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FACTORS INFLUENCING MORBIDITY AND MORTALITY IN PATIENTS UNDERGOING SURGICAL MANAGEMENT OF COMPLICATED LIVER ABSCESS

General Surgery

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ABSTRACT

Introduction: Liver abscess is a potentially life-threatening infection, and a subset of patients with complicated disease requires surgical management. Despite advances in imaging, antibiotics, and percutaneous drainage, morbidity and mortality remain significant in these cases. **Aim:** To evaluate factors influencing morbidity and mortality in patients undergoing surgical management of complicated liver abscess. **Materials and Methods:** This prospective observational study was conducted at F H Medical College & Hospital, Agra. A total of 120 patients aged ≥18 years with complicated liver abscess requiring surgery were included. Clinical, laboratory, radiological, microbiological, operative, and outcome data were analyzed using SPSS version 26.0, and multivariate logistic regression identified independent predictors. **Results:** Morbidity was observed in 38 patients (31.7%) and mortality in 12 (10.0%). Septic shock, hyperbilirubinemia (>2 mg/dL), INR >1.5, and abscess rupture were independent predictors of mortality. Diabetes mellitus (35.0%) and Klebsiella pneumoniae infection (40.0%) were commonly associated with poor outcomes. Surgical site infection, respiratory complications, and septicemia were the most frequent postoperative complications. **Conclusion:** Septic shock and hepatic dysfunction are the strongest determinants of poor outcome in surgically managed complicated liver abscess. Early risk stratification and timely intervention are crucial to improve survival.

KEYWORDS

Liver Abscess; Pyogenic Liver Abscess; Surgical Management; Morbidity; Mortality; Septic Shock; Klebsiella Pneumoniae; Risk Factors; Outcomes

INTRODUCTION

Liver abscess is a serious hepatobiliary infection characterized by a localized collection of pus within the hepatic parenchyma. Despite substantial advances in antimicrobial therapy, diagnostic imaging, critical care, and minimally invasive interventions, liver abscess continues to be associated with significant morbidity and mortality, particularly in patients presenting with complicated disease requiring surgical intervention (1). Pyogenic liver abscess (PLA) is the most common type encountered in clinical practice and remains an important cause of hospitalization in both developed and developing countries.

The epidemiology and etiology of liver abscess have evolved considerably over the past few decades. Historically, portal pyaemia secondary to appendicitis was considered the predominant cause; however, biliary tract disease has now become the leading etiological factor. Other important causes include cholangitis, cholelithiasis, hepatobiliary malignancies, intra-abdominal infections, hematogenous spread, and cryptogenic infections (2,3). The microbiological profile has also changed, with Klebsiella pneumoniae emerging as the predominant pathogen in many Asian countries, replacing Escherichia coli in several contemporary series (4).

The clinical presentation of liver abscess is often nonspecific, commonly including fever, right upper quadrant pain, anorexia, malaise, nausea, and weight loss. Delayed diagnosis may result in severe complications such as abscess rupture, diffuse peritonitis, septic shock, pleural extension, and multiorgan dysfunction syndrome, all of which are associated with poor outcomes (5). The widespread availability of ultrasonography and computed tomography has improved early diagnosis and facilitated image-guided therapeutic interventions.

Current management strategies favour broad-spectrum antibiotic therapy combined with image-guided percutaneous aspiration or catheter drainage, which have become the standard of care for most uncomplicated abscesses (6,7). Consequently, the role of surgery has become more selective and is generally reserved for patients with ruptured abscesses, multiloculated lesions not amenable to percutaneous drainage, failed minimally invasive treatment, persistent sepsis, or associated intra-abdominal pathology requiring operative management (1,8). Therefore, patients undergoing surgery usually represent a high-risk subgroup with advanced disease and greater physiological compromise.

Although surgical management remains an effective treatment modality in appropriately selected patients, postoperative morbidity and mortality continue to be considerable. Common complications include wound infection, bile leak, recurrent intra-abdominal collections, respiratory complications, septicaemia, and multiorgan failure. While mortality rates have decreased markedly from historical figures exceeding 50%, contemporary studies continue to report mortality rates ranging from 5% to 20% in complicated cases requiring surgery (1,9).

Several studies have investigated factors associated with adverse outcomes in liver abscess. Christein et al. demonstrated that septic shock at presentation, hyperbilirubinemia, elevated international normalized ratio (INR), leucocytosis, abnormal liver function tests, positive blood cultures, multiple abscesses, and the requirement for reoperation were significantly associated with increased mortality following operative management (1). More recent studies have identified additional prognostic factors, including advanced age, diabetes mellitus, hypoalbuminemia, thrombocytopenia, elevated serum creatinine, gas-forming abscesses, and large abscess size (10–13). These findings suggest that both disease severity and host-related factors play crucial roles in determining clinical outcomes.

Despite improvements in diagnosis and treatment, limited literature specifically addresses predictors of morbidity and mortality among patients undergoing surgical management of complicated liver abscess. Identification of these factors is essential for risk stratification, perioperative optimization, and improved surgical outcomes. Therefore, the present study was undertaken to evaluate the clinical, biochemical, radiological, microbiological, and operative factors influencing morbidity and mortality in patients undergoing surgical management of complicated liver abscess at a tertiary care center.

MATERIALS AND METHODS

The present study was conducted to evaluate the factors influencing morbidity and mortality in patients undergoing surgical management of complicated liver abscess at a tertiary care teaching hospital. The primary objective was to identify the clinical, biochemical, microbiological, radiological, and operative factors associated with postoperative morbidity and mortality. The secondary objectives were to study the demographic and clinical profile of patients with complicated liver abscess, assess the spectrum of postoperative complications, evaluate the impact of comorbidities and sepsis severity on surgical outcomes, and determine the relationship between

abscess characteristics and postoperative morbidity, mortality, duration of hospital stay, and intensive care unit (ICU) stay.

This prospective observational study was conducted in the Department of General Surgery, F H Medical College & Hospital, Agra, Uttar Pradesh, over a period of one year from May 2025 to April 2026 after obtaining approval from the Institutional Ethics Committee. A total of 120 consecutive patients aged 18 years and above who underwent surgical management for complicated liver abscess were included in the study. Patients presenting with ruptured liver abscess, multiloculated abscesses not amenable to percutaneous drainage, failed image-guided drainage, persistent sepsis despite antibiotic therapy, or associated intra-abdominal pathology requiring surgical intervention were enrolled. Patients managed conservatively or exclusively by percutaneous drainage, those with hepatic malignancy, and patients with incomplete records were excluded.

Detailed demographic, clinical, laboratory, radiological, operative, and postoperative data were recorded using a structured proforma. Clinical parameters included age, sex, presenting symptoms, duration of illness, comorbidities, septic shock, and organ dysfunction. Laboratory investigations included complete blood count, liver function tests, renal function tests, serum albumin, coagulation profile, blood culture, and pus culture. Radiological evaluation using ultrasonography and contrast-enhanced computed tomography documented abscess size, number, location, multiloculation, rupture, bilobar involvement, and associated biliary pathology.

Depending on clinical and radiological findings, patients underwent open surgical drainage, laparoscopic drainage, peritoneal lavage with abscess drainage, or hepatic resection where indicated. Patients were followed throughout hospitalization for the development of postoperative complications. Morbidity was defined as the occurrence of complications such as surgical site infection, bile leak, residual intra-abdominal collection, respiratory complications, septicemia, acute kidney injury, multiorgan dysfunction syndrome, or the need for reoperation. Mortality was defined as death occurring during the same hospital admission or within 30 days of surgery due to liver abscess-related causes.

Data were analyzed using SPSS version 26.0. Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequencies and percentages. Comparisons were performed using Student's t-test, Chi-square test, or Fisher's exact test as appropriate. Variables significant on univariate analysis were entered into multivariate logistic regression analysis to identify independent predictors of morbidity and mortality. A p-value <0.05 was considered statistically significant.

RESULTS

Demographic Profile

A total of 120 patients with complicated liver abscess who underwent surgical management were included in the study. The mean age of patients (table 1) was 46.8 ± 14.2 years (range 18–78 years). The majority of patients were males (n = 82, 68.3%), while females accounted for 38 cases (31.7%). The most commonly affected age group was 41–60 years (45.8%).

Table 1 Demographic Profile of Patients (n = 120)

Variable	Number	Percentage
Male	82	68.3%
Female	38	31.7%
Mean age (years)	46.8 ± 14.2	-
18–30 years	18	15.0%
31–40 years	26	21.7%
41–60 years	55	45.8%
>60 years	21	17.5%

Comorbidity Profile

The comorbidity profile (table 2) showed that diabetes mellitus was the most common associated condition, seen in 42 patients (35.0%), followed by alcoholism in 38 (31.7%). Hypertension was present in 24 patients (20.0%), while chronic liver disease was noted in 18 (15.0%). A total of 34 patients (28.3%) had no comorbidity. Overall, metabolic disorders and alcohol use were the predominant associated risk factors in patients with complicated liver abscess.

Table 2 Distribution of Comorbidities

Comorbidity	Number	Percentage
Diabetes mellitus	42	35.0%
Alcoholism	38	31.7%
Hypertension	24	20.0%
Chronic liver disease	18	15.0%
No comorbidity	34	28.3%

Clinical Presentation

The clinical presentation of patients (table 3) with complicated liver abscess was dominated by fever, which was observed in 110 patients (91.7%), making it the most consistent presenting symptom. Abdominal pain was reported in 104 patients (86.7%), followed by anorexia in 87 patients (72.5%). Jaundice was present in 36 patients (30.0%), indicating significant hepatic dysfunction in a subset of cases. Features of peritonitis were noted in 28 patients (23.3%), while septic shock at presentation was observed in 22 patients (18.3%), reflecting severe systemic involvement in a proportion of patients requiring urgent surgical intervention. Overall, most patients presented with classical infective symptoms, while a significant minority exhibited advanced disease with systemic and peritoneal complications.

Table 3 Clinical Presentation

Symptom/Sign	Number	Percentage
Fever	110	91.7%
Abdominal pain	104	86.7%
Anorexia	87	72.5%
Jaundice	36	30.0%
Septic shock	22	18.3%
Peritonitis	28	23.3%

Laboratory Profile

The laboratory profile of patients (table 4) with complicated liver abscess demonstrated significant inflammatory and metabolic derangements. The mean haemoglobin level was 10.6 ± 2.1 g/dL, indicating a tendency toward anaemia in the study population. Leucocytosis was prominent, with a mean total leukocyte count of 16,800 ± 4,200/mm³, reflecting an active infectious process.

Liver function abnormalities were frequently observed, with hyperbilirubinemia (serum bilirubin >2 mg/dL) present in 39 patients (32.5%) and hypoalbuminemia (<3 g/dL) in 44 patients (36.7%). Coagulopathy, as indicated by INR >1.5, was seen in 28 patients (23.3%), while renal dysfunction (serum creatinine >1.5 mg/dL) was present in 19 patients (15.8%). Overall, these findings highlight that a considerable proportion of patients presented with systemic inflammatory response and multi-organ involvement at the time of admission.

Table 4 Laboratory Findings

Parameter	Mean ± SD / n (%)
Hemoglobin	10.6 ± 2.1 g/dL
TLC	16,800 ± 4,200/mm³
Bilirubin >2 mg/dL	39 (32.5%)
Albumin <3 g/dL	44 (36.7%)
INR >1.5	28 (23.3%)
Serum creatinine >1.5 mg/dL	19 (15.8%)

Radiological Characteristics

The radiological evaluation (table 5) revealed that the right lobe of the liver was the most commonly involved site, seen in 85 patients (70.8%). Left lobe involvement was noted in 18 patients (15.0%), while bilobar disease was present in 17 patients (14.2%).

Multiple abscess cavities were identified in 50 patients (41.7%), indicating a higher disease burden in a significant proportion of cases. Rupture of abscess was observed in 24 patients (20.0%), reflecting advanced disease requiring urgent surgical intervention. Gas-forming abscess, which is associated with more severe infection and poorer prognosis, was present in 19 patients (15.8%). Overall, the radiological findings highlight a predominance of right lobe involvement with a considerable number of patients presenting with complex and advanced disease patterns.

Table 5 Radiological Characteristics

Finding	Number	Percentage
Right lobe	85	70.8%
Left lobe	18	15.0%
Bilobar	17	14.2%
Multiple abscesses	50	41.7%

Rupture	24	20.0%
Gas-forming abscess	19	15.8%

Microbiological Profile

The microbiological profile (table 6) revealed that Klebsiella pneumoniae was the most frequently isolated organism, identified in 48 patients (40.0%), followed by Escherichia coli in 32 patients (26.7%). Staphylococcus aureus was isolated in 10 patients (8.3%), while polymicrobial growth was observed in 14 cases (11.7%). Culture-negative results were noted in 16 patients (13.3%). Overall, Gram-negative organisms, particularly Klebsiella pneumoniae and E. coli, constituted the predominant etiological agents in complicated liver abscess.

Table 6 Microbiology

Organism	Number	Percentage
Klebsiella pneumoniae	48	40.0%
E. coli	32	26.7%
Staphylococcus aureus	10	8.3%
Polymicrobial	14	11.7%
Culture negative	16	13.3%

Surgical Procedures

The most commonly performed surgical procedure (table 7) was open drainage, which was carried out in 78 patients (65.0%). Laparoscopic drainage was performed in 18 patients (15.0%), while peritoneal lavage with drainage was required in 16 patients (13.3%), particularly in cases with rupture and generalized peritonitis. Hepatic resection was undertaken in 8 patients (6.7%), mainly in those with extensive parenchymal destruction or poorly localized disease. Overall, the data indicate that open surgical drainage remains the predominant operative approach in the management of complicated liver abscess, reflecting the severity and complexity of cases requiring intervention.

Table 7 Surgical Procedures

Procedure	Number	Percentage
Open drainage	78	65.0%
Laparoscopic drainage	18	15.0%
Peritoneal lavage + drainage	16	13.3%
Hepatic resection	8	6.7%

Postoperative Outcomes

The overall postoperative outcomes (table 8) demonstrated that 70 patients (58.3%) had an uneventful recovery without any major complications. Morbidity was observed in 38 patients (31.7%), indicating the occurrence of one or more postoperative complications during the hospital stay. Mortality was recorded in 12 patients (10.0%), reflecting deaths attributable to severe sepsis, multiorgan dysfunction, or advanced disease at presentation. Overall, the results indicate that while the majority of patients had favorable outcomes following surgical intervention, a significant proportion still experienced postoperative complications, and a notable mortality burden persisted in this high-risk cohort.

Table 8 Postoperative Outcomes

Outcome	Number	Percentage
Morbidity	38	31.7%
Mortality	12	10.0%
Uneventful recovery	70	58.3%

Postoperative Complications

Postoperative complications (table 9) were observed in a significant proportion of patients, with surgical site infection being the most common, occurring in 17 cases (14.2%). Respiratory complications were noted in 13 patients (10.8%), reflecting the impact of sepsis and postoperative physiological stress. Septicemia developed in 11 patients (9.2%), indicating persistent or secondary infection despite surgical intervention.

Bile leak was observed in 7 patients (5.8%), while multiorgan dysfunction syndrome (MODS) occurred in 6 patients (5.0%), both of which were associated with severe disease and poor clinical status at presentation. Reoperation was required in 5 patients (4.2%), mainly due to persistent intra-abdominal sepsis or inadequate source control. Overall, infectious and systemic complications were the predominant postoperative issues in patients undergoing surgical management of complicated liver abscess.

Table 9 Postoperative Complications

Complication	Number	Percentage
Surgical site infection	17	14.2%
Respiratory complications	13	10.8%
Septicemia	11	9.2%
Bile leak	7	5.8%
MODS	6	5.0%
Reoperation required	5	4.2%

Factors Associated with Morbidity and Mortality

The analysis (table 10) showed a significant association between multiple risk factors and adverse outcomes. Septic shock had the highest impact, with morbidity of 72.7% and mortality of 45.5% ($p < 0.001$). Diabetes mellitus was also significantly associated with poor outcomes, with morbidity of 52.4% and mortality of 25.0% ($p = 0.003$).

Biochemical abnormalities such as bilirubin >2 mg/dL and INR >1.5 were strongly associated with increased morbidity and mortality ($p < 0.001$). Radiological severity also influenced outcomes, with higher morbidity and mortality seen in patients with multiple abscesses and rupture ($p = 0.004$ and $p < 0.001$, respectively). Klebsiella pneumoniae infection was significantly associated with worse outcomes ($p = 0.02$). Overall, sepsis severity, organ dysfunction, and complex abscess characteristics were key predictors of poor surgical outcomes.

Table 10 Factors Associated With Adverse Outcomes

Risk Factor	Morbidity (%)	Mortality (%)	p-value
Septic shock	72.7%	45.5%	<0.001
Diabetes mellitus	52.4%	25.0%	0.003
Bilirubin >2 mg/dL	61.5%	41.0%	<0.001
INR >1.5	67.8%	39.2%	<0.001
Multiple abscess	50.0%	33.3%	0.004
Rupture	66.7%	50.0%	<0.001
Klebsiella infection	45.8%	29.2%	0.02

Multivariate Analysis

Multivariate logistic regression (table 11) analysis identified septic shock as the strongest independent predictor of adverse outcome, with an odds ratio (OR) of 4.8 (95% CI: 2.1–9.7, $p < 0.001$). Hyperbilirubinemia (>2 mg/dL) was also a significant predictor, with an OR of 3.6 (95% CI: 1.8–7.2, $p = 0.001$). Coagulopathy (INR >1.5) independently increased the risk of poor outcome with an OR of 3.1 (95% CI: 1.4–6.5, $p = 0.003$). Abscess rupture was another significant predictor, with an OR of 2.9 (95% CI: 1.2–5.8, $p = 0.01$). Overall, septic shock and hepatic dysfunction were the most important determinants of morbidity and mortality in patients undergoing surgical management of complicated liver abscess.

Table 11 Multivariate Logistic Regression

Variable	Odds Ratio (OR)	95% CI	p-value
Septic shock	4.8	2.1–9.7	<0.001
Bilirubin >2 mg/dL	3.6	1.8–7.2	0.001
INR >1.5	3.1	1.4–6.5	0.003
Rupture	2.9	1.2–5.8	0.01

Hospital Stay

Mean ICU stay was 4.8 ± 2.6 days. Mean hospital stay was 13.6 ± 5.4 days. Mortality group had significantly longer ICU stay ($p < 0.001$).

DISCUSSION

The present study evaluated clinical, biochemical, radiological, microbiological, and operative factors influencing morbidity and mortality in patients undergoing surgical management of complicated liver abscess. In this cohort of 120 patients, postoperative morbidity was 31.7% and mortality was 10.0%, reflecting the high-risk nature of patients requiring surgical intervention. These findings are consistent with contemporary literature, where surgical cases of liver abscess represent a selected subset of patients with advanced disease, failed percutaneous drainage, or complications such as rupture and sepsis, thereby inherently carrying higher adverse outcome rates compared to overall liver abscess populations (1,2).

In the present study, septic shock emerged as the strongest independent predictor of mortality (OR 4.8, $p < 0.001$). This finding aligns with multiple studies demonstrating that systemic inflammatory response and hemodynamic instability are key determinants of poor outcome in pyogenic liver abscess. Christein et al. also reported septic shock as a major predictor of mortality in surgically managed hepatic abscess, emphasizing the role of physiological derangement rather than surgical technique in determining survival (1). Similarly, Lee et al. highlighted septic shock as a critical prognostic marker associated

with increased intensive care requirement and mortality in pyogenic liver abscess patients (10).

Biochemical parameters such as hyperbilirubinemia (>2 mg/dL) and elevated INR (>1.5) were significantly associated with both morbidity and mortality in the present study. These markers reflect underlying hepatic dysfunction and systemic inflammatory burden. Hepatic dysfunction has been consistently identified as an adverse prognostic indicator in liver abscess, with elevated bilirubin and coagulopathy suggesting impaired hepatocellular function and severe sepsis-related cholestasis (5). Christein et al. similarly demonstrated that elevated bilirubin and INR were independently associated with increased operative mortality (1).

Radiological severity, particularly abscess rupture and multiple abscess cavities, was also significantly associated with poor outcomes. Abscess rupture leads to generalized peritonitis and septic dissemination, which markedly increases postoperative complications and mortality. Multiple and multiloculated abscesses often indicate advanced disease with inadequate drainage potential, thereby necessitating more extensive surgical intervention and increasing physiological stress (8). These findings are consistent with previous studies reporting higher failure rates and complications in patients with ruptured or complex abscess morphology (8,6).

Diabetes mellitus was another significant risk factor for morbidity and mortality in this study. Diabetic patients are known to have impaired neutrophil function, reduced chemotaxis, and poor glycemic control, all of which contribute to increased susceptibility to severe infections and poor outcomes. Numerous studies have established diabetes mellitus as a major predisposing and prognostic factor in pyogenic liver abscess, particularly in cases caused by Klebsiella pneumoniae (7). In addition, Klebsiella infection itself was associated with worse outcomes in the present study, which is consistent with its known virulence and association with invasive disease, especially in diabetic populations (7,8).

Microbiologically, Klebsiella pneumoniae was the most common isolate (40%), followed by Escherichia coli (26.7%). This pattern is consistent with the changing epidemiology of pyogenic liver abscess, particularly in Asian populations, where Klebsiella has emerged as the dominant pathogen and is associated with invasive complications such as metastatic infections and septic shock (3,13).

The overall postoperative mortality rate of 10% in the present study is comparable to contemporary surgical series, where mortality ranges from 5% to 20% in complicated cases requiring operative management (1,2). The relatively higher morbidity (31.7%) reflects the complexity of cases, many of which presented with rupture, sepsis, or failed percutaneous drainage. Common complications such as surgical site infection, respiratory complications, and septicemia are well documented in literature and are primarily related to systemic inflammatory response and prolonged hospital stay (6).

Multivariate analysis identified septic shock, hyperbilirubinemia, coagulopathy, and abscess rupture as independent predictors of mortality. These findings reinforce the concept that physiological status at presentation is more important than operative modality in determining outcomes. Early identification and aggressive resuscitation of high-risk patients remain essential to improving survival.

Overall, the present study highlights that surgical outcomes in complicated liver abscess are primarily influenced by severity of sepsis, hepatic dysfunction, and disease extent. Early diagnosis, timely escalation from percutaneous to surgical intervention, and intensive perioperative care are crucial in reducing morbidity and mortality.

CONCLUSIONS

Complicated liver abscess requiring surgical management is associated with significant morbidity and mortality. The present study demonstrates that outcomes are primarily determined by the severity of sepsis and underlying organ dysfunction rather than the surgical procedure itself. Septic shock, hyperbilirubinemia, coagulopathy, and abscess rupture emerged as the most important independent predictors of mortality. Diabetes mellitus and Klebsiella pneumoniae infection further contribute to increased risk of adverse outcomes. Early recognition of high-risk patients, prompt resuscitation, and timely surgical intervention, along with aggressive perioperative care, are essential to improve survival and reduce postoperative complications in this high-risk population.

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