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Original Article

Role of Computed Tomography Scan in the Assessment and Management of Blunt Splenic Trauma in a Tertiary Care Hospital, Assam, India

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ABSTRACT

Introduction: Trauma is the most common cause of mortality and morbidity in young individuals. Penetrating splenic injuries are more common than blunt injuries. The management of blunt splenic trauma has substantially evolved over the last few decades, moving from routine splenectomy to preserving the spleen wherever feasible.

Aim: To determine the role of Multidetector Computed Tomography (MDCT) in the diagnosis and treatment of blunt splenic trauma.

Materials and Methods: This hospital-based retrospective study was conducted in Department of General Surgery, Tezpur Medical College and Hospital, Tezpur, Assam, India, from 1st October 2021 to 31st August 2022. During the study period, there were 132 cases of blunt trauma abdomen. Among them, 122 patients had undergone MDCT of the abdomen. The clinical data of these 122 patients were recorded. Of these 122 patients who underwent MDCT, 21 had splenic injuries. The patients who were treated conservatively were traced and the outcome of the treatment on follow-up was taken, from the clinical notes. The preliminary MDCT findings of the patients were correlated with the final diagnosis and treatment. Fisher's-exact tests and Chi-square were used for statistical analysis.

Results: The 21 splenic injuries in this study were classified based on the American Association for the Surgery of Trauma (AAST) grading scales for organ injury, and 14 (66.67%) had Non Operative Management (NOM). Of the four patients with Contrast Material Extravasation (CME), all of them had undergone laparotomy related to the spleen (100%) and demonstrated active bleeding during surgery, but only three of the remaining 17 patients without CME (17.65%) required laparotomy related to the spleen; the difference was statistically found to be significant ($p<0.01$).

Conclusion: The accurate diagnosis provided by MDCT evaluation of blunt splenic injuries helps in formulating the right approach for better management.

Keywords: Contrast material extravasation, Non operative management, Spleen

INTRODUCTION

The most common cause of mortality and morbidity in individuals below the age of 35 is trauma. In the 2012, National Trauma Data Bank (NTDB) showed abdominal injuries affected 14.8% of all patients, with penetrating mechanisms being more common than blunt injuries (23.8% versus 12.1%) [1]. Among them, splenic injuries are observed in 23.8% of patients with abdominal trauma. Mortality after blunt splenic injury in NTDB is 9.3%. Although less common, penetrating splenic trauma is still present in 8.5% of all penetrating abdominal injuries in the NTDB. This is consistent with the rate of penetrating abdominal injuries involving the spleen that was reported in a large series from Grady Memorial Hospital and Ben Taub General Hospital between 1980 and 1990, at 9.2% and 7.2%, respectively [2].

The treatment of blunt splenic trauma has substantially evolved over the past century, moving from routine splenectomy to preserving the spleen whenever feasible. Splenic trauma was usually treated with conservative measures. The idea of splenectomy was adopted in the 18th century. "No evil effects follow its removal, while the danger of haemorrhage is effectively stopped," stated Dr. Emil Kocher [3]. Since then, every patient has had a splenectomy. NOM has replaced surgery as the standard of care for patients with haemodynamic stability due to knowledge of physiological splenic functions and developments in diagnostic and interventional radiology [4,5]. Benefits of NOM include lower costs, earlier discharge, and the absence of asplenic morbidity. Failure of NOM necessitates the undertaking of an operative procedure. It occurs in almost 10-20% of cases. In large series, the rate of late bleeding was 10.6%, though the rate varies significantly depending on the severity of splenic injuries [6]. Therefore, even in patients with stable haemodynamic, Contrast-Enhanced Computed Tomography (CECT) of the abdomen is necessary and suggested. Because of the speed, wide availability, diagnostic accuracy, and non invasive procedure, it is the diagnostic imaging of choice [7-10].

With the emergence of MDCT, haemodynamically stable patients can now opt for NOM. As a result of faster image acquisition, MDCT is more sensitive in detecting active bleeding and Contained Vascular Injuries (CVI), which can deteriorate haemodynamic [11]. MDCT better visualises organs and vascular structures in a different phase of contrast enhancement. The clinical effects of vascular injuries on the treatment of patients with splenic trauma are, however, still debatable [12]. Observation, splenic artery embolisation, splenorrhaphy, and splenectomy are all forms of treatment for splenic injuries that are still evolving. The primary goal of present study was to retrospectively evaluate the MDCT results and subsequent surgical requirements in a group of patients.

MATERIALS AND METHODS

The present retrospective hospital-based study was conducted in the Department of General Surgery, Tezpur Medical College and Hospital, Tezpur, Assam, India from 1st September 2022 to 30th December 2022. The period during which data was collected, was from 1st October 2021 to 31st August 2022. Ethical clearance was obtained from the Institutional Ethical Committee (IEC Sl. No: 121/2022/TMC&H).

Study Procedure

During the study period, there were 132 cases of blunt trauma abdomen. Among them, 122 patients had undergone MDCT of the abdomen. Among those 122 cases, those who had splenic injuries were included in the study. The clinical data were retrospectively traced for those 122 patients who had MDCT for possible blunt trauma of the abdomen. The resultant final population included 21 patients. The patients who were treated conservatively were traced and the outcome of the treatment on follow-up, from the clinical notes. The preliminary MDCT findings of the patients were associated with the final diagnosis and treatment.

A 128-slice MDCT system having a collimation of 0.625 mm and a 1 mm reconstruction section thickness were used for all examinations [13]. A voltage of 120 kV and 300 mAs was utilised for patients of average build. The iterative dose optimised the current (mA) to body attenuation. The pitch was one, and the resolution was standard. Iohexol 300 mg/mL, a non ionic contrast agent having low osmolarity, was injected into the body in 90 mL at a rate of 3 mL/s, followed by 30 mL of saline at the same rate. The Portal Venous Phase (PVP) and the Arterial Phase (AP), measured at 70 and 30 seconds after injecting the contrast material, were a part of the standard trauma protocol.

The Organ Injury Scaling Committee graded splenic injury using AAST's standards [Table/Fig-1] [14]. The collection with attenuation similar to or greater than that of the aorta or a major adjacent was observed, and the presence of perisplenic or intrasplenic CME was recorded.

Grade	Injury	Criteria
I	Haematoma	Subcapsular, <10% of surface area.
	Laceration	Capsular tear, <1-cm parenchymal depth.
II	Haematoma	Subcapsular, 10-50% of surface area.
	Laceration	Intraparenchymal, <5-cm diameter 1 cm to 3 cm parenchymal depth that does not involve a trabecular vessel.
III	Haematoma	Subcapsular, >50% of surface area or expanding.
	Laceration	Ruptured subscapular or parenchymal haematoma >5 cm diameter. >3 cm parenchymal depth or involving trabecular vessels.
IV	Vascular	Splenic vascular injury or active bleeding within the splenic capsule.
	Laceration	Laceration producing major devascularisation of >25% of the spleen.
V	Vascular	Splenic vascular injury with active bleeding beyond the spleen into the peritoneum.
	Laceration	Completely shattered spleen.
Advance one grade for multiple injuries (upto Grade III).		

[Table/Fig-1]: Classification of splenic injuries as proposed by the American Association for the Surgery of Trauma (AAST), 2018 Revision [14].

STATISTICAL ANALYSIS

Data was collected and Fisher's-exact tests and Chi-square were used for statistical analyses of the relationships between the severity of the splenic injury, CME, and management using International Business Machines (IBM) Statistical Package for the Social Sciences (SPSS) version 21.0 software. A p-value of <0.01 was considered significant statistically.

RESULTS

During the period of the study, 122 patients had MDCT of the abdomen for blunt trauma of the abdomen, and 21 patients (17.21%) were found to have a splenic injury. Of these 21 patients, 16 patients (76.19%) were male, and five patients (23.81%) were females, with a mean age of (29±10.79 years) and a median of 26 years (range 17-71 years). The most common cause of trauma was two-car collisions in 17 (80.95%), followed by falling from height in three (14.29%) and workplace injury in one (4.76) patients. MDCT was done within six hours of trauma in 19 (90.48%) and after 24 hours in 2 (9.52%) patients.

Of the 21 patients who had splenic injury, 14 patients were found to have only splenic injury, while the rest had associated liver injury (n=3), kidney injury (n=2), and bowel with mesenteric injury (n=2). Seven patients had two or more intra-abdominal visceral injuries [Table/Fig-2]. Out of these seven patients, four patients had two visceral organ injuries, while the remaining three patients had three or more injuries.

Injured organ	Number (n)	Percentage (%)
Spleen only	14	66.67
Associated liver	3	14.29
Associated kidney	2	9.52
Associated bowel and mesentery	2	9.52

[Table/Fig-2]: Splenic injury and associated injured visceral organs in the 21 patients.

The 21 splenic injuries included in the study were classified based on AAST grading scales for organ injury, out of which 14 (66.67%) underwent NOM. Of the five patients who had Grade III splenic injury, one of them had perisplenic CME and was treated by surgical means. Three of the four patients who had Grade IV splenic injury were also managed surgically. Out of these three patients, two of them had CME (one intrasplenic and one perisplenic) and deteriorated haemodynamically after CT examination. In contrast, the other patient had associated notable bowel and mesenteric injury observed by MDCT [Table/Fig-3].

Grade	Number	Contrast Media Extravasation (CME)		Management	
		Intrasplenic	Perisplenic	Non operative	Operative
I	3 (14.29%)	0	0	3	0
II	6 (28.57%)	0	0	6	0
III	5 (23.81%)	0	1	4	1
IV	4 (19.05%)	1	1	1	3
V	3 (14.28%)	0	1	0	3
Total	21 (100%)	1	3	14	7

[Table/Fig-3]: The grades of the 21 patients having injury of the spleen based on the American Association for Surgery of Trauma (AAST), Contrast Media Extravasation (CME) and the management.

Of seven patients who underwent OM, splenectomy was performed in all seven patients, including three with Grade V injury, three with Grade IV injury, and one with Grade III injury of the spleen. The splenic artery embolisation provision was unavailable in the hospital during the period of study. Of the four patients who had CME, all of them underwent laparotomy (100%) related to the spleen and had active haemorrhage during surgery, but only three of the remaining 17 patients without CME (17.65%) required laparotomy related to the spleen; the difference was significant statistically ($p<0.01$) [Table/Fig-4].

Contrast Material Extravasation (CME)	Non Operative Management (NOM)	Operative management	Total
Present	0	4	4
Absent	14	3	17
Total	14	7	21

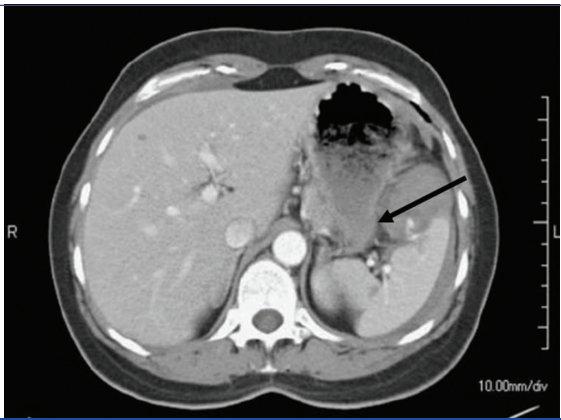
[Table/Fig-4]: Association between Contrast Material Extravasation (CME) and management.
Fisher-exact test statistical value $p=0.0058$ (Significant). (Fishers-exact test since in some cell values are less than 5)

All patients who had NOM or OM were followed-up for five months according to the hospital protocols. None of the patients with NOM presented with features of delayed rupture of the spleen.

Statistical analysis revealed a strong association between injury grades, CME, and management plans. In comparison to patients having low-grade organ injuries with no sign of CME, those with high-grade organ injuries were more likely to undergo surgery [Table/Fig-5]. [Table/Fig-6-8] shows CT image of grade III, IV and V.

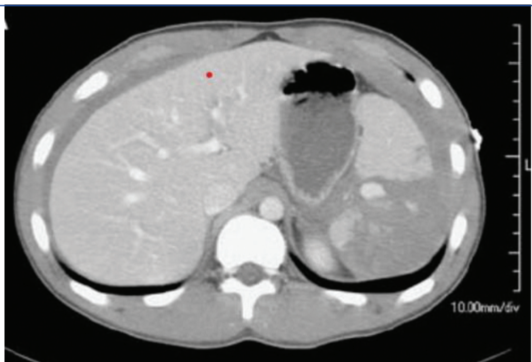
Splenic injuries (n)	Non Operative Management (NOM) (n)	Operative management (n)	Total
Grade I-III	13	1	14
Grade IV	1	3	4
Grade V	0	3	3
Total	14	7	21

[Table/Fig-5]: Association between splenic injury grade and management.
p=0.0012 (which was statistically significant)



[Table/Fig-6]: Grade III splenic injury, as demonstrated by large perisplenic haematoma with a splenic laceration. The black arrow showing large subcapsular haematoma without any vascular pedicle injury.

[Table/Fig-7]: Grade IV splenic injury with contrast extravasation suggesting active haemorrhage (red arrow).



[Table/Fig-8]: Grade V splenic injury, showing a completely shattered spleen.

DISCUSSION

Preserving the spleen's immunologic and haematologic functions is the goal of NOM for splenic injury [15]. The accurate diagnosis and proper management of these patients now focus on detecting active bleeding and the presence of pancreatic, bowel, or mesenteric injuries necessitating laparotomy due to the widespread acceptance of NOM in blunt trauma of the abdomen for solid organ injuries. CT scan is one of the most relevant investigations in the evaluation of trauma patients [16].

The choice of surgical or non surgical treatment for blunt trauma of the spleen has traditionally been made primarily based on the patient's clinical characteristics, such as age, injury severity scores, and haemodynamic status [17,18].

The CME, an observation on standard CT scan images of patients with blunt trauma of the abdomen, which was earlier rare [19], is now more commonly observed with the MDCT [20]. On CT scans, a focal intrasplenic or perisplenic CME indicative of active bleeding caused by ruptured splenic vessels may be seen [21]. While undergoing a CT scan, these patients are usually haemodynamically stable, but 40-90% may soon develop hypotension [21,22]. Four of the 21 patients in the study (19.05%) had CME on their MDCT exams, and all underwent surgery to treat the condition (100%) with confirmed active haemorrhage during the laparotomy. Three of the remaining 17 patients (14.29%) who had no CME needed laparotomies related to their spleens. CME can be considered a definitive predictor in management planning.

The study found that CME was more prevalent in patients with injuries of higher grade (Grade IV and V) than in patients with lower grade injuries (42.86% vs 7.14%), which may be attributed to the high shearing impact of a splenic injury with high-grade, which may result in vascular tear. However, CME in 66.67% of patients with Grade V injuries who required surgical intervention could not be detected. Considering the finding by Nix JA et al., it is suggested that the severity of splenic injury still retains a substantial bearing on the choice and outcome of NOM [23].

One of four patients with Grade IV splenic injury received a NOM following the exclusion of mesenteric and bowel injury by MDCT and the absence of CME. Throughout his or her stay in the hospital and the period of follow-up, the patient was doing well, and no complication was noted.

The NOM is the preferred treatment modality (in 69% of patients), followed by splenectomy (in 28%) and splenorrhaphy (in 4%) in non trauma centres, and 65%, 33% and 2%, respectively, in trauma centres, according to Garber BG et al., the author of a retrospective multicentric study conducted in Ontario (Canada) [24].

According to a study conducted by Vadodariya KD et al., 15 cases who underwent surgery had a haemoperitoneum and/or solid organ injury, thus proving that CT scan was 100% sensitive in diagnosing haemoperitoneum [25].

The regular use of CT scan as the initial imaging modality has encouraged a shift towards non surgical management of blunt injury of spleen in trauma patients who are clinically stable, according to the study conducted by Hassan R et al., [26].

The present study found a higher rate for NOM (66.67%) and a lower splenectomy rate (33.33%) in blunt trauma of the spleen. This might be illustrated by a more careful choice of patients for NOM following precise assessment of the grades of injury of the spleen by MDCT, with the exclusion of active haemorrhage, indicated by CME, as well as other relevant injuries like bowel perforation, which is contraindicated for NOM. Comparison with similar studies is shown in [Table/Fig-9] [27,28].

Study/Year	Place of study	Splenic injury patients (n)	Non Operative Management (NOM)		Operative management (n)
			Success (n)	Failure (n)	
Margari S et al., (2018) [27]	Italy	263	168	23	72
Selim YARM and Albroumi SA (2015) [28]	Oman	44	32	0	12
Present study, 2023	India	21	14	0	7

[Table/Fig-9]: Table showing outcomes of previous studies [27,28].

Limitation(s)

The present study had some limitations such as less sample size and retrospective nature. Further studies need to be conducted with higher sample sizes in high-volume centres to assess the outcome of MDCT findings and management strategy in blunt trauma of the spleen.

CONCLUSION(S)

In MDCT, CME is more common in patients with splenic injuries which are of high-grade (Grade IV and V) than in patients with low grade injures. The evaluation of blunt splenic injuries by MDCT provides precise diagnosis, including injury grades, associated active haemorrhage and/or other significant visceral injuries, more specifically CME findings of splenic injury which determine the appropriate strategy for successful management (Non operative/ Operative) and decrease the unnecessary exploratory laparotomy rate. Thus, MDCT by consistently identifying the vascular and parenchymal lesion supports the NOM as the standard of care and contributes to the shift towards NOM in haemodynamically stable patients.

REFERENCES

[1] Sabiston Textbook of Surgery: The Biological Basis of Modern Surgical Practic/ (edited by) Courtney M. Townsend, Jr, R. Daniel Beauchamp, B. Mark Evers, Kenneth L. Mattox.-20th edition. Section III, CHAPTER 16, page number 432.
[2] Nicholas JM, Rix EP, Easley KA, Feliciano DV, Cava RA, Ingram WL, et al. Changing patterns in the management of penetrating abdominal trauma: The more things change, the more they stay the same. J Trauma. 2003;55(6):1095-108; discussion 1108. Doi: 10.1097/01.TA.0000101067.52018.42, PMID 14676657.
[3] Lee JT, Slade E, Uyeda J, Steenburg SD, Chong ST, Tsai R, et al. American society of emergency radiology multicenter blunt splenic trauma study: CT and clinical findings. Radiology. 2021;299(1):122-30.
[4] Richardson JD. Changes in the management of injuries to the liver and spleen. J Am Coll Surg. 2005;200(5):648-69. Doi: 10.1016/j.jamcollsurg.2004.11.005, PMID 15848355.
[5] Stassen NA, Bhullar I, Cheng JD, Crandall ML, Friese RS, Guillamondegui OD, et al. Selective nonoperative management of blunt splenic injury: An Eastern Association for the surgery of trauma practice management guideline. J Trauma Acute Care Surg. 2012;73(5):S294-300. Doi: 10.1097/TA.0b013e3182702afc, PMID 23114484.
[6] Tugnoli G, Bianchi E, Biscardi A, Coniglio C, Isceri S, Simonetti L, et al. Nonoperative management of blunt splenic injury in adults: There is (still) a long way to go. The results of the Bologna-Maggiore Hospital trauma center experience and development of a clinical algorithm. Surg Today. 2015;45(10):1210-17. Doi: 10.1007/s00595-014-1084-0, PMID 25476466.
[7] Becker CD, Spring P, Glättli A, Schweizer W. Blunt splenic trauma in adults: Can CT findings be used to determine the need for surgery? AJR Am J Roentgenol. 1994;162(2):343-47. Doi: 10.2214/ajr.162.2.8310923, PMID 8310923.
[8] Shanmuganathan K, Mirvis SE, Boyd-Kranis R, Takada T, Scalea TM. Non surgical management of blunt splenic injury: Use of CT criteria to select patients for splenic arteriography and potential endovascular therapy. Radiology. 2000;217(1):75-82. Doi: 10.1148/radiology.217.1.r00oc0875, PMID 11012426.
[9] Shanmuganathan K, Mirvis SE, Sover ER. Value of contrast-enhanced CT in detecting active hemorrhage in patients with blunt abdominal or pelvic trauma. AJR Am J Roentgenol. 1993;161(1):65-69. Doi: 10.2214/ajr.161.1.8517323, PMID: 8517323.
[10] Thompson BE, Munera F, Cohn SM, MacLean AA, Cameron J, Rivas L, et al. Novel computed tomography scan scoring system predicts the need for intervention after splenic injury. J Trauma. 2006;60(5):1083-86. Doi: 10.1097/01.ta.0000218251.67141.ef. PMID: 16688074.
[11] Anderson SW, Varghese JC, Lucey BC, Burke PA, Hirsch EF, Soto JA. Blunt splenic trauma: Delayed-phase CT for differentiation of active haemorrhage from contained vascular injury. Radiology. 2007;243(1):88-95. Doi: 10.1148/radiol.2431060376. PMID: 17293574.
[12] Beuran M, Gheju I, Venter MD, Marian RC, Smarandache R. Non-operative management of splenic trauma. J Med Life. 2012;5(1):47-58.
[13] Nagpal P, Prakash A, Pradhan G, Vidholia A, Nagpal N, Saboo SS, et al. MDCT imaging of the stomach: Advances and applications. Br J Radiol. 2017;90(1069):20160412. Doi: 10.1259/bjr.20160412. PMID: 27785936.
[14] Sabiston Textbook of Surgery: The Biological Basis of Modern Surgical Practice/ [edited by] Courtney M. Townsend, Jr, R. Daniel Beauchamp, B. Mark Evers, Kenneth L. Mattox. 21st edition. SECTION III, CHAPTER 17, page number 415.
[15] Morrell DG, Chang FC, Helmer SD. Changing trends in the management of splenic injury. Am J Surg. 1995;170(6):686-89; discussion 690. Doi: 10.1016/s0002-9610(99)80042-7. PMID: 7492027.
[16] Novelline RA, Rhea JT, Rao PM, Stuk JL. Helical CT in emergency radiology. Radiology. 1999;213(2):321-39. Doi: 10.1148/radiology.213.2.r99nv01321. PMID: 10551209.
[17] Umlas SL, Cronan JJ. Splenic trauma: Can CT grading systems enable prediction of successful nonsurgical treatment? Radiology. 1991;178(2):481-87. Doi: 10.1148/radiology.178.2.1987612. PMID: 1987612.
[18] Coccolini F, Montori G, Catena F, Kluger Y, Biffl W, Moore EE, et al. Splenic trauma: WSES classification and guidelines for adult and pediatric patients. World J Emerg Surg [Internet]. 2017;12(1):40. Available from: http://dx.doi.org/10.1186/s13017-017-0151-4.
[19] Taylor GA, Kaufman RA, Sivit CJ. Active hemorrhage in children after thoracoabdominal trauma: Clinical and CT features. AJR Am J Roentgenol. 1994;162(2):401-04. Doi: 10.2214/ajr.162.2.8310935. PMID: 8310935.
[20] Willmann JK, Roos JE, Platz A, Pfammatter T, Hilfiker PR, Marincek B, et al. Multidetector CT: Detection of active hemorrhage in patients with blunt abdominal trauma. AJR Am J Roentgenol. 2002;179(2):437-44. Doi: 10.2214/ajr.179.2.1790437. PMID: 12130447.
[21] Federle MP, Courcoulas AP, Powell M, Ferris JV, Peitzman AB. Blunt splenic injury in adults: Clinical and CT criteria for management, with emphasis on active extravasation. Radiology. 1998;206(1):137-42. Doi: 10.1148/radiology.206.1.9423663. PMID: 9423663.
[22] Hallinan JTPD, Tan CH, Pua U. The role of multidetector computed tomography versus digital subtraction angiography in triaging care and management in abdominopelvic trauma. Singapore Med J [Internet]. 2016;57(9):497-502. Available from: http://dx.doi.org/10.11622/smedj.2015179.
[23] Nix JA, Costanza M, Daley BJ, Powell MA, Enderson BL. Outcome of the current management of splenic injuries. J Trauma. 2001;50(5):835-42. Doi: 10.1097/00005373-200105000-00010. PMID: 11371838.
[24] Garber BG, Mmath BP, Fairfull-Smith RJ, Yelle JD. Management of adult splenic injuries in Ontario: A population-based study. Can J Surg. 2000;43(4):283-88. PMID: 10948689.
[25] Vadodariya KD, Hathila VP, Doshi SM. The role of computed tomography in blunt abdominal trauma as investigative tool conducted at tertiary level hospital, Vadodara. Int J Med Sci Public Health. 2014;3(4):433-35. Doi: 10.5455/ijmsph.2014.260120145.
[26] Hassan R, Abd Aziz A, Md Ralib AR, Saat A. Computed tomography of blunt spleen injury: A pictorial review. Malays J Med Sci. 2011;18(1):60-67. PMID: 22135575.
[27] Margari S, Garozzo Velloni F, Tonolini M, Colombo E, Artioli D, Allievi NE, et al. Emergency CT for assessment and management of blunt traumatic splenic injuries at a Level 1 Trauma Center: 13-year study. Emerg Radiol. 2018;25:489-97. https://Doi.org/10.1007/s10140-018-1607-x.
[28] Selim YARM, Albroumi SA. Initial multidetector computed tomography of blunt splenic injury: Impact on management. Egypt J Radiol Nucl Med [Internet]. 2015;46(3):573-80. Available from: http://dx.Doi.org/10.1016/j.ejrnm.2015.05.001.

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