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Liver Echinococcosis - A Single-Center Retrospective Study

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Abstract

BACKGROUND/AIMS: Liver echinococcosis, endemic to Mediterranean and livestock-farming regions, is characterized by hydatid cyst formation, primarily affecting the liver. Surgical management remains the primary treatment for large or complex cysts. The study aimed to evaluate surgical outcomes, complications, and recurrence rates associated with the Papadimitriou procedure, hepatic resections, and splenectomy in patients with liver echinococcosis at a single center.

MATERIALS AND METHODS: A retrospective analysis was conducted on 144 patients who underwent surgical treatment for liver echinococcosis over 13 years. Patients were divided into two groups: those undergoing urgent surgeries and those undergoing elective surgeries. Data on cyst localization, surgical approach, postoperative complications, albendazole use, and outcomes were analyzed.

RESULTS: Among the 144 patients, 75% had right-lobe cysts and 25% had left-lobe involvement. The Papadimitriou procedure was performed in 88.9% of cases, and 33.6% of cases required biliostasis management. Cholecystectomy was performed in 17.4% of patients and segmental hepatic resection in 2.1%. Elective surgery accounted for 91% of cases. Postoperative complications (subphrenic abscess, hemorrhage, biliary leakage) each occurred in 0.7% of cases. Albendazole was administered postoperatively to 18.8% of patients. The mean hospital stay was 10.8 days.

CONCLUSION: The Papadimitriou procedure demonstrated excellent outcomes with low morbidity and recurrence rates, particularly when combined with postoperative albendazole therapy. Early surgical intervention and comprehensive postoperative care are essential for achieving optimal treatment outcomes.

Keywords: Liver echinococcosis, hydatid cyst, Papadimitriou, liver resection, single center

INTRODUCTION

Liver echinococcosis, also known as hydatid disease of the liver, is a zoonotic parasitic infection caused by Echinococcus granulosus. The disease remains endemic in regions with close contact between livestock and dogs, with the highest prevalence reported in the Mediterranean, the Middle East, South America, and other areas where extensive farming is practiced.[1] Human infection occurs through ingestion of parasite eggs, usually via food or water contaminated with dog feces. After ingestion, the larvae (oncospheres) hatch in the intestine, penetrate the intestinal wall, and spread through the portal circulation, most commonly reaching the liver. The liver is involved in approximately 75% of cases, followed by the lungs. Hydatid liver cysts often remain asymptomatic for long periods and are frequently discovered incidentally on imaging. When symptoms occur, they generally include vague abdominal discomfort or right upper quadrant pain and occasionally a palpable abdominal mass.[2] In one clinical series, abdominal pain was reported in 87% of patients, hepatomegaly or an abdominal mass in 60%, and approximately 11% were asymptomatic. Acute complications, such as rupture of a cyst into the peritoneal cavity or biliary tree, or secondary infection of the cyst, can present with severe abdominal pain or jaundice and carry significant risks, including anaphylaxis, and therefore require prompt intervention. Management of hepatic hydatid cysts depends on cyst size, location, symptoms, and the presence of complications.

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Small, asymptomatic cysts may be managed conservatively with antiparasitic therapy, such as albendazole or mebendazole, along with careful observation.[3] Percutaneous aspiration techniques, such as puncture, aspiration, injection, re-aspiration, have emerged as an option for selected uncomplicated cysts. However, for large cysts (>5-10 cm) or complicated cases, surgical intervention remains the definitive treatment, providing immediate parasite eradication and preventing potentially serious sequelae.[4] Surgical approaches for hepatic hydatid disease range from conservative, cyst-directed procedures to radical hepatic resections. The primary objectives are complete parasite eradication, preservation of maximal functional liver tissue, and minimization of operative morbidity. A widely employed conservative technique is the Papadimitriou procedure, which involves partial cystectomy (partial pericystectomy or cyst unroofing), removing the cyst contents and the superficial cyst wall, while leaving the deeper pericystic tissue, which is adherent to vital structures, intact.[5] Adjunctive measures, including the use of scolicidal agents, closure of biliary communications, and omentoplasty, are employed to sterilize the cyst and manage the residual cavity. This organ-preserving approach aims to minimize operative risk while effectively treating the disease. In contrast, radical hepatic resections, such as segmentectomy or lobectomy, involve the removal of the cyst along with the surrounding liver tissue. Although radical surgery may reduce recurrence by ensuring the complete elimination of parasitic elements, it is associated with higher morbidity and a significant loss of functional hepatic parenchyma. Such procedures are typically reserved for giant cysts, deeply located lesions, or cases in which extensive involvement of a hepatic lobe makes conservative management impractical or unsafe.[6] Hydatid cysts can also involve other organs, with the spleen third-most commonly affected site, accounting for only 0.5-4% of cases. In instances of multisystem involvement, splenectomy may be required to achieve complete disease control. Despite advances in pharmacologic therapy, surgery remains the mainstay of treatment for hepatic hydatid disease, especially in endemic regions. The choice between conservative cystectomy and radical resection continues to be debated and should be individualized according to cyst characteristics, patient factors, and available resources.[7,8]

This study aims to evaluate the outcomes, complications, and recurrence rates of the Papadimitriou partial cystectomy, compared with those of hepatic resections. Furthermore, it assesses the role of adjunctive albendazole therapy and seeks to provide additional insight into the efficacy, safety, and optimal surgical strategies for the management of hepatic echinococcosis, particularly in resource-limited settings.

MATERIALS AND METHODS

Study Design and Patients

A retrospective, descriptive study was conducted, that included all patients who underwent surgical treatment for hepatic hydatid cysts at our hospital between 2013 and 2025. A total of 144 patients with imaging-confirmed hepatic echinococcosis were included. Patients were retrospectively evaluated for age, gender, cyst location, imaging methods and laboratory tests used for cystic echinococcosis diagnosis, treatment administered, and presence of relapse or complications. The study was approved by the Ss. Cyril and Methodius University in Skopje Faculty of Medicine for Human Research Ethics Committee (approval number: 03-4312/2, date: 14.07.2025).

Imaging and Diagnosis

Abdominal ultrasonography, computed tomography (CT), or magnetic resonance imaging (MRI) were used depending on cyst location. Ultrasonography, capable of detecting lesions as small as 1 cm, served as the initial diagnostic modality, while contrast-enhanced CT, which had 100% sensitivity for hepatic hydatids, provided detailed anatomical information to guide surgical planning (Figure 1). Cysts were classified according to the Gharbi/ World Health Organization criteria, using imaging features to aid treatment selection. Hydatid serology, primarily using enzyme-linked immunosorbent assay[9], was performed when available and was positive in most cases; however, treatment proceeded in patients with imaging-consistent findings regardless of serological results.

Patient Groups

Patients were divided into two groups: elective surgeries (n=131, 91%) and urgent surgeries (n=13, 9%). Elective cases included patients with sizable cysts that were identified during routine workup or that caused chronic symptoms. Urgent cases required emergency intervention because of complications such as cyst rupture into the peritoneal cavity or biliary tree; secondary infection resulting in sepsis or peritonitis; or severe compression of the inferior vena cava or biliary obstruction leading to jaundice.

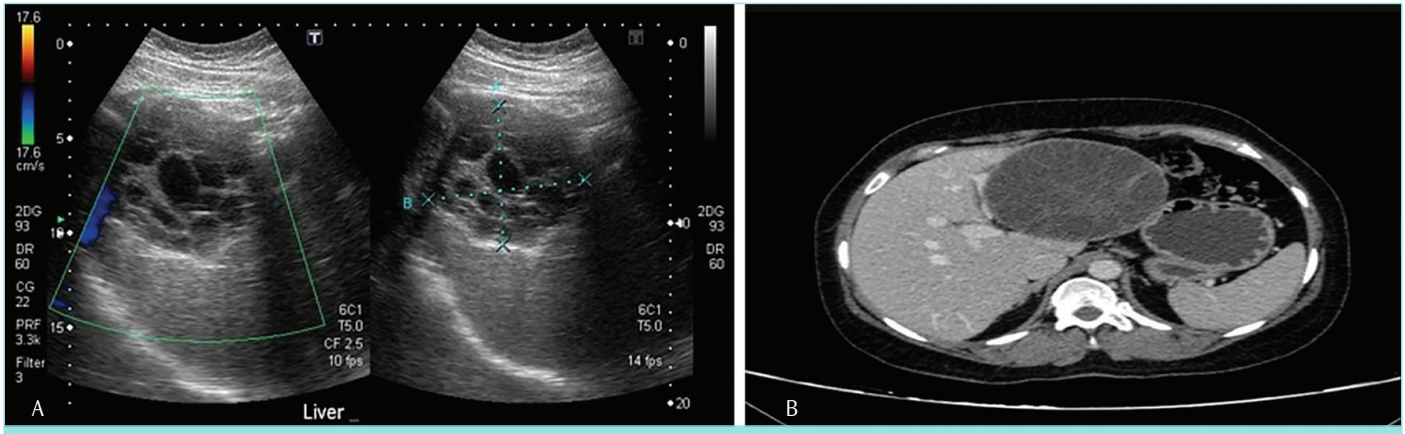

Figure 1. Imaging of hepatic hydatid cysts. (A) Abdominal ultrasonography demonstrates a cystic lesion with daughter cysts in the right hepatic lobe. (B) Contrast-enhanced computed tomography demonstrates the same lesion with a well-defined cyst wall and internal septations.

Preoperative Evaluation and Optimization

All patients underwent preoperative assessment with abdominal ultrasonography and contrast-enhanced CT. Preoperative optimization of comorbidities was performed as needed. Routine preoperative albendazole therapy was not administered; however, a short (1-2-week) course was initiated in selected urgent cases or situations with a high risk of intraoperative cyst dissemination to sterilize cyst contents and reduce the risk of spillage. Broad-spectrum antibiotic prophylaxis was administered perioperatively, particularly in patients with infected cysts, along with standard venous thromboembolism prophylaxis.

Surgical Techniques

All surgical procedures were performed via open laparotomy under general anesthesia. Strict intraoperative precautions were employed to prevent spillage of hydatid fluid and to minimize the risk of secondary cyst implantation or an anaphylactic reaction. The operative field was isolated with gauze packs soaked in scolicidal solutions (20% hypertonic saline or povidone-iodine) before cyst manipulation.

Selection of Surgical Approach

The choice between partial cystectomy and radical hepatic resection was based on cyst characteristics and operative considerations:

- Papadimitriou's partial cystectomy was the first-line technique for the majority of cases, particularly for cysts that were superficial, peripherally located, or that did not replace an entire hepatic segment. This approach was also preferred for single or multiple cysts that could be safely managed without significant loss of liver tissue.

Radical hepatic resection (wedge resection or segmentectomy) was reserved for cases with:

- Giant cysts replacing an entire segment or lobe.
- Complex, clustered cysts where multiple cystectomies would be unsafe or technically challenging.
- Suspicion of co-existing malignancy requiring en bloc resection.

Surgical steps:

- Cyst aspiration followed by injection of a scolicidal agent, allowing sufficient time for parasitic sterilization.
- Cystotomy with evacuation of cyst contents, including daughter cysts and hydatid sand, with careful removal of the germinal membrane.
- Partial pericystectomy, excising the superficial cyst wall while preserving fibrous pericyst adherent to major vascular or biliary structures to avoid hemorrhage or bile duct injury.
- Inspection and closure of biliary communications with fine absorbable sutures to ensure biliostasis.
- Management of the residual cavity by omentoplasty (placement of a greater omentum flap) or capitonnage in smaller, superficial cavities.

A closed-suction drain was placed in the residual cavity or subhepatic space in all cases. Cholecystectomy was performed concurrently in 25 patients (17.4%) when indicated by cyst proximity, coexisting cholelithiasis, or the need for biliary exploration. In cases of biliary involvement, the common bile duct was explored, debris was removed, and T-tube drainage was placed when necessary. No splenectomies were performed in this cohort, though institutional protocols dictated that any identified splenic hydatid cysts would be treated with splenectomy or partial splenectomy as indicated.

Postoperative Management and Follow-Up

Following surgery, all patients were monitored in the surgical ward, with intensive care admission for 24-48 hours in cases of emergency surgery or intraoperative complications. Abdominal drains were maintained until output was minimal and non-bilious. Serial liver function tests and complete blood counts were obtained to detect bile leakage, hemorrhage, or infection. Any suspected bile leak was further evaluated using imaging and, if necessary, endoscopic retrograde cholangiopancreatography with biliary stenting. Broad-spectrum intravenous antibiotics were administered perioperatively and continued postoperatively in cases involving ruptured or infected cysts. Postoperative albendazole therapy was administered to 27 patients (18.8%), typically initiated within the first postoperative week once oral intake was tolerated, at a dose of approximately 10 mg/kg/day for 1-3 months. Indications included intraoperative spillage, multiple cysts, and residual cysts in other organs. Structured follow-up included clinical examination and imaging at 1 month, 6 months, and annually thereafter for a minimum of 2 years, with a mean follow-up of 3.5 years (range 2-10 years). Abdominal ultrasonography was the primary imaging modality, with CT or MRI used for suspicious lesions or detailed anatomical assessment. Patient compliance was high, with less than 5% lost to follow-up; outcomes for these patients were supplemented with data from outpatient records and telephone interviews. Recurrence was defined as the appearance of a new cystic lesion at a previous surgical site or elsewhere in the liver, confirmed by imaging and clinical correlation.

Statistical Analysis

Descriptive statistics were used to summarize patient demographics, cyst characteristics, surgical procedures, complications, and outcomes. Categorical variables (e.g., postoperative complications, recurrence) were expressed as frequencies and percentages. Continuous variables (e.g., length of hospital stay) were presented as means. Comparative analyses of categorical outcomes between groups (e.g., complications with Papadimitriou vs. other techniques, recurrence in albendazole-treated vs. untreated) were performed using Fisher's exact test because of the small number of events. Continuous variables for which subgroup data were available were compared using Independent Samples t-tests. A p-value <0.05 was considered statistically significant. All statistical analyses were performed using SPSS for Windows, version 25.0 (IBM Corp., Armonk, NY, USA).

RESULTS

A total of 144 patients underwent surgical treatment for liver echinococcosis during the study period. The cohort included both sexes, predominantly from rural, livestock-raising areas, reflecting the endemic nature of hydatid disease in our region. Demographic and baseline characteristics of the patients are presented in Table 1.

Clinical Presentation

The most common symptoms were upper abdominal pain or discomfort (approximately 80% of patients) and palpable mass or hepatomegaly (20% of patients). A minority were diagnosed incidentally on imaging. Thirteen patients (9%) presented emergently with complications such as cyst rupture or acute cholangitis.

Postoperative Outcomes

- **Mortality:** 0% (no intraoperative or postoperative deaths)
- **Morbidity:** Overall complication rate was 2.1%, with three major complications:
  - Subphrenic abscess (0.7%)
  - Intra-abdominal bleeding (0.7%)
  - Biliary leakage (0.7%)
- Minor wound infections occurred in a few cases (approximately 2-3%)

Hospital stay: 5-20 days (mean 10.8 days)

All complications were successfully managed without permanent sequelae.

Albendazole Use and Recurrence

- Postoperative albendazole was administered to 27 patients (18.8%) and was typically initiated once oral intake resumed (10 mg/kg/day for 1-3 months).
- Recurrence was observed in 2 patients (1.4%); neither had received postoperative albendazole. No recurrences occurred in the albendazole-treated group (0%).

These results suggest that postoperative albendazole therapy may significantly reduce recurrence risk.

Overall, our center achieved high success rates, with low morbidity (2.1%), zero mortality, and very low recurrence (1.4%), which demonstrates the efficacy of organ-preserving surgery (Papadimitriou procedure) for the majority of hepatic hydatid cyst cases. The outcomes are summarized in Table 2.

Comparative analysis showed that all postoperative complications (n=3) occurred in patients undergoing the Papadimitriou procedure (2.3%), while no complications were observed in patients treated with other surgical techniques; this difference was not statistically significant (Fisher's exact test, p=1.0). Recurrence was observed only in the untreated group (2/117, 1.7%), whereas no recurrences occurred among patients who received postoperative albendazole (0/27, 0%). This difference was not statistically significant (Fisher's exact test, p=1.0).

Cyst Characteristics

- **Location:** Right lobe involvement in 75% (113 patients), left lobe in 25% (36 patients), with some patients having bilobar disease.
- **Size:** Cyst diameters ranged from 3-20 cm (mean, approximately 8-10 cm).

Table 1. Demographic and baseline characteristics of patients

Parameter	Value
Total patients	144
Age, mean ± SD (range)	42.3±15.7 years (18-78)
Gender, n (%)	Male: 82 (57%) Female: 62 (43%)
Residence, n (%)	Rural: 110 (76%) Urban: 34 (24%)
Symptom presentation, n (%)	Abdominal pain/discomfort: 115 (80%) Palpable mass/hepatomegaly: 29 (20%) Asymptomatic/incidental: 16 (11%)

SD: Standard deviation.

Table 2. Summarized key operative and outcome data

Parameter	Value
Total patients	144
Elective surgeries	131 (91%)
Urgent/emergency surgeries	13 (9%)
Papadimitriou partial cystectomy	128 (88.9%)
Hepatic resections (wedge/segmental)	3 (2.1%)
Cholecystectomy	25 (17.4%)
Biliostasis required (suturing bile ducts)	43 (33.6%)
Subphrenic abscess (complication)	1 (0.7%)
Intra-abdominal bleeding (complication)	1 (0.7%)
Biliary leakage (complication)	1 (0.7%)
Overall major complication rate	2.1%
Mortality	0%
Hospital stay range (mean)	5-20 days (mean 10.8 days)
Postoperative albendazole use	27 patients (18.8%)
Recurrence rate	2 patients (1.4%)
Recurrence in the albendazole-treated group	0%

- **Multiplicity:** Approximately 15% had multiple hepatic cysts. Surgical procedures Papadimitriou's partial cystectomy was performed in 128 patients (88.9%), with preservation of maximal liver parenchyma.
- Hepatic resections were necessary in only 3 patients (2.1%) and involved wedge or segmental resections.
- Cholecystectomy was performed in 25 patients (17.4%), primarily to facilitate exposure or address coexistent cholelithiasis.
- Biliostasis was achieved in 43 cases (33.6%) by suturing biliary communications identified within the cyst cavity.
- Among the operations, 131 (91%) were elective, while 13 (9%) were urgent due to complications such as intrabiliary rupture, peritonitis following free rupture, or cyst infection.

DISCUSSION

This 13-year single-center study provides valuable insights into the outcomes of different surgical strategies for hepatic echinococcosis. The most salient finding is the excellent efficacy of the Papadimitriou partial cystectomy technique, which was performed in approximately 89% of

patients. This organ-sparing procedure achieved cure (no recurrence) in the vast majority of patients, with minimal morbidity (approximately 2% complication rate) and no mortality.[10] By contrast, formal liver resection was required in only 2.1% of cases, suggesting that even large or multiple cysts were usually manageable without sacrificing major portions of the liver. Our findings support a conservative surgical approach. Careful prevention of cyst spillage and secure maintenance of biliostasis are essential for achieving excellent outcomes. Even giant cysts (>15-20 cm) were successfully managed through careful evacuation and partial cystectomy with omentoplasty, preserving liver parenchyma and minimizing the risks of major hepatectomy.[11]

Preservation of liver tissue is particularly important in regions where patients may have underlying liver disease or multiple cysts affecting both lobes. The Papadimitriou technique not only preserves functional hepatic units but also reduces the incidence of serious complications compared with radical surgery. In our cohort, postoperative bleeding and bile leakage occurred in only two patients following partial cystectomy, demonstrating that even these risks are minimal when meticulous surgical technique is applied.[12] Comparisons in the literature, such as the study by Shi et al.[13], suggest that while radical surgery may offer a slight reduction in recurrence, it comes with a higher complication rate (e.g., bile leakage and longer hospital stays). Our findings support a conservative surgical approach. With careful measures to prevent cyst spillage and to secure biliostasis, we achieved an exceptionally low recurrence rate, comparable to radical surgery, but with fewer risks. Biliostasis was critical to this success, as one-third of the cysts had biliary communications that required suturing, thereby keeping the bile leak rate below 1%. These results emphasize that conservative surgery is not a "minimal or simple procedure", it requires thorough inspection, evacuation, and careful handling of the cyst cavity.

The cyst distribution in our series (right lobe: 79%; left lobe: 25%; some overlap) aligns with previous reports and reflects the hemodynamic dominance of the right portal vein. Bilobar involvement (approximately 3-4%) posed additional challenges but was successfully managed with multiple cystectomies in a single session, avoiding major resections or liver transplantation. Emergency operations accounted for 9% of cases and were performed for acute complications such as rupture or cholangitis. Despite these risks, outcomes were excellent with no mortality, highlighting the importance of prompt and effective management. The predominance of elective surgeries (91%) underscores the value of early intervention to prevent cyst rupture or biliary complications. Postoperative recurrence was extremely low (~1.4%), far below the 5-30% reported in the literature. Key factors contributing to this success included careful intraoperative handling to prevent spillage, thorough evacuation of cyst contents, and adjuvant postoperative albendazole therapy administered to 18.8% of patients, particularly in high-risk cases. Notably, none of the albendazole-treated patients experienced recurrence, consistent with evidence that antiparasitic therapy significantly reduces recurrence risk.[14] Compared with other published series, our morbidity (2.1%) and mortality (0%) rates are notably lower, as many reports cite morbidity rates of 10-20% and mortality rates of 1-3%. While limitations exist, including the lack of randomization between surgical methods and incomplete long-term follow-up for all patients, the large sample size and consistent methodology strengthen the validity of our findings. Although open surgery predominated in our series, largely due to cyst characteristics and the study period, the potential role of laparoscopic hydatid surgery warrants consideration. Evidence suggests that laparoscopic partial cystectomy can be safe and effective in selected patients, offering reduced morbidity and a faster recovery. Gradual adoption of minimally invasive techniques, particularly for moderate-sized, anterior cysts, could further improve outcomes. Although splenic hydatid disease was rare in our cohort, management principles remain important. Splenectomy remains the treatment of choice for splenic hydatids, and synchronous surgery may be considered when cysts are present in both the liver and spleen.

Study Limitations

This study has several limitations that should be acknowledged. It was conducted retrospectively at a single tertiary surgical center. Although this design ensured uniformity in surgical approach, perioperative management, and follow-up protocols, it also limits the generalizability of our results. The favorable outcomes observed may reflect the experience of a specialized surgical team and the regional characteristics of the patient population. Moreover, retrospective data collection carries an inherent risk of selection bias, as only patients who underwent surgery were included, potentially excluding those managed conservatively or at other institutions. Future multicenter, prospective studies with larger and more diverse populations are warranted to validate these findings and assess their applicability to different clinical settings.

CONCLUSION

Hydatid cysts of the liver remains a significant surgical challenge in endemic areas, although excellent outcomes can be achieved with appropriate management. Our single-center, 13-year experience demonstrates that the Papadimitriou partial cystectomy is a highly effective first-line surgical approach for hepatic echinococcosis. This organ-preserving technique resulted in near-zero recurrence and minimal complications, confirming its role in conserving liver tissue without compromising cure rates. Hepatic resection is rarely necessary and should be reserved for selected cases where conservative surgery is impractical, such as giant or anatomically complex cysts. When indicated, limited resections can yield favorable results but carry greater operative risks and must be weighed carefully against potential benefits. Adjunctive perioperative albendazole therapy markedly improved outcomes in our cohort, with no recurrences observed among treated patients, supporting its routine use where not contraindicated. Our results provide a benchmark for conservative surgical management of hepatic echinococcosis. Surgeons in endemic regions should be proficient in performing partial cystectomy and should reserve liver resection for exceptional cases. A strategy combining organ-preserving surgery with targeted adjunctive therapy achieves high cure rates with low morbidity. This approach, exemplified by the Papadimitriou procedure with perioperative albendazole, offers patients the best chance of complete recovery while preserving maximal liver function. Future efforts should emphasize early detection programs and the broader adoption of minimally invasive techniques to further enhance outcomes. Overall, our findings reinforce the growing body of evidence that conservative, organ-sparing strategies should be considered the standard of care for hepatic hydatid disease.

MAIN POINTS

- Early elective intervention for sizable hydatid cysts simplifies surgery and reduces emergency presentations. Screening and early referral should be emphasized in endemic areas.
- The Papadimitriou partial cystectomy (cyst unroofing with cavity obliteration) is validated as an effective standard technique, achieving radical clearance of parasites while preserving liver function.
- Meticulous surgical technique, including preventing spillage, securing biliostasis, performing omentoplasty, and diligent postoperative care, including imaging follow-up and chemoprophylaxis, is critical to successful outcomes.
- Minimally invasive surgery represents a promising frontier, where expertise is available, laparoscopic management can further reduce patient morbidity and hospital costs, without deviating from the core principles of the open Papadimitriou method.

ETHICS

Ethics Committee Approval: The study was approved by the Ss. Cyril and Methodius University Faculty of Medicine for Human Research Ethics Committee (approval number: 03-4312/2, date: 14.07.2025).

Informed Consent: Retrospective study.

Footnotes

Authorship Contributions

Surgical and Medical Practices: O.K., Concept: I.K., Design: I.K., Data Collection and/or Processing: O.K., I.K., Analysis and/or Interpretation: O.K., I.K., Literature Search: I.K., Writing: I.K.

DISCLOSURES

Conflict of Interest: No conflict of interest was declared by the authors.

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