EUROPEAN JOURNAL OF BIOMEDICAL AND PHARMACEUTICAL SCIENCES
http://www.ejbps.com

ISSN 2349-8870
Volume: 1
Issue: 3
615-627
Year: 2014

CYSTIC LIVER LESIONS AND FEATURES OF THEIR SURGICAL TREATMENT: A LITERATURE REVIEW

Taras Adamovych Kadoshchuk[1], Vadym Ivanovych Stoika*[2] and Serhii Stepanovych Stukan[3]

[1]Professor, Department of Surgery of Medical Faculty Nr. 2, Vinnitsa National Pirogov Memorial Medical University, Ukraine.

[2]Graduate Student, Department of Surgery Nr. 1, Vinnitsa National Pirogov Memorial Medical University, Ukraine.

[3]Assistant, Department of Surgery Nr. 1, Vinnitsa National Pirogov Memorial Medical University, Ukraine.

Article Received on 21/10/2014 **Article Revised on 11/11/2014** **Article Accepted on 01/12/2014**

***Correspondence for Author**
Vadym Ivanovych Stoika
Graduate Student, Department of Surgery Nr. 1, Vinnitsa National Pirogov Memorial Medical University, Ukraine.

ABSTRACT

Over the past decade, there has been an intensive development of surgical hepatology, driven by the introduction of new technologies in the diagnosis and treatment of patients with various focal liver diseases. The diagnosis and treatment of focal liver diseases remain one of the pressing issues in modern surgical hepatology. The incidence of volumetric liver formations is increasing despite the successes achieved in treating this pathology. Many complex and unresolved questions persist regarding differential diagnosis and the choice of surgical treatment strategies. This article is a critical and descriptive review on parasitic and non-parasitic cysts and and features of their surgical treatment. The literature review indicates that liver cysts, both parasitic and non-parasitic in origin, remain a complex challenge in modern surgical hepatology, requiring a differentiated approach to diagnosis and treatment depending on etiology, size, location, and the presence of complications. Surgical intervention, despite advancements in the use of minimally invasive technologies such as laparoscopy and puncture methods, is still associated with risks of recurrence, postoperative complications, and loss of functional liver parenchyma. The further development of treatment methods aimed at reducing invasiveness, preventing hemorrhagic complications, and preserving liver

function is a key task for improving the long-term outcomes of therapy for cystic liver lesions.

KEYWORDS: Liver, focal liver diseases, parasitic cysts, non-parasitic cysts, surgical treatment.

INTRODUCTION

Over the past decade, there has been an intensive development of surgical hepatology, driven by the introduction of new technologies in the diagnosis and treatment of patients with various focal liver diseases. The structure of focal liver diseases encompasses numerous and diverse processes in terms of form and stage of development: parasitic and non-parasitic cysts, malignant and benign neoplasms.[43]

The diagnosis and treatment of focal liver diseases remain one of the pressing issues in modern surgical hepatology.[11] The incidence of volumetric liver formations is increasing despite the successes achieved in treating this pathology. Many complex and unresolved questions persist regarding differential diagnosis and the choice of surgical treatment strategies.

Among cystic liver formations, echinococcosis is the most prevalent[24], with its frequency ranging from 65% to 80% of all cystic liver lesions.

Following surgical interventions, morphological changes in liver tissues and signs of liver failure do not disappear but progress, negatively affecting the long-term outcomes of liver cyst treatment.

The issue of treating liver cysts remains far from fully resolved. According to various authors, the incidence of liver cysts of different etiological origins ranges from 2% to 7.3%. The treatment approach for patients with cystic liver diseases varies significantly depending on the etiology, type, and clinical course of the disease.[32] For instance, in cases of parasitic cysts, many authors prescribe chemotherapy with albendazole 3–4 weeks prior to surgery, while non-parasitic cysts are treated using puncture methods under ultrasound guidance or laparoscopically.[43]

The choice of treatment for focal liver diseases depends on the size of the affected liver area, the nature of the process, and the severity and type of complications. However, surgical treatment can lead to complications such as liver failure or massive intraoperative bleeding

resulting in hemorrhagic shock. Therefore, reducing the invasiveness of operations, preventing hemorrhagic complications, and maximizing the preservation of functional liver parenchyma are among the most critical directions in the development of surgery for focal liver diseases.[42]

The aim of this study was to conduct a critical and descriptive review of parasitic and nonparasitic cysts and the features of their surgical treatment.

MATERIALS AND METHODS

This article is a critical and descriptive review on parasitic and non-parasitic liver cysts and and features of their surgical treatment. Articles collected from open scientific databases had been reviewed and analysed extensively.

RESULTS AND DISCUSSION

Parasitic Cysts

Human echinococcosis is a severe parasitic disease prevalent in endemic regions across many countries, remaining a significant medical challenge to this day. In recent years, there has been a noticeable trend of echinococcosis spreading not only among individuals involved in animal husbandry but also among urban populations. This is associated with increased migration from rural areas to cities, low levels or absence of population screening, and unresolved sanitary-epidemiological and socioeconomic issues. In Uzbekistan, one of the five endemic foci of the disease, the number of annual surgeries for echinococcosis rose from 1,500 in the 1990s to 4,500 by 2001. Researchers from countries endemic for echinococcosis report discouraging recurrence rates after surgical treatment, reaching 16.2% in Turkey and 19.4% in Greece. Moreover, complicated forms of liver echinococcosis can occur in up to 84.6% of cases, with recurrences observed in 54.0% of cases.[9,27]

Echinococcal cysts grow slowly. The progression of liver echinococcosis is conventionally divided into three stages.[21]

The first stage (initial) corresponds to the period from the penetration of the echinococcus into the liver until the first signs of the disease appear. This stage can last for years and decades. Patients feel satisfactory. The cyst is detected incidentally during examinations related to another pathology.

In the second stage, various symptoms appear, associated with the cyst pressing on liver

tissue or surrounding organs. Patients are troubled by sensations of heaviness, distension, and aching pain in the right upper quadrant and epigastrium, less commonly in the chest. If the parasitic cyst is located on the diaphragmatic surface of the liver, pain radiates to the back, lumbar region, and right shoulder blade. A right-sided phrenic nerve symptom is observed, and radiologically, there is a high position of the right diaphragmatic dome.

The third stage is characterized by the onset of cyst complications: suppuration, rupture, compression of hepatic ducts and the portal vein, and calcification.

With suppuration of the cyst, intense pain appears in the area of its location, along with hectic fever and chills. The parasitic cyst increases in size. The outcomes of suppuration may include sepsis and abscess rupture into the abdominal or pleural cavity.[17,30]

Cyst rupture is accompanied by sharp, intense pain localized in the right upper quadrant. In some cases, collapse occurs. Sometimes cysts empty into the bronchus, intrahepatic bile ducts, stomach, intestines, or gallbladder. The entry of the echinococcal cyst contents into the abdominal cavity leads to dissemination of the process, the development of urticaria, and anaphylactic shock. When the echinococcal cyst ruptures into the bronchus, a sudden severe cough appears with the expectoration of watery sputum containing numerous daughter echinococcal cysts. When the cyst empties into the intrahepatic bile ducts, cholangitis and jaundice progress. As a result of the echinococcal cyst compressing the hepatic ducts and portal vein, mechanical jaundice and portal hypertension develop. Emptying of the cyst into the pleural cavity leads to purulent pleuritis and lung abscess.[13]

Extremely rarely, spontaneous death of the parasite occurs, followed by calcification of its walls, leading to self-healing of the body.

In patients with echinococcosis, the liver is enlarged. When the parasitic cyst is located on the anterior-inferior surface of the liver, protrusion of the abdominal wall is observed; with lateral localization, deformation of the costal arch and ribs occurs. On palpation, the cyst has a smooth surface. Its consistency depends primarily on its contents: an uncomplicated cyst is soft and elastic. When adjacent to the anterior abdominal wall, fluctuation and the “hydatid thrill” symptom may be detected. The vibration is caused by oscillations of daughter cysts within the cavity.[21,31]

Diagnosis of liver echinococcosis is confirmed by reactions based on the detection of specific

antibodies produced in response to the parasite invasion. The most widely used is the intracutaneous Casoni test, employing sterile echinococcal cyst fluid from humans or domestic animals (0.1–0.2 ml). A positive result manifests as itching, hyperemia, and skin swelling at the injection site, occurring in 75–85% of echinococcosis patients. The test becomes negative one year after the parasite's death. In addition to the Casoni test, complement fixation, latex agglutination (using latex-synthetic resin as an antigen adsorbent), and indirect hemagglutination tests are used. Eosinophilia is often found in the blood of affected patients.[17,21]

Diagnosis is refined using ultrasonography, computed tomography, radioisotope hepatoscanning, hepatic angiography, and plain radiography of the abdominal cavity and subdiaphragmatic spaces.[3]

Surgical intervention is successful if the parasite is completely removed. Often, surgical procedures are controversial, involving liver resection or opening parasitic cysts followed by parasite extraction. Minimally invasive procedures are safer and less complex than radical surgeries, though they carry a higher risk of recurrence due to residual cavities.[2,6,18]

Radical operations for liver echinococcosis include pericystectomy and liver resection, while minimally invasive procedures involve removing cyst contents, sterilizing the residual cavity, and partial cyst resection.[3] To prevent postoperative complications from residual cavities, methods such as omentoplasty, capitonnage, external drainage, and synthetic fibrin use have been proposed.[3,21] However, some researchers agree that external drainage is associated with a significantly higher complication rate (e.g., residual cavity infection, cholangitis) compared to omentoplasty or capitonnage. Higher complication rates have also been demonstrated with combined external drainage and omentoplasty.[3]

A potential solution could be the adoption of gentler electrosurgical techniques, such as argon plasma coagulation.

In a study by Akhmedov I.G. et al. (2004), among 247 patients operated on for presumed liver echinococcosis, 21 (8.5%) were found to have non-parasitic liver diseases or conditions of other organs: non-parasitic cysts (7), hemangiomas (4), abscesses (4), malignant tumors (3), right kidney hydronephrosis (2), and polycystic liver and right kidney disease (1). It was established that in regions with high echinococcosis prevalence, ultrasound results have

greater diagnostic value than serological tests. To avoid diagnostic errors in cystic formations, multipositional ultrasound is recommended to identify features corresponding to the hydatid cyst's life cycle phases.[3,4]

Laparoscopic echinococcectomy, adhering to antiparasitic principles, was performed in 37 patients with solitary, uncomplicated hydatid liver cysts. A detailed set of measures to ensure antiparasitic safety during laparoscopic interventions was outlined, along with various techniques and devices for cyst puncture. In one case, conversion to laparotomy was required due to the intrahepatic location of the cyst. In the remaining 36 patients, the postoperative period was significantly smoother than after traditional surgery. Complications included leakage of echinococcal fluid into the abdominal cavity (1), bile leakage from the residual cavity (2), and suppuration of the residual cavity (1). These were resolved without laparotomy, and all patients recovered. The average hospital stay was 5–6 days.

Researchers consider laparoscopic echinococcectomy a promising method for surgically treating uncomplicated liver echinococcosis. Improvements in laparoscopic techniques for parasitic liver cysts are highly promising, particularly in preventing disease recurrence, which remains a significant scientific and practical challenge today.[21,29]

It should be noted that laparoscopic technologies are widely applied today for various focal liver diseases, including tumor lesions, non-parasitic cysts, and liver abscesses.

However, for hydatid cysts, many researchers combine radical interventions with resections, including extensive ones, due to the need for complete removal of the fibrous capsule. It is now proven that protoscoleces penetrate the fibrous capsule's thickness, and microbial infiltration occurs during cyst suppuration. Leaving the fibrous capsule increases not only the risk of recurrence but also the likelihood of postoperative complications related to the residual cavity. This risk is heightened in complicated echinococcosis cases, where changes in the fibrous capsule such as calcification, rigidity, connections to bile ducts, or microbial invasion due to suppuration occur following the parasite's death. Thus, removing the fibrous capsule enhances the radical nature of the surgery and reduces complication rates.[14,20,39]

Abbas M. et al. (2006) argue that the advantages of conservative methods over radical ones are achievable only in uncomplicated liver echinococcosis.[1] Kaharov M.A. (2003) reported on puncture treatment of 23 patients with simple, primary solitary cysts without daughter

vesicles, noting no true recurrences over 6 months to 7 years of follow-up.[28] Thus, puncture and conservative methods should be applied under strict indications and in the absence of complications.

Rudakov V.A. and Poluektov L.V. (1997) observed no recurrences after radical echinococcosis treatment, whereas puncture sclerotherapy led to recurrence in 16.6% of cases.[38]

Zhuravlev V.A. argues that liver resection should be the method of choice for echinococcosis treatment, citing higher trauma rates with pericystectomy (22.2% complications) compared to resection (9.3% complications). Undoubtedly, resection aligns better with antiparasitic principles.[6,7]

However, given that echinococcosis often involves multiple liver lesions and central segment involvement, resection must be chosen cautiously to avoid significant loss of functional parenchyma. Hemihepatectomy is indicated for predominant, massive involvement of one lobe, justified by the need to prevent complications from incompletely resolved residual cavities in a functionally impaired lobe. In cases involving segments II and III, peripheral or deep parenchymal cysts, economical resections segmental or sectoral are more appropriate. Resections of central segments, among the most complex liver interventions, should be performed in specialized surgical hepatology units.[5]

Non-parasitic cysts

Non-parasitic liver cysts encompass a heterogeneous group of diseases that differ in etiology, prevalence, and manifestations from parasitic cysts and liver tumors. Sometimes differential diagnosis can become a challenging task. With the improvement of diagnostic methods and the development of minimally invasive technologies, the treatment of hepatic cystic disease continues to evolve.[37]

Liver cysts are observed in approximately 1.8% of the population, and according to autopsy data, the frequency of undetected non-parasitic liver cysts reaches 1.86%. In women, cysts occur 3–5 times more frequently than in men, manifesting between the ages of 30 and 50. According to modern pathogenetic approaches, true cysts in the liver arise from aberrant bile ducts; that is, during embryonic development, certain intralobular and interlobar bile ducts fail to connect to the biliary system, and the lack of involution of these ducts is the cause of

liver cyst development.[4]

False cysts develop after traumatic central or subcapsular liver rupture, with their walls consisting of fibrotically altered liver tissue. False cysts may also form after the treatment of a liver abscess or echinococcectomy. The contents of liver cysts consist of clear light or brownish transparent fluid with traces of blood or bile. They are more commonly found in the left lobe of the liver.[10,25,33,36,45]

True liver cysts do not undergo involution and slowly increase in size. In pathoanatomical studies, cysts appear as cavities filled with lemon-colored fluid, varying in size and number. They are lined with biliary-type epithelium and do not connect to excretory ducts.[1,4,35] Thus, the greater prevalence of this form of focal liver lesion makes the issue of its surgical treatment highly relevant.

The primary feature of non-parasitic liver cysts is their predominantly asymptomatic course. Disease manifestations (pain in the right upper quadrant and other abdominal regions) are rare and associated with stretching of the liver capsule or abdominal wall due to compression of adjacent organs and bile ducts. Instrumental diagnostic methods play a leading role in establishing the diagnosis. Traditionally, the detection of focal liver lesions in patients is an incidental finding during ultrasound examination of the abdominal organs or CT.[34]

Tomographic studies show that as the cyst grows, the volume of parenchyma does not increase, but the enlargement of the liver is proportional to the size of the growing cyst. Researchers propose differentiating small cysts with a diameter of up to 3 cm, medium cysts of 3–5 cm, and large cysts with a diameter exceeding 5 cm. Solitary cysts occur in 61% of cases, multicystic liver disease in 36% of cases, and polycystic disease is significantly rarer, accounting for 1.87% of detected liver cysts.

In determining indications for surgical treatment and the scope and nature of the surgical intervention in patients with polycystic liver disease, a differentiated approach must be followed, guided by the size and location of the cysts, the presence of complications, and concomitant diseases.[23] Overall, for non-parasitic liver cysts, unlike parasitic ones, a strategy of minimally invasive interventions is more widely applied.

Indications for laparoscopic surgical treatment of non-parasitic cysts include suppuration, rupture, and bleeding (absolute indications). Additionally, conditional-absolute indications

are identified: giant cysts of any location (greater than 10 cm in diameter); cysts centrally located at the liver hilum (with compression of the biliary tract and/or signs of portal hypertension); cysts with pronounced clinical symptoms (persistent pain in the upper quadrant, dyspeptic symptoms, weight loss, etc.). Laparoscopic surgeries are also performed for large cysts (3 to 10 cm in diameter); isolated cysts in segments III–IV; and recurrent cysts in cases where puncture methods have proven ineffective.[22]

The surgical technique depends on the patient's condition, diagnostic procedure results, and the absence of contraindications. Several types of operations exist, each with different execution techniques.[16] Thus, a radical operation involves resection or liver transplantation, implying partial or complete removal of the affected part. In conditionally radical operations, excision of the cyst walls or enucleation is performed using laparotomic or laparoscopic access. Another surgical option may involve removing the "roof" of the cyst followed by treating its walls with electrocoagulation or argon plasma coagulation.

Radical operations ensure a low recurrence rate of the disease. However, alongside this, the number of complications arising from radical surgical interventions is higher compared to conditionally radical operations.[26,40] Laparoscopic surgeries are becoming increasingly popular for treating liver cysts. This is due to several advantages of laparoscopic treatment, namely reduced postoperative pain and discomfort, a low recurrence rate, early mobilization, a short hospital stay and rehabilitation period, and an excellent cosmetic effect. However, there are currently no clear indications for laparoscopic treatment.[46]

Minimally invasive techniques for treating cystic liver lesions also include ablation of the cyst cavity under ultrasound guidance.[12] The procedure is performed as follows: a 7Fr–10Fr catheter is inserted into the cyst under ultrasound control. After evacuating the cyst contents, a sclerosant is introduced. Ethanol or acetic acid can be used as the sclerosant. The number of ablation procedures may vary from 1 to 3 and is determined by the time required for complete obliteration of the cyst cavity.[47]

CONCLUSIONS

The literature review indicates that liver cysts, both parasitic and non-parasitic in origin, remain a complex challenge in modern surgical hepatology, requiring a differentiated approach to diagnosis and treatment depending on etiology, size, location, and the presence of complications.

Surgical intervention, despite advancements in the use of minimally invasive technologies such as laparoscopy and puncture methods, is still associated with risks of recurrence, postoperative complications, and loss of functional liver parenchyma.

The further development of treatment methods aimed at reducing invasiveness, preventing hemorrhagic complications, and preserving liver function is a key task for improving the long-term outcomes of therapy for cystic liver lesions.

REFERENCES

1. Abbas M, Nafeh AI, Youssef YF, Nasr MM, Radwan HS. Conservative versus radical surgery for treatment of uncomplicated hepatic hydatid cysts. J Egypt Soc Parasitol, 2006; 36(2): 559-576.
2. Abdullaev AG, Agaev RM. Treatment policy for postoperative complications in patients with hepatic echinococcosis and bile duct affection. Khirurgiya, 2006; 7: 21-26.
3. Abdullaev AG, Movchun AA, Agaev RM. Surgical policy in echinococcosis of the liver with affection of bile ducts. Khirurgiya, 2005; (2): 38-42.
4. Abu-Wasel B, Walsh C, Keough V, Molinari M. Pathophysiology, epidemiology, classification and treatment options for polycystic liver diseases. World J Gastroenterol, 2013; 19(35): 5775-5786.
5. Agarwal N, Kumar S. Budd-Chiari syndrome owing to liver hydatid disease: case report and review of the literature. Ann Trop Paediatr, 2009; 29(4): 301-304.
6. Agrawal S, Parag P. Hydatid cyst of head of pancreas mimicking choledochal cyst. BMJ Case Rep., 2011; 2011: bcr0420114087.
7. Akhmedov IG, Osmanov AO, Kurbanov AE. Ultrasonic examination in diagnosis of hydatid echinococcosis. Khirurgiya, 2004; 3: 18-22.
8. Akhmedov IG, Osmanov AO, Kurbanov AE. Ultrasonic examination in diagnosis of hydatid echinococcosis. Khirurgiya, 2004; 5: 27-33.
9. Atmatzidis KS, Pavlidis TE, Papaziogas BT, Mirelis C, Papaziogas TB. Recurrence and long-term outcome after open cystectomy with omentoplasty for hepatic hydatid disease in an endemic area. Acta Chir Belg, 2005; 105(2): 198-202.
10. Avgerinos ED, Pavlakis E, Stathoulopoulos A, Manoukas E, Skarpas G, Tsatsoulis P. Clinical presentations and surgical management of liver hydatidosis: our 20 year experience. HPB, 2006; 8(3): 189-193.
11. Bahirwani R, Reddy KR. Review article: the evaluation of solitary liver masses. Aliment

Pharmacol Ther., 2008; 28(8): 953-965.

12. Boufana B, Stidworthy MF, Bell S, Chantrey J, Masters N, Unwin S, Wood R, Lawrence RP, Potter A, McGarry J, Redrobe S, Killick R, Foster AP, Mitchell S, Greenwood AG, Sako Y, Nakao M, Ito A, Wyatt K, Lord B, Craig PS. Echinococcus and Taenia spp. from captive mammals in the United Kingdom. Vet Parasitol, 2012; 190(1-2): 95-103.
13. Brunetti E, Kern P, Vuitton DA; Writing Panel for the WHO-IWGE. Expert consensus for the diagnosis and treatment of cystic and alveolar echinococcosis in humans. Acta Trop., 2010; 114(1): 1-16.
14. Burpee SE, Kurian M, Murakame Y, Benevides S, Gagner M. The metabolic and immune response to laparoscopic versus open liver resection. Surg Endosc, 2002; 16(6): 899-904.
15. Buttenschoen K, Kern P, Reuter S, Barth TF. Hepatic infestation of Echinococcus multilocularis with extension to regional lymph nodes. Langenbecks Arch Surg., 2009; 394(4): 699-704.
16. Cobzaru RG, Dumitrescu AM, Ciobotaru M, Rîpă C, Leon M, Luca M, Iancu LS. Epidemiological aspects of hydatidosis in children, in some areas of north-eastern Romania. Rev Med Chir Soc Med Nat Iasi., 2013; 117(3): 754-757.
17. Craig P. Echinococcus multilocularis. Curr Opin Infect Dis., 2003; 16(5): 437-444.
18. Craig PS, Woods ML, Boufana B, O'Loughlin B, Gimpel J, San Lett W, McManus DP. Cystic echinococcosis in a fox-hound hunt worker, UK. Pathog Glob Health, 2012; 106(6): 373-375.
19. Dietrich CF, Mertens JC, Braden B, Schuessler G, Ott M, Ignee A. Contrast-enhanced ultrasound of histologically proven liver hemangiomas. Hepatology, 2007; 45(5): 1139-1145.
20. Dülger AC, Bora A, Mete R, Gündüz AM. Budd–Chiari syndrome Due to Echinococcus Multilocularis infection: A case Report Van Med J., 2007; 14(2): 57-60.
21. Filippou D, Tselepis D, Filippou G, Papadopoulos V. Advances in liver echinococcosis: diagnosis and treatment. Clin Gastroenterol Hepatol, 2007; 5(2): 152-159.
22. Gavrilin AV, Eryomina EV. Results of ultrasound monitoring for abdominal and pleural fluid collections in patients after liver surgery. Ultrasound and functional diagnostics, 2004; 3: 21-29.
23. Gigot JF, Metairie S, Etienne J, Horsmans Y, van Beers BE, Sempoux C, Deprez P, Materne R, Geubel A, Glineur D, Gianello P. The surgical management of congenital liver cysts. Surg Endosc, 2001; 15(4): 357-363.
24. Grosso G, Gruttadauria S, Biondi A, Marventano S, Mistretta A. Worldwide

epidemiology of liver hydatidosis including the Mediterranean area. World J Gastroenterol, 2012; 18(13): 1425-1437.

25. Gursoy S, Ucvet A, Tozum H, Erbaycu AE, Kul C, Basok O. Primary intrathoracic extrapulmonary hydatid cysts: analysis of 14 patients with a rare clinical entity. Tex Heart Inst J., 2009; 36(3): 230-233.
26. Ibodov KI, Sharipov AM, Rofiev RR. Bronchial fistulae closure by hydatid lung cysts in children. Khirurgiya, 2011; (10): 43-46.
27. Jiang CP, Don M, Jones M. Liver alveolar echinococcosis in China: clinical aspect with relative basic research. World J Gastroenterol, 2005; 11(30): 4611-4617.
28. Kakharov MA, Kubyshkin VA, Vishnevskiĭ VA, Ikramov RZ, Istratov VG, Mukhiddinov ND. Rationale for removal of fibrous capsule in echinococcectomy from the liver. Khirurgiya, 2003; 1: 31-35.
29. Kara M, Tihan D, Fersahoglu T, Cavda F, Titiz I. Biliary peritonitis due to "fallen" hydatid cyst after abdominal trauma. J Emerg Trauma Shock, 2008; 1(1): 53-54.
30. Kern P. Clinical features and treatment of alveolar echinococcosis. Curr Opin Infect Dis., 2010; 23(5): 505-512.
31. Malikova MS, Frolova IV, Raskin VV, Dzemeshkevich AS, Voronina TS, Parshin VD, Sedov VP, Blagova OV, Sinitsin VE, Mershina EA, Dzemeshkevich SL. The simultaneous surgery of heart and echinococcosis under artificial blood circulation. Khirurgiya, 2012; (2): 79-82.
32. Mashkovskiy GY, Nichitaylo MY, Izhovskiy OJ. Differential diagnosis of hepatic cystic affection. Klin Khir., 2008; (6): 20-23.
33. Meimarakis G, Grigolia G, Loehe F, Jauch KW, Schauer RJ. Surgical management of splenic echinococcal disease. Eur J Med Res., 2009; 14(4): 165-170.
34. Merzlikin NV, Alperovich BI, Paramonova MM, Tskhay VF, Iaroshkina TN. The repeated operations for focal liver lesions. Khirurgiya, 2011; (8): 51-57.
35. Morgenstern L. Rupture of solitary nonparasitic cysts of the liver. Ann Surg, 1959; 150(1): 167-171.
36. Nagarajan K, Sekar D, Babu JV, Kamath A. Hydatid cyst of the liver causing inferior vena caval obstruction. J Assoc Physicians India, 2013; 61(9): 671-673.
37. Nunnari G, Pinzone MR, Gruttadauria S, Celesia BM, Madeddu G, Malaguarnera G, Pavone P, Cappellani A, Cacopardo B. Hepatic echinococcosis: clinical and therapeutic aspects. World J Gastroenterol, 2012; 18(13): 1448-1458.
38. Rudakov VA, Poluektov LV. Cryosurgical treatment in echinococcosis and non-parasitic

cysts. Annals of surgical hepatology, 1997; (2): 20-24.

39. Schurer J, Shury T, Leighton F, Jenkins E. Surveillance for Echinococcus canadensis genotypes in Canadian ungulates. Int J Parasitol Parasites Wildl, 2013; 2: 97-101.
40. Skipenko OG, Polishchuk LO, Chekunov DA, Khrustaleva MV, Kim SI. The burst of the hydatid cyst into the biliary tree, complicated by the choledochduodenal fistula. Khirurgiya, 2012; (7): 80-82.
41. Tak WY, Park SY, Jeon SW, Cho CM, Kweon YO, Kim SK, Choi YH, Chung JM. Ultrasonography-guided percutaneous radiofrequency ablation for treatment of a huge symptomatic hepatic cavernous hemangioma. J Clin Gastroenterol, 2006; 40(2): 167-170.
42. Vetshev PS, Nesterov SN, Khanaliev BV. Evaluation parameters of traumaticity of laparoscopic and traditional surgical techniques. Khirurgiya, 2008; (12): 65-67.
43. Vishnevskiy VA, Efanov MG, Ikramov RZ, Nazarenko NA, Chzhao AV. Surgery of liver hydatid cyst. Russian Journal of Evidence-Based Gastroenterology, 2013; (2): 18‑25.
44. von Herbay A, Vogt C, Willers R, Häussinger D. Real-time imaging with the sonographic contrast agent SonoVue: Differentiation between benign and malignant hepatic lesions. J Ultrasound Med., 2004; 23(12): 1557-1568.
45. Yagci G, Ustunsoz B, Kaymakcioglu N, Bozlar U, Gorgulu S, Simsek A, Akdeniz A, Cetiner S, Tufan T. Results of surgical, laparoscopic, and percutaneous treatment for hydatid disease of the liver: 10 years experience with 355 patients. World J Surg, 2005; 29(12): 1670-1679.
46. Zaporozhchenko BS, Mishchenko VV, Shishlov VI. Cryodestruction of liver metastases in complex treatment of colorectal cancer. Annals of surgical hepatology, 2003; (2): 296-297.
47. Zarivchatsky MF, Pirozhnikov OI, Maryanovsky AA. Use of antihomotoxic drugs in the complex treatment of polycystic liver disease. Bulletin of new medical technologies, 2008; 1: 222.
48. Zeng Q, Li Y, Chen Y, Ouyang Y, He X, Zhang H. Gigantic cavernous hemangioma of the liver treated by intra-arterial embolization with pingyangmycin-lipiodol emulsion: a multi-center study. Cardiovasc Intervent Radiol, 2004; 27(5): 481-485.
49. Zhuravlev VA, Cheremisinov OV. Traditional, new and controversial in the treatment of liver echinococcosis. Annals of surgical hepatology, 2005; 2: 109-109.
50. Zhuravlev VA, Rusinov VM, Shcherbakova NA. Hydatid echinococcosis of the liver. Issues of surgical treatment. Khirurgiya, 2004; 4: 51-54.