in the future [4].

This study aimed to evaluate the incidence of splenic abscess after conservatively managing the splenic injuries after blunt abdominal trauma. According to our study, follow-up CT findings 1 month after the trauma revealed that two (2.9%) cases out of 68 patients had splenic abscess formation and seven (10.3%) patients had splenic residual hematoma decreasing in size after 1 month

Table 3 Comparative data between two groups

Age	Group A: abscess formation					Group B: no abscess					*P* value
	Mean	SD	Median	Minimum	Maximum	Mean	SD	Median	Minimum	Maximum	
	24.50	10.61	24.50	17.00	32.00	18.57	16.19	15.00	0.25	78.00	0.425
TLC on admission	20.00	2.83	20.00	18.00	22.00	16.67	5.37	16.50	6.50	29.90	0.300
Follow-up TLC after 1 month	19.00	1.41	19.00	18.00	20.00	6.01	1.44	6.00	4.00	11.00	0.001
Duration of hospital stay	6.00	1.41	6.00	5.00	7.00	4.73	1.07	5.00	3.00	7.00	0.211

TLC, total leukocyte count.

Table 4 Comparative data between two groups

	Abscess formation [*n* (%)]		No abscess [*n* (%)]		*P* value
	Count	Row	Count	Row	
Sex					
Female	1	5.6	17	94.4	0.462
Male	1	2.0	49	98.0	
Comorbidities					
Diabetic	1	25.0	3	75.0	0.197
Diabetic, HTN	0	0.0	1	100.0	
Epileptic	0	0.0	1	100.0	
HTN	0	0.0	1	100.0	
None	1	1.6	60	98.4	
CT finding after trauma					
Grade II splenic injury	0	0.0	24	100.0	0.610
Grade III splenic injury	2	5.4	35	94.6	
Grade IV splenic injury	0	0.0	7	100.0	
Fever					
Yes	2	100.0	0	0.0	<0.001
No	0	0.0	66	100.0	
Left hypochondrial pain					
Yes	2	100.0	0	0.0	<0.001
No	0	0.0	66	100.0	

CT, computed tomography; HTN, hypertension.

In correspondence with our study, the most common symptom at presentation in the Lee *et al*. [10] study was abdominal pain in 12 (66.7%) patients of their splenic abscess patients.

Similar to our study, in a case report of splenic abscess in a 35-year old male by Datey *et al*. [11], imaging showed a large splenic abscess that was initially treated by broad-spectrum antibiotics. Aspiration under sonographic control was unsuccessful due to thick pus and debris in the abscess. Open splenectomy was done with a complete recovery of the patient.

Peitzman and colleagues reported a NOM rate of 61.5% in 1488 adults from 27 trauma centers within the United States. The failure rate was 10.8%, with most failures occurring within 24 h and 90% within 72 h [12].

In a subsequent study of the subgroup with unsuccessful NOM, Peitzman *et al*. [13] reported that 30–40% of the failures were found to be due to underestimation of hemodynamic instability or misinterpretation of diagnostic images, emphasizing the importance of clinical judgment.

Lee *et al*. [10] in their study stated that splenic injury is associated with hematomas with microinfarction, which could lead to infection or bacteremia. Therefore, in about 2–4 weeks' posttrauma, an abscess could appear.

In accordance with our study, De la Cruz-Temores *et al*. [9] reported in their case report that their patient who developed posttraumatic splenic abscess was diabetic. Also, Lee *et al*. [10] reported that splenic abscesses generally occur in patients with underlying comorbidities such as diabetes.

Increasing grades indicate an increasing severity of injury to the spleen and may have implications for management strategies in addition to increased risk of developing splenic abscess if conservative managed was decided [14].

The Frumiento *et al*. [15] study was undertaken to elucidate the rate of delayed complications and their impact on NOM of splenic injuries. They included 40 children who underwent NOM of splenic injuries and reviewed them for complications and success of NOM. They reported that NOM was successful in all children, but a 16-year old (grade IV injury) had a splenic abscess 8 days postinjury that was drained percutaneously with CT guidance.

Lee *et al*. [10] in their study stated that the classical triad of a splenic abscess includes fever, left hypochondrial pain, and leukocytosis. In the Tung *et al*. [16] study, the majority of splenic abscess patients (83%) had leukocytosis.

When we compared between both groups in this study, we found that there was significant difference between both groups regarding follow-up TLC after 1 month and the incidence of fever and left hypochondrial pain ($P<0.001$).

Several studies have confirmed these predictors and identified other risk factors associated with failure of NOM, such as contrast extravasation, arteriovenous fistula, pseudoaneurysm, age over 55 years, and multiple injuries. Age over 55 years has been suggested as a predictor of failure of NOM. In one study addressing this patient group specifically, in which conservative treatment is attempted in around 60%, success rates range from 76 to 90% [17]. However, it is important to emphasize that morbidity and mortality rates in older patients are high compared with those in younger patients in all treatment categories. The variation in success rate reported between different levels of trauma centers can probably be explained by different resource availability, and institutional protocols should probably reflect these differences. The small number of patients was the main obstacle in this study, to be fulfilled over a large scale in the future research.

Conclusion

Follow-up CT abdomen with intravenous contrast is recommended for all patients with grade III or more splenic injury who underwent conservative management of splenic trauma, especially who had persistent fever and left hypochondrial pain.

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All authors approved this final form of manuscript and have contributed equally to this work.

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Conflicts of interest

There are no conflicts of interest.

References

1 Dickinson CM, Vidri RJ, Smith AD, Wills HE, Luks FI. Can time to healing in pediatric blunt splenic injury be predicted? Pediatr Surg Int 2018; 34:1195–1200.

2 Freiwald S. Late-presenting complications after splenic trauma. Perm J 2010; 14:41–44.

3 Cocanour CS, Moore FA, Ware DN, Marvin RG, Clark JM, Duke JH. Delayed complications of nonoperative management of blunt adult splenic trauma. Arch Surg 1998; 133:619–625.

4 Lee MC, Lee CM. Splenic abscess: an uncommon entity with potentially life-threatening evolution. Can J Infect Dis Med Microbiol 2018; 2018:8610657.

5 Sahu M, Kumar A, Nischal N, Bharath BG, Manchanda S, Wig N. Splenic abscess caused by salmonella typhi and co-infection with leptospira. J Assoc Physicians India 2017; 65:95–97.

6 Chan YH. Biostatistics102: quantitative data – parametric & non-parametric tests. Singapore Med J 2003; 44:391–396.

7 Chan YH. Biostatistics 103: qualitative data – tests of independence. Singapore Med J 2003; 44:498–503.

8 Hildebrand DR, Ben-Sassi A, Ross NP, Macvicar R, Frizelle FA, Watson AJ. Modern management of splenic trauma. BMJ 2014; 348:g1864.

9 De la Cruz-Temores S, Islas-Rodríguez JP, Leonher-Ruezga KL, Michel-Mercado IG. Post-traumatic splenic abscess manifested as pleuropulmonary syndrome. Rev Med 2017; 8.9:221–224.

10 Lee WS, Choi ST, Kim KK. Splenic abscess: a single institution study and review of the literature. Yonsei Med J 2011; 52:288–292.

11 Datey SM, Charles N, Patidar H, Bandil S, Bajpai S, Gadodia M. Splenic abscess: review article. J Evol Med Dent Sci 2015; 4:5569–5576.

12 Watson GA, Rosengart MR, Zenati MS, Tsung A, Forsythe RM, Peitzman AB, Harbrecht BG. Nonoperative management of severe blunt splenic injury: are we getting better? J Trauma 2006; 61:1113-1118; discussion 1118–1119.

13 Peitzman AB, Harbrecht BG, Rivera L, Heil B; Eastern Association for the Surgery of Trauma Multiinstitutional Trials Workgroup. Failure of observation of blunt splenic injury in adults: variability in practice and adverse consequences. J Am Coll Surg 2005; 201:179–187.

14 Shanmuganathan K, Mirvis SE, Boyd-Kranis R, Takada T, Scalea TM. Nonsurgical management of blunt splenic injury: use of CT criteria to select patients for splenic arteriography and potential endovascular therapy. Radiology 2000; 217:75–82.

15 Frumiento C, Sartorelli K, Vane D. Complications of splenic injuries: expansion of the nonoperative theorem. J Pediatr Surg 2000; 35:788–791.

16 Tung CC, Chen FC, Lo CJ. Splenic abscess: an easily overlooked disease?, Am Surg 2006; 72:322–325.

17 McIntyre LK, Schiff M, Jurkovich GJ. Failure of nonoperative management of splenic injuries: causes and consequences. Arch Surg 2005; 140:563–569.