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Clinical and Surgical Study of Cystic Echinococcosis of the Liver in Children: A Comparative Analysis of Traditional and Modern Treatment Methods

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Abstract: The study is dedicated to analyzing the treatment outcomes of 153 children with cystic echinococcosis of the liver at the Specialized Pediatric Surgical Clinic of Samarkand State Medical University (2006–2017). The patients were divided into a control group (2006–2011, n=82) and a main group (2012–2017, n=71) to compare traditional and modern surgical methods. The main group was treated using topical minilaparotomy, cyst processing with 80% glycerol, low-frequency ultrasound cavitation, express diagnostics, and albendazole chemoprophylaxis. This approach eliminated postoperative complications (0% vs. 12.2% in the control group), halved blood loss, and prevented recurrences over a 15-year follow-up period. The results confirm the high efficacy of the proposed approach in pediatric surgery.

Keywords: cystic echinococcosis, children, minilaparotomy, low-frequency ultrasound cavitation, albendazole, chemoprophylaxis, recurrence.

Relevance

Cystic echinococcosis of the liver remains a significant health issue in endemic regions around the world, including Central Asia [1, 2, 7]. In children, the disease is characterized by a high frequency of complications (such as suppuration and cyst rupture) and recurrence development [4, 8, 10]. Traditional treatment methods, including laparotomy with cyst treatment using formalin, often result in postoperative complications in up to 20% of cases and recurrence rates of 10% to 15% [3, 5, 11]. In contrast, modern approaches, including minimally invasive access and albendazole chemoprophylaxis, have shown better outcomes [2, 6, 9].

Aim of the Study

To compare the effectiveness of traditional and modern methods in the treatment of hepatic echinococcosis in children, by assessing both immediate and long-term treatment outcomes.

Materials and Methods

The study was conducted at the Specialized Pediatric Surgical Clinic of Samarkand State Medical University. The subjects of this research were 153 pediatric patients aged 3 to 18 years diagnosed with hepatic echinococcosis, who received inpatient treatment between 2006 and 2017. Additionally, 129 of these patients (84.3%) were followed up over a long-term period of up to 15 years. Among the 153 children, 9 had recurrent echinococcosis and were re-operated at our clinic. All patients underwent comprehensive clinical, laboratory, and instrumental evaluations.

Based on the surgical treatment approach, the patients were divided into two groups.

- The **control group** included 82 patients who were treated from 2006 to 2011.
- The **main group** consisted of 71 patients treated from 2012 to 2017.

Table 1. Age Distribution of Operated Patients by Group

Age Group	Main Group (n=71)	Control Group (n=82)	Total (n=153)
3–6 years	4 (5.6%)	7 (8.5%)	11 (7.2%)
6–10 years	34 (47.9%)	34 (41.5%)	68 (44.4%)
10–18 years	33 (46.5%)	41 (50%)	74 (48.4%)

As shown in Table 1, most patients in both groups were aged 6–10 and 10–18 years (44.4% and 48.4%, respectively), with no significant age differences between the groups.

Both groups had a male predominance: 53.5% males and 46.5% females in the main group, and 54.9% males and 45.1% females in the control group.

Table 2. Number of Surgeries for Patients with Isolated and Combined Hepatic Echinococcosis

Patient Group	Disease Distribution	Total
	Isolated	Combined
Main	61 (85.9%)	10 (14.1%)
Control	70 (85.4%)	12 (14.6%)
Total	131 (85.6%)	22 (14.4%)

Note: Among the 22 patients with combined hepatic echinococcosis, 24 pulmonary echinococcectomies were performed.

As shown in Table 2, there were no statistically significant differences between the groups regarding the number of operations performed for isolated and combined hepatic echinococcosis.

In 22 patients, liver echinococcosis was accompanied by pulmonary echinococcosis, with bilateral pulmonary involvement noted in 2 cases. Thus, 177 echinococcectomies were performed on the 153 patients: 153 liver surgeries and 24 lung surgeries. In both groups, patients with solitary echinococcosis predominated over those with multiple echinococcosis (66.7% vs. 33.3%), and patients with uncomplicated cases predominated over complicated ones (71.9% vs. 28.1%).

Therefore, both groups were comparable and showed no significant differences in baseline characteristics.

Surgical Treatment Methods

In the **control group**, the surgical approach followed this standard method:

- Laparotomy
- Identification of the echinococcal cyst
- Puncture at the thinnest point of the fibrous capsule
- Aspiration of cyst contents
- Opening of the fibrous capsule
- Removal of the chitinous membrane
- Treatment of the residual cavity with 2% formalin solution
- In cases of suppuration, additional irrigation with 96% ethanol

- Obliteration of the residual cavity by inverting the edges of the fibrous capsule inward according to the clinic's technique
- Layered closure of the surgical wound

If suppuration or biliary fistulas were present, a drainage tube was placed in the residual cavity.

Albendazole chemoprophylaxis was not administered to patients in the control group postoperatively.

In the **main group**, a differentiated approach was used in selecting the surgical tactic. The choice of surgical access was based on ultrasonographic findings, taking into account the number, location, and size of the cysts. Topical minilaparotomy or minithoracotomy was performed accordingly.

For uncomplicated echinococcal cysts, the following procedure was used:

- Topical minilaparotomy
- Identification of the echinococcal cyst
- Careful isolation using gauze pads soaked in 80% glycerol heated to 70°C
- Puncture of the cyst at the thinnest fibrous capsule point
- Aspiration of the fluid contents
- Injection of 80% heated glycerol (70°C) into the cyst cavity with 1–2 minutes exposure
- Aspiration of the treated fluid
- Antiparasitic opening of the fibrous capsule
- Drying of the residual cavity with gauze
- Repeat glycerol treatment with exposure
- Express microscopic evaluation of antiparasitic effectiveness
- Once effectiveness was confirmed, obliteration of the residual cavity using the clinic's method (inward inversion of the fibrous capsule edges)
- Layered closure of the surgical wound

All patients in the main group received postoperative outpatient albendazole chemoprophylaxis.

Modern technologies used during echinococcectomy in the main group included:

- The Covidien Force FX electrocautery unit, which ensured effective hemostasis and minimized tissue trauma
- Absorbable suture materials, promoting faster healing and reduced risk of complications

The residual cavity was eliminated by inverting the fibrous capsule edges along with adjacent liver tissue inward, forming a fold ("knee-like duplication") on which interrupted sutures were applied.

Table 3. Average Laparotomy Incision Length During Hepatic Echinococcectomy

Type of Incision	Control Group (n=82)	Main Group (n=71)
Right subcostal	16.9 ± 0.17 cm	*10.8 ± 0.21 cm ($p_1 < 0.001$)
Upper midline	12.7 ± 1.2 cm	**8.5 ± 0.44 cm ($p_2 < 0.01$)

Notes:

- *$p_1 < 0.001$: Significant difference in right subcostal incision length between groups
- **$p_2 < 0.01$: Significant difference in upper midline incision length between groups

As shown in Table 3, the average incision length during topical minilaparotomy in the main group was significantly shorter than that in the control group undergoing traditional laparotomy. This shorter incision resulted in less tissue trauma and reduced intraoperative blood loss.

By implementing topical minilaparotomy and modern techniques such as:

- Electrocoagulation with the Covidien Force FX device (providing reliable hemostasis and minimal tissue damage)
- Use of absorbable sutures (promoting faster healing and reducing complications),

the intraoperative blood loss in the main group was reduced by 50% compared to the control group.

For topical minithoracotomy in the main group, the average incision length was 5.25 ± 0.18 cm, which was also significantly shorter than the 8.58 ± 0.57 cm used for standard thoracotomy in the control group.

Table 4. Immediate Postoperative Outcomes of Surgical Treatment for Hepatic Echinococcosis in Children

Complications and Hospital Stay	Main Group (n=71)	Control Group (n=82)
Wound suppuration	–	8 (9.8%)
Exudative pleuritis	–	1 (1.2%)
Suppuration of the residual cavity	–	1 (1.2%)
Total complications	–	**10 (12.2%)**
Postoperative hospital stay (days)	**9.1 ± 0.2***	**11.3 ± 0.4**

*Note: $p < 0.001$ — statistically significant reduction in hospital stay in the main group

As shown in Table 4, the control group experienced 12.2% postoperative complications, including wound infections, exudative pleuritis, and suppuration of the residual cavity.

In contrast, the main group had no postoperative complications, which can be attributed to the improved surgical strategy. Additionally, the average hospital stay was significantly reduced from 11.3 ± 0.4 days in the control group to 9.1 ± 0.2 days in the main group.

Table 5. Long-Term Outcomes of Hepatic Echinococcosis Treatment in Both Groups

	Recurrent Echinococcosis		Residual Echinococcosis	
	Main Group (n=60)	Control Group (n=69)	Main Group (n=60)	Control Group (n=69)
Absolute (abs.)	–	9	–	1
Percentage (%)	0%	13%	0%	1.4%

Note: One patient in the control group had both residual and recurrent echinococcosis.

Among the 129 patients who were followed up long-term (60 in the main group, 69 in the control group), recurrences of the disease were observed in 9 patients (13%) from the control group. Of these:

- 7 were re-operated in the main group
- 2 were re-operated in the control group

Additionally, 1 patient from the control group had both residual and recurrent echinococcosis.

Importantly, no recurrences were observed in the main group during the entire follow-up period of up to 15 years.

Conclusion

Thanks to a differentiated approach to intraoperative antiparasitic treatment of echinococcal cysts and their fibrous capsules, as well as:

- Express diagnostics of antiparasitic effectiveness,
- Postoperative outpatient albendazole chemoprophylaxis,

there were no postoperative recurrences of hepatic echinococcosis in the main group during the entire 15-year observation period. This demonstrates the high efficacy of the proposed treatment method.

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