REVIEW ARTICLE

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IMAGING DIAGNOSIS OF SPLENIC TRAUMA: NARRATIVE REVIEW

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ABSTRACT

INTRODUCTION: The spleen has an important role in the running of the human blood defense system, removing old red blood cells and holds a reserve of blood. However, this function can be compromised if occours an splenic trauma, that is the most commom kind of abdominal trauma, it can be classified as penetranting or blunt. The blunt splenic trauma can be caused, for example, by sporting injuries. Whilst the penetrating splenic trauma is caused by, for example, by gunshot wound. So, there is the gold standard diagnosis, the computed tomography, wich leaves room for non-operative management.

OBJECTIVE: Review, identify and describe the imaging characterization of splenic traumas.

METHODOLOGICAL PROCEDURES: This study can be characterized as a narrative review with emphasis on a collection of images. The databases were MEDLINE via PubMed, LILACS via BIREME, Scielo and Academic Google. The health descriptors (MeSH terms) in English are "splenic rupture", "spleen", "wounds and injuries" and "diagnostic imaging. Studies (clinic trials, pictorial essays, literature reviews, among others) that had images of diagnostic methods that were in accordance with the research objective and available online in full text published in the last 10 years, in english, spanish and portuguese.

RESULTS AND DISCUSSION: Splenic trauma presents as an imaging finding mainly the spleen laceration, seen as a hypodense line, which may or may not be irregular. Such a condition corresponds to the splenic hematoma and hemiperitoneum, as well as the fluid adjacent to the liver and in the paracolic, related to hemorrhage. Subcapsular and parenchymal hematoma can also be seen, as well as the presence of hypo-anechoic fluid collection in the subcapsular or perisplenic space. In addition, the computed tomography has a better performance when contrast is used.

CONCLUSION: The imaging diagnosis of splenic trauma should be done using preferably computed tomography, but focused assessment with sonography in trauma and ultrasonography also can be used with further confirmation by computed tomography.

KEYWORDS: SPLENIC TRAUMA. DIAGNOSTIC IMAGING. COMPUTED TOMOGRAPHY. SPLEEN.

INTRODUCTION

The spleen is one of the various organs that make up the human immune system, protecting the body against the risk of severe infectious diseases[1]. In general, the spleen removes old red blood cells and acts as a blood reservoir. However, its different regions, such as the splenic marginal zone, white pulp, and red pulp, have some essential functions[2]. The marginal zone contains B cells that produce many of the IgM and IgG antibodies, which react with blood-borne pathogens. The B follicular cells of the white pulp produce highly specific antibodies to combat these pathogens, an action known as adaptive immunity. Lastly, the red pulp of the spleen has intravascular macrophages that eliminate bacteria and other external materials. Therefore, the spleen can be considered the center of the immune system[2,3].

Due to its importance, splenic trauma puts the maintenance of human life at risk, as the injury or removal of this organ hinders the action of the immune system. Such trauma is the most common in relation to the abdomen, and can be perforating, caused for example by firearms, or blunt, caused mainly by car accidents, sports or even falls from great heights[2,4]. Its rupture can also occur after surgical procedures and infections2. Furthermore, it can affect all age groups and genders and has a high mortality rate of 7-18% when diagnosed late[5].

The advancement of radiology has greatly facilitated both the diagnosis and decision-making regarding the treatment of splenic trauma[2]. In addition to this, pain in the upper left quadrant of the abdomen, pain in the left shoulder, diffuse abdominal pain, and pain in the lower left chest are also indicative for diagnosis[2]. However, a splenic rupture can be masked by other injuries, and if it is a contained rupture, its initial symptoms may be minimal[2].

The Extended Focused Assessment with Sonography for Trauma (eFAST) and computed tomography (CT) are two imaging tests that can be used to diagnose such traumas[2]. The first reveals free abdominal fluids, such as blood or gastrointestinal contents, being very useful in hemodynamically unstable patients, as it is accessible, portable and non-invasive[2,5]. The latter is recommended for hemodynamically stable patients, with sensitivity and specificity of 96-100%[5]. CT is also considered the gold standard for blunt splenic trauma,

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having been fundamental for the development of Non-Operative Treatment (NOT) in this type of spleen trauma, even reducing the need for exploratory laparotomies. The correct use of these diagnostic methods reduces the chances of worsening the lesions, which could lead to extreme situations, such as splenectomy[2].

The American Association for the Surgery of Trauma (AAST) has formulated an organ injury scale, graded from I to V, with increasing severity, ranging from less than 10% involvement to complete rupture of the spleen, taking into account the extent of hematoma and the depth of laceration[2]. Based on this classification in conjunction with CT imaging, it is possible to determine the need for surgical intervention[2].

In cases of blunt splenic trauma, after correct classification of the injury, most cases I and II can be treated through NOM5. In grade III cases, the success percentage is 50%, reducing even further in IV and V cases6. Furthermore, for this method to be successful, there must be no peritonitis and associated injuries that require laparotomy, or hemodynamic instability. Therefore, angiography of the splenic artery may be used, which uses catheters guided with the aid of radiography with the aim of finding possible obstructed vessels, and angioembolization, which uses mechanical or chemical agents to reach obstructed vessels close to or distant from the bleeding point [2,4]. Such methods increase in need depending on the increase in the degree of the injury. The NOM failure rate is low, 4-15% of cases[7].

Regarding perforating splenic trauma, laparotomy is the gold standard of treatment[5]. More common in military areas or areas with endemic urban violence, it accounts for around 5-14% of cases of splenic trauma[8]. However, currently, there is an attempt to avoid splenectomy and invasive treatments as much as possible, resorting to non-operative treatments, as is the case of injuries caused by stabbing, in which if there is hemodynamic stability accompanied by the necessary diagnostic tests, the use of NOM can be indicated[1]. In hemodynamically unstable patients, perforating splenic traumas present fewer foci of blood loss than blunt traumas, which makes it possible to reduce the need for rapid removal of the spleen[1]. Thus, the use of laparotomy increases according to the degree of severity of the injury, with splenectomies occurring in cases of degree equal to or greater than III5.

OBJECTIVES

Review, identify and describe the imaging characteristics of splenic trauma.

METHODOLOGY

This is a narrative review with an emphasis on the collection of images. The databases were MEDLINE via PubMed, LILACS via BIREME, Scielo and Google Scholar. The health descriptors (MeSH term) in English are "splenic rupture", "spleen", "wounds and injuries" and "diagnostic imaging" in the following search strategy: (((spleen AND (wounds and injuries)) OR (splenic rupture) AND (diagnostic imaging)). Studies were included (clinical trials, pictorial essays, literature reviews, case reports, among others) that addressed the topic, that had images of diagnostic methods, that were in accordance with the objective of the research and that were available online in full text, published in the last 10 years in English, Spanish and Portuguese.

RESULTS AND DISCUSSION

Splenic trauma presents as imaging findings mainly the laceration of the spleen, which will be graded according to its severity, seen as a hypodense line, which may be irregular or not accordingly. This condition is accompanied by splenic hematoma and hemiperitoneum, as well as fluid adjacent to the liver and in paracolic gutters, related to hemorrhage. Subcapsular and parenchymal hematoma may also be observed. The identification of such findings allows the diagnosis to be made quickly. Furthermore, computed tomography performs better in terms of an assertive diagnosis when performed using contrast.

Computed tomography, ultrasound (US) and FAST 1-9 images display the features found in splenic trauma.

The images below show the portal venous displaying two examples of splenic lacerations. The left image depicts a small laceration (AAST classification level I), indicated by the arrow, appearing as a hypodense line extending from the spleen's surface with a small subcapsular hematoma (arrowhead). The right image shows a wide laceration with irregular margins (arrowhead), complicated by a ruptured subcapsular hematoma, with hemoperitoneum extending beyond the boundaries of the splenic capsule (arrows), classified as AAST level III4 - Figure 1.

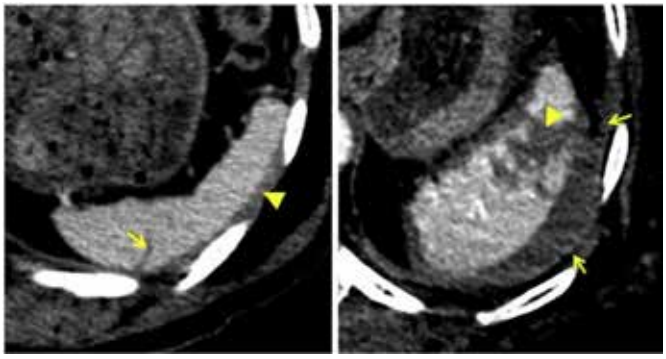

Figura 1 – Trauma esplênico contuso com laceração. Imagens de tomografia computadorizada[4].

In the figure below it is indicated in the portal venous phase: small (AACT level I) subcapsular hematoma (arrow) seen as a growing slightly hypodense collection with a smooth border in the portal venous phase – Figure 2. The following image displays the venous phase of the portal: intra-parenchymal hematoma (arrow) seen as a very globular hypodense "mass" in the spleen in the venous phase of the portal. It is <5 cm in size, a level II lesion on AACT4 – Figure 3.

Figure 2 – Blunt splenic trauma: subcapsular hematoma. Computed tomography image[4].

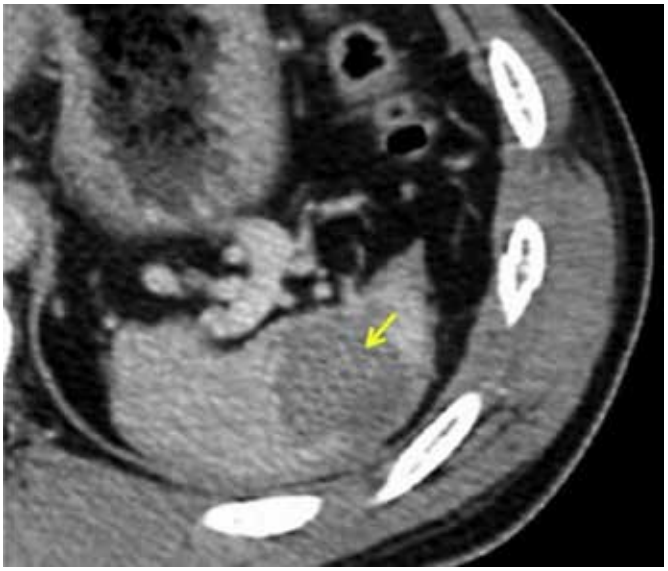

Figure 3 – Blunt splenic trauma: intra-parenchymal hematoma. Computed tomography image[4].

The CT image below of a 60-year-old woman after colonoscopy that was performed without contrast, showing a heterogeneous, hyperattenuating lesion in the spleen, 11.7 cm in maximum diameter, consistent with a large splenic hematoma, with only a small amount of normal splenic parenchyma being visible along the medial margin[9] – Figure 4.

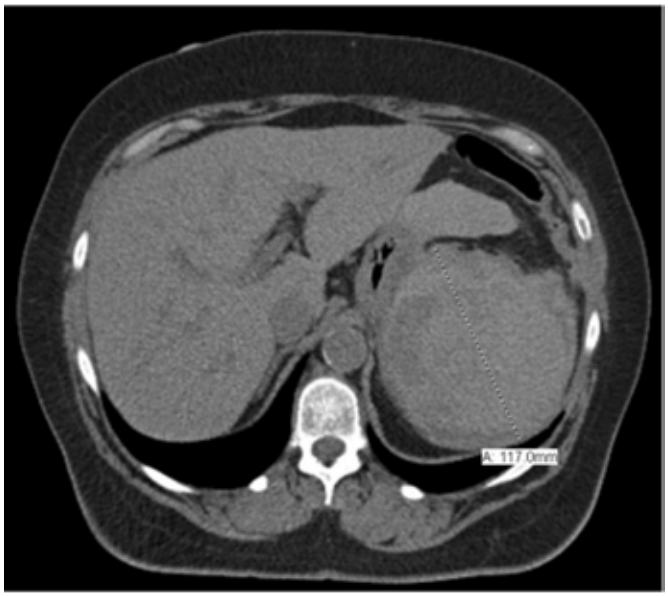

Figure 4 – Computed tomography of a 60-year-old woman after colonoscopy with splenic rupture performed without contrast[4].

The image below shows a FAST, which revealed heterogeneous echogenicity of the spleen consistent with splenic hemorrhage. Red arrowheads show hyperechoic areas and yellow arrowhead shows hypohechoic area. The curve of the diaphragm is indicated by D and the splenic trauma was confirmed by CT. The patient was treated with laparotomy[10] – Figure 5.

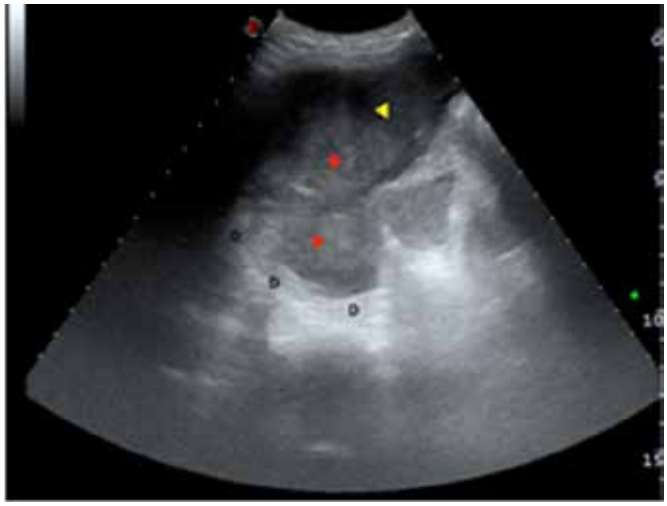

Figure 5 - FAST of a splenic trauma, later confirmed by computed tomography, and the patient treated with laparotomy[10].

The figure below shows an US and a CT of a 64-year-old man who is admitted to the emergency room close to syncope, with pain in his left flank and shoulder. Two days earlier he had undergone a colonoscopy due to a tortuous colon. Additionally, he reported significant left upper quad-

rant abdominal pain with guarding. During examinations it is possible to observe hemoperitoneum and splenic laceration. He developed hypovolemic shock and was treated surgically[11] – Figure 6.

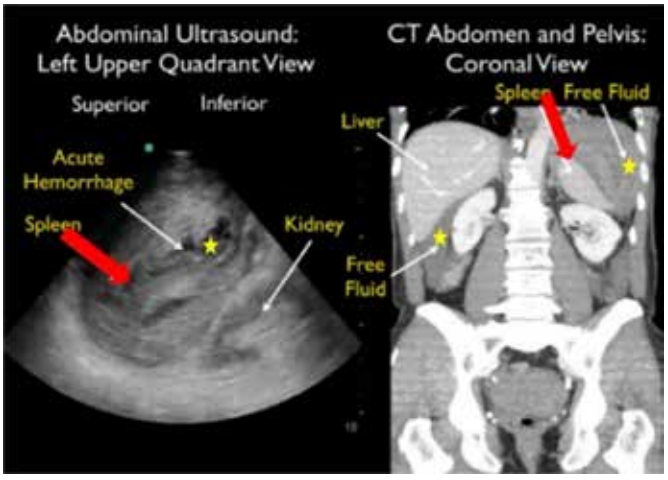

Figure 6 - Ultrasound image (left) and computed tomography (right) showing splenic trauma in a 64-year-old man who presented to the emergency room, developed hypovolemic shock, and was treated surgically[11].

The image below shows in A a longitudinal US of a spleen after blunt trauma, which demonstrates an intra-parenchymal laceration with a linear hypoechoic area (white arrow). In B, a post-contrast CT, which confirms the splenic injury (white arrow) and shows a laceration of the left hepatic lobe (black arrowhead) [12] – Figure 7.

Figure 7 - Ultrasound and computed tomography images of splenic trauma in a child[12].

The figure below shows a splenic trauma. In ("A") there is a gray scale and in ("B") a transabdominal Doppler examination technique, which show a smooth heterogeneity of the lower pole of the spleen (thin white arrow) associated, in ("C"), with the presence of rupture of the splenic capsule (thin white arrow) and resulting perisplenic hematoma [12] – Figure 8.

Figure 8 – Gray scale ultrasound ("a"), transabdominal Doppler examination technique ("b") and presence of rupture of the splenic capsule ("c") [12].

Finally, the figure below shows a contrasted US. In "a" a longitudinal sonography after blunt trauma that shows an area of poorly defined echogenicity in the middle of the spleen and in "b", a hypoechoic lesion along the surface[12] – Figure 9.

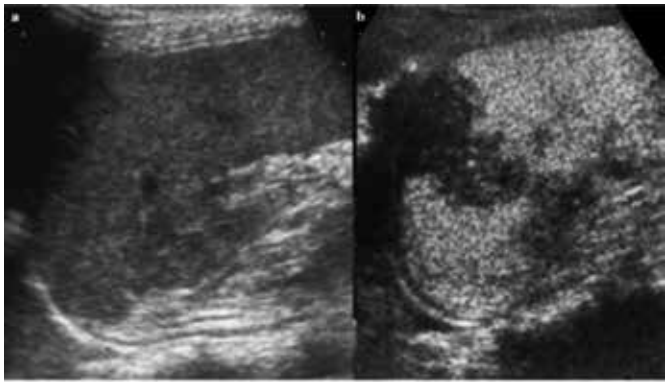

Figure 9 – Contrast ultrasound of splenic trauma. In "a" longitudinal sonography and in "b", a hypoechoic lesion [12].

CONCLUSION

The imaging diagnosis of splenic trauma should preferably be made using computed tomography, and FAST and US can also be used with subsequent confirmation by CT. Knowledge of the specific imaging findings of this abdominal trauma by the health professional provides greater agility in treating the patient, which may result in a better outcome of the case.

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