

Splenic Hydatid Cysts Treated by Partial Splenectomy: Case Series and Literature Review

Beatrice M. Tivadar^{1,2}, Corina E. Minciună^{1,2}, Cătălin Vasilescu^{1,2}

¹Department of General Surgery, Fundeni Clinical Institute, Bucharest, Romania

²Carol Davila University of Medicine and Pharmacy, Bucharest, Romania

*Corresponding author:

Professor Cătălin Vasilescu

Department of General Surgery

Fundeni Clinical Institute

258 Fundeni street, Bucharest, Romania

E-mail: catvasilescu@gmail.com

Rezumat

Chisturi hidatice splenice tratate prin splenectomie parțială: serii de cazuri și revizuire a literaturii

Introducere: Chistul hidatic (HC) apare rar la nivel splenic, mai ales ca unică localizare. Splenectomia parțială (PS) este o tehnică larg utilizată pentru prezervarea parenchimului splenic și a funcției splenice, însă mai puțin utilizată în tratamentul HC splenic. Acest studiu își propune să prezinte cazuistica unui singur centru și în același timp să expună rezultatele unui review de literatură a cazurilor de HC splenic tratate prin PS.

Materiale și Metodă: Baza de date a Institutului Clinic Fundeni 2000-2023 a fost studiată retrospectiv. Pentru review de literatură au fost căutați și termeni cheie în bazele de date PubMed, Medline și Google Scholar. Termenii cheie au fost "partial splenectomy", "splenic hydatid cyst" etc, pentru a identifica articolele publicate în limba engleză în aceeași perioadă de timp. Au fost excluse studiile care nu au fost publicate în engleză și acele articole din care nu s-au putut extrage date relevante urmărite de acest studiu.

Rezultate: Seria de cazuri a constat în 10 cazuri de HC splenic operate. Au fost 6 pacienți de sex feminin și 4 de sex masculin cu vârste cuprinse între 16 și 41 de ani (31±8.43). Nouă chisturi au fost localizate în porțiunea superioară a splinei pentru care a fost prezervat polul inferior splenic și un singur chist poziționat la nivelul polului inferior pentru care s-a practicat o rezecție de pol inferior splenic. Au fost 4 intervenții prin abord deschis, 2 PS laparoscopice și 4 robotice. Nu au fost complicații postoperator și nu s-au înregistrat recidive ale bolii hidatice la 2 ani.

Revizia literaturii a constat din 14 articole din care au fost extrase și analizate 42 de cazuri de HC splenic tratate prin PS.

Concluzii: PS pentru tratamentul HC splenic este o opțiune

Received: 17.06.2024

Accepted: 22.08.2024

fezabilă prin care se obține înlăturarea complete a chistului, cu risc scăzut de diseminare a materialului hidatic și păstrarea parenchimului splenic și al funcției sale imunologice. PS poate fi efectuată și laparoscopic sau robotic, pacientul beneficiind în acest fel de beneficiile chirurgiei minimal invazive.

Cuvinte cheie: splenectomie parțială, splenectomie laparoscopică, chist hidatic, splenectomie robotică, splenectomia cu preservare de parenchim

Abstract

Purpose: Hydatid cysts (HC) rarely occur primarily in the spleen. Partial splenectomy (PS) is an established procedure for preserving spleen parenchyma, but rarely used in the treatment of HC. We aim to present our experience with PS for HC and to review the literature of splenic HC treated by PS.

Material and Methods: The databases of PS performed between 2000 and 2023 in the Department of General Surgery Fundeni Clinical Institute (Bucharest) for HC were reviewed retrospectively. Searching the PubMed, Medline, and Google Scholar databases for keywords such as “partial splenectomy”, “splenic hydatid cyst” etc, we retrieved publications from 2000 to December 2023 in English for a literature review. We excluded studies which were not published in English and studies which did not provide accurate or specific data regarding the treatment of splenic HC by PS.

Results: There were 10 PS for HC. Six females and 4 males, ages between 16 and 41 (31±8.43), 9 with HC in the upper splenic pole (UP) treated by PS with lower pole (LP) preservation and one inferior pole HC treated by LP PS. There were 4 open, 2 laparoscopic and 4 robotic PS. There were no complications or recurrences at follow up (2 years). The literature review consists of 14 full-text articles, presenting 42 PS for HC.

Conclusion: PS for HC is feasible, achieves complete removal of the cyst, while preserving splenic function. The procedure can be performed laparoscopically or robotically with the advantages of minimally invasive surgery.

Key words: partial splenectomy, laparoscopic splenectomy, hydatid cysts, robotic splenectomy, spleen preserving surgery

Introduction

Hydatid disease is caused by infection with the Echinococcus parasite, Echinococcus granulosus being the infective agent in over 95% of reported cases around the world. Most HC occur in the liver and lung, while splenic HC are rare even in endemic areas. Splenic HC are either primary, or secondary, occurring concomitant or after the treatment of HC of other organs (1). The slow growth of these cysts (0.3–2.0 cm/year) makes them initially asymptomatic, being clinically evident when

they grow big enough to cause LUQP or to become palpable. Other clinical manifestations can include fever and malaise, but cases of incidental splenic HC have been reported (2). Serology tests along with ultrasonography (US), abdominal computed tomography (CT) and chest X ray (RX) to exclude a pulmonary HC are sufficient as diagnostic tests (3). Classically treatment options consisted of deroofting of the cyst, inactivation and evacuation of the cystic contents or TS for very large splenic cysts (2). The localisation in either extremity of the spleen and adequate vascular

ture are two main conditions which, if met, allow the performing of a PS. This ensures complete elimination of the HC and the preserving of the splenic parenchyma (4-7).

This retrospective study was done to review the effectiveness of PS for splenic HC, also to compare the open with the minimally invasive approach, and finally to compare our series with cases presented in the literature and establish whether PS is a suitable treatment option for HC.

Materials and Methods

The databases of surgical interventions performed between 2000 and 2023 in the Department of General Surgery of Fundeni Clinical Institute (Bucharest) for HC were reviewed retrospectively. We reviewed demographic and clinical data as well as radiological findings in 10 cases of splenic HC treated by PS. In addition, the outcomes of these cases were compared with cases reported in the literature. Searching the PubMed, Medline, and Google Scholar databases for keywords such as “partial splenectomy”, “splenic hydatid cyst” etc, we retrieved publications from 2000 to December 2023 in English language of HC treated by PS. Articles not published in English were excluded.

Results

Case Series

Between 2000 to 2023, out of 21 cases of splenic HC, 11 underwent total splenectomy while 10 patients with splenic HC underwent PS in our institution. The individual characteristics of the case series are presented in *Table 1*.

There were 6 females and 4 males, with a mean age of 29.3. The main symptom was LUQ in 7 patients, followed by fever in 4 cases. Serology was negative in 2 patients and not mentioned/performed in the other 8. All of the cysts were discovered by CT, 3 of them initially by US and then CT. In all cases, CT showed classic features of a HC: a cystic lesion containing daughter cysts. Definitive diagnosis of HC was made by pathology. Cysts ranged from 1.5 cm to 10 cm, in 4 cases, the size of the cyst was not mentioned. The average cyst size was approximately 5cm. Only one HC was located in the lower pole, 90% were located in the upper pole of the spleen. All of the cysts were primary

Table 1. PS for splenic HC

ID	Age	Sex	Clinical	Imaging	Cyst size	Location	Primary	Other locations	Approach	Type PS	Other procedures	Duration (min)	Blood loss (ml)
1	21	F	LUQP	CT	7cm	UP	Yes	No	Open	UPR	-	110	100
2	34	F	fever	CT	NA	UP	Yes	No	Robotic	Partial	-	100	50
3	24	F	fever, LUQP	CT	1.5cm	UP	Yes	No	Robotic	Subtotal	-	120	60
4	31	F	LUQP	US, CT	5.5cm	UP	Yes	No	Open	Subtotal	-	120	100
5	22	M	LUQP	US, CT	NA	UP	Yes	No	Robotic	Partial	-	180	70
6	33	M	LUQP	CT	3cm	LP	Yes	No	Laparoscopic	Partial	-	60	40
7	41	F	LUQP	CT	NA	UP	Yes	No	Laparoscopic	Partial	Cholecystectomy	110	50
8	30	M	fever	CT	NA	UP	Yes	No	Robotic	Partial	-	240	120
9	41	M	LUQP	CT	10cm	UP	Yes	No	Open	Subtotal	-	180	200
10	16	F	fever	US, CT	4cm	UP	Yes	No	Open	Subtotal	-	120	80

splenic cysts with no other HC. There were 4 open procedures, 2 laparoscopic, and 4 robotic PS. The open procedure was chosen in cases where there was increased concern for cyst rupture (larger cysts or difficult access to the cyst).

Four resections were subtotal (removal of the cyst including the greater part of the spleen), 5 were PS (strictly the splenic parenchyma containing the cyst was removed) and one upper pole resection (UPR). In only one case there was an associated cholecystectomy for lithiasis. On average, PS took 136.66 ± 51.46 minutes to perform (132.5 ± 32.01 minutes for open, 160 ± 63.24 minutes for robotic and 85 ± 35.35 minutes for laparoscopic PS). Blood loss was 87 ml on average, 120 ml for open, 75 for robotic and 45 ml for laparoscopic PS.

Surgical Technique for Laparoscopic PS

The patient is positioned in a right lateral decubitus and in moderate reverse Trendelenburg. Following insertion of the Veress needle, through an incision on the mid-clavicular line at the level of the umbilicus, a 12 mmHg pneumoperitoneum is achieved, allowing the insertion of the optical port. Another 3 trocars are inserted: a 12 mm port along the anterior axillary line above the patient's anterior superior iliac spine for a haemostatic instrument, a 5 mm port placed under the xiphoid and another 5 mm port below the twelfth rib between the mid to post axillary line. The placement of the trocars may suffer some modifications in the case of splenomegaly or other anatomical particularities.

Peritoneal attachments are divided and the anatomy of the splenic vessels is assessed. The selective ligation of vessels is carried out depending on the type of PS to be performed (upper short gastric vessels are preserved for the preservation of the splenic UP, while a branch of the gastroepiploic artery is preserved to ensure the vascularisation of the LP). The splenic hilum is carefully dissected preventing pancreatic tail injury; this can be generally performed with a LigaSure Atlas Sealer/Divider™ (Tycho Healthcare, Boulder,

CO). Monopolar electrocautery, LigaSure, ultrasonic scalpel, or staplers may be used to transect the spleen. While electrocautery alone has proven sufficient to ensure haemostasis a more reliable method is stapling the spleen. Even though the parenchyma has a certain thickness, an Endo GIA Reticulator™ blue cartridge stapler. In order to ensure perfect haemostasis the transection of the splenic parenchyma needs to be 5 mm away from the ischemic line of demarcation following vascular ligation (*Fig. 1*).

The specimen is placed in a EndoCatch™ pouch, morcellated and extracted either through an accessory port incision or a Pfannenstiel incision. After peritoneal washing, a splenopexy may be performed, if necessary, by suturing the remnant to the lateral abdominal wall, and then the greater omentum may be placed to cover the spleen. Drains are optional but are routinely placed and kept for 2 days postoperatively.

The median hospital stay was 5 days (ranging from 5 to 7 days), with an average of 5 days for laparoscopic, 6 days for robotic approach and 5.5 for the open approach. There was no need for postoperative blood transfusion and there were no post-splenectomy infections or other complications.

Literature Review

After a comprehensive literature review on

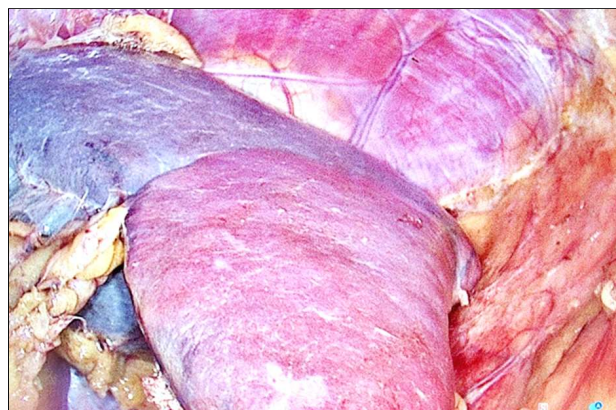


Figure 1. Laparoscopic PS for a hydatid cyst located in the upper part of the spleen

this topic, 14 articles remained relevant. The specific data of each article are presented in Table 2. There were 42 patients with splenic HC treated by PS. Of the 42 patients, papers offered clear data about age for only 17 of them, for the others data are either unspecified or unclear. For the 17, the average age was 26.82. Data regarding the sex of the patients were available for 37 patients: 19 females, 18 males.

As clinical presentation LUQ pain was present in 12 patients (28.57%), 4 presented with a palpable mass in the left hypochondrium (9.52%), and in 2 cases (4.76%) the HC was an incidental finding. For 21 (50%) patients there were no data about clinical presentation. It was difficult to retrieve information about serology for *E. granulosus*: serology confirmed the infection in 23 patients (54.76%), the serology was negative in 3 cases (7.14%), and not mentioned or mentioned as collective data without specific data for the patients treated by PS in the rest of the cases (38.09%).

Diagnosis of the splenic HC was done via abdominal ultrasonography in 30 cases (71.42%), but the most

Table 2. Literature review cases of splenic HC treated by PS

Reference	Year	Age	Sex	Clinical	Imaging	Cyst size or average size (cm)	Cyst location	Number SC	Primary	Other location	Approach	Other procedures	Complications
Dar (12)	2002	21	M	Palpable mass	Rx, US	12x10	LP	1	NS	No	NS		Bleeding - TS
Durakbasa (28)	2006	15	M	LUQ pain, Palpable mass	Us, CT	12	LP	1	Yes	No	NS	Omentoplasty	-
Jiao (8)	2006	48	F	LUQ pain	CT	4x3	LP	1	No	Yes - 2 liver HC	Open		
Karadayi (9)	2011	NS	NS	NS	CT	3x3	UP	1	Yes	No	Open		
Oussama (14)	2014	28	M	LUQ pain	US, RX, CT	4.8	NS	1	Yes	No	Open		1 Bleeding - cauterization and gelatin sponge
	42	M	M	LUQ pain	US, RX, CT	4.8	NS	1	Yes	No	Open		
Ben Ameur (17)	2015	NS	NS - 3 patients	LUQ pain	US, CT	7 4 8	Up 1 LP 2	1	Yes	No	Open		
Costi (10)	2015	30 (17-46)	1F, 3M	LUQ pain	CT	NS	UP 3 LP 1	1	Yes 3 No 1	No 3 Yes 1 - liver	Open 3 Laparoscopic 1 Open	Right hepatectomy 1	
Ozogul (29)	2015	NS	NS - 1 patient	NS	CT	6.5x8	LP	1	NS	No	Open		
Golmohammadzadeh (30)	2016	37 33	M M	LUQ pain LUQ pain	CT CT	8x17 11x12	NS NS	1 1	Yes Yes	No No	Open Open	Removal of torsion omentum	
	16	F	F	LUQ pain	CT	1x6	NS	1	No	Yes - multiple liver HC	Open		
	37	F	F	LUQ pain, palpable mass	CT	9x12	NS	1	No	Yes - liver HC	Open	Drainage of liver HC	
Mirjaniyan (6)	2018	18	F	Palpable mass	US, CT	24x17x14	LP		Yes	No	Open		
Morshed (11)	2018	NS	NS - 12 F and 8 M	NS	US, CT	NS	NS	1	NS	No	Laparoscopic		
Ahmad (31)	2019	79	F	Malaise	US, CT	20x20	NS	1	Yes	No	Open		
Mejiri (13)	2021	54	M	Incidental finding	US, CT	4	LP	1	Yes	No	Open		Hemorrhage - hemostasis
Merad (24)	2021	28	F	Incidental	US, CT	7x5	LP	1	Yes	No	Open		

relied upon was the abdominal CT which provided the diagnosis in 35 cases (83.33%). A chest X-ray to exclude pulmonary involvement was mentioned in only 3 articles. Data about the size of the splenic cyst were provided for 21 patients (50%), on average the size of the HC being 7.14 cm, ranging from HC as small as 4cm to 24x17x14cm, the largest HC in the series. All HC were solitary splenic cysts.

Two patients had liver HC, of which one patient with two cysts in segments VII and VIII were treated by partial cystectomy, omentoplasty, and intracystic drainage, with a total pericystectomy with the “cool-tip” radiofrequency–assisted technique for the segment VIII cyst. The other patient with liver HC underwent drainage of the cyst.

There were 19 (45.2%) open PS, 21 (50%) laparoscopic, and in 2 cases the manner of approach was not mentioned. Ten cysts were located in the LP (23.80%), and 5 (11.90%) in the UP, for which the corresponding pole was resected, while in the remaining cases the part of the spleen removed was not specified.

Operative time was difficult to assess because it was rarely mentioned or it was mentioned as an average for PS, regardless of the manner of approach. Jiao et al (8) report the transection of the splenic parenchyma lasted just 4.5minutes using radiofrequency assisted resection. The same manner of transection was used by Karadayi et al (9) and the resection took 12 minutes. Costi et al (10) reports an average of 74 minutes for 3 open and one laparoscopic PS. Of all the articles analysed, Morshed et al (11) reported the most cases of splenic HC treated by PS (20 patients) and the average time reported is 150 minutes for laparoscopic PS.

Blood loss was also not mentioned in most of the articles, Morshed et al (11) reported no bleeding intraoperatively, while Karadayi et al (9) reports a bleeding of 25 ml.

There were three complications reported: one patient with PS for a large HC presented with postoperative bleeding which required the complete removal of the spleen (12), and two others case of haemorrhage were reported which required reintervention and haemostasis

(13,14). Hospitalization days were also scarcely mentioned, ranging from 5 to 15 days.

There were no deaths reported in the literature reviewed.

Discussions

Splenic HC is the third most common localization of hydatid disease after the liver and the lung and while it can occur alongside the liver and/or lung HC, it may also occur as an isolated lesion or, at the opposite end, as part of advanced disseminated disease with multiple abdominal HC (2). The splenic symptomatology of the splenic HC depends on the size of the cyst, most often causing pain in the left upper quadrant but a long evolution without any symptoms is also possible. In other cases, rupture or infection may cause fever, nausea, anaphylactic reactions or in case of traumatic rupture it may present as an acute abdomen (2,15,16). In our series the main symptom was left upper quadrant pain, consistent with data from the literature.

Diagnosis is usually based on US and/or CT and the differential diagnosis is mainly with simple cysts, splenic abscess and cystic neoplasms which can produce the same symptoms as a splenic HC, in which case immunological-serological tests may be useful to establish the diagnosis, even if they might sometimes be inconclusive (10,17).

There are several anthelmintic drugs available for the treatment of hydatid disease. Benzoimidazole carbamates are effective, but mebendazole has proven to have a poor absorption. Albendazole has a better absorption rate and is currently the most used anthelmintic drug (18). Albendazole can be used in splenic HC, as sole treatment for small cysts as suggested by Korkut et al (2), however, sole use of Albendazole remains controversial. While there is no established protocol for Albendazole treatment for splenic HC, treatment protocols seem to follow those for hepatic hydatid disease. A study aimed to show the effectiveness of Albendazole administered preoperatively for hepatic HC reported that the minimum effective duration of treatment is 4

weeks, while a shorter course of 2 weeks proved insufficient (19). It is therefore recommended that medical treatment be used as adjuvant therapy perioperatively, 10-15 mg/ kgc/day at least one week before surgery and 4 weeks postoperatively for maximum results (1).

Among the options for treating splenic HC the literature mentions: percutaneous treatment, splenic parenchyma sparing options such as cystotomy and unroofing, partial splenectomy and even total splenectomy in case of large cysts that occupy the majority of the spleen. These methods each have their merits and can be applied judging by size, location and factors depending on the patient's status, preference etc (20-24). Our series consists of splenic HC localised in the upper pole of the spleen in most cases (only one case of lower pole HC) which were ideal for PS. While the procedure might be associated with an increased risk of bleeding compared to other methods, it also ensures complete removal of the HC, diminished chance of dissemination in the abdominal cavity and also, with enough experience, the procedure can successfully be performed in a minimally invasive approach which adds on the benefits of less pain, fewer hospitalisation days and aesthetic results (4,6,25-27).

In our series the cysts were relatively small which were perfectly suited for PS and therefore no inactivation was necessary, the cyst along with adjacent parenchyma being resected without rupture and extracted without spillage. For these small cysts percutaneous drainage can be performed but there are risks such as spillage, abscess formation and also, multivesicular cysts may be difficult to drain (2).

The risk of bleeding postoperatively in PS can be diminished by radiofrequency assisted resection as suggested by Jiao et al and Karadayi et al. who report bleeding less than 25ml for PS (8,9). While the technique was performed for other indications, one resection was performed for splenic HC. In our series usually the monopolar cautery is used to ensure the transection of the parenchyma, but also stapling devices with excellent results,

minimal bleeding intraoperatively and no reinterventions for complications.

The large splenic cysts were operated on by open approach (4 cysts of 10, 7, 5.5 and 4 cm) and a subtotal splenectomy was performed in these cases, as most of the splenic parenchyma was involved. The other cysts were approached in a minimally invasive fashion. Having more experience in laparoscopy, the laparoscopic PS were quicker than the robotic ones, one of the two laparoscopic interventions lasting longer due to the fact that a cholecystectomy was also performed.

Blood loss was on average 90ml, with the open approach being slightly more prone to cause more blood loss (120 ml), but overall, PS for HC is an operation which should not cause bleeding, given how the vascular approach ensures clamping the vessels afferent to the part of the spleen to be resected and the ischemia line ensures a clear line of demarcation to guide the parenchyma transection. In the literature review, however, the complications and reinterventions were due to bleeding, and thus a more reasonable conclusion is that PS is slightly more challenging than a total splenectomy, especially in ensuring proper haemostasis but using the right technique and instruments this complication can be avoided.

In our series there were no complications, hospitalisation was on average 5 days, and no recurrence was reported in a follow up period of 2 years.

Conclusions

PS for splenic HC is a safe procedure that ensures complete removal with minimal chance of intra-abdominal dissemination and is an effective treatment option with minimal chance of recurrence, while preserving splenic parenchyma, splenic function and avoiding TS complications such as overwhelming post-splenectomy infection syndrome. Minimally invasive approaches can also be used to ensure optimal results: minimal scars, decreased postoperative pain, faster discharge. Case selection is important, smaller HC can be approached laparoscopically or robotically, whereas larger

cysts may require an open approach to avoid cyst rupture and dissemination.

Author's Contributions

BT and CM independently screened the literature and extracted data; any disagreement was discussed and managed under CV's supervision.

Conflicts of Interest and Source of Funding

The authors have no financial or proprietary interests in any material discussed in this article, and they did not receive support from any organisation for the submitted work.

Ethical Statement

The article has the approval of the ethical committee of Fundeni Clinical Institute to use and process the data required for this study.

References

1. Akbulut S, Sogutcu N, Eris C. Hydatid disease of the spleen: single-center experience and a brief literature review. *J Gastrointest Surg.* 2013;17(10):1784-95.
2. Korkut E, Aksungur N, Öztürk G. A retrospective evaluation of spleen hydatid cyst treatments: the spleen-preserving conservative approach is preferable to splenectomy. *Eurasian J Med.* 2022;54(2):133-137.
3. Rasheed K, Zargar SA, Telwani AA. Hydatid cyst of spleen: a diagnostic challenge. *N Am J Med Sci.* 2013;5(1):10-20.
4. Costi R, Ruiz CC, Romboli A, Wind P, Violi V, Zarzavadjian Le Bian A. Partial splenectomy: who, when and how. A systematic review of the 2130 published cases. *J Pediatr Surg.* 2019;54(8):1527-1538.
5. Esposito F, Noviello A, Moles N, Cantore N, Baiamonte M, Coppola Bottazzi E, et al. Partial splenectomy: a case series and systematic review of the literature. *Ann Hepatobiliary Pancreat Surg.* 2018;22(2):116-127.
6. Mirijanyan MM, Gevorgyan VG, Martirosyan EV, Datumyan GS. Partial splenectomy as the method of choice for the surgical treatment of giant splenic hydatid cyst. *The New Armenian Medical Journal.* 2018;12(3):91-95.
7. Vasilescu C, Tudor S, Popa M, Tiron A, Lupescu I. Robotic partial splenectomy for hydatid cyst of the spleen. *Langenbecks Arch Surg.* 2010;395(8):1169-74.
8. Jiao LR, Tierris I, Ayav A, Milicevic M, Pellicci R, Navarra G, et al. A new technique for spleen preservation with radiofrequency. *Surgery.* 2006;140(3):464-6.
9. Karadayi K, Turan M, Sen M. A new technique for partial splenectomy with radiofrequency technology. *Surg Laparosc Endosc Percutan Tech.* 2011;21(5):358-61.
10. Costi R, Castro Ruiz C, Zarzavadjian Le Bian A, Scerrati D, Santi C, Violi V. Spleen hydatidosis treated by hemi-splenectomy: A low-morbidity, cost-effective management by a recently improved surgical technique. *Int J Surg.* 2015;20:41-5.
11. Morshed G, El-Gaabary T. New technique for laparoscopic partial splenectomy to decrease blood loss. *Int Surg J.* 2018;5(3):983-986.
12. Dar MA, Shah OJ, Wani NA, Khan FA, Shah P. Surgical management of splenic hydatidosis. *Surg Today.* 2002;32(3):224-9.
13. Mejri A, Arfaoui K, Ayadi MF, Aloui B, Yaakoubi J. Primitive isolated hydatid cyst of the spleen: total splenectomy versus spleen saving surgical modalities. *BMC Surg.* 2021;21(1):46.
14. Oussama, B, Makrem M, Karim A, Brahim K, Moussa Mohamed B, Samy B. Surgical treatment and outcomes of hydatid cyst of the spleen. *Open Journal of Gastroenterology.* 2014;4:51-55.
15. Arikanoğlu Z, Taskesen F, Gumus H, Onder A, Aliosmanoğlu I, Gul M, et al. Selecting a surgical modality to treat a splenic hydatid cyst: total splenectomy or spleen-saving surgery? *J Gastrointest Surg.* 2012;16(6):1189-93.
16. Belli S, Akbulut S, Erbay G, Koçer NE. Spontaneous giant splenic hydatid cyst rupture causing fatal anaphylactic shock: a case report and brief literature review. *Turk J Gastroenterol.* 2014;25(1):88-91.
17. Ben Arneur H, Affes N, Abdelhedi C, Kchaou A, Boujelbene S, Issam Beyrouti M. Hydatid cyst of the spleen: Tunisian series of 21 cases. *Indian J Surg.* 2015;77(Suppl 2):515-9.
18. Anadol D, Özçelik U, Kiper N, Göçmen A. Treatment of hydatid disease. *Paediatr Drugs.* 2001;3(2):123-35.
19. Vahidirad A, Mansouri M, Shamshirian A, Berenji F, Motie MR. Efficacy of preoperative albendazole on protoscolices viability in Hydatid Cyst of the liver. *Iran J Parasitol.* 2022;17(4):483-487.
20. Kumar P, Hasan A, Kumar M, Singh V. Isolated hydatid cyst of spleen: A rare case with rare presentation. *Int J Surg Case Rep.* 2016;28:279-281.
21. Manciu S, Tudor S, Vasilescu C. Splenic cysts: a strong indication for a minimally invasive partial splenectomy. Could the splenic hilar vasculature type hold a defining role? *World J Surg.* 2018;42(11):3543-3550.
22. Manouras A, Nikolaou CC, Katergiannakis VA, Apostolidis NS, Golematis BC. Spleen-sparing surgical treatment for echinococcosis of the spleen. *Br J Surg.* 1997;84(8):1162.
23. Meimarakis G, Grigolia G, Loehe F, Jauch K-W, Schauer RJ. Surgical management of splenic echinococcal disease. *Eur J Med Res.* 2009;14(4):165-70.
24. MERAD, Z., Solitary Splenic Hydatid Cyst. *Journal of Clinical and Diagnostic Pathology,* 2021. 1(4): p. 1-4.
25. Wiwanitkit V. Partial robotic splenectomy in hydatid disease. *Langenbecks Arch Surg.* 2019;404(Suppl 1):5.
26. Khan AH, Bensoussan AL, Ouimet A, Blanchard H, Grignon A, Ndoye M. Partial splenectomy for benign cystic lesions of the spleen. *J Pediatr Surg.* 1986;21(9):749-52.
27. Balaphas A, Buchs NC, Meyer J, Hagen ME, Morel P. Partial splenectomy in the era of minimally invasive surgery: the current laparoscopic and robotic experiences. *Surg Endosc.* 2015;29(12):3618-27.
28. Durakbasa CU, Tireli GA, Sehiralti V, Sander S, Tosyalı AN, Mutus M. An audit on pediatric hydatid disease of uncommon localization: incidence, diagnosis, surgical approach, and outcome. *J Pediatr Surg.* 2006;41(8):1457-63.
29. Ozogul B, Kisaoglu A, Atamanalp SS, Ozturk G, Aydinli B, Yildirgan Mİ, et al. Splenic hydatid cysts: 17 cases. *Indian J Surg.* 2015;77(Suppl 2):257-60.
30. Golmohammadzadeh H, Maddah G, Hojjati YS, Abdollahi A, Shabahang H. Splenic cysts: analysis of 16 cases. *Caspian J Intern Med.* 2016;7(3):217-221.
31. Ahmad M, Saqib M, Ahmad M, Raees M. Removal of a large hydatid cyst in spleen. *Anaesthesia, Pain & Intensive Care.* 2011;15(1):48-50.