ORIGINAL RESEARCH PAPER
Volume - 15 | Issue - 03 | March - 2026 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

# CURRENT APPROACHES FOR SURGICAL MANAGEMENT IN HEPATIC HYDATID DISEASE: A COMPARATIVE STUDY OF DIFFERENT TREATMENT MODALITIES

General Surgery

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## ABSTRACT

**Background:** Hepatic hydatid disease, caused by *Echinococcus granulosus*, is a common surgical condition in endemic regions, with the liver being the most frequently affected organ . Surgery remains the mainstay of treatment, with open and laparoscopic approaches currently practiced. This study aimed to compare treatment modalities based on cyst characteristics, cystobiliary communication, postoperative bile leak, intraoperative time, and hospital stay. **Methods:** A retrospective observational case series was conducted at L.N. Medical College and Research Center, Bhopal, from September 2024 to November 2025, including 25 patients undergoing surgical management . Inclusion criteria were patients aged 18–65 years with diagnosed hepatic hydatid cyst receiving perioperative albendazole for 6 weeks . Twelve patients underwent laparoscopic surgery and thirteen underwent open surgery . Data were analyzed using Chi-square/Fisher's exact test for categorical variables and Student's t-test for continuous variables, with $p < 0.05$ considered statistically significant. **Results:** Laparoscopic group (n=12) included 5 conservative and 7 radical procedures, while the open group (n=13) included 6 conservative and 7 radical procedures . Cystobiliary communication was observed in 16.7% (2/12) of laparoscopic cases and 38.5% (5/13) of open cases . Laparoscopic surgery demonstrated reduced operative time and shorter hospital stay. Postoperative biliary leak was more frequent in the open group. Major cysts were predominantly located in the right lobe and centrally placed. **Conclusion:** Laparoscopic surgery is safe, feasible, and associated with reduced morbidity and faster postoperative recovery. Although cyst size and anatomical location influence surgical selection, most hepatic hydatid cysts can be effectively managed laparoscopically, making it the preferred treatment modality in the majority of cases.

## KEYWORDS

Hepatic hydatid disease, Laparoscopic surgery, Open surgery, Cystobiliary communication, Postoperative bile leak, Surgical outcomes.

## INTRODUCTION

Hepatic hydatid disease is a significant surgical problem in endemic regions and continues to pose diagnostic and therapeutic challenges in developing countries. It is caused by *Echinococcus granulosus*, a cestode parasite that primarily affects the liver following ingestion of ova through contaminated food or water[1]. The liver acts as the first filter in the portal circulation and is therefore the most commonly involved organ[2]. Although the disease may remain asymptomatic for prolonged periods, progressive enlargement of the cyst can lead to pressure symptoms, biliary obstruction, rupture into the biliary tract or peritoneal cavity, and secondary infection[3]. With increasing globalization and migration, hydatid disease is also being encountered more frequently in non-endemic regions[4].

Surgery remains the cornerstone of treatment for hepatic hydatid disease[5].The principal goals of surgical management are complete evacuation of the parasitic contents, prevention of spillage and dissemination, management of the residual cavity, and identification and control of cystobiliary communication[6].Over the decades, multiple surgical modalities have evolved, broadly categorized into open and laparoscopic approaches. The choice of technique depends on cyst size, number, anatomical location, proximity to major biliovascular structures, and the presence of complications such as cystobiliary communication[7].

Traditionally, open surgery has been considered the standard approach, particularly for large, centrally located, deeply intraparenchymal cysts or those associated with significant biliary communication[8]. Open procedures allow direct access to the cyst cavity, secure control of vascular and biliary structures, and management of complex anatomy. However, open surgery is associated with longer operative time, increased blood loss, postoperative pain, wound-related complications, and prolonged hospital stay[9].

With advancements in minimally invasive techniques, laparoscopic management of hepatic hydatid cysts has gained increasing acceptance. Initially limited to simple drainage procedures, laparoscopic surgery now includes conservative procedures such as cystectomy and partial pericystectomy, as well as radical procedures including total cystectomy in selected cases[10]. The laparoscopic approach offers several advantages, including magnified visualization of the cyst cavity, precise identification of biliary leaks, reduced postoperative pain, lower wound infection rates, decreased blood loss, and shorter hospital stay[11]. Earlier concerns regarding intraperitoneal spillage, recurrence, and technical difficulty have gradually reduced with increasing surgical expertise and improved instrumentation[12].

Cyst characteristics play a crucial role in detering the operative strategy. Larger cysts are more likely to be associated with elevated liver enzymes, biliary tract dilatation, and cystobiliary communication[3]. Central cysts near the hepatic hilum are technically more challenging and often incline surgeons toward open procedures, whereas peripheral cysts are more amenable to laparoscopic management[13]. Furthermore, the presence of cystobiliary communication significantly influences perioperative planning, as undetected leaks may result in postoperative biliary fistula[14]. Endoscopic retrograde cholangiography (ERC) has an important diagnostic and therapeutic role in selected cases, particularly when jaundice, cholangitis, or radiological biliary dilatation is present[3].

## MATERIALS AND METHODS

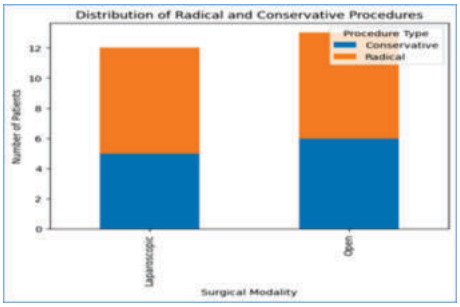
This retrospective observational case series was conducted at L.N. Medical College and Research Center, Bhopal, over a period from September 2024 to November 2025. A total of 25 patients with radiologically and serologically confirmed hepatic hydatid cyst who underwent surgical management were included in the study. Inclusion criteria comprised patients aged between 18 and 65 years, presence of single or multiple hepatic hydatid cysts, and those receiving perioperative albendazole therapy. Exclusion criteria included inoperable cases managed conservatively, patients treated exclusively with PAIR (Puncture-Aspiration-Injection-Reaspiration), isolated extrahepatic hydatid disease without liver involvement, and patients with severe comorbid conditions contraindicating surgery. Demographic, clinical, radiological, intraoperative, and postoperative data were retrieved from institutional medical records. Statistical analysis was performed using Microsoft Excel. Categorical variables were analyzed using Chi-square test or Fisher's exact test, while continuous variables were compared using Student's t-test. A p-value < 0.05 was considered statistically significant.

**Comparative Profile of All 25 Patients**

| S. No | Age (years) | Sex | Lobe Involved | Segment Involved | Cyst Size(cm) | Number of Cysts | Surgical Modalities | | Operative time (min) | Intra-op spillage | Cystobiliary Communication | Post-op Bile Leak | Hospital Stay (days) | Recurrence |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 32 | F | Right | V ,VI | 8 | Single | Laparoscopic | Partial pericystectomy | 90 | NO | YES | NO | 5 | NO |
| 2 | 45 | M | Right | V,VI,VII | 12 | Single | Open | Total cystectomy | 110 | NO | NO | NO | 7 | NO |
| 3 | 29 | F | Left | IV b | 6 | Single | Laparoscopic | Cystectomy | 80 | NO | NO | NO | 3 | NO |
| 4 | 38 | F | Right | V , VI | 10 | Single | Open | Partial pericystectomy | 150 | NO | YES | YES | 10 | NO |
| 5 | 50 | M | Bilobar | IVa,V ,VI | 14 | Multiple | Open | Cystectomy | 106 | YES | NO | NO | 8 | NO |
| 6 | 41 | F | Right | V | 5 | Single | Laparoscopic | Cystectomy | 35 | NO | NO | NO | 3 | NO |
| 7 | 34 | M | Left | III, IVb | 9 | Single | Open | Partial pericystectomy | 93 | NO | NO | NO | 8 | NO |
| 8 | 60 | F | Right | V,VI,VII | 13 | Multiple | Laparoscopic | Cystectomy | 118 | YES | NO | NO | 6 | NO |
| 9 | 27 | F | Right | V | 5 | Single | Open | Total cystectomy | 60 | NO | NO | NO | 4 | NO |
| 10 | 55 | M | Bilobar | IVa ,V | 11 | Multiple | Open | Partial pericystectomy | 150 | NO | YES | NO | 12 | NO |
| 11 | 39 | F | Right | VI ,VII | 9 | Single | Laparoscopic | Partial pericystectomy | 86 | YES | NO | NO | 5 | NO |
| 12 | 48 | M | Right | VII ,VIII | 10 | Single | Open | Cystectomy | 100 | NO | NO | NO | 6 | NO |
| 13 | 31 | F | Left | III ,IV b | 6 | Multiple | Laparoscopic | Cystectomy | 55 | NO | NO | NO | 4 | NO |
| 14 | 44 | M | Right | V,VI,VII | 12 | Single | Laparoscopic | Cystectomy | 100 | YES | YES | YES | 10 | NO |
| 15 | 36 | F | Right | VI,VII | 8 | Single | Open | Partial pericystectomy | 90 | NO | NO | NO | 7 | NO |
| 16 | 58 | M | Right | V,VI | 15 | Single | Laparoscopic | Cystectomy | 110 | NO | NO | YES | 4 | NO |
| 17 | 26 | F | Right | V | 4 | Single | Laparoscopic | Total cystectomy | 55 | NO | NO | NO | 3 | NO |
| 18 | 40 | M | Left | II ,III | 9 | Single | Open | Total cystectomy | 102 | NO | NO | NO | 5 | NO |
| 19 | 52 | F | Right | V ,VI | 11 | Single | Laparoscopic | Total cystectomy | 98 | NO | NO | YES | 6 | NO |
| 20 | 33 | M | Right | V ,VI | 10 | Single | Open | Partial pericystectomy | 110 | NO | YES | NO | 7 | NO |
| 21 | 47 | F | Right | VII,VIII | 13 | Single | Open | Partial pericystectomy | 150 | NO | NO | NO | 7 | NO |
| 22 | 29 | F | Left | IV b | 5 | Single | Laparoscopic | Cystectomy | 65 | NO | NO | NO | 3 | NO |
| 23 | 61 | M | Right | V,VI,VII | 14 | Multiple | Open | Cystectomy | 160 | NO | YES | YES | 12 | NO |
| 24 | 35 | F | Right | VI ,VII | 8 | Single | Laparoscopic | Total cystectomy | 63 | NO | NO | YES | 6 | NO |
| 25 | 54 | M | Right | VI ,VII | 10 | Single | Open | Total cystectomy | 100 | NO | YES | NO | 11 | NO |

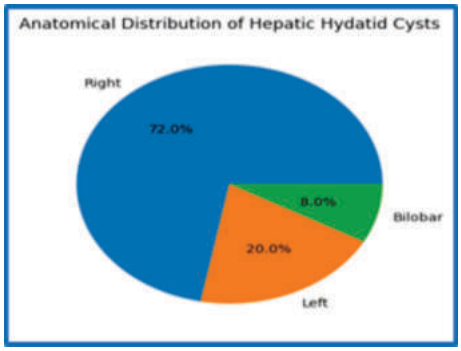
## RESULTS

A total of 25 patients underwent surgical management for hepatic hydatid disease during the study period. The cohort was almost equally distributed between the two treatment modalities to enable a fair comparison. Twelve patients (48%) underwent laparoscopic surgery, while thirteen patients (52%) underwent open surgery (Graph 1: Distribution of Radical and Conservative Procedures)



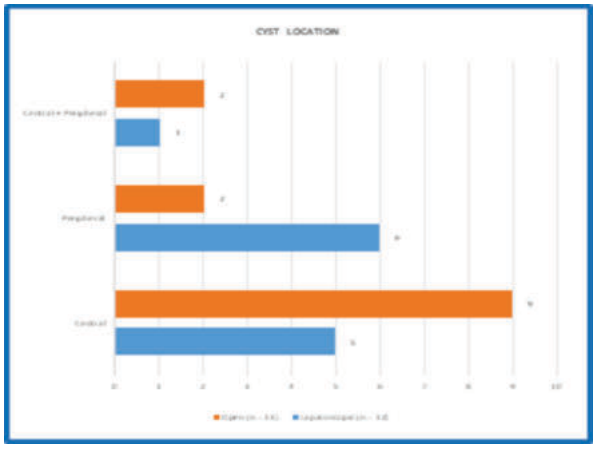

***Graph 1:*** *Distribution of Radical and Conservative Procedures*

Among the laparoscopic group (n = 12), 5 patients (41.7%) underwent conservative procedures and 7 patients (58.3%) underwent radical procedures. In the open group (n = 13), 6 patients (46.2%) underwent conservative procedures and 7 patients (53.8%) underwent radical procedures. (Graph 2: Anatomical Distribution of Hepatic hydatid Cyst)




***Graph 2:*** *Anatomical Distribution of Hepatic hydatid Cyst*

The majority of cysts were located in the right lobe of the liver, with a predominance of centrally situated lesions.(Graph 3: Cyst Location Within the Liver) Central localization was more frequently associated with open surgical intervention, whereas peripheral cysts were more commonly managed laparoscopically. Major cysts were observed predominantly in the right lobe and central segments. However, large cysts were also successfully excised laparoscopically, reflecting growing surgical expertise and improved minimally invasive techniques.

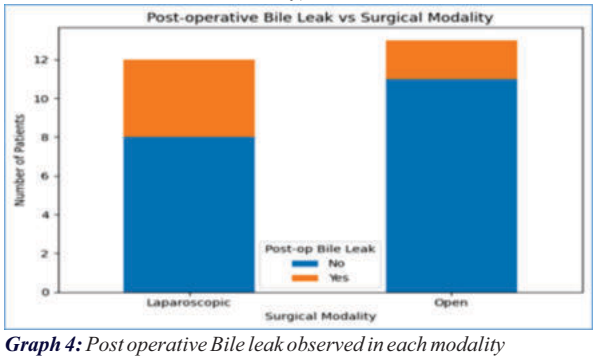



***Graph 3:*** *Cyst Location Within the Liver*

Cystobiliary communication was one of the primary outcome variables assessed. In the laparoscopic group, 2 out of 12 patients (16.7%) demonstrated cystobiliary communication. In contrast, 5 out of 13 patients (38.5%) in the open group had cystobiliary communication.

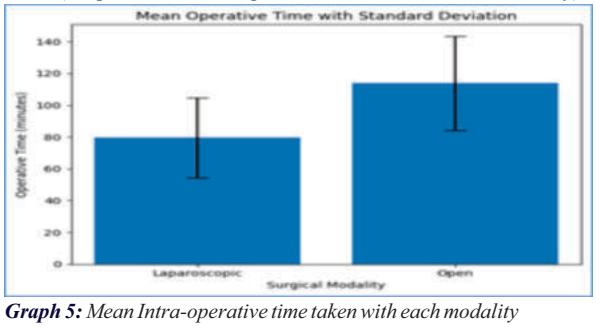
| *Surgical Approach* | *Present* | *Absent* |
|---|---|---|
| *Laparoscopic* | 2 | 10 |
| *Open* | 5 | 8 |

Postoperative bile leak was observed more frequently in the Laparoscopic surgery group. The graphical data indicate that biliary leak incidence was higher in patients undergoing Laparoscopic procedures compared to Open management. (Graph 4: Post operative Bile leak observed in each modality)



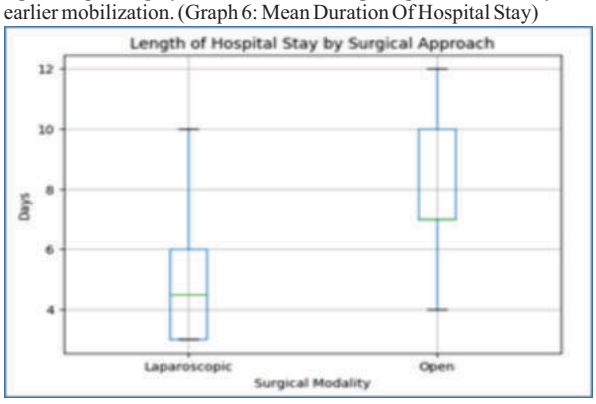

***Graph 4:*** *Post operative Bile leak observed in each modality*

The comparative graph demonstrates reduced intra-operative time in the laparoscopic group compared to the open group. Despite the known steep learning curve associated with laparoscopic hydatid cystectomy, operative duration was shorter in minimally invasive cases. (Graph 5: Mean Intra-operative time taken with each modality)



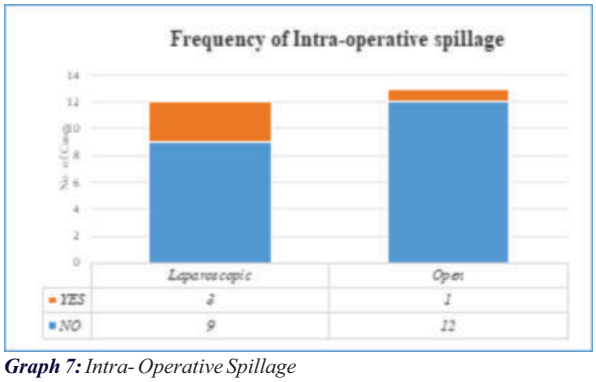

***Graph 5:*** *Mean Intra-operative time taken with each modality*

Duration of hospital stay was significantly shorter in the laparoscopic group as depicted in the graphical analysis. Patients undergoing laparoscopic surgery demonstrated faster postoperative recovery and earlier mobilization. (Graph 6: Mean Duration Of Hospital Stay)




***Graph 6:*** *Mean Duration Of Hospital Stay*

Among 25 cases, intraoperative spillage was observed in 4 patients (16%), with 3 cases in the laparoscopic group and 1 case in the open group. Overall incidence was low in both modalities, indicating effective intraoperative precautionary measures. (Graph 7: Intra-Operative Spillage)




***Graph 7:*** *Intra- Operative Spillage*

**Operative And Radiological Findings**

Axial CT image demonstrates a well-defined cystic lesion in the right lobe of the liver with internal septations, consistent with a hydatid cyst.

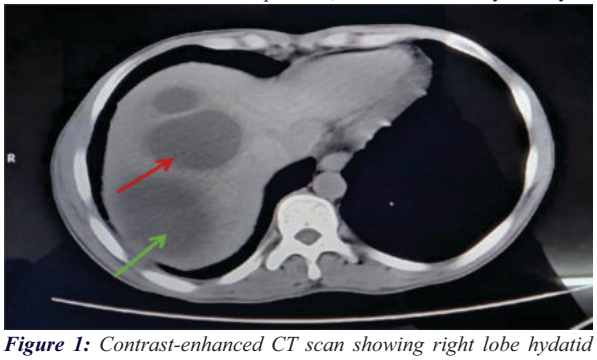


***Figure 1:*** *Contrast-enhanced CT scan showing right lobe hydatid cysts of variable sizes (Red and Green)*

The image reveals a large multiloculated cyst occupying a significant portion of the liver, correlating with operative findings.

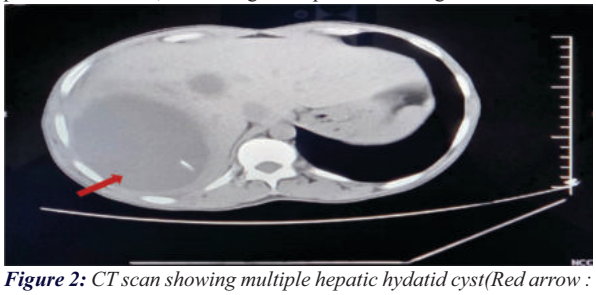


***Figure 2:*** *CT scan showing multiple hepatic hydatid cyst(Red arrow :*

*Largest cyst of size ~12cm in diameter in right lobe)*

Axial CT scan demonstrating a large multiloculated cystic lesion in the right hepatic lobe with internal septations (daughter cysts), producing mass effect on adjacent liver parenchyma, characteristic of a complicated hydatid cyst of the liver.

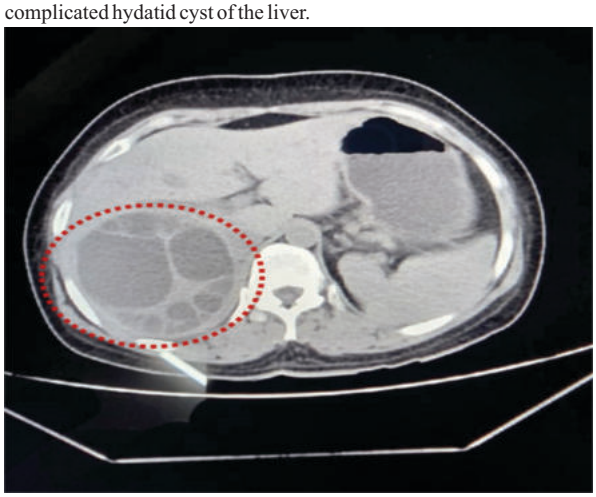


***Figure 3:*** *CT scan showing multiloculated cyst (Encircled in red) in right hepatic lobe*

The image demonstrates evacuated hydatid cyst contents collected in a surgical bowl, showing translucent daughter cysts and hydatid fluid characteristic of *Echinococcus* infection.

***Figure 4:*** *Gross hydatid cyst contents after evacuation*

This image depicts the thick, pearly white laminated membrane being separated from the pericyst during open surgery, a hallmark feature of hepatic hydatid disease.

***Figure 5:*** *Intraoperative appearance of laminated membrane*

The photograph shows an opened hepatic hydatid cyst cavity filled with thick purulent material, suggestive of secondary infection..

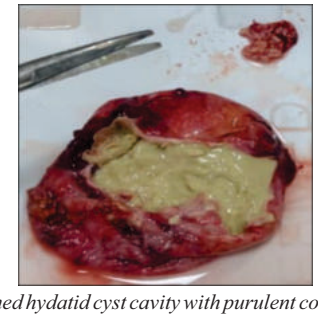


***Figure 6:*** *Opened hydatid cyst cavity with purulent contents*

This image illustrates the operative field during radical excision, with complete mobilization of the cyst and surrounding pericystic tissue from the liver parenchyma

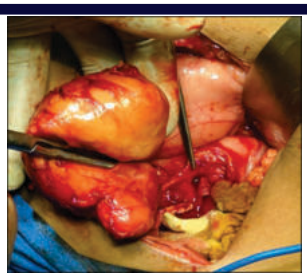


***Figure 7:*** *Intraoperative view during radical cystopericystectomy*

Intra-operative view of Laparoscopic Cystectomy of liver showing a tense hydatid cyst on the surface. The cyst is isolated with gauze packs and being punctured for controlled aspiration to prevent spillage.

***Figure 8:****Intra operative laparoscopic image of hydatid cyst of liver*

***Figure 9 and 10:****Removal of the laminated membrane (germinal layer) using forceps, completing the evacuation of cyst contents prior to inspection of the residual cavity.*

**DISCUSSION**

This retrospective observational study of 25 patients compares laparoscopic (n = 12) and open (n = 13) surgical management of hepatic hydatid disease.Nearly equal group distribution ensured a balanced comparison of operative time, cystobiliary communication, postoperative bile leak, and hospital stay.

Cyst characteristics significantly influenced surgical approach. Most cysts involved the right lobe and were centrally located, consistent with reported epidemiology where right lobe involvement ranges from 55–80% According to Bayrak et al., centrally located and large cysts favor open surgery due to proximity to major vascular and biliary structures. However, in our series, selected large and centrally placed cysts were successfully managed laparoscopically, reflecting growing expertise and improved minimally invasive techniques.

Cystobiliary communication was observed in 16.7% of laparoscopic cases and 38.5% of open cases . The higher incidence in the open group likely reflects selection bias, as larger and more complex cysts were preferentially treated with open surgery. Literature reports intrabiliary rupture rates between 2% and 42%, with larger cysts demonstrating higher risk (Ramia et al., Kayaalp et al.) . Our findings align with this, reinforcing cyst size as a predictor of biliary communication and postoperative complications.

Operative time was shorter in the laparoscopic group, consistent with reported outcomes showing significantly reduced operative duration in minimally invasive surgery . Enhanced magnification enables precise dissection, accurate identification of biliary radicals, and controlled evacuation of cyst contents. Blood loss was also lower in laparoscopic cases, likely due to the tamponade effect of pneumoperitoneum and improved visualization.

Postoperative bile leak was more frequent following open procedures, correlating with increased cystobiliary communication. Laparoscopy allows direct intracavitary inspection and suturing under

magnification, potentially reducing fistula formation. Similar findings have been reported in comparative studies.

Hospital stay was shorter in the laparoscopic group, reflecting benefits of minimally invasive surgery including reduced pain, fewer wound complications, and faster recovery . This translates into improved patient turnover and decreased healthcare burden.

Both conservative (cystectomy, partial pericystectomy) and radical procedures were performed in comparable proportions . Evidence suggests no significant difference in recurrence between conservative and radical techniques when meticulous surgical technique and postoperative albendazole therapy are applied . In our series, recurrence and mortality were negligible in both groups.

Laparoscopic surgery demonstrates reduced operative time, lower blood loss, decreased morbidity, and shorter hospital stay with comparable safety and recurrence outcomes. Open surgery remains important for very large, deeply situated, or technically complex cysts. Surgical approach should be individualized based on cyst size, location, biliary communication, and surgeon expertise, with laparoscopy emerging as the preferred modality in most patients with hepatic hydatid disease.

## CONCLUSION

The present comparative analysis of laparoscopic and open surgical management of hepatic hydatid disease demonstrates that minimally invasive surgery is a safe, feasible, and effective modality in appropriately selected patients. Based on operative outcomes and comparative assessment, laparoscopic surgery showed clear advantages in terms of reduced operative time, lower intraoperative blood loss, decreased postoperative morbidity, and shorter hospital stay, while maintaining comparable recurrence rates and zero mortality. These findings support the expanding role of laparoscopy as a standard surgical approach in hepatic hydatid disease.

Cyst size and location are major factors in operative planning. Larger, centrally located cysts have higher rates of cystobiliary communication and technical difficulty, which explains the greater biliary involvement in patients undergoing open surgery in our series.ERCP plays an important adjunctive role in managing biliary communication and has expanded the scope of laparoscopic surgery.Conservative and radical procedures show comparable recurrence rates when performed meticulously with albendazole therapy. Laparoscopy offers better visualization, less pain, and faster recovery, while open surgery remains indicated for very large, deeply located, posterior segment cysts or complex anatomy. Surgical management should be individualized.

In conclusion, laparoscopic surgery should be considered the preferred approach in the majority of patients with hepatic hydatid disease due to its safety profile, reduced morbidity, and enhanced recovery benefits. Open surgery remains indispensable in technically challenging cases. With increasing surgical expertise and integration of endoscopic adjuncts, the scope of laparoscopic management continues to expand, reinforcing its position as the contemporary standard of care.

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