

## PRESENTATION AND MANAGEMENT OF SPLENIC INJURIES: A REVIEW OF LITERATURE.

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### ABSTRACT

**BACKGROUND:** The burden of managing splenic injuries has been on the rise. Most patients with blunt abdominal trauma do sustain splenic injuries with varying degrees of severity. The success in managing such depends on a sound clinical judgment and early intervention.

**METHOD:** An in-depth search and review of relevant literature on splenic injuries was carried out. Also used in literature search were selected texts as well as online searches using Pubmed and African journal online (Ajol)

**RESULTS:** Splenic injuries have been reported from all over the world. Majority of splenic trauma in our environment are due to vehicular accidents. Tropical spleen enlargement in malaria endemic regions is an identified predisposing factor to sustaining splenic injuries. Splenic conservation methods have evolved over the years ranging from operative to minimally invasive techniques. The management of post-splenectomy complications has also witnessed modifications over the last two decades.

**CONCLUSION:** Successful management of splenic injuries anchors on good understanding of both structural and function derangement that accompany such. Timely intervention and appropriate treatment is invaluable.

**KEYWORDS:** Spleen, Trauma, Grades of injuries, Classification, Treatment, Prophylaxis.

**RUNNING TITLE:** Splenic injuries, current classification and Treatment.

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## INTRODUCTION

The spleen is a vital organ in the body that is bestowed with immunological and haemopoietic functions. The spleen has been noted to be the most injured solid organ following blunt, penetrating and thoraco-abdominal injuries.<sup>1-4</sup> This could arise from domestic injuries, vehicular trauma, fall from height, missile or ballistic injuries.<sup>5,6</sup> The occurrence of splenic injuries may result in sudden deterioration of the patient's clinical status with consequent mortality timely intervention is not given.<sup>7</sup> More often than not, splenic injuries could be diagnosed on clinical grounds however; radiological assessment could be invaluable to a better management outcome.<sup>8</sup> This bony protection is lost when the spleen pathologically enlarges as in the case of tropical splenomegaly in malaria endemic regions thus, predisposing the

spleen to injuries. Hence, the bony protection now becomes the cause of injury.

### METHOD

An in-depth computerized search and review of relevant literature on splenic injuries in both local and international journals was carried out using databanks such as MEDLINE. Also used in literature search were selected texts, topics, seminar titles, original and review articles using Pubmed and African journal online (Ajol). Emphasis was laid on with search focus on splenic trauma, aetiology, clinical presentation, classification, treatment modalities, complications and management of complications as well as prophylaxis after splenectomy.

### Clinical presentation

The mode of presentation essentially depends on the extent of the injury. Some patients with low to moderate grade of injuries may present with haemodynamic stability while some may present in shock. Some patients may not even present initially to the hospital until after few hours or days when such will complain of abdominal pain, dizziness and weakness. Others may present with

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features of peritonism while some may exsanguinate and die in transit. The diagnosis of splenic injury can be established clinically from a detailed history and clinical examinations findings. The patient (if conscious) gives a history of sustenance of trauma and events surrounding such; he/she may also complain of dizziness, pains in the abdomen and/or chest. Otherwise, such history is narrated by an eyewitness.

There could be referred pain to the tip of left shoulder caused by irritation of inferior concavity of left hemi-diaphragm (Kehr's sign). Pain can also be referred to the left cervical region due to irritation of left phrenic nerve. These referred pains are usually encountered in patients with slow leaking bleeds hence, should not be expected in an emergency situation. Physical signs that are pathognomonic of splenic injury include London's sign, Balance's sign, seat belt sign among others.

### Clinical Evaluation

Radiological signs of splenic injury depend on the modality being used. Plain erect abdominal radiograph may reveal a ground -glass appearance, obliteration of Psoas shadow (in asthenic patients), indentation of gastric shadow and shift of gastric shadow to the right. Lower left rib fractures could also be seen. Percutaneous trans-abdominal sonography or focused assessment sonography for trauma [F.A.S.T.] may reveal the integrity of the splenic parenchyma, peri-splenic haematoma. Extended F.A.S.T (E-F.A.S.T) assesses if there is any pericardial or intrapleural collection. Although this modality does not involve exposure to ionizing radiation, it is an operator-dependent. The computerized tomography (CT) scan gives a better resolution and may reveal integrity of parenchymal damage, intra parenchymal haematoma<sup>10</sup>. CT scan is associated with risk of exposure to irradiation. Magnetic resonance imaging (MRI) gives almost

the same information like the CT scan but with no risk of exposure to irradiation. MRI is contra-indicated if the patient has metallic implant in-situ.

The use of diagnostic laparoscopy (DPL) in splenic trauma should be caution as this modality is unspecific about the source of bleeding. It is useful in haemodynamically stable patients to decide on management protocol<sup>12</sup>. Laparotomy becomes inevitable where facilities and expertise for diagnostic laparoscopy are not available and/or when a patient's condition is deteriorating and/or when a patient presents in shock and unresponsive to resuscitation. Abdominal paracentesis may yield non-clotted blood and this modality may be useful in areas where there are no luxuries of having sonography, CT scan or MRI. However, care must be taken to avoid inadvertent injury to the epigastric vessels during the tap.

### Classification of splenic injury

The classification propounded by Uphadyaya et al (1968) essentially focuses on paediatric splenic trauma while that of Moore et al was essentially focused on adult series. The classification of splenic injuries according to the American Association for the surgery of trauma (AAST) tend to look at the anatomical damage to the spleen using radiological techniques like the ultrasonography, MRI and CT scan. None of these classifications made reference to the associated physiological derangement that comes with the trauma. In 2016, the World Society of Emergency Surgery (WSES) came up with a new classification model that portends both anatomical and physiological basis for classifying splenic injuries. The WSES classification can be applied to both children and adults hence, very vital in decision making and prognosticating.<sup>14</sup>

AAST-splenic injury scale <sup>4</sup>	Uphadyaya and Simson <sup>12</sup>	Moore et al <sup>13</sup>
<p><b>I</b>-Subcapsular haematoma &lt;10% surface area/ parenchymal laceration &lt;1cm deep</p> <p><b>II</b>- Subcapsular haematoma 10 -50% surface area/ parenchymal tear 1 -3 cm deep without vessel involvement/ intraparenchymal haematoma &lt;5cm</p> <p><b>III</b>-Subcapsular haematoma &gt;50%surface area/parenchymal haematoma &gt;5cm/ ruptured haematoma/ laceration &lt;3cm with trabecular vessel involvement</p> <p><b>IV</b>-Subcapsular haematoma &gt;50%surface area/parenchymal haematoma &gt;5cm/ ruptured haematoma/ laceration &lt;3cm with trabecular vessel involvement causing &gt;25% devascularization of spleen</p> <p><b>V</b>-Shattered spleen/hilar vascular injury causing complete devascularization of spleen/ ruptured pathological spleen/associated multiple organ injuries</p>	<p><b>A</b>-Incomplete parenchymal laceration</p> <p><b>B</b>-Parenchymal laceration extending to hilum but not dividing it.</p> <p><b>C</b>-Complete parenchymal tear dividing spleen into two fragments, each with an intact blood supply.</p> <p><b>D</b>-Complete fragmentation with torn hilar vessels. The extravasated blood has filled the peritoneal fold of the hilum.</p>	<p><b>I</b>-Subcapsular haematoma &lt; 10% surface area/ parenchymal laceration &lt; 1cm deep.</p> <p><b>II</b> Subcapsular haematoma(non -expanding) 10 - 50% surface area / parenchymal tear 1 -3 cm deep without vessel involvement/non -expanding intraparenchymal haematoma &lt;2cm</p> <p><b>III</b> Subcapsular haematoma &gt;50%surface area/parenchymal haematoma &gt;2cm/ ruptured haematoma with active bleeding/ laceration &gt;3cm with trabecular vessel involvement</p> <p><b>IV</b> Ruptured haematoma with active bleeding/ laceration &lt;3cm with trabecular vessel involvement with &gt; 25% devascularization of spleen</p> <p><b>V</b>-Shattered spleen/hilar vascular injury with splenic devascularization</p>

	WSES grade	AAST	Haemodynamic
Minor	WSES grade I	I-II	Stable
Moderate	WSES grade II	III or segmental vascular injuries	Stable
Severe	WSES grade III	IV-V or any grade parenchymal lesion with main vessels dissection/occlusion	Stable
	WSES grade IV	Any	Unstable

WSES World Society of Emergency Surgery, AAST American Association for the Surgery of Trauma

### Treatment options and guidelines.

Generally speaking, splenic injuries could be managed either non-operatively or operatively. For non-operative management (NOM), factors to be considered include the age of the patient, the haemodynamic status, nature of the injury (blunt or penetrating), type of energy transfer (low or high energy transfer), presence or absence of peritoneal inflammation/contamination, presence or absence of concomitant organ injuries and availability of support system (radiology and blood bank services).<sup>15</sup> Opinions differ from surgeon to surgeon with regards to NOM of splenic trauma and over the years, many surgeons have reviewed their policies with respect to NOM.<sup>16,17</sup>

Considering the option of operative intervention or NOM, the benefits and risks have to be weighed in every patient bearing in mind the local protocols, available diagnostic and laboratory facilities and ease of accessing such. However, it should be borne in mind that other injuries (such as bowel perforations) could be missed especially in blunt abdominal trauma when managing non-operatively.<sup>15</sup> As such, the surgeon should know when not to entertain or abandon NOM. Non-operative management is generally considered in patients with grade I or II (AAST) injury using either percutaneous sonography or CT scan to assess and monitor the injury. When splenic preservation is desired in this category of patients, any of these treatment options could be useful: splenorrhaphy, partial splenectomy, omentoplasty, use of mesh, biological sealants and use of pledgets. Minimal invasive techniques in interventional radiological techniques have been employed in the management of splenic trauma. Examples include splenic arterial embolization (SAE), selective splenic arterial embolization (SSAE) and argon beam laser coagulator.<sup>18, 19</sup> However, this modality is not without complications as splenic infarction, renal failure (due to contrast medium) and splenic abscess could ensue after arterial embolization.<sup>20</sup>

Indications for operative management (OM) laparotomy include hemodynamic instability, ongoing blood loss, high grade injuries (AAST IV-V) or splenic injuries (irrespective of the grade) [associated faecal peritoneal contamination associated traumatic brain injury (to prevent secondary brain injury), splenic trauma due high velocity missile or ballistic injury, presence or any other significant organ injury], transfusion of 40 mL/kg of all blood products within 24 hours or if more than 4 units of blood fail to stabilize the patient hemodynamically.<sup>21-23</sup> Options in OM include total splenectomy, partial splenectomy, splenorrhaphy and splenic re-implantation. Total splenectomy is carried out for Laparoscopic splenectomy, a minimal invasive technique has been found useful in the operative management of splenic trauma.

### Complications

Splenectomy results in alteration of the immune system such as reduction in the serum levels of T and B lymphocytes, Ig-G, Ig-M and Ig-A, tuftsin and properdin factors.<sup>24</sup> These alterations in the immune system weaken the body's ability to combat invading microbial insults. The deficiency of the tuftsin (a tetrapeptide that enhances phagocytic activities) and properdin (a factor involved in initiating alternative complement pathway) result in reduced immunity with predisposition of the individuals to infections by encapsulated organisms causing an overwhelming post-splenectomy infection (OPSI). It is a catastrophic complication with a high mortality rate especially in children. OPSI is caused by encapsulated organisms like *Streptococcus pneumoniae*, *Haemophilus influenzae type b*, *Neisseria meningitidis*, *Escherichia coli*, *Plasmodium falciparum*, *Babesia microti*, *Capnocytophaga canimorsus*, *Bartonella spp.*<sup>25</sup>

Clinical manifestation of OPSI usually starts with non-specific symptoms like fever, headaches, chills and malaise. These symptoms get worsened and patients may progress to developing septic shock, hypotension, oliguria and hypoglycaemia with progression to circulatory collapse if not abated by aggressive fluid and antibiotics therapy within 24-72 hours.<sup>26</sup> Prevention is by giving polyvalent pneumococcal vaccine, malarial and antibiotics prophylaxis should not be underrated in asplenic individuals. Other reported complications after splenic trauma and surgery

include pancreatic fistula and deep vein thrombosis (DVT).<sup>27</sup> Appropriate prevention and management guidelines of these conditions should followed. Other supportive measures include early mobilization of patients, the use of graduated compression stockings as well as adequate hydration of the patients.<sup>28,29</sup>

### Prophylaxis guidelines.

The table below illustrates the recommended prophylaxis for asplenic or hyposplenic patients. Though the best time to give this vaccination has been controversial for decades, many opined that it is best given within 2 weeks after splenectomy (preferably before the patient is discharged from the hospital). Such vaccination should cover for *H.influenzae*, *Strept. Pneumococcus*, *Neisseria meningitides*, *malaria*. Also, antibiotics prophylaxis for surgical procedures is mandatory. The Centres for Disease control and Prevention have also stipulated some guidelines to protect the asplenic patients from overwhelming infections.<sup>30,31</sup>

### CONCLUSION

The successful outcome in the clinical management of splenic injuries anchors on timely intervention. Knowing the extent of damage to the spleen and other organs is vital in choosing the appropriate treatment option. Recent classification by WSES not only gives an idea about the anatomical and pathophysiological derangement that may affect the patient's outcome but also guide in instituting the best management protocol for the patient. Operative management should be unhindered especially in resource-limited settings.

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