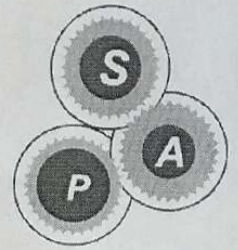


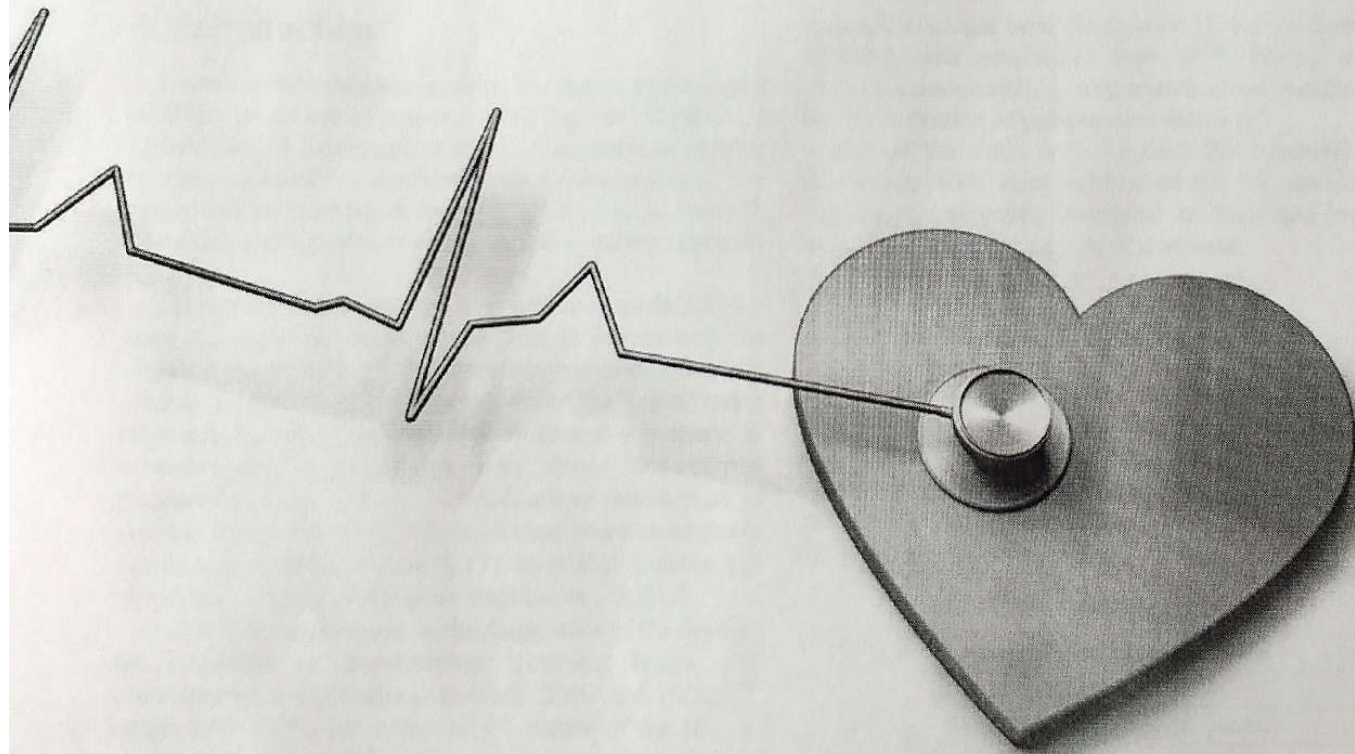
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# Liver Echinococcosis: Improving of Surgical Tactics

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**Abstract** The aim of the study was to improve the treatment results of patients with liver echinococcosis by developing a differentiated approach to surgical treatment and improving tactical and technical aspects of treatment. **Material and methods.** The present work is based on the examination and treatment analysis results of 359 patients with various forms of liver echinococcosis. All patients were divided into two groups: control - 243 (68%) patients who were admitted between 2013 and 2016 and the main one - 116 (32%) patients who were hospitalized in 2017-2019. **Results.** The proposed set of therapeutic measures for liver echinococcosis provides a differentiated approach to the choice of a surgical team depending on the severity of the surgical intervention, increases the efficiency of intraoperative treatment of the residual cavity, improves the technical aspects of surgical intervention and reduces the frequency of postoperative complications from 18.9% to 10.3%, postoperative mortality - from 1.2% to 0%.

**Keywords** Echinococcosis, Liver, Hydatid cyst, Residual cavity of the liver

## 1. Introduction

Human echinococcosis remains an urgent public health problem in endemic regions, including the Republic of Uzbekistan [1]. Echinococcosis is a serious medical problem in many countries of the world where large endemic foci persist and an increase in the number of cases is observed. The disease affects almost all organs and systems of the body [2].

The number of patients with liver echinococcosis (LE) has been increased for recent years. This is due to both the introduction of highly informative diagnostic methods into clinical practice and the downgrade of the social living standards in some regions. The treatment efficiency of echinococcosis is associated with timely and correct diagnostics of this disease. The widespread introduction of modern highly informative instrumental research methods (ultrasound investigation and CT) into clinical practice has significantly improved the early diagnostics of LE [3].

Despite the improvement in the diagnostics of the disease, the frequency of unsatisfactory treatment results and postoperative complications exceeds 20% and mortality ranges from 1-2% depending on the nature of the disease course. One of the unfavorable moments is the fact that, despite the high antiparasitic efficacy of the agents (in particular 100% glycerol) used for intraoperative treatment of the residual cavity of liver (RCL), the analysis of long-term results shows that the specific gravity of the LE

recurrence has not been changed [4-5]. Echinococectomy, especially with complicated forms of the disease and giant cysts, is accompanied by suppuration of the residual cavity and the formation of gall-purulent fistula [6].

**Aim** of the study is to improve the treatment results of patients with liver echinococcosis by developing a differentiated approach to surgical treatment and improving tactical and technical aspects of treatment.

## 2. Material and Methods

The study is based on the examination and treatment analysis results of 359 patients with various forms of liver echinococcosis. All patients were divided into two groups: control - 243 (68%) patients who were admitted between 2013 and 2016 and the main one - 116 (32%) patients who were hospitalized in 2017-2019.

Table 1. Distribution of patients by gender

Gender	Control group	Main group	t-Student
Men	136 (56.0±3.2%)	56 (48.3±4.6%)	1.367
Women	107 (44.0±3.2%)	60 (51.7±4.6%)	1.367

Table 2. Distribution of patients by age

Years	Control group	Main group	t-Student
Up to 19 years	10 (4.1±1.3%)	3 (2.6±1.5%)	0.785
20-44 years	153 (63.0±3.1%)	76 (65.5±4.4%)	0.474
45-60 years	60 (24.7±2.8%)	28 (24.1±4.0%)	0.114
61-75 years	19 (7.8±1.7%)	8 (6.9±2.4%)	0.316
Over 75 years	1 (0.4±0.4%)	1 (0.9±0.9%)	0.473



Such a division is connected with different approaches to treatment as they develop and improve therapeutic and tactical measures. The distribution of patients by gender and age is given in Tables 1 and 2.

55 (23%) patients in the control group had a complicated course of the disease and 188 (77%) had an uncomplicated course. 236 (97%) patients were performed surgical treatment as planned after a preliminary examination and preoperative preparation; 1 (0.4%) patient with a rupture of an echinococcal cyst (EC) into the pleural cavity was operated in an emergency-delayed manner after drainage of the pleural cavity; 5 (2%) patients with a EC rupture into the bile ducts and moderate obstructive jaundice were also operated on an emergency-delayed way after retrograde pancreatocholangiography (RPCG) with endoscopic papillosphincterotomy (EPST); 1 patient was urgently operated when EC had ruptured into the free abdominal cavity.

The overall frequency of postoperative complications was 18.9%. *Early surgical complications were noted in 9.9% of them:* seromas of postoperative wounds were developed in 8 (3.3%) cases; suppuration of postoperative wounds was noted in 5 (2.1%) patients; bile duct drainage from the abdominal cavity was noted in 4 (1.6%) cases in the postoperative period; an external bile fistula was developed in 3 (1.2%) patients in the postoperative period; biliary peritonitis was developed in 2 (0.8%) cases (1 patient had a fatal outcome); a subphrenic abscess in 1 (0.4%) patient was formed in the postoperative period; a clinics of early adhesive intestinal obstruction was developed in 1 (0.4%) observation.

*General complications in the postoperative period were developed in 5.8% of cases:* reactive pleuritis was developed in 5 (2.1%) cases; 7 (2.9%) patients had pneumonia; the development of acute myocardial infarction which caused the death of the patient was noted in 1 (0.4%) patient; pulmonary thromboembolism which led to death occurred in 1 (0.4%) case.

*The frequency of late surgical complications made up 3.3%:* in 4 (1.6%) patients a residual cavity of the liver was diagnosed, suppuration of the residual cavity was observed in 2 (0.8%) cases, postoperative ventral hernia was developed in 1 (0.4%) patient, acute adhesive intestinal obstruction was developed in 1 (0.4%) case. Thus, clinical treatment results analysis of patients in the control group showed that the frequency of postoperative complications was quite high (18.9%). Mortality in this case made up 1.2%.

We conducted a critical analysis of postoperative complications in the control group, the purpose of which was to identify existing shortcomings and to eliminate them. As the analysis of the results showed, one of the main reasons for the development of postoperative complications was the incomplete preparation of the surgeon for surgical intervention, inadequate intraoperative processing of EC, and low antiparasitic effectiveness of the agents used to treat the residual cavity. We carried out bacteriological crops to clarify the role of microbial flora on the results of treatment.

These studies were carried out before (at the time of puncture of EC and obtaining echinococcal fluid) and after treatment of the residual cavity of the liver (RCL) (after treatment of RCL before capitonage). Analysis of bacterial crops showed that after treatment of RCL, the level of both aerobic and anaerobic cultures was not decreased, especially from the initial level. The remaining bacterial focus contributed to the development of various infectious complications. Analysis of the lethal outcome against the background of the biliary peritonitis development showed that suturing of the large fistulas does not allow to get adequate tightness, and when tightness was achieved the risk of its failure development was high.

We have developed a system for assessing the severity of surgical interventions in LE. This scale included 7 main criteria: the number of cysts; the presence of combined injury of other organs; localization of cysts by liver segments; features of localization of cysts; the presence of LE complications; diameter of cysts; concomitant pathology that affects the technical aspects of surgical intervention. Each criterion was conditionally divided into three gradations: light, moderate and severe. Depending on the combination of different gradations of the severity criteria, all operations at LE were divided into three degrees. A "light" surgical intervention was considered in the presence of "light" criteria of severity or their combination with at least one criterion of "medium" severity; "medium" severity - in the presence of "light" criteria or their combination with criteria of "medium" severity or a combination of "light" and "medium" criteria of severity with at least one criterion of "severe" degree; "severe" severity - with various combinations of "light" and "medium" in combination with at least 2 "severe" criteria of severity. All this contributed to the fact that, based on a retrospective analysis of the control group results, we created a system for the quantitative assessment of preparedness - the surgeon's rating. At a general rating of up to 3.4 points, the surgeon does not have the right to independently perform the operation; at a rating from 3.5 to 4.3 points, the surgeon can independently perform operations of the "light" degree and the operation of "medium-severe" degree together with the surgeon of a higher rating; at a rating from 4.4 to 10.5 points, the surgeon can independently perform "medium-severe" operations with a surgeon of lower professional training, and with a surgeon of a higher rating he can perform "severe" operations; and finally, a surgeon with a rating of 10.6 points or more can perform any surgical intervention at LE.

When a diameter of the bile fistula was 5 mm or more, in the presence of inflammation, infiltration or calcification of tissues around the fistula, with a central localization of the fistula, we proposed a new method for closing it. After common echinococectomy, a trapezoidal flap was cut from a removed fibrous capsule. On the wall of the fistulous opening, along its circumference, at a distance of 2-3 mm from each other, sutures were applied to which the top of the flap was sewn. When tightening the sutures, the fistulous opening was closed with a flap in the form of an airtight



patch which provided sufficient reliability of the sutures.

We proposed the use of an electrolysis aqueous solution (EAS) of sodium hypochlorite for intraoperative treatment of the cavity of the removed EC. We conducted screening studies in the concentration range from 0.1 to 0.8% with a processing time of 1 to 30 minutes to study the antiparasitic effect of EAS of sodium hypochlorite. The conducted studies have shown that treatment with 0.8% solution for 4 minutes, 0.4% and 0.6% solutions for 5 minutes had the highest antiparasitic effect. Morphological studies of the chitin and fibrous membranes, liver parenchyma showed that the safest treatment is 0.4% EAS of sodium hypochlorite for 5 minutes.

Based on the foregoing points, we proposed a tactic for the surgical treatment of LE which consisted of a differentiated approach to the choice of a surgical team, the use according to the indications of our proposed technical working-out for echinococectomy, intraoperative treatment with EVR of sodium hypochlorite, which along with antiparasitic action had a high antimicrobial efficacy which became especially relevant for complicated EC, in particular at suppuration of cysts.

### 3. Results

The proposed therapeutic tactics was used in 116 patients of the main group. 24 of them had a complicated course of the disease, 92 – uncomplicated one. After examination and preoperative preparation 112 patients were performed

elective surgery; 3 patients with a rupture to the bile ducts and phenomena of obstructive jaundice were performed an emergency-delayed surgery after RPCG with EPST; 1 patient was operated on an emergency basis when EC was ruptured into the free abdominal cavity.

According to our system, in 61 ( $52.6 \pm 4.6\%$ ) cases surgical intervention was rated as "light", in 36 ( $31.0 \pm 4.3\%$ ) - as "moderate-severe" and in 19 ( $16.4 \pm 3.4\%$ ) - as "severe". There were 131 ( $53.9 \pm 3.2\%$ ;  $t = 0.235$ ), 74 ( $30.5 \pm 3.0\%$ ;  $t = 0.112$ ) and 38 ( $15.6 \pm 2.3\%$ ;  $t = 0.179$ ) observations in the control group respectively. The absence of a statistically significant difference in the frequency of surgical interventions by their severity in clinical groups indicates the representativeness of the comparative studies.

The overall frequency of early postoperative surgical complications was 4.3%. Seroma of the postoperative wound was most often observed, the frequency of which was 1.7% (2 cases). Suppuration of the postoperative wound was noted in 1 (0.9%) patient. Bile leakage was noted in 1 (0.9%) observation. Bleeding from the abdominal cavity on the 2nd day after echinococectomy of the liver and dissection of adhesions with recurrent echinococcosis was noted in 1 (0.9%) case. Conducted conservative hemostatic therapy was ineffective. The patient was reoperated. In a comparative aspect, the incidence of early surgical complications in the main group significantly decreased relative to the control group from  $9.9 \pm 1.9\%$  to  $4.3 \pm 1.9\%$  ( $t = 2.072$ ).

Table 3. Clinical results in the compared groups

Indices	Control group		Main group		t-Student
	n	%	n	%	
<b>Early surgical complications</b>	<b>24</b>	<b>9.9±1.9</b>	<b>5</b>	<b>4.3±1.9*</b>	2.072
Seroma of postoperative wound	8	3.3±1.1	2	1.7±1.2	0.942
Suppuration of postoperative wounds	5	2.1±0.9	1	0.9±0.9	0.955
Bile duct drainage	4	1.6±0.8	1	0.9±0.9	0.662
External bile fistula	3	1.2±0.7	0	0	1.743
Biliary peritonitis	2	0.8±0.6	0	0	1.420
Subphrenic abscess	1	0.4±0.4	0	0	1.002
Bleeding to abdominal cavity	0	0	1	0.9±0.9	1.004
Early adhesive intestinal obstruction	1	0.4±0.4	0	0	1.002
<b>General complications</b>	<b>14</b>	<b>5.8±1.5</b>	<b>5</b>	<b>4.3±1.9</b>	0.603
Reactive pleuritis	5	2.1±0.9	0	0*	2.259
Postoperative pneumonia	7	2.9±1.1	4	3.4±1.7	0.283
Acute myocardial infarction	1	0.4±0.4	1	0.9±0.9	0.473
Pulmonary thromboembolism	1	0.4±0.4	0	0	1.002
<b>Late surgical complications</b>	<b>8</b>	<b>3.3±1.7</b>	<b>2</b>	<b>1.7±1.2</b>	0.942
Development of residual cavity	4	1.6±0.8	1	0.9±0.9	0.662
Suppuration of the residual cavity	2	0.8±0.6	0	0	1.420
Postoperative ventral hernia	1	0.4±0.4	1	0.9±0.9	0.473
Acute adhesive intestinal obstruction	1	0.4±0.4	0	0	1.002
<b>Total</b>	<b>46</b>	<b>18.9±2.5</b>	<b>12</b>	<b>10.3±2.8*</b>	2.269
Lethality	3	1.2±0.7	0	0	1.743



The total frequency of general complications in the postoperative period in the main group was 4.3%. The development of postoperative congestive pneumonia was noted in 4 (3.4%) cases. The development of acute myocardial infarction against the background of existing CHD in the early postoperative period was noted in 1 (0.9%) patient. There were no significant differences between the clinical groups in a comparative aspect, the frequency of general postoperative complications in the main group slightly decreased relative to the control group from  $5.8 \pm 1.5\%$  to  $4.3 \pm 1.9\%$  ( $t = 0.603$ ). In the late postoperative period, the complication rate was 1.7%. In 1 (0.9%) patient with a giant LE complicated by a rupture into the abdominal cavity, a residual liver cavity was developed in the postoperative period. A ventral hernia was developed in 1 (0.9%) case 1 year after surgery. There were no cases of relapse. A statistically insignificant decrease in late postoperative complications from  $3.3 \pm 1.7\%$  to  $1.7 \pm 1.2\%$  was noted in the main group relative to the control group. There were no lethal outcomes in the main group, but in a comparative aspect with the control group, where the mortality rate was  $1.2 \pm 0.7\%$ , there was no statistically significant difference ( $t = 1.743$ ) (Tab. 3).

An analysis of treatment results inpatients of the control group showed that it was necessary to continue the scientific search in terms of justifying a differentiated approach to choosing a surgical team depending on the severity of the upcoming operation and the preparedness of the surgeon. It is necessary to improve the technical aspects of surgical interventions for giant cysts located in the posterior segments of the liver, to modernize approaches to the elimination of large biliary fistulas, to develop new ways for achieving intraoperative aseptism with minimal aggression on liver tissue.

#### 4. Discussion

The analysis of the clinical treatment results of patients in the control group showed that the incidence of postoperative complications was 18.9%, mortality - 1.2%. Our results treatment of patients with EP completely correlate with the data of Agaev R.M. (2001), Wafin A.Z. (2002), Zhuravlev V.A. (2004), which indicate that the incidence of postoperative complications ranges from 4.8% to 9.7%, with a total mortality rate reaching 1% [7-9]. It should be noted that the relatively high frequency of postoperative complications is due to tactical approaches to the treatment of LE. These authors adhere resection methods of treatment (pericystectomy, economical liver resection, anatomical liver resection). Many domestic researchers (Akmedov R.M., 2003; Karimov Sh.I., 2006), like us, consider echinococectomy with the implementation of various methods of the residual liver cavity capitonnage as the main method of treatment. Their results are approximately

identical to ours (the incidence of postoperative complications ranges from 5.2 to 5.9%, mortality - from 0.6 to 0.9%) [10-11].

As Lebedev N.V. (2007) has shown in his research, the high incidence of postoperative complications is due to difficulties in diagnosing complicated forms of the disease, the lack of objective criteria for determining the severity of an upcoming operation, the presence of errors and complications in the surgical treatment of LE [12]. Given this fact, Lokhvitsky V.S. (1991) believes that improving of surgical treatment results largely depends on an adequate approach in assessing the severity of the patients' condition, a rating approach to surgical intervention [13-14].

Gaybatov S.P. (2006) in his studies proved a direct dependence of the infectious complications frequency from the residual cavity of the liver (RCL) on the level of microbial contamination. The incidence of RCL suppuration at bacterial contamination of echinococcal fluid in 103-104 CFU / ml is 5.4% and at dissemination of 107-108 CFU / ml - 64.8% [15]. Intraoperative RCL treatment is advisable at complicated forms of LE. Electrolysis aqueous solution (EAS) obtained by electrochemical oxidation, in particular sodium hypochlorite, have found increasing application in medicine for recent years. As it has been shown by Petrosyan's E.A. (1991) research, during blood electrolysis in the form of an intermediate product, sodium hypochlorite is formed which has an evident antibacterial effect, a sharp increase of bacteria sensitivity to antibiotics, a disinfectant action [16].

We developed quantitative criteria for evaluating a surgeon's rating, adequate methods for assessing the severity of surgical interventions at LE and indications for a particular surgical team to perform various surgical interventions were determined by conducting statistical studies, depending on the severity of the upcoming operation. We have chosen EAS of sodium hypochlorite, which has a number of properties that fully meets our requirements for intraoperative treatment of RCL. Our experimental studies have revealed the antiparasitic properties of EAS of sodium hypochlorite, once again have proved the high antimicrobial effectiveness of this antiseptic and morphological studies have proved its safety.

Of course, our studies do not completely solve the problem of LE surgical treatment. Currently, it is necessary to continue the search for ways to improve the results of surgical treatment of echinococcosis. It is necessary to improve methods for early diagnostics of the disease, prevention of relapse, to reduce the frequency of complicated forms. Existing accesses to various segments of the liver need technical improvement. The search for tools that can achieve high anti-parasitism and reduce microbial contamination with minimal aggression on the liver tissue is needed. The use of video endoscopic interventions for LE requires the development of treatment standards.



## 5. Conclusions

At the traditional treatment of LE, the overall incidence of postoperative complications was 18.9%, mortality - 1.2%. The analysis revealed that the unsatisfactory treatment results were due to the lack of a differentiated approach to the choice of surgical team depending on the severity of the upcoming operation and the preparedness of the surgeon, the presence of technical shortcomings in surgical interventions with a high risk of developing inconsistency of sutures of sutured large biliary fistulas, the need to develop new ways to achieve intraoperative aparasitism with minimal aggression on the liver tissue.

Determining the level of the surgeon's preparedness allows to have a differentiated choice of the surgical team depending on the severity of the upcoming operation.

The proposed set of treatment measures for LE allows to increase the efficiency of intraoperative treatment of the residual cavity, to improve the technical aspects of surgical intervention and helps to reduce the frequency of postoperative complications from 18.9% to 10.3%, postoperative mortality - from 1.2% to 0%.

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