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Celioscopic splenectomy

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Abstract

Celioscopic splenectomy is the surgical method of laparoscopic extirpation of the spleen. The main objective is the extirpation of the spleen, absolute vital indications (blood pathologies). Myeloproliferative syndromes associated with advanced-stage blood coagulation disorders are also contraindications for laparoscopic splenectomy. Celioscopic splenectomy offers as advantages: simple postoperative evolution, rapid resumption of intestinal transit, decreasing of abdominal wall complications, pulmonary and infectious diseases, reduced hospitalization, and a more rapid socio-professional reintegration. Uncontrollable coagulopathy is an absolute contraindication because the risk of bleeding during vascular dissection is higher in the laparoscopic approach. The most important intraoperative complication is bleeding. The conversion rate is 8.5-40%, due to the large size of the spleen and intraoperative bleeding.

Key words: celioscopic splenectomy, myeloproliferative syndromes, spleen.

Лапароскопическая спленэктомия

Лапароскопическая спленэктомия является хирургическим методом удаления селезенки лапароскопическим путем. Основной целью является удаление селезенки по весьма жизненным показаниям (заболевания крови). Предоставляются такие преимущества, как быстрое возобновление кишечного транзита, отсутствие осложнений брюшной стенки и легочных инфекционных заболеваний, более быстрая социально-профессиональная реинтеграция. Неконтролируемая коагулопатия является абсолютным противопоказанием для лапароскопии, так как риск кровотечения во время операции выше при лапароскопическом подходе. Миелопролиферативные синдромы, связанные с нарушениями свертывания крови, также являются противопоказанием для лапароскопической спленэктомии. Наиболее опасным интраоперационным осложнением является кровотечение. Процент конверсий составляет от 8,5% до 40% из-за больших размеров селезенки и интраоперационного кровотечения.

Ключевые слова: лапароскопическая спленэктомия, миелопролиферативные синдромы, селезенка.

Introduction

Celioscopic surgery is part of the third and final revolution in the second half of the last century, following the emergence of open – heart surgery and organ transplantation [2, 4, 6, 7, 10, 11]. Although new in its development, the discipline is characterized by a long evolution.

Laparoscopy had its beginnings in 1901 in two different parts of the world; , independently of each other, a German surgeon Georg Kelling (Dresden) and a Russian gynecologist, Oskarovich Dimitri Ott, managed to achieve the first "views" into the abdominal cavity, without resorting to abdominal incision [1, 4, 2, 6, 10, 16, 17, 20]. Kelling has called this investigation Koeliscopy (from the Greek "koilia' – womb). For the visualization of the abdominal cavity organs, he used a cystoscope; his first patient was a dog. It is interesting to note that he introduced air into the peritoneal cavity to set

the organs apart from each other. In the same period, Ott utilized a device used by gynecologists, a vaginal speculum and light reflected from a mirror, and he called the maneuver ventroscopy (from the Latin "venter" – womb) [3, 5, 8, 9].

The next step was important and is associated with a Swedish physician, Hans Christian Jacobaeus, whose specialty was internal medicine. In 1910, he was the first to perform laparoscopy and thoracoscopy on humans. H. C. Jacobaeus within a year performed 115 examinations in 72 patients [1, 3, 5].

The subsequent years yielded significant contributions to the development of laparoscopy with doctors such as Kurt Semm in Kiel (Germany), who, in 1944, introduced the first system of creation of pneumoperitoneum, and in 1983 performed the first laparoscopic appendectomy; Miuhe (1985, Germany) carried out the first laparoscopic cholecystectomy (with a Rectoscope); Ph. Mouret (1987, France) completed the first laparoscopic cholecystectomy with standard laparoscopic equipment, [6, 8, 9, 11, 15, 17, 21, 22] etc.

Celioscopic splenectomy is the surgical method of laparoscopic extirpation of the spleen. The history of spleenectomy, laparotomic at the beginning and laparoscopic later, dates back to the XVth century, when Vesalius (1514-1564) first performed splenectomy on animals showing that the spleen is not a vital organ [2, 3, 4, 9, 10, 13]. The first reference to a splenectomy on a pathological spleen belongs to Quittenbaum (1826). The first successful splenectomy on a splenic cyst is attributed to Pean in 1867; he also established some indications for splenectomy [5, 7, 9]. The first splenectomy for an abdominal contusion with a splenic rupture was made in 1892 [14].

Celioscopic splenectomy was carried out for the first time by Delaitre in Paris, in 1991. He was followed by Poulin, in Quebec and Carroll, in Los Angeles in 1992 [6, 9, 15, 17]. In Romania, the first laparoscopic splenectomy was performed by S. Duca in 1996 [8]. In Moldova, the first laparoscopic splenectomy was performed in the beginning of 2010 in the Gastrology department of the Oncology Institute (V. Godoroja, I. Cucu, N. Ghidirim, L. Antoci, L. Codreanu).

The advantages of the method

The fundamental advantage offered by laparoscopy is the reduced surface area of the parietal trauma, and its subsequent consequences, both for the patient and the surgeon: moderate postoperative pain, quicker recovery, a shorter hospital stay, a better aesthetic result, and a reduced rate of eventration. The operation takes place with a closed peritoneal cavity. The surgeons' eyes and hands can not directly see and feel the anatomical structures. The large incisions of the abdominal wall required for the access of the surgeon's hands to the spleen were replaced by small 5-10 mm incisions, necessary for the introduction of laparoscopic instruments into the abdominal cavity. The small incisions mean a reduced surgical aggression on the body, particularly on the abdominal wall muscles [6, 7, 15, 26].

The advantages of this method are:

1. Reduced postoperative pain – due to smaller incisions through the abdominal wall rather than the larger incisions with a classical splenectomy. Laparoscopy offers patients a significantly lower level of pain intensity and duration; pain lasts for hours rather than days [2, 6, 8, 18, 19].

2. Easy evolution of the postoperative period – the quick recovery and the rapid resumption of intestinal transit.

3. Reduced hospitalization – hospitalization periods are significantly reduced from 10-14 days to 3-4 days [5, 8, 9, 10, 15].

4. The decreasing of parietal complications, including pulmonary and infectious forms.

5. Quick socio-professional adaptation – on average two weeks faster than after a classical operation.

6. Ability to undertake physical activity in a shorter time period after surgery – the absence of a large abdominal incision decreases the possibility of postoperative eventration.

7. Better aesthetic result – postoperative scars are smaller, resulting in a more cosmetically advantageous result.

8. Financial advantage– due to shorter hospitalization period, associated costs are also decreased

9. Aseptic effect – inflammatory complications are rare in celioscopic splenectomy.

Disadvantages

Laparoscopy also has disadvantages: working with long instruments outside of the abdomen, the surgeon does not have the opportunity to feel the organs with their fingers and cannot palpate the tissues inside the abdomen. Skilled surgeons are said to have "eyes" on their fingertips; in the case of laparoscopists, they can get experience in feeling the organs and tissues from outside by using the forceps [6, 7, 9, 12, 14, 16, 17, 24, 26].

Indications and contraindications

The main objective of celioscopic splenectomy is the extirpation of the spleen, in case of absolute vital indications (blood pathologies). In some diseases of the spleen, such as hereditary spherocytosis, benign tumors (hamartoma, schwannoma, and metastasis), a partial, subtotal or total splenectomy is recommended [12]. Elective surgery for a partial splenectomy is especially recommended for children with hereditary spherocytosis [6, 13, 14, 15].

Long-term studies have shown that keeping a segment of the spleen reduces the rate of severe postoperative infection and thromboembolic accidents, although some patients may develop (bilestones) biliary calculus [16]. There is no consensus on the amount of splenic tissue to be excised for optimum results. Normally, about 3/4 of the spleen in the superior or inferior pole are resected [14, 16, 17]. There is a theoretical possibility to practice partial laparoscopic splenectomy in traumas [18, 19]. Through surgical experience, a proper selection of patients, technical equipment, precise anatomical dissection and careful hemostasis, accidents and intraoperative complications can be prevented [3].

The correct positioning of the patient is essential for a proper exposure of the spleen. The patient's position can be altered during the surgery to provide a better exposure of the

hilum, to facilitate the dissection of the vessels. Some authors recommend preoperative splenic artery embolization in order to reduce intraoperative blood loss [20, 21].

Indications for laparoscopic splenectomy refer to such conditions as idiopathic thrombocytopenic purpura, hereditary spherocytosis, autoimmune thrombocytopenia, autoimmune hemolytic anemia, thrombotic thrombocytopenic purpura, splenic cysts, small incipient splenic tumors [1, 6, 7]. For the patients with idiopathic thrombocytopenic purpura who did not respond to corticosteroids or who require increasing doses of steroids, a splenectomy is indicated only if the spleen has not enlarged in volume. These patients are often small and weak, most commonly young women, which have surgery. In hereditary spherocytosis, the spleen size is variable. There are cases when surgery is somewhat more difficult as patients with concurrent and vesicular lithiasis (pigmentation calculi) requiring simultaneous laparoscopic cholecystectomy.

Other indications for celioscopic splenectomy are spleen lymphomas, splenic infarcts without abscesses, staging Hodgkin's disease, some severe autoimmune hemolytic anemia. Splenectomy may be indicated in symptomatic hypersplenism in hairy cell leukemia, chronic lymphocytic leukemia, chronic myelogenous leukemia, myeloid metaplasia, thalasemia major, Felty's syndrome, splenomegaly caused by haemodialysis, the AIDS splenomegaly, Gaucher's disease and splenic vein thrombosis (when the diameter of the spleen does not exceed 20 cm) [1, 2, 5, 15, 20]. Patients with moderate splenomegaly with idiopathic thrombocytopenic purpura are ideal candidates for laparoscopic spleenectomy.

Laparoscopic splenectomy in patients with AIDS or immune thrombocytopenia may be indicated due to the potential benefits and reduce possibility of viral infection of the surgical team.

Contraindications

There are absolute contraindications and relative contraindications for celioscopic splenectomy.

Absolute contraindications include:

1) Significant spleenomegaly with portal hypertension (high risk bleeding and it is difficult to control).

2) Traumatic splenic injury of type IV, V massive haemoperitoneum and hemodynamic instability.

3) Intense perisplenitis.

4) Severe coagulation disorders.

Uncontrollable coagulopathy is an absolute contraindication as the risk of bleeding during vascular dissection is higher in the laparoscopic approach. Myeloproliferative syndromes associated with advanced-stage blood coagulation disorders are also contraindications for laparoscopic splenectomy. Significant splenomegaly, pregnancy, morbid obesity, lymphatic nodes hyperplasia in the hilum spleen (Hodgkin's disease), peritoneal adherence syndrome, and contraindications to general anesthesia and inflammatory processes in the spleen are considered relative contraindications.

Significant splenomegaly (the long axis exceeding 20 cm) creates difficulties in surgical hemostasis, dissection, and even the extraction out of the abdominal cavity.

In pregnancy, the presence of uterus resutss in a limited access to the surgical field and the effects of pneumoperitoneum on the fetus and uterus are still unknown; there were reported cases of laparoscopic cholecystectomy performed on patients who are pregnant.

Laparoscopic intervention is contraindicated for hypersplenism of hepatic cirrhosis because the risk of intraoperative bleeding is very high and its hemostasis is difficult to control celioscopically.

Laparoscopic splenectomy can be performed only by experienced laparoscopic surgeons with a well-trained surgical team.

Surgical instruments

To perform a celioscopic splenectomy, an adequate set of instruments and equipment are necessary. For the purpose of vizualization of the spleen lodge and checking the splenic hemostasis as well as for the highlighting of the left subphrenic space and the parietocolic space, it is necessary to use a 30 or 45 laparoscope or a semi-flexible laparoscope. The examination of the abdominal cavity organs is achieved by means of a telescope, an instrument equipped with optical lens that magnifies the image up to 10 times. The video image is fixed and sent to a screen, which in modern versions has a high-resolution image (HD High-definition) [15, 18, 19, 21].

During celioscopic splenectomy, the following instruments and apparatus are required: special endoscopic spreaders, type Babock atraumatic forceps, atraumatic forceps for the stomach, retractors, clip appliers, an irrigation-suction device which has a capacity for hydro dissection. An aspirator with a 10 mm width and a 32 mm length is required to eject blood and clots that may occur during the resection of the spleen. Laparoscopic linear staplers with vessel cartridge are used for rapid hemostasis and coagulation and a section of fibro-vascular structures in the gastro-splenic ligaments. Needle-holder, knot-pushers, suture tools, and threads for intra- or extracorporeal ligation for hemostasis assurance are also required. For laparoscopic extirpation of the spleen, a plastic bag is necessary for the prevention of the dissemination of malignant cells or fragments of splenic tissue into the abdominal cavity.

The spleen size is the most important factor for choosing one of the splenectomy techniques: the celioscopic or the classical. For massive splenomegaly spleens more than 17 cm in diameter and weighing 600 gr) and "super massive" splenomegaly with spleens over 22 cm and 1600 gr respectively) [35] the Hand Assisted Laparoscopic Splenectomy is indicated (HALS) [35], which provides better operatory comfort, decreased intraoperative complications, and decreases the length of surgery and blood loss during surgery. HALS also preserves the integrity of the spleen for histopathological examination of accuracy [32, 33, 34, 35]. For huge splenomegaly, this approach is superior to SL [31]. Laparoscopy is transferred to one of the lateral trocars and the spleen is fixed with a pair of

Babcock forceps and extracted completely or morselized. Before the morselization, the spleen is placed into a special bag, which will then be extracted through the umbilical trocar. For immediate removal, the umbilical incision is extended vertically over a distance of 5-7 cm and then the spleen is removed manually by the surgeon from the abdominal cavity. However, when splenectomy is accompanied by lymphadenectomy this technique can not be used. In cases of massive splenomegaly, when the spleen reaches the navel, having a length greater than 25 cm and a weight of over 2000 gr, the use of celioscopic splenectomy is unjustified.

Laparoscopic splenectomy can be performed using three positions, depending on which anatomy of the region is more or less "classical" [2, 7, 8, 11, 15, 16, 18]:

- The anterior approach with the patient in dorsal decubitus, inferior limbs in abduction, the surgeon at the feet of the patient; the anatomy is similar to the classical technique [5, 6, 7, 8, 10].
- The lateral approach with the patient in right lateral decubitus. In this position, the spleen moves to the right ("hanging spleen"), offering optimal access for sustentaculum liens and spleno-phrenic ligaments. In this position, the anatomy of the spleen is reversed [5, 6, 7, 8, 10].
- The "double access" approach combines the advantages of the two types mentioned.

The stages of celiosopic splenectomy

The steps of celioscopic splenectomy are as follows:

1. The establishing of the pneumoperitoneum.
2. The introduction of the trocar.
3. The mobilization of the inferior pole and the dissection of the gastro-lien ligament by means of clipping short gastric vessels.
4. The hilum dissection and ligation of splenic artery.
5. The final dissection of all adhesions retroperitoneal and ligaments of the spleen.
6. The extraction of the morselized spleen from the abdominal cavity.
7. The end of intervention [5, 7, 22, 45, 46].

Laparoscopic splenectomy can be carried out according to the following time operators (Katkhouda):

- The suturing of short gastric vessels and the opening of retrogastric cavity.
- The dividing of the phrenico-colicum ligament and the dissection of the lower polar vessels.
- The haemostasis of the hilum vessels; the section of the phrenicosplenic ligament.
- The extraction of the spleen in a special sac.

G. B. Cadiere suggested a new technique for laparoscopic splenectomy, used in splenomegaly, which he called „a dexterity glove". It uses a sleeve-like cylindrical plastic bag, with one sealed end at the edges of the minilaparotomy. At the other end, the assistant inserts the left hand and then the sleeve is tightly tied around the arm. Through this minilaparotomy, the manual intraperitoneal mobilization of the spleen is executed. The procedure starts with the establishment of the pneumoperitoneum; a laparoscope is passed through a 10 mm trocar, inserted in the third lower xiphoumbilical midline, the spleen is visualized by observing the size and location in order to determine the safe positioning of additional trocars. A 7 cm transverse minilaparotomy in the left lower quadrant is advisable. Three trocars are inserted in a semicircular position around the spleen. The assistant inserts the left hand into the abdominal cavity by means of the "dexterity glove" thus maintaining traction of the suspensory ligaments of the spleen. The spleen is retracted to the highest point of the left upper quadrant, while the omentum, the stomach, and the splenic angle of the colon are drawn back from the spleen. Digital palpation is very useful in the location of the splenic artery and compression in case of bleeding. Next, the steps described above are performed: the splenico-colic ligament dissection, the dissection of the gastro-splenic ligament, the dissection of the upper pole of the spleen, the suturing of the short gastric vessels and the gastro-splenic ligament section, the dissection of the spleen hilum, and the suturing of the spleen vessels away from the pancreas tail. The spleen is fully mobilized, the system " dexterity glove" is extracted through the abdominal wall and the spleen is exteriorized through the previously practiced minilaparotomy. The incision is sutured in anatomical planes.

A very important step in splenectomy is the hilum dissection and the suturing of the lienal artery. A sign for the stopping of arterial irrigation of the spleen is the change in the colour of the organ to a much darker tone and a decrease in the spleen volume [20, 21, 23, 24, 28, 30].

Hand-assisted laparoscopy was introduced into clinical practice in 1994 by Leahy, Meijer and Bannenberg who established the principles of this technique and invented the first devices [31, 32, 33]. The method is achieved by placing the surgeon's or the assistant's hand into the peritoneal cavity by means of a special devises blowing gas. At present, there are three types of devices that allow access of the hand into the peritoneal cavity.

Intraoperative incidents and accidents

The most important intraoperative complication is hemorrhage. Hemostasis is easier to achieve in case of short vessels: a vessel is clamped with traumatic forceps, the surgical field is irrigated to assess the intensity of the bleeding; after bleeding is stopped, clips will be applied. Hemorrhaging in larger vessels like the splenic artery, splenic vein, or their terminal branches are more difficult to control as the quick blood flow obscures the surgical field within a short time. If haemostatic maneuvers do not stop the bleeding, it will be achieved by means of a subcostal incision on the left. During the discharge of the upper pole of the spleen the diaphragm may be perforated. Diaphragmatic lesions can occur after laparoscopic injury in old spleen infarcts causing adhesions to the diaphragm [22]. The conversion rate varies: 10% [31], 7% [23], and even less than 5% [29]. The causes of the conversion are the large sizes of the spleen

and intraoperatory bleeding. Hypertension or arrhythmia can appear during the operation due to the hemodynamic changes in insufflations (0.2%); intestine injuries with the Veress needle and during the trocar introduction – especially in patients with previous abdominal surgery – minor or major vascular injuries are also possible.

Results and prognoses

Laparoscopic splenectomy is a feasible method that can be realized in well-equipped and experienced centers. Despite remarkable technical progress achieved in recent years, not all cases can be solved by means of this technique due to different reasons such as the lack of modern laproscopic equipment and instruments in hospitals. This method has been figuratively called "the surgery through a keyhole". This method offers advantages including simple postoperative evolution, rapid resumption of transit, a lack of abdominal wall complications, decreased pulmonary and infectious diseases, reduced hospitalization, and greater rapid socio-professional reintegration. The conversion rate is 8.5 – 40%, due to the large size of the spleen and intraoperative bleeding.

In splenectomy for idiopathic thrombocytopenic purpura, statistics show better results after laparoscopic splenectomy, including reduced costs. The major morbidity rate is 5% for laparoscopic splenectomy and 13% for usual classic splenectomy. Taking into consideration the advantages mentioned, our clinic, Gastrology Department of Oncology Institute, advocates for celioscopic splenectomy especially in hematological pathology.

Conclusions

Laparoscopic splenectomy offers a series of advantages: the postoperative recovery evolves much more easily; the quick resumption of intestinal movement; the absence of abdominal wall complications, pulmonary and infectious diseases; reduced hospitalization; more rapid socio-professional reintegration.

The recommended access for the splenectomy is the "double access", which combines the advantages of the anterior and lateral access.

New technologies, especially LigaSure® system facilitate surgery and reduce its time by a half. The aseptic effect is explained by the following fact – inflammatory, purulent complications represent a rarity in celioscopic splenectomy.

The economic advantage is also very important – after classical splenectomy, patients stay in the hospital between 10 to 14 days, in case of celioscopic splenectomy the time is reduced to 3-4 days.

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