Laparoscopic approach for nonparasitic splenic cysts and splenic abcesses

Ann Ital Chir, 2022 93, 6: 671-679
pii: S0003469X22036442
free reading: www.annitalchir.com

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Splenic cysts are classified as primary (parasitic and nonparasitic) or secondary cysts. The aim of this study was to evaluate the efficacy of laparoscopic approach in surgical treatment of splenic cysts and abscesses. Methods: Between 2002 and 2017, 17 patients underwent laparoscopic approach for splenic cysts and abscesses: 9 laparoscopic splenectomies (4 hydatid cysts, 3 primitive nonparasitic cysts, one posttraumatic cysts and one abscess) and conservative laparoscopic treatment 8 patients (2 hydatid cysts, 2 primitive nonparasitic cysts, 2 secondary cysts and 2 abscesses). The lateral approach with a four-trocar technique was used. Patient demographics, diagnosis, and outcomes were reviewed. Results: In laparoscopic splenectomy, spleen volume was 300 ml and blood loss 30 - 65 ml. There are 3 conversions and 2 postoperative complications (Clavien II). No late complications were observed during the follow-up. Conclusions: The laparoscopic approach to splenic cysts offers many advantages and may be the treatment of choice for this pathology. Spleen-preserving techniques should be attempted in every case of splenic cyst types 1,2,3, especially non-parasitic cysts, in young patients.

KEY WORDS: Abcesses, Splenic cysts, Laparoscopic approach, Laparoscopic splenectomy, Laparoscopic cyst excision.

Introduction

Splenic cysts are classified in two main categories: *parasitic* (caused in 80% of cases by Echinococcus granulosus) [1]; *nonparasitic* which consists of primary and secondary cysts. Primary or true cysts have epithelial lining (epidermoid, dermoid and mesothelial) or endothelial cover (hemangioma, lymphangioma) [2]. Primary or congenital cysts are encountered more commonly in children and young adults comprising 25% of all nonparasitic cysts [2]. Nonparasitic splenic cysts (NPSC) are rare (0.07% on large autopsy series) [3,4]. Secondary cysts are related to trauma and splenic infarction with complications such as rupture and abscess formation. Secondary splenic cysts include 75% of nonparasitic types and may spread after blunt abdominal trauma [5] The treatment of splenic cysts is becoming increasingly less aggressive and more conservative [1,6].

This study aims to evaluate the feasibility, safety, and efficacy of laparoscopic approach for nonparasitic splenic cysts and pyogenic splenic abscesses.

Masterials and Method

We performed a retrospective study between 2002 and 2017 based on the database analysis of the First Surgical Clinic, University Hospital "St. Spiridon" Iasi, regarding all medical records of patients, laparoscopically operated for splenic cysts and spleen diseases, including surgical protocols and histopathological examinations.

Pervenuto in Redazione Aprile 2021. Accettato per la pubblicazione Maggio 2021
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For laparoscopic splenectomy we prefer a hemilateral position at the beginning of the procedure for division of the short gastric vessels with Ligasure. Then the table can be tilted to a lateral position in which the spleen separates of other organs, falls medially by gravity and offer access to the posterior face of the spleen and the perisplenic ligaments and hilum. The ligaturation of the splenic vessels of the hilum was performed with vascular stapler.
For spleen conservation, we practice a partial cystectomy as wide as possible, after punction and suction of the contents, followed by argon hemostasis and drainage. The open wide residual cavity and epithelial destruction in primitive non-parasitic cysts avoided recurrences, which are possible. For abscesses, evacuating content, excising of the exterior wall, lavage and drainage of the cavity was easy even in the presence of adherences. We did not perform partial splenectomy.

Results

During this period 149 splenectomies were performed (excluding indication for splenectomy in other organs pathology) with various indications (trauma, cystic and solid tumors, hematological diseases); of which 35 were laparoscopic splenectomies (23.48%). The tradition of our Clinic to preserve the spleen, especially in trauma, has made us familiar with the conservative treatments.
Between 2002 and 2017 the laparoscopic approach was performed in 17 patients with splenic cysts and abscesses: 9 laparoscopic splenectomies (4 hydatid cysts, 3 primitive nonparasitic cysts, one case with posttraumatic cysts and one case with a splenic abscess); 8 cases with conservative laparoscopic treatment (two hydatid cysts, two primitive nonparasitic cysts, two secondary cysts and two splenic abscesses).

Fig. 1: Abdominal ultrasound of nonparasitic primitive splenic cyst.: 51/97 mm hypoechoic round splenic lesion, with acoustic posterior enhancement, located in the middle third of the spleen.

Fig. 2: CT of nonparasitic primitive splenic cyst: hypoattenuating, fluid density, well-defined intrasplenic lesion, thin wall, with sharp demarcation to the splenic parenchyma. There is no wall or content enhancement.

In the above mentioned period 52 patients with spleen cysts and splenic abscesses were operated on: 32 hydatid cysts, 8 non-parasitic splenic cysts, 6 non-parasitic cysts and 6 splenic abscesses. Of these, the laparoscopic approach was chosen for 6 hydatid cysts (18.7%), 5 non-parasitic primitive cysts (62.5%), 3 secondary cysts (50%) and 3 splenic abscesses (50%). We could say that primitive non-parasitic cysts represent the ideal indication of laparoscopic approach and conservative treatment. We approached 5 patients laparoscopically with non-parasitic primitive cysts: 2 males and 3 females aged between 26 and 38 (mean age 30 years). One case was asymptomatic, being ultrasound incidentally detected, the rest of the patients had a low intensity pain in left upper quadrant. Ultrasound confirmed the diagnosis of non-parasitic splenic cyst in 4 cases (Fig. 1) and CT in all 5 cases, specifying the exact dimensions, confirmed intraoperatively, between 6 and 14 cm (mean 10 cm) (Fig. 2).
The cyst localization was upper pole in 3 cases (type 2), central (type 3) and hill (type 5) one case each. All cysts were solitary and unilocular. Laparoscopic cystectomy was performed in 2 cases (Fig. 3), laparoscopic splenectomy in 2 cases with cysts over 10 cm and a conversion, followed by open splenectomy in one case. In all cases the diagnosis was confirmed histopathologically and immunohistochemically: 2 epidermoid cysts, 2 endodermic and one mesothelial (Fig. 4).
Postoperative hospital stay was between 3 and 9 days (mean 6 days), the highest in case of conversion that complicated with a parietal infection. The follow-up was between 1 and 10 (mean 5 years) and did not record recurrences (Tables I, II).
We treated laparoscopically even the 3 patients (one male and 2 females) aged between 38 and 66 (mean age 49 years) with secondary non-parasitic splenic cysts. All the patients employed of pain in left upper quadrant and in the past 2 had a left thoracic and abdominal trauma. Ultrasound and CT diagnosed a non-parasitic splenic cyst, specifying the location (polar 2 cases and central one case) and the dimensions (mean diameter 9 cm).

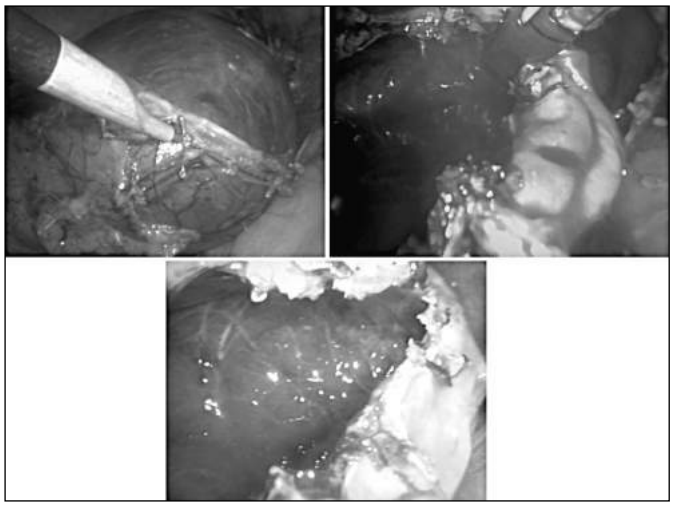

Fig. 3: Laparoscopic approach of nonparasitic primitive splenic cyst - intraoperative view.

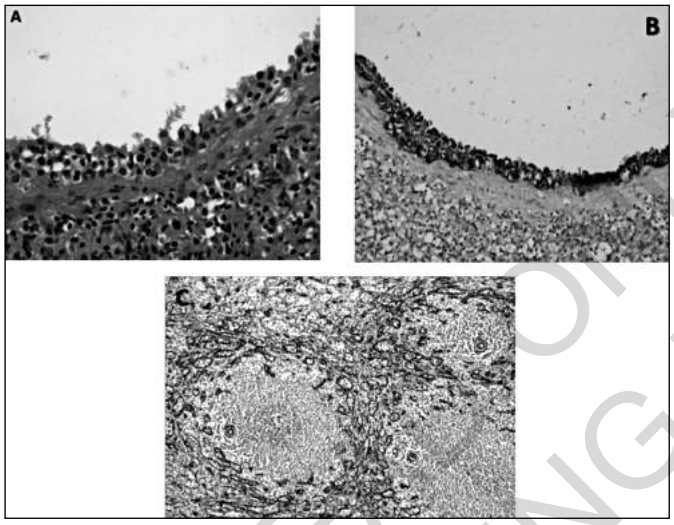

Fig. 4: Hystopathological aspect of nonparasitic primitive splenic cyst: A. splenic cyst wall coated with a cubic specimen epithelium, HE, x 40; B. Detail splenic cyst with positive epithelial marker, IHC - ckAE1 & 3, x 20; C. Splenic tissue with morphology preserved with positive mark on medullary vessels, IHC - CD34, x 10.

Laparoscopic partial cystectomy and drainage were performed in 2 cases (Fig. 5) and conversion, open splenectomy, in another case. Histopathologically, the cystic wall did not present epithelium. Hospital stay was between 3 and 9 days (mean 6 days) and postoperative follow-up was between 2 and 10 years (mean 6 years) and did not show relapse.

The laparoscopic approach was also used in 3 cases with splenic abscesses (2 females and a male), elderly (64-82 years, mean age 71.3 years) with modified general condition with endocarditis (one case), diabetes mellitus (2 cases), heart failure (one case) with pain at the base of the left chest and left upper quadrant, fever and leukocytosis. Ultrasound and CT suspected a splenic abscess

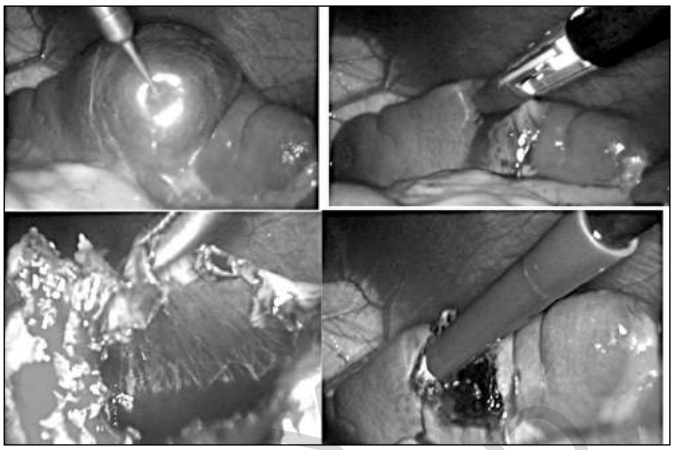

Fig. 5 Secondary nonparasitic splenic cyst: intraoperative view. Conservative treatment: laparoscopic partial cystectomy.

with a mean diameter of 9.6 cm (8-11 cm). In all cases broad-spectrum antibiotics were used. Laparoscopic drainage was performed in 2 cases. In one case we employed initially a percutaneous drainage for multiple splenic abscesses. This lead to the failure of the treatment but after laparoscopy, conversion and open splenectomy we finally obtained good postoperative course. The bacteria identified in the abscesses were Staphylococcus aureus, Streptococcus. Hospital stay was longer, 11 days, and follow-up 1 to 4 years (mean 2.6 years) did not show relapse.

Discussion

The literature in this area is rich and repetitive. We shall summarize it so that it might serve our future comments.

The first splenectomy made by Pean in 1867 had as indication a splenic cyst (cit. 1). Splenic cysts are of two types: parasitic (determined in over 80% of cases of Echinococus granulosus infection, especially occurring in endemic areas) and non-parasites. Morgenstern are classified nonparasitic cysts in primary cysts and secondary cysts [3]. Primary cysts include congenital cysts (epidermoids), cystic hemangiomas, lymphangiomas, dermoid cysts, neoplastic cysts, lined on the inside of an epithelial, mesothelial cell layer. Secondary cysts, or pseudocysts, developed in post-traumatic or postinfectious splenic parenchyma, do not have this basal cellular layer 1.

Approximately 60% of primary splenic cysts are parasitic cysts [1], confirmed by our study. The classification of the NPSC (Nonparasitic splenic cysts) after Martin is depending on the existence of an epithelial lining: true cysts possess an epithelium lining (type 1), while pseudocysts do not (type 2) (cit 1). The term of true cysts is also found as primitive, congenital, epidermoid and epithelial. The occurrence of epithelial cysts, uncovered after incidental imaging is rare: 0.07% (800 cases report-

Table I - *Nonparasitic Splenic Cyst (NPSC) and abscess. Demographic data and preoperative diagnosis*

	Sex	Age	Location, Tip Losanoff	Diag.	Main symptoms/signs				Imaging suggestive for NPSC		
					Asymptomatic	Thoracic symptoms	Abdominal symptoms	Associate diseases	Ultrasound scan	CT scan Size cm	Radiologic features suggestive for Splenic Cyst
1	M	33	upper spleen pole, 2	primary NPSC			pain upper left abdomen		Y/+/	Y+/ 8/7 (200cmc)	
2	F	21	Hil and center of the spleen 5	primary NPSC	Y				Y/+	Y+ 12/10-	
3	M	32	center of the spleen 3	primary NPSC		-	pain upper left abdomen	Renal cyst	Y/-	Y/+ 14/12-	IRM
4	F	38	upper spleen pole 3	primary NPSC			Pain, Dyspepsia		Y/+	Y/+ 10/8	
5	F	26	upper spleen pole 2	primary. NPSC		Y	pain upper left abdomen		Y/+	Y/+/ 6/4	
6	F	38,	lower spleen pole 3	secondary NPSC			pain upper left abdomen		Y/-	Y/- 8/6	
7	F	43	upper spleen pole 2	secondary NPSC			pain upper left abdomen		Y		
8	M	66	hil and center of the spleen 5	secondary NPSC			pain upper left abdomen	Renal cyst	Y	Y 9/8	
9	M	68	center of the spleen 3	splenic abscess (Stafilococcus aureus)		Y	Fever pain upper left abdomen	AVC DM	Y	Y 11/7	
10	F	64	multiple 4	splenic abscess (Streptococcus)		Y	Fever pain upper left abdomen	Endocarditis	Y	Y/8	
11	F	82	lower spleen pole 3	splenic abscess			Fever pain upper left abdomen	cardiac insufficiency, diabetes mellitus	Y	Y/10	

ed in the British literature in 2014) [7]. The first case was described in the literature by Andral in 1929 (cit. 8). Their incidence increased with the rise of the number of imaging explorations (ultrasound, CT).

One of the more recent pathogenic classification consists of dividing NPSC into congenital (10%) or neoplastic subtypes (cystic hemangiomas, lymphangiomas, dermoid cysts), degenerative, traumatic (pseudocyst) [8]. Congenital cysts are further divided into epidermoid (90%), dermoid, and simple (endodermal) cysts [4]. Three theories explain the formation of congenital cysts: mesothelial invagination theory, lymph space theory, endodermal inclusion theory [8]. Epidermoid cysts can also develop from ectopic splenic tissues intra-pancreatic supernumerary spleen [9-11]. Losanoff identifies 5 types of splenic cysts: type 1 - peripheral marginal cyst, subcapsular; type 2 - cyst that occupies less than half of the splenic parenchyma, type 3 - cyst occupying more than half of the splenic parenchyma, type 4 - multiple cysts, type 5 - cyst located in the splenic hill with vascularization compromised [12].

This classification is useful in choosing the method of treatment. Congenital, primitive non-parasitic cysts are more often found in children [13], especially in female population or in the second and third decade of age; usually it presents as asymptomatic for a long period. [7], which is also verified in our study. Only 30-40% of cases [7] are accompanied by pain or a cystic tumor mass in

Table II - *Nonparasitic splenic cyst and abscess: Surgical approach, immediate results and follow-up.*

	Sex	Age	Size Cm	Surgical treatment	Drainage	Postoperative morbidity	Hospital stay (days)	Follow-up (years)	Recurrence
1	M	33	8/7	Laparoscopic cystectomy	Y-		3	1	no
2	F	21	12/10	Laparoscopic Splenectomy	Y		6	10	no
3	M	322	14/12	laparoscopic approach – conversion (adhesions) splenectomy	N	Parietal infection	9	5	no
4	F	38	10/8	Laparoscopic Splenectomy	Y		8	5	no
5	F	26	6/4	Laparoscopic cystectomy	Y		4	5	no
6	F	39	8/6	laparoscopic cystectomy	Y		3	2	no
7	F	43	9/7	laparoscopic cystectomy	Y		6	6	no
8	M	65	9/8	Laparoscopy Conversion, Splenectomy	Y	Parietal infection	9	10	no
9	M	68	11/7	Laparoscopic drainage	Y		12	3	no
10	F	64	8/7	Laparoscopy Conversion, Splenectomy	Y		11	1	no
11	F	82	10/8	Laparoscopic drainage	Y		10	4	no

the left upper quadrant. In the scientific literature, cases discovered during pregnancy [14-16] can be found. In general complications are rare: rupture, infection or bleeding [4,17]. Laboratory analysis can reveal an increase in serum markers: carbohydrate antigen (CA 19-9) and carcinoembryonic antigen (CEA) [18-21]. We have encountered increasing CA 19-9 values in two non-parasitic cyst primitive cysts. CA 19-9 is also increased in the epidermoid cyst content being produced by the squamous epithelium [22].

Most of the primitive epithelial splenic cysts are solitary and unilocular [23]). Ultrasound (US) and computed tomography (CT) are most often used in the diagnosis of NPSC. Most of the epidermoid cysts of the spleen show a thin-walled anechoic on US with no evidence of calcification on CT [24]. The diagnosis is only confirmed by histopathological examination.

Histologically, primary splenic cysts have epithelial lining (flattened, low cuboidal, low columnar or squamous type). Epidermoid cysts have stratified squamous epithelium with a fibrocollagenous cyst wall [7]. In the typical true splenic cysts, the lining epithelium is positive for keratins (epithelium) and negative for factor VIII (endothelium). Differentiating between epidermoids and mesothelial cysts may be difficult only by histological examination. They can be differentiated through immunohistochemistry. We consider that the diagnosis of these cases should be specified immunohistochemically, as we have done in all our cases. Epidermoid cysts are positive for CEA, CA 19-9 and cytokeratin, but negative for calretinin, whereas mesothelial cysts are positive for cytokeratin and calretinin, but negative for CEA and CA 19-9 25. Sometimes the lining epithelium of the typical cyst can be thought to be endothelium, which could in turn lead to a false diagnosis of lymphangioma or hemangioma .[26, 27]

Surgical approach of primary splenic cysts is indicated for symptomatic patients and for cysts larger than 5 cm [28]. Percutaneous sclerotherapy is a minimally invasive technique, which preserves splenic tissue, however there is a rate of recurrence of 30% [29,30]. The laparoscopic management offers the benefits of minimally invasive

surgery. The spleen-preserving technique is indicated, especially considering the spleen's significant role in hematopoiesis, immunity, and protection against infections and malignancies. Conservative surgery is usually preferred in order to prevent postsplenectomy complications (sepsis 4%, with a mortality rate of 1.5%) [7]. Laparoscopic cleavage and laparoscopic cystectomy are the preferred surgical approach for splenic cyst, but as we know, there is a chance of recurrence [3,16,31,32]. In our cases we destroyed the cyst wall with argon and did not have recurrences, but there are few cases and this affirmation must be confirmed by large statistics. Partial laparoscopic splenecto
my is the gold standard with a very good outcome [33,34]. The first successful partial splenectomy for an epidermoid cyst was performed in 1980 (Morgenstern) [3]. The greatest experience regarding partial laparoscopic and robotic splenectomy in the treatment of splenic cysts has C. Vasilescu from Fundeni Hospital Bucharest [35]. We did not perform partial splenectomy for non-parasitic splenic cyst. Advances in operative techniques (hemostasis with fibrin glue, argon plasma coagulation, radiofrequency ablation, LigaSure instrument and stapler techniques) have made spleen-preserving procedures safe and feasible [36,37]. It is also worth noting that robot-assisted partial splenectomy for nonparasitic cysts has been successfully used [38]. Single port laparoscopy is also an option [39]. We usually resort to splenectomy, by open or laparoscopic approach, in cases of very large cyst in the hilum of the spleen or an intraparenchymal splenic cyst almost surrounded by splenic parenchyma.

Type II of NPSC (Martin) (secondary cysts) are also known as false cysts (pseudocysts), which lack of epithelial lining. Secondary splenic cysts consist of 80% of all splenic cysts and can be developed after abdominal trauma, infarction or rarely as a result of infection (mononucleosis or tuberculosis) [4]. The majority of NPSC appear after blunt abdominal trauma where the non-surgical management of blunt splenic injury in stable patients was preferred. The small number of cases in our statistics can be explained by the fact that they are not diagnosed in the presence of minor clinical signs.

Pseudocysts of the spleen are usually asymptomatic and associated with a history of trauma, infarction or infection. One of the reasons for the increase in the prevalence of NPSC is the increase in the use of computed tomography (CT) and the successful conservative approach of splenic injuries, infarctions or infections [40]. Treatment options include partial splenectomy, total cystectomy, marsupialization, or cyst decapsulation and unroofing, by laparoscopy or rarely by open approach [41,42]. In the case of surgical contraindications or when the patient is a child, percutaneous sclerotherapy with ethanol 99% can be used [43].

Splenic abscesses are rare (incidence of 0.1-0.7% in autopsy studies) but with high mortality rates 12-47%) [44]. They may appear after a hematogenic systemic infection [45] which also includes endocarditis [46-48] or contiguous infection by direct spread [46], left colon cancer [47]. There are cited cases where they have appeared postoperative: after laparoscopic Nissen fundoplication: a consequence of short gastric vessel division [49], after splenic artery ligation in living donor liver transplantation [50], after sleeve gastrectomy [51], and also after splenic blunt injury angioembolization [52].

The risk factors are: immunocompromised patients [53], infection with human immunodeficiency virus (HIV), the use of intravenous drugs, diabetes mellitus, immunosuppressive treatments, hepatic parenchymal disease (notably chemoembolization for hepatocellular carcinoma), and aggressive chemotherapy [54].

All 3 patients in the study group were elderly, with diabetes and associated diseases. Aseptic abscesses are a rare and dangerous extraintestinal manifestation of inflammatory bowel disease [55,56]. Splenic tuberculosis (multiple splenic cold abscesses) is a rare disease [57], especially in an immunocompetent patient [58].

The most common bacteria, that is isolated from cultures, consists of aerobic microbes (Staphylococus, Streptococus, Salmonella, Escherichia coli, Klebsiella. The first two germs were also identified in our cases. It is less common to encounter anaerobic organisms, or mycobacteria and fungi in immunosuppressed patients. Splenic abscesses are polymicrobial in 36% of cases [59,60]. Actinomycosis abscess is very rare [61].

The symptoms of splenic abscess are polymorphic. Fever is present in 90% of patients with splenic abscess, however in only 66% of cases is there the classical triad present: fever, left upper quadrant pain and splenomegaly. All of our patients had fever, pain and defenses in the left upper quadrant. The peritonitis has been rarely encountered [62].

US and CT scan of the abdomen were useful in the diagnosis. CT scan is the gold standard [63]. CT scans are very useful in the differential diagnosis of splenic abscesses [64] (parasitic hydatid disease, congenital cyst, posttraumatic pseudocysts, infection, metastatic disease, and cystic neoplasm) and planning for a percutaneous drainage [65].

Splenic abscess in children is usually rare (Salmonella infection). Long-term antibiotic therapy is needed. Treatment can also consist of percutaneous drainage [66]. There is less risk involved with the minimally invasive methods: percutaneous imaging-guided drainage, spleen-preserving methods and laparoscopic splenectomy. US-guided percutaneous aspiration of splenic abscesses can be used as a bridge to surgery in patients who are critically ill or have several comorbidities [67,68].

The most reliable treatment option is still splenectomy, especially for patients with multiple abscesses, failed percutaneous drainage, abscess diameter of more than 10 cm, and also for recurrent abscesses [69]. Two of our patients have failed percutaneous drainage.

Conclusions

The laparoscopic approach to splenic cysts and abscesses can be a viable option, as it demonstrates our little casuistry.
In young people, spleen preservation needs to be considered and is desirable to be attempted. If this is unsuccessful, the last resort is laparoscopic splenectomy.
The treatment should be tailored for each patient. The choice of the therapeutic method should be made depending on the 5 types of the Losanoff classification.

Riassunto

Le cisti spleniche sono classificate in cisti primitive – parassitarie e non parassitarie – o secondarie. Lo scopo di questo studio era di valutare l'efficacia dell'accesso laparoscopico nel trattamento chirurgico delle cisti e degli ascessi splenici.
Tra il 2002 e il 2017, 17 pazienti sono stati sottoposti con accesso laparoscopico ad intervento chirurgico per cisti e ascessi splenici: 9 splenectomie laparoscopiche (4 cisti idatidee, 3 cisti primitive non parassitarie, una cisti post-traumatica e un ascesso) e trattamento laparoscopico conservativo 8 pazienti (2 cisti idatidee, 2 cisti primitive non parassitarie, 2 cisti secondarie e 2 ascessi).
È stato utilizzato l'approccio laterale con una tecnica a quattro trocar. I dati demografici dei pazienti, la diagnosi e gli esiti sono stati rivisti.
Risultati: nella splenectomia laparoscopica, il volume della milza era di 300 ml e la perdita di sangue di 30 - 65 ml. Ci sono state 3 conversioni e 2 complicanze postoperatorie (Clavien II). Non sono state osservate complicanze tardive durante il follow-up.
In conclusione l'utilizzo dell'accesso laparoscopico per l'eliminazione di cisti spleniche offre molti vantaggi e può essere il trattamento di scelta per questa patologia. Le tecniche di conservazione della milza dovrebbero essere tentate in ogni caso di cisti spleniche di tipo 1,2,3, in particolare cisti non parassitarie, in pazienti giovani.

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