PLEADING FOR A CONSERVATIVE SURGERY OF THE SPLEEN

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PLEADING FOR A CONSERVATIVE SURGERY OF THE SPLEEN (Abstract): For a long period of time, splenectomy was considered the treatment of choice for the traumatic and intraoperative injuries of the spleen, because this organ was not regarded as a vital one. The recognition of the fundamental role of the spleen in the immune response has led to effort of preserving the spleen after injury. The conservative surgery of the spleen is enabled by its segmental architecture and the interlobar and intersegmental plaines make possible the partial resection of the spleen.

Key words: SPLENIC LESIONS, CONSERVATIVE SURGERY

INTRODUCTION

In 1919, Morris and Bullock showed increased mortality in splenectomised and inoculated with the plague bacillus rats. In 1929, O’Donnell reported the first case of fatal sepsis in a splenectomised patient. Subsequently, King and Schumaker concluded that the removal of the spleen, in the case of infants spherocytosis, leads to serious infections. This syndrome, called OPSI (overwhelming postsplenectomy infection) can occur immediately or after several years postoperatively. The risk of this syndrome is only 0.3% -0.5%, but mortality is 50-60%.

The concern to preserve the splenic parenchyma was induced by all these observations, which showed the possibility of serious infections with high mortality in splenectomised patients. Conservative surgical treatment of the spleen was initiated by Christo (in 1962, performs the first partial splenectomy in animals and then applies this technique in 8 patients with splenic injury) and Morgenstern (in 1966, performs subtotal splenectomy in myelofibrosis). Thus, the possibility of achieving partial preservation of the spleen for splenic trauma and massive splenomegaly was demonstrated [1].

MATERIAL AND METHODS

Resuming an earlier study [2], we followed 100 pancreatic-spleen pieces, obtained in autopsy and treated by injection-corrosion method, to highlight the extra- and intraparenchymal branching of splenic artery.

RESULTS

The results indicated that the splenic artery ends in 65% of cases in the spleno-renal ligament, in the pancreatic segment in 30% and the hilar segment in 5% of the cases. The arterial pedicle is long (more than 30 mm) in 65% of cases and short (20-30 mm) in 35% cases (table 1). The splenic pedicle has a length of 20-60 mm (average 35 mm). In 85% of cases, the artery branches into two lobar arteries: upper and lower; in 15% of cases, the artery trifurcates. Usually, there are only bifurcations and trifurcations of the splenic artery, very rarely, there have been described 4-6 segmental arteries (table 2).

In terms of surgery, a long pedicle facilitates splenectomy as approximately 6-8 arterial branches enter the hilum, over a wide area, enabling ligation hemostasis of each branch. In case of a short pedicle, the splenic artery splits right into the hilum, T-shaped, small branches penetrating the organ at right angles, which makes hemostasis more difficult during splenectomy, increasing the risk of damage to the tail of the pancreas.

Splenic artery branches cover three successive levels [3, 4, 5, 6]:

1. **Local** branches originate from the main arterial pedicle and are responsible for the vascularization of the splenic parenchyma. They are situated in the splenic hilum and are responsible for the vascularization of the splenic pulp.
2. **Segmental** arteries are the first branches of the splenic artery and are responsible for the vascularization of the splenic parenchyma. They are situated in the splenic hilum and are responsible for the vascularization of the splenic pulp.
3. **Pulmonary** arteries are the final branches of the splenic artery and are responsible for the vascularization of the splenic parenchyma. They are situated in the splenic hilum and are responsible for the vascularization of the splenic pulp.

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Lobar arteries, one for each spleen lobe (2-3).
- Segmental arteries, each irrigating one lobe segment.
- Sub-segmental arteries that irrigate areas that compose the splenic segment.

Segmental arteries from the upper lobar artery give 4-10 sub-segmental arteries, those from the lower lobar artery give 6-12 sub-segmental arteries, and those from the medium lobar artery, after branching in arteries segmental, have an average 4 sub-segmental branches. Arterioles branch further to 4 divisions of fourth degree, reaching level 7 divisions. Sub-segmental arteries are the major final branches of the splenic artery.

Before entering the spleen, arterial branches join each other at an angle of 90°, but more numerous are intraparenchymal anastomoses (only a few interlobular). The plan describes the concepts of intersegmental upper/lower and interlobar plan. The intersegmental plans are paucivascular and interlobar plan - approximately perpendicular to the long axis of the spleen - is practically avascular. The existence of these plans almost avascular enable conservative surgery of the spleen.

In 85% of cases, there was a division of the spleen in two arterial regions, corresponding to the two distinct spleen lobes. Each lobe has, in general, four segments (two superior and two inferior) separated by planes of cleavage.

The configuration of the lobes and splenic segments is of great importance surgery. The disposal of avascular plans in relation to the body axis, such as the fact that the planes extend through the entire thickness of the spleen, allow the surgeon to extirpate a segment or lobe with relative ease. Overlapping arterial areas with the venous ones demonstrates that the vessels are intra-lobar and intra-segmental and not inter-lobar and inter-segmental. Performing a partial splenectomy should carefully follow these inter-lobular and inter-segmental plans, thus reducing the risk of bleeding.

**DISCUSSIONS**

If in the case of traumatic spleen, surgery was decided, then it must be directed toward splenic preservation to maintain the immunological function of the spleen (6, 7, 8, 9).

The careful dissection and spleen dislocation from its place deep under diaphragm in the surgical field avoids other iatrogenic injuries of the organ. Thus, after laparotomy and highlighting the splenic lesion, the hilum of the spleen is digitally compressed (temporary hemostasis), which allows thorough inspection of the abdominal cavity and inventory of potential associated abdominal injuries. Then, the spleen is carefully released from its attachments so that they remain fixed only in the hilar zone and tail of the pancreas. The spleen is brought into the surgical field, following the short gastric vessels. Further, with a vascular clamp, the hilum is compressed, sparing the tail of the pancreas and achieving hemostasis. Now the spleen injuries can be appreciated, falling into a severity scale (table 3).

There are at least 5 ways to preserve the spleen, wholly or partially, which allows a conservative surgery in 40-70% of cases of splenic trauma (10, 11, 12, 13, 14).

- Hemostatic substances: Tissucol (fibrin glue), Tabotamp (oxidized cellulose) and Tacho-Comb strips (collagen, thrombin, bovine aprotinin and human fibrinogen);
- Hemostasis by electrocoagulation, ultrasonics, beam of argon or criocoagulation;
- Splenorrhapy: the wires are put in U, following the axis of the spleen, to avoid damage of arranged radial splenic vessels. The suture can be simple suture and associated with epiploonplasty or with applying of a hemostatic agent;
- Resorbable mesh packaging - polyglycol (splenic wrapping), which has the effect of splenorrhapy;
- Partial splenectomy.

**CONCLUSIONS**

The surgeon faced with a spleen injury should aim to preserve the splenic tissue, to maintain the immunological function of the spleen and

<table>
<thead>
<tr>
<th>Splenic pedicle length</th>
<th>Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 – 30 mm</td>
<td>35 cases</td>
</tr>
<tr>
<td>30 – 40 mm</td>
<td>45 cases</td>
</tr>
<tr>
<td>40 – 50 mm</td>
<td>12 cases</td>
</tr>
<tr>
<td>50 – 60 mm</td>
<td>8 cases</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100 cases</strong></td>
</tr>
</tbody>
</table>
### TABLE 2
Segmentation of splenic artery

<table>
<thead>
<tr>
<th></th>
<th>Upper lobar artery</th>
<th>Medium lobar artery</th>
<th>Lower lobar artery</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 segmental arteries</td>
<td>75</td>
<td>15</td>
<td>65</td>
</tr>
<tr>
<td>3 segmental arteries</td>
<td>20</td>
<td>2</td>
<td>29</td>
</tr>
<tr>
<td>4 segmental arteries</td>
<td>4</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>6 segmental arteries</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>99</strong></td>
<td><strong>17</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

### TABLE 3
Severity scale of traumatic lesions of the spleen

<table>
<thead>
<tr>
<th>Degree</th>
<th>Lesion</th>
<th>Description of the lesion</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Hematoma</td>
<td>subcapsular, comprising less than 10% of the area</td>
</tr>
<tr>
<td></td>
<td>Dilaceration</td>
<td>capsular rupture, rupture of the parenchyma &lt;1 cm depth</td>
</tr>
<tr>
<td>II</td>
<td>Hematoma</td>
<td>subcapsular, 10-15% of the surface, parenchymal &lt;5 cm</td>
</tr>
<tr>
<td></td>
<td>Dilaceration</td>
<td>1-3 cm depth in the parenchyma without damaging trabecular vessels</td>
</tr>
<tr>
<td>III</td>
<td>Hematoma</td>
<td>subcapsular, &gt; 50% of the surface or expanding; intra-parenchymal hematoma &gt; 5 cm or expanding</td>
</tr>
<tr>
<td></td>
<td>Dilaceration</td>
<td>&gt; 3 cm parenchymal depth or interesting the trabecular vessels</td>
</tr>
<tr>
<td>IV</td>
<td>Dilaceration</td>
<td>segmental or hilar vessels interest, causing a major devascularisation (&gt; 25% of spleen)</td>
</tr>
<tr>
<td>V</td>
<td>Dilaceration</td>
<td>spleen completely destroyed</td>
</tr>
<tr>
<td></td>
<td>Vascular</td>
<td>hilar damage which pumps blood out of the spleen</td>
</tr>
</tbody>
</table>

To avoid the possibility of significant disturbance in immune resistance of the body, which can result in the installation of sepsis (OPSI- overwhelming postsplenectomy infection).

Thus, in case of minor lesions, 1st and 2nd degree, hemostatic agent can be used: Tabotamp (oxidized cellulose) TachoComb (collagen, thrombin, bovine aprotinin and human fibrino-
Tissucol (fibrin glue). One can try hemostasis using electrocautery, ultrasounds or argon beam; sometimes gives results splenorrhaphy with epiploonplasty.

In IIIrd degree lesions, can be efficient the described methods can not achieve the desired hemostasis, being time consuming. Therefore, in these situations apply the packing with polyglycol mesh (splenic wrapping) or resort to partial splenectomy.

If it is not possible to preserve the spleen (IV-Vth degree lesions), splenectomy should be completed with self-transplantation of spleen tissue.

REFERENCES
8. Voicu Lucia Maria. Splina in insuficienta circulatorie (teza de doctorat), UMF Iasi, 1982