


Review

New horizons in splenic traumatism management: literature review

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Abstract

Purpose Review of the new horizons of management for splenic trauma and a proposal of an algorithm for its management.

Methods Literature review using PubMed search engines using the keywords splenic trauma, splenic angioembolisation, management.

Results Non-operative management (NOM) is the first strategy in stable patients with splenic traumatic injury. In AAST grade I-II patients' observation with close monitoring should be considered. Endovascular management (EVM) improves the results of NOM and should be consider in AAST III-IV grade when its available. Fail of NOM should be considered when there are clinical, analytical or imagine signs of active bleeding. Surgery is mandatory in unstable patients. Also indicate when NOM fails, in grade III-IV stable patients if EVM is unavailable, AAST grade V or if associated injuries that are suspected. Laparoscopy have probe to be a feasible and safe technique in stable trauma patients. Preserving the organ when possible is the trend in surgical strategy of splenic trauma.

Conclusions The EVM has improve the success of NOM and it's recommended in AAST grade III-V when its possible. The risk of NOM failure and its early detection must be taken into account. Laparoscopy is safe in stable trauma patients. Open splenectomy remains the gold-standard for unstable patients.

Keywords Splenic trauma · Non-operative management · Angioembolizations · Parenchymal preservation

1 Introduction

The spleen is one of the most frequent organs injured following blunt abdominal trauma. Usually this leads to emergent splenectomy with consequent loss of the hematologic and immunologic function. In light of the AAST classification of splenic lesions (Table 1), we can reconsider the appropriateness of total splenectomies [1, 2].

In the last century the paradigm in the management of these trauma has evolve. NOM had been implemented in the last decades, and its results had improved since the combination with endovascular techniques for bleeding control [3, 4]. The implementation of electrocauterization devices and topic haemostatics improves the organ salvage strategies. This paradigm shift raises pertinent questions about the optimal balance between aggressive surgical interventions and organ-preserving strategies in the context of splenic trauma. Our aim is to present a case of a AAST grade III splenic trauma treated with EVM and to review new horizons in the management of blunt splenic trauma. We suggest a step-up management and surgical approach algorithms in splenic trauma.

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Table 1 AAST splenic injury scale

I	Hematoma	Subcapsular < 10% of surface area
	Laceration	Capsular tear < 1 cm parenchymal depth
II	Hematoma	Subcapsular 10–50% of surface area Intraparenchymal < 5 cm in diameter
	Laceration	Capsular tear 1–3 cm parenchymal depth, not involving trabecular vessels
III	Hematoma	Subcapsular > 50% of surface area or expanding Ruptured subcapsular or parenchymal hematoma Intraparenchymal hematoma > 5 cm or expanding
	Laceration	> 3 cm parenchymal depth or involving trabecular vessels
IV	Laceration	Laceration involving segmental of hilar vessels, producing major devascularization (> 25% of spleen)
V	Hematoma	Shattered spleen
	Laceration	Hiliar vascular injury that devascularizes spleen

2 Case report

A 76-year-old man with a history of atrial fibrillation treated with oral anticoagulation, COPD, OSA with need for CPAP, and thoracic aneurysm, arrived complaining of acute abdominal pain, pallor and profuse sweating followed by fainting, to a first level hospital with 24-h EVM. On arrival he presented with arterial hypotension and confusion. Heart rate was 90 bpm. Abdomen was soft but painful in the left flank. Blood tests showed a haemoglobin of 10 mg/dl, which in the following hours dropped to 8.2 mg/dl. The patient responded to initial fluid resuscitation and was taken to CT scan showing moderate haemoperitoneum with perisplenic haematoma greater than 50% of the organ, corresponding to AAST grade III. The patient had taken oral anticoagulants 12 h earlier. The haematologist suggested a very high risk of haemorrhage in case of surgery. The patient was taken to EVM where intraparenchymal haemorrhage was observed and embolization of the splenic artery was performed. In the following days the patient recovered satisfactorily, but in the following weeks complained of fever and pain in the left quadrant. A Splenic abscess was diagnosed and delayed splenectomy was performed.

3 Discussion

In the last decades NOM of the splenic trauma had increased. Nowadays It should be considered in blunt splenic trauma in stable patient [4–6]. The implementation of EVM had decreased the failure of the NOM [7–10]. Currently we can follow a stepped strategy (Fig. 1) [11].

In NOM, close clinical and analytical must be monitored closely. Stability of the patient is the main need. Treatment of AAST grades I-II without signs of active bleeding could be treated just this way [12].

EVM continues with the NOM strategy and improves its results [13]. It can be considered for stable patients with grade III-IV or signs of active bleeding regardless the injury grade [5, 6, 14]. Some authors suggest that EMV should be consider in AAST grade V, but still controversial [8, 9]. In patients with a high surgical risk (heart disease, respiratory insufficiency, anticoagulation, etc.), regardless of the degree of trauma is a good alternative to surgery.

When contrast blush is described usually is used to describe two different scenarios: the presence of extravasation within the splenic parenchyma and active extravasation into the peritoneal cavity. The first one may lead to pseudoaneurysm formation in delay, and benefits from embolization; the second one is more likely to fail when EVM is perform [9].

Miller et al. [9] describes a higher rate of NOM failure in patients who had angiography but not embolisation and suggest embolization of all patients who have undergone angiography. However, although prophylactic embolization is described when there is a high risk of NOM failure, there is no consensus [6, 16–20].

The embolization must be proximal, occluding the splenic artery 2 cm distal to the dorsal pancreatic artery as distal AE associates more risk of segmental splenic infraction and abscess formation [10, 21]. The viability of the spleen is ensured by collateral circulation [16, 22]. Lauerman et al. [23] describe that embolization decreases the risk of secondary pseudoaneurysm in comparison with observation management. Complications after EVM include rebleeding,

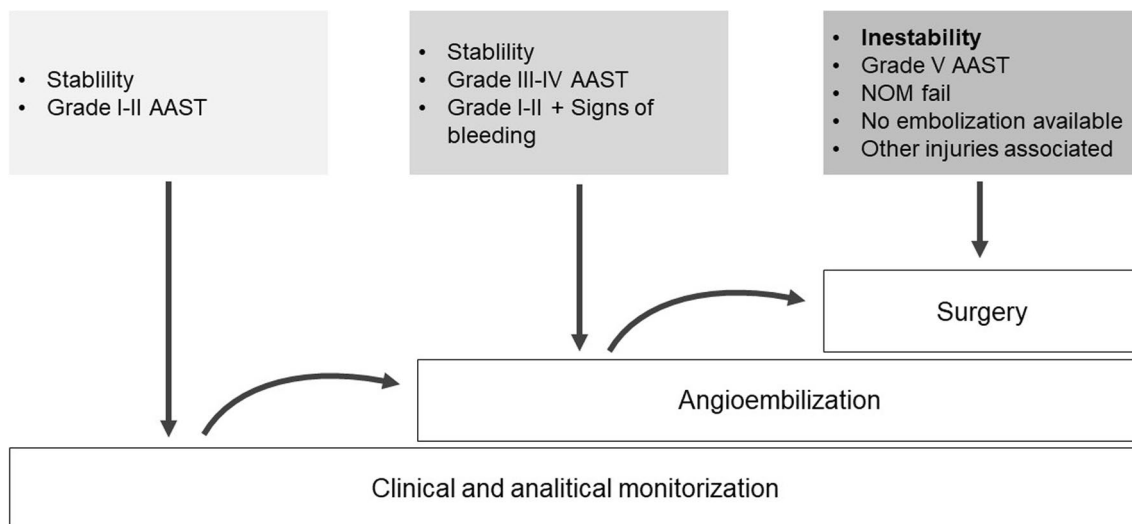


Fig. 1 Step-up approach in splenic trauma

necrosis of the embolized segment, or abscess formation. Availability is the main the limitation of this technique as its implementation may not be feasible depending on the centre’s schedule or level [24].

Failure of the NOM, associated or not with EVM, should be considered if the patient shows signs of active bleeding such of drop of haemoglobine, need of repeated blood transfusions, suggestive radiological findings or if becomes unstable [4].

The Eastern Association of Surgery of Trauma (EAST) describes the failure of NOM as 5% in AAST grade I, 10% in grade II, 20% in grade III, 33% in grade IV and up to 75% in grade V [25]. Factors that increase the risk of failure of NOM include patient age > 55 years, hemoperitoneum > 300 cc (Table 2) [10], ISS > 25, need for transfusion, more than two organs affected, association with traumatic brain injury or AAST > III grades [4, 6, 7, 15, 26–31].

If the patient arrives unstable, the initial surgical approach is mandatory. Surgical approach should also be performed in case of no possibility of EVM, high risk of NOM failure, or associated lesions requiring surgery [32].

Classically, the surgical approach to splenic trauma has been total splenectomy. The organ function implies the risk overwhelming post-splenectomy infection (OPSI) by encapsulated bacteria and implies the need vaccination. The actual trend is organ preservation, although the techniques of partial splenectomy and splenorrhaphy are described, they are now obsolete [33].

Since the first reported trauma laparoscopy was described in the mid-1920 it has been implemented from the beginning of the 21th century, and splenic trauma is not left behind [4, 34–43]. A correct selection of the candidates is crucial. It can be considered in a centre with high experience in laparoscopy and by experience surgeons with adequate laparoscopy skills and able to convert to open surgery if needed. Some situations where laparoscopy splenectomy can be considered (Fig. 2) [4, 7]:

- EVM fail, contraindicated (allergy to iodine contrast), no available or unsuccessful.
- High risk of failure of NOM.
- Penetrant injuries of thoracoabdominal area where diaphragm may be injured.
- Discordance between clinical examination and radiological findings.

Table 2 Classification of hemoperitoneum, taking into account 7 intraperitoneal spaces: right subphrenic, left subphrenic, subhepatic, right paracolic, left paracolic, pelvis, intramesenteric [10]

		Volume of hemoperitoneum (ml)
1–2 intraperitoneal spaces	Small	250 ml
2–4 intraperitoneal spaces	Moderate	250–500 ml
> 4 intraperitoneal spaces	Large	> 500 ml

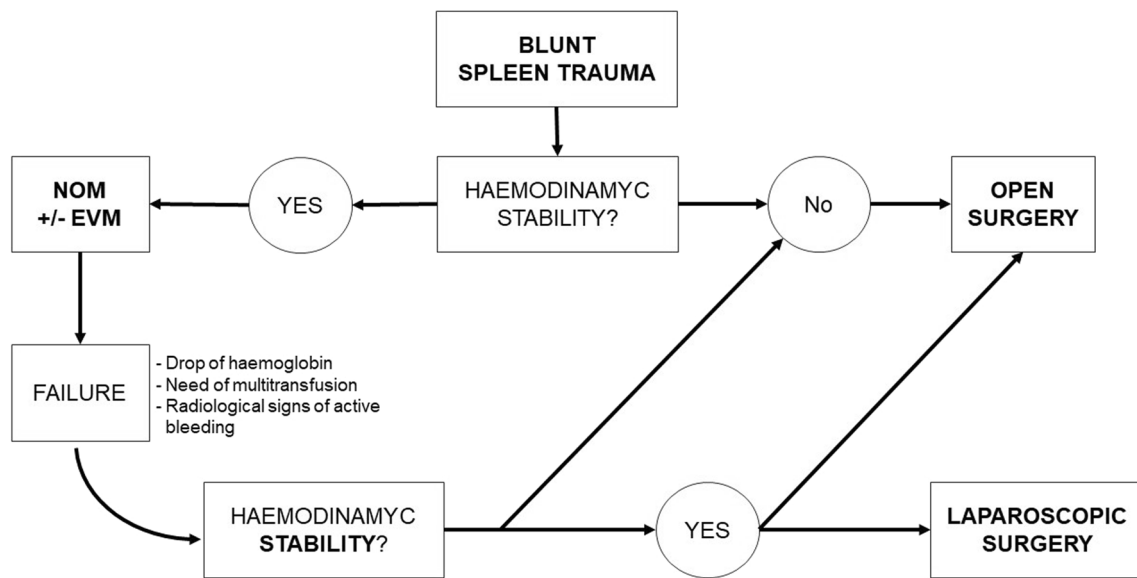


Fig. 2 Surgical approach to blunt spleen trauma

Coagulopathy induced by trauma and EVM increases the risk of thromboembolic events. The prophylaxis with low molecular weight heparin in the next 48 h is safe and does not increase the risk of failure of NOM [44, 45].

4 Conclusions

Although immediate open surgery is necessary in unstable splenic trauma, NOM should be considered in stable patients AAST grade I-IV. EMV improves the success rate of NOM, but we must be aware of the risk factors for failure and not delay the surgical approach when NOM fails. Laparoscopy is feasible and safe in some cases of splenic trauma.

Author contribution AAMF, AOS, AFJ and MJCS prepared the main manuscript. MJCS and MDCM were the surgeons that made the initial approach to the patient and made a literature review about the topic. MJCS, MDCM and JMPG reviewed and corrected the manuscript and advised on the implementation of the systematic review. All authors reviewed the manuscript. All authors made substantial contributions in the conception or design of the work and approved the final version.

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Code availability Not applicable.

Declarations

Competing interests The authors declare no competing interests.

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