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## Laparoscopic near-total splenectomy. Report of a case

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## ABSTRACT

**INTRODUCTION:** Splenectomy is a surgical procedure indicated for the treatment of most benign and malignant splenic diseases, especially hematologic disorders. Laparoscopic approach is preferable to the open surgery for most indications because it reduces intra- and post-operative complications and shortens hospital stay. Laparoscopic approach is also feasible for partial splenectomy. Spleen-preserving techniques reduce the risk of severe infections and thromboembolic events that can occur after total splenectomy

**CASE PRESENTATION:** We report a case of a 50-year old woman with an incidentally discovered voluminous lesion in the superior pole of spleen. A laparoscopic near-total splenectomy was performed.

**DISCUSSION:** The evidence about the potential complications in splenectomised patients speaks in favour of performing spleen-sparing surgical techniques whenever possible. Most common indications for laparoscopic partial splenectomy are non-parasitic splenic cystic, benign splenic tumors, splenic haematological diseases, non-cystic intraparenchymal lesions, spleen rupture, splenic abscess, vascular abnormalities. Laparoscopic near total splenectomy is an innovative partial splenectomy technique consisting on preserving a residual spleen volume.

**CONCLUSION:** LNTS seems to be a safe and effective technique for the management of benign spleen diseases. The comparison between other spleen preserving techniques shows that LNTS is associated with a lower rate of secondary surgery and postoperative recurrence of anaemia.

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## 1. Introduction

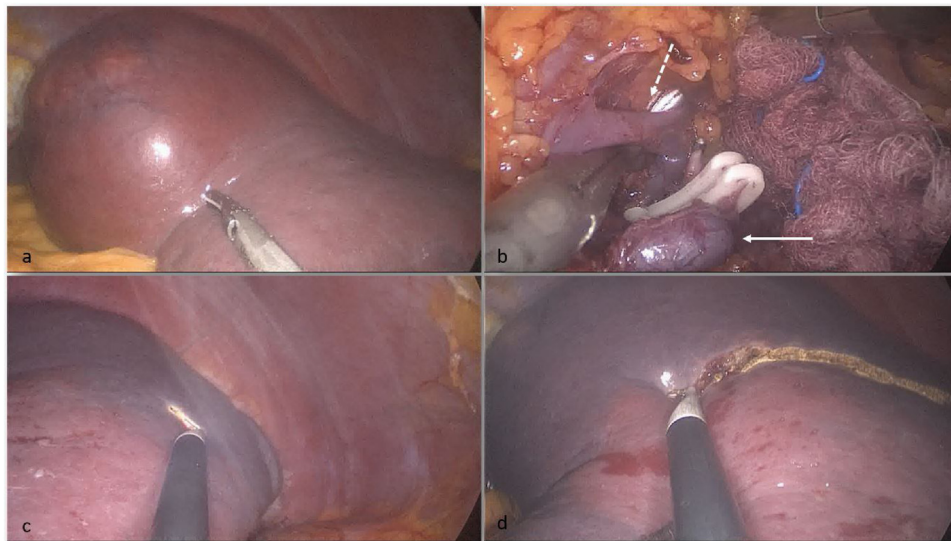
Splenectomy is a surgical procedure indicated for the treatment of most benign and malignant splenic diseases, especially hematologic disorders. Laparoscopic approach is preferable to the open surgery for most indications because it reduces intra- and post-operative complications and shortens hospital stay. Laparoscopic approach is also feasible for partial splenectomy. Indications for spleen-sparing techniques include nonparasitic cysts, benign tumors, splenomegaly of unknown origin and single metastasis [1]. Spleen-preserving techniques reduce the risk of severe infections and thromboembolic events that can occur after total splenectomy. Laparoscopic near-total splenectomy (LNTS) is an innovative and effective parenchyma-preserving surgical procedure for management of spleen disease. We describe a case of LNTS in line with the SCARE criteria [2,3].

## 2. Case presentation

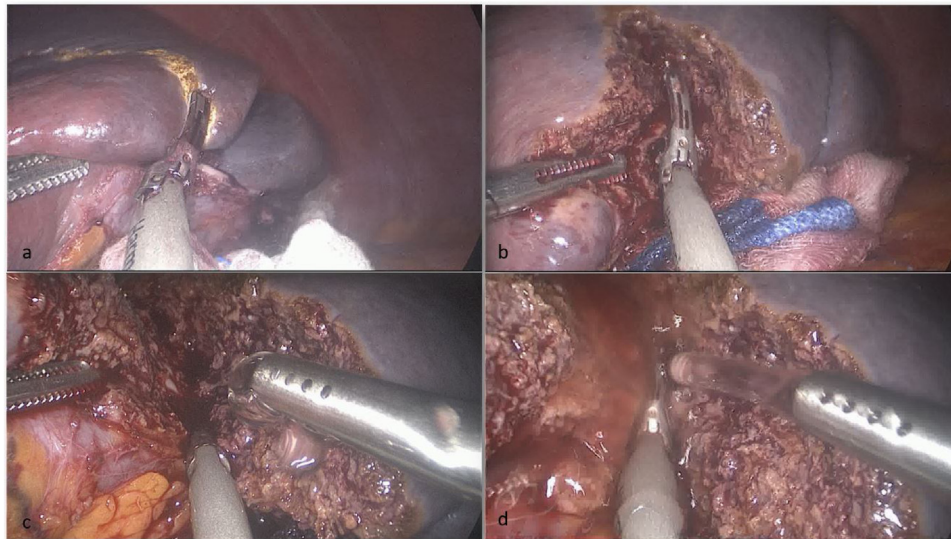
We report a case of a 50-year old woman with an incidentally discovered voluminous lesion of 10 cm in the upper pole of spleen, during a computed tomography (CT) abdominal scan carried out for non-specific abdominal colic pain. She had no other comorbidities and her family history was negative for other splenic or hematologic diseases. After general anaesthesia the patient was placed on the right flank on the operating table. The procedure was performed by a senior resident with an equipe experienced in laparoscopic surgery [4–6]. We used Veress needle to induce pneumoperitoneum and placed 3 trocars on the subcostal arch [7,8]. Into peritoneal cavity we found the already known voluminous lesion of 10 cm in the upper pole of the spleen (Fig. 1). There were no other macroscopic peritoneal lesions. Since the lesion was wide large, we could not perform a simple partial splenectomy in order to obtain a radical resection of the spleen nodule. We decided for a near total splenectomy, assuring the complete excision of the lesion, and at the same time a minimal critical residual mass of splenic parenchyma. After dissection of the lateral gastrocolic and splenorenal ligaments, we proceeded to full mobilization of the spleen with Harmonic ACE [9,10]. The splenic hilum was carefully dissected with identification, clipping and section of splenic artery and vein. We preserved vascular pedicle of the inferior splenic pole

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**Fig. 1.** Details of surgical procedure: a) laparoscopic exploration with identification of voluminous lesion in the upper pole of the spleen; b) clipped splenic artery (arrow) and splenic vein (dashed arrow); c–d) ischemic parenchyma demarcation zone treated with monopolar hook.



**Fig. 2.** Details of surgical procedure: a–b) dissection of splenic parenchyma with Harmonic device; c–d) use of warm saline solution in order to improve coagulation and reduce the fog of operating field.

to realize a near total splenectomy. Ischemic parenchyma demarcation zone allowed us to carry out a precise splenic transection with Harmonic device and bipolar forceps (Fig. 2). At the end of procedure we also used haemostatic matrix (FloSeal) above the residual spleen that was put into its natural cavity using fibrin sealant (Fig. 3) [11]. We extracted the surgical specimen via a Pfannestiel incision. The postoperative course was regular with no complication. The patient was discharged on fourth postoperative day and was satisfied with the treatment received for the rapid postoperative recovery and advantages of this surgical conservative spleen procedure. Pathology examinations described a sclerosing angiomatoid nodular transformation of the spleen.

### 3. Discussion

Laparoscopic splenectomy (LS) was first performed in 1992 [12]. Since its introduction LS gained indications especially for the treatment of haematological diseases. The advantages of the minimally invasive technique are well recognised worldwide determining a

reduction in complications, morbidity and postoperative pain. It is considered a safe and effective approach [13]. When total splenectomy is performed, an increased risk of potentially lethal infections arises. Asplenia and impaired splenic function are related to the increase of morbidity and mortality from infectious complications [14]. The overwhelming post splenectomy infections (OPSI) are mostly represented by fulminating sepsis, meningitis or pneumonia, and those conditions are mainly triggered by encapsulated bacteria, such as *S. pneumonia*, *N. meningitidis* and *H. influenzae* type B in splenectomised and hyposplenic patients [15]. This clinical condition may also predispose to thromboembolic complications [16]. It has been demonstrated that preservation of more than one third of the splenic parenchyma may assure an appropriate immunological response against encapsulated bacteria, preventing life threatening OPSI syndromes [17]. The evidence about the potential complications in splenectomised patients speaks in favour of performing spleen-sparing surgical techniques whenever possible. Thus, this evidence led to consider partial splenectomy a potential optimal treatment for benign splenic



**Fig. 3.** a) the results at the end of surgical procedure; b–c–d) use of the haemostatic matrix (FloSeal®) above the residual spleen that was put into its natural cavity using fibrin sealant.

lesions [18]. LS is indicated nowadays for the treatment of most benign and malignant splenic disease. It is possible to combine minimally invasive technique with the purpose of preserving a minimal residual spleen, avoiding at last most feared complications that usually follow total splenectomy [19,20]. Most common indications for laparoscopic partial splenectomy are non-parasitic splenic cystic, benign splenic tumors, splenic haematological diseases such as thalassemia and spherocytosis, non-cystic intraparenchymal lesions, spleen rupture, splenomegaly of unknown origin, splenic abscess, vascular abnormalities and symptomatic splenic ischemia [21,22]. The first laparoscopic partial splenic resection for nonparasitic splenic cyst was reported in 1994 by Uranüs et al. [23]. Nowadays laparoscopic partial splenectomy is considered safe and effective technique since it provides all the advantages of minimally invasive surgery with parenchyma-sparing and consequent immunological benefits, but it is still known to be a challenging procedure for the risk of intraoperative and/or postoperative bleeding due to the specific vascular anatomy of spleen. The transection of the splenic parenchyma can be possible for the presence of an end-vascular distribution of intra-splenic vessels. Spleen is supplied by superior and inferior polar arteries which divide in several segmental intrasplenic end-arteries: the intraoperative interruption of these segmental terminal branches at splenic hilum leads to a selective devascularisation and a consequent focal ischemia of spleen, with the formation of an ischemic parenchymal demarcation zone, which can be clearly detected on the spleen surface and resected [24]. A preoperative CT angiography can also be carried out in order to provide a mapping of the splenic vascular tree and vascular distribution variations. In order to proceed with ligation of segmental splenic vessel at the hilum, which is nowadays the most diffuse approach, is mandatory an accurate dissection of the splenic hilum for identification of the branches tributary of the segment to be resected [25]. LNTS is an innovative partial splenectomy technique consisting on preserving a residual spleen volume of around 10 cm<sup>3</sup> containing all 3 functional parts of the spleen, such as the red pulp, the white pulp and the marginal zone. This is considered to be the optimal residual volume of spleen assuring maintenance of splenic function [26]. The preserved splenic section must be located closer to the hilum, in order to minimize vascular injury, maintaining optimal blood flow to the splenic remnant and high rate of venous return, which is a crucial condition in order to guarantee the functioning of the remnant spleen and to prevent portal vein

thrombosis. LNTS seems to be a safe and effective technique for the management of benign splenic diseases. On the other hand, even if spleen-preserving techniques may have immunological advantages, they can also cause haematological complications and lead to secondary surgical procedures. The comparison between other spleen preserving techniques shows that LNTS is associated with a lower rate of secondary surgery and postoperative recurrence of anaemia [27].

#### 4. Conclusion

Partial splenectomy has shown to be a valid approach, when possible, in order to treat several splenic diseases and to prevent the occurrence of those conditions that follows total splenectomy, such as increased risk of potentially lethal infections and thromboembolic complications. The laparoscopic approach is nowadays considered the treatment of choice when applicable for all well known advantages of mini-invasive surgery. Among the various techniques of laparoscopic partial splenectomy, laparoscopic near total splenectomy has shown favourable outcomes in terms of radical treatment of the primary splenic disease without compromising the splenic function. Moreover this innovative technique is associated with lower rate of secondary procedures and postoperative anaemia. Despite these encouraging findings, further investigations are needed due to the lack of studies about LNTS.

#### Declaration of Competing Interest

The authors report no declarations of interest.

#### Funding

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#### Ethical approval

Ethical Approval was not necessary for this study.  
We obtained written patient consent to publication.

#### Consent

We obtained written patient consent to publication.



# Author's contribution

Di Buono Giuseppe: study design, data collections, data analysis and writing.

Maienza Elisa: study design, data collections, data analysis and writing.

Buscemi Salvatore: data collections.

Gulotta Leonardo: data collection.

Romano Giorgio: study design, data collections, data analysis and writing.

Agrusa Antonino: study design, data collections, data analysis and writing.

# Registration of research studies

Not applicable.

# Guarantor

Di Buono Giuseppe.

Agrusa Antonino.

# Provenance and peer review

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# Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

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