ORIGINAL ARTICLE

Optimizing Catheter Removal in Amebic Liver Abscess: A Simplified Protocol for Faster Recovery

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Abstract

Introduction: Percutaneous catheter drainage (PCD) is widely used in the management of large amebic liver abscesses (ALA). However, considerable variation exists in catheter removal practices, and concerns regarding residual cavities often result in prolonged catheterization and hospital stay. This study assessed whether an early catheter removal strategy could improve clinical outcomes without increasing complications.

Methods: In this prospective observational study, 40 adult patients with uncomplicated ALA requiring percutaneous drainage were enrolled. Catheter removal was attempted after 72 hours in patients demonstrating sustained clinical improvement, defined by resolution of fever and abdominal pain, declining leukocyte counts, and at least a 50% reduction in abscess cavity volume on ultrasonography. Patients were followed clinically and with serial ultrasound examinations to assess outcomes and the behavior of residual cavities.

Results: The study population was predominantly male (90%), with 62.5% having abscesses larger than 10 cm and 75% involving the right hepatic lobe. Early catheter removal was successfully achieved in 36 patients (90%) without procedure-related complications or mortality. The median duration of catheterization and hospital stay was 3 days each. Residual cavities were frequently observed on follow-up imaging (87.5% at 2 weeks and 82.5% at 1 month) but showed progressive reduction in size over time, decreasing from a mean of 6.5 ± 3.3 cm at discharge to 3.0 ± 1.7 cm at 1 month. Clinical recovery was rapid, with median resolution times of 2 days for fever and 3 days for abdominal pain.

Conclusion: Early removal of percutaneous catheters in patients with uncomplicated amebic liver abscess is safe and effective, significantly reducing catheter duration and length of hospitalization without increasing adverse outcomes. Although residual cavities are common, they regress gradually and do not justify prolonged catheter retention.

Keywords: Amebic liver abscess, Catheter drainage, Residual cavities.

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Introduction

Amebic liver abscess (ALA) represents the predominant extraintestinal manifestation of invasive amebiasis and continues to contribute significantly to morbidity in endemic regions.[1–6] Most patients respond well to antiamebic therapy, with nitroimidazoles such as metronidazole, tinidazole, and satranidazole forming the backbone of treatment.[3,7] A particularly severe complication of amebic liver abscess is rupture into the pleural, peritoneal, or pericardial cavities, a situation that may necessitate surgical intervention or insertion of an intercostal chest drain.

Although uncomplicated and smaller abscesses are typically managed with pharmacotherapy alone, a notable proportion of patients require concurrent abscess drainage.[7] Drainage is generally indicated in selected clinical scenarios such as left-lobe involvement, features suggestive of impending rupture, inadequate response to medical therapy, or diagnostic uncertainty. Image-guided percutaneous interventions constitute the mainstay of abscess decompression, with percutaneous needle aspiration (PNA) generally reserved for smaller cavities and percutaneous catheter drainage (PCD) preferred for larger collections (>5 cm).[8–11]

Considerable heterogeneity exists in catheter removal protocols, with proposed criteria ranging from sustained low daily drainage volumes to near-complete radiological resolution of the abscess cavity. The mean duration of PCD in these studies was 7–10 days.[8–12]

Persistent cavities are commonly identified on follow-up ultrasonography or computed tomography, leading to uncertainty regarding their clinical relevance. The exact prevalence of these residual cavities is unclear, and there is no standardized approach to their management.[8] Prolonged catheter use may lead to complications such as catheter slippage, leakage, and fistula formation and also increases the duration of hospitalization and costs.

We hypothesized that removing the PCD catheter as early as 3 days after clinical improvement and a 50% reduction in abscess volume would be effective in managing most cases of large, uncomplicated amebic liver abscesses (ALA). This approach may offer prompt symptomatic relief while minimizing the risk of complications.

The present study was designed to assess the safety and efficacy of early PCD removal in such patients and to evaluate the nature and clinical significance of any residual cavities.

Methods

This was a single-center, prospective observational study carried out in the Department of Gastroenterology at Sawai Man Singh Medical College and Hospital, Jaipur, over a 14-month period spanning January 2024 to February 2025.

Adults aged 18 years or older with radiologically confirmed uncomplicated ALA who fulfilled predefined indications for drainage were consecutively enrolled. The diagnosis of amebic liver abscess (ALA) was established using a combination of clinical presentation (including fever, right upper quadrant pain, and tender hepatomegaly), characteristic imaging

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findings on ultrasonography or contrast-enhanced computed tomography, gross appearance of aspirated material, and supportive serological evidence of amebic infection, where available.

Percutaneous drainage was undertaken in patients with features suggestive of impending rupture, left-lobe abscesses, cavity size exceeding 5 cm, or persistent symptoms despite at least 72 hours of antiamebic therapy.

Patients were excluded if they had abscesses that did not require drainage or presented with complications such as pleural, bronchial, or pericardial fistulization, or peritonitis at initial assessment. Other exclusion criteria included uncorrectable coagulopathy, pregnancy, pyogenic liver abscess, human immunodeficiency virus (HIV) infection, or failure to provide informed consent.

Approval for the study protocol was obtained from the institutional ethics committee, and written informed consent was secured from all participants before enrollment. At admission, a detailed clinical history and physical examination were documented. Laboratory investigations included hemoglobin concentration, creatinine, total white blood cell count, markers of inflammation including C-reactive protein and erythrocyte sedimentation rate, as well as liver function tests, coagulation profile, blood glucose levels, viral serology, and amebic serology. Baseline abdominal ultrasonography was performed in all patients, with contrast-enhanced computed tomography obtained when clinically indicated, to define the number, location, and size of abscess cavities. The size of the abscess was assessed by measuring two perpendicular dimensions, and the cavity volume was subsequently calculated using a conventional geometric formula.[13]

All patients received oral or intravenous metronidazole at a dose of 40 mg/kg/day in three divided doses, along with concomitant injectable ofloxacin 200 mg twice daily. Antibiotic therapy was administered for a minimum of 7 days or until removal of the PCD catheter, whichever was longer, after obtaining at least one set of blood cultures. Metronidazole was continued for a total duration of 14 days.

Ultrasonography-guided Percutaneous Drainage of the Abscess

Ultrasonography-guided PCD was performed under aseptic conditions by the radiology team using a standard wire-guided catheter insertion technique. An 8–12 French Malecot drainage catheter was positioned within the abscess cavity. Aspirated material was submitted for Gram staining, bacterial culture, and antibiotic susceptibility testing. The catheter was attached to a closed drainage system, and routine catheter maintenance protocols were followed. Following drainage, patients were monitored daily for clinical improvement (resolution of fever and abdominal pain) and for trends in inflammatory markers. Drain output was recorded every 24 hours.

Criteria for Catheter Removal

An attempt at catheter removal was made after a dwell time of 72 hours when patients showed sustained symptomatic improvement (defined by resolution of fever and abdominal pain) with falling leukocyte counts, and ultrasonography demonstrated a reduction of ≥50% in cavity volume compared with baseline. Notably, persistence of a residual cavity on follow-up ultrasonography was not considered a contraindication to catheter removal, and no additional catheter manipulation or aspiration was performed. Patients not meeting removal criteria underwent repeat ultrasonographic assessment every 48 hours until eligibility for catheter removal was achieved. Potential complications, including bile leak or secondary infections, were actively evaluated and managed appropriately.

Follow-up and Assessment of Residual Cavities

Patients were discharged once clinically stable and afebrile, tolerating oral intake, and once PCD had been removed. Outpatient follow-up visits were scheduled at 1, 2, and 4 weeks after discharge. Ultrasonography was performed at each visit to document the evolution of residual cavities.

Statistical Analysis

Categorical variables describing demographic characteristics and clinical findings were expressed as percentages. Continuous variables were summarized using the mean with standard deviation or the median with interquartile range, depending on the distribution of the data. Changes in abscess size over time (at discharge, 2 weeks, and 4 weeks) were analyzed using the Friedman test for repeated measures. Data analysis was performed using SPSS software (version 25.0, IBM Corp., Armonk, NY, USA). A two-sided p-value < 0.05 was considered statistically significant.

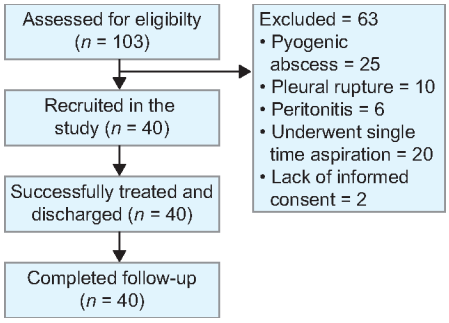

Fig. 1: Enrollment flowchart

Results

During the study period, 103 patients were evaluated for eligibility, 63 were excluded for various reasons (Fig. 1), and 40 patients were ultimately enrolled. Most patients were male (36/40), and a substantial proportion (65%) had a history of significant alcohol use disorder. The mean age was 46.6 ± 10.5 years. Fever and tender hepatomegaly were almost universally present (95 and 100%, respectively). The majority of patients (80%) had solitary abscesses, while 8 (20%) had multiple abscesses (Table 1).

The indications for abscess drainage were impending rupture (8/40), left-lobe abscess (10/40), failure to respond to medical therapy after 72 hours (22/40), and >1 indication (30/40). Twenty-five patients (62.5%) had a baseline abscess diameter >10 cm, while only four patients (10%) had an abscess diameter <5 cm. In this subgroup, indications for abscess drainage included impending rupture (2 patients), left-lobe involvement (2 patients), and failure to respond to medical therapy after 72 hours (1 patient).

The majority of patients (38/40) underwent 1 PCD placement, and only 2 patients required 2 PCD placements. Their hospital stay was not significantly prolonged compared to that of patients who required only 1 PCD placement.

Catheter drainage was successfully performed in all patients without any major intraprocedural or immediate postprocedural complications. However, 2 patients experienced moderate-to-severe pain at the catheter site following the procedure and required intravenous analgesia. None of the catheter aspirate cultures demonstrated bacterial growth.

The time to resolution of fever and abdominal pain is detailed in Table 2. Most patients (36/40; 90%) demonstrated rapid clinical improvement, with normalization of symptoms occurring within 3 days of PCD insertion. In the remaining 4 patients (10%), symptom resolution occurred beyond 3 days following catheter placement. All patients

Table 1: Baseline characteristics

Variables	*N = 40*
Age (years)[#]	46.6 ± 10.5
Males, *n* (%)	36 (90%)
Alcoholics, *n* (%)	26 (65%)
Clinical features	
Fever, *n* (%)	38 (95%)
Duration of fever (days)*	10.0 (4.8–13.2)
Abdominal pain, *n* (%)	40 (100%)
Duration of pain (days)*	10.0 (5.0–16.0)
Diarrhea, *n* (%)	6 (15%)
Anorexia, *n* (%)	22 (55%)
Tender hepatomegaly, *n* (%)	40 (100%)
Comorbidities	
Diabetes mellitus, *n* (%)	4 (10.0%)
Investigations (at admission)	
Hemoglobin (gm/dL)*	9.2 (7.2–11.2)
Total leukocyte count (number/μL)*	13.8 (11.8–15.7)
Erythrocyte sedimentation rate (mm after 1 hour)*	50.0 (34.0–64.0)
C-reactive protein (mg/L)*	33.5 (18.0–53.3)
Bilirubin (mg/dL)	1.4 (1.3–2.1)
Abscess characteristics	
Single abscess, *n* (%)	32 (80%)
Multiple abscesses, *n* (%)	8 (20%)
Right lobe location, *n* (%)	30 (75%)
Left lobe location, *n* (%)	4 (10%)
Both lobe location, *n* (%)	6 (15%)
Mean abscess size (cm)*	10.0 (5.8–13.0)
Baseline abscess size >10 cm, *n* (%)	25 (62.5%)
Indication of abscess drainage	
Left lobe abscess, *n* (%)	10 (25.0%)
Impending rupture, *n* (%)	8 (20%)
Size >5 cm, *n* (%)	36 (90%)
Lack of response to medical therapy, *n* (%)	22 (55%)
>1 indication, *n* (%)	30 (75%)

*Median (interquartile range); [#]Mean ± standard deviation

who improved within the initial 3-day period had an uncomplicated hospital course and were discharged without adverse events.

Patients with delayed clinical improvement underwent further assessment for potential local or systemic complications. A persistent biliary leak was identified in 1 patient and was successfully managed with endoscopic retrograde cholangiopancreatography, sphincterotomy, and placement of a temporary plastic stent. The remaining 3 patients continued to have fever, with abscess volume failing to decrease by >50% from baseline. All 3 patients subsequently improved with continued drainage and medical therapy, without the need for any additional invasive intervention.

Early percutaneous catheter removal was therefore successful in 36 patients (90%). The median time to catheter removal was 3 days [interquartile range (IQR), 2–5 days], and the median length of hospital stay was 3 days (IQR, 2–7 days). Notably, all patients who underwent successful early catheter removal demonstrated a drainage output of <20 mL on day 3.

Residual abscess cavities were commonly observed, with 38 of 40 patients (95%) having residual cavities at the time of PCD removal. Serial imaging revealed that residual cavities persisted in the majority of patients, with 87.5% (35/40) showing persistent cavities at the 2-week follow-up and 82.5% (33/40) at 1 month. However, there was a significant and progressive reduction in abscess size over time, from a mean of 6.5 ± 3.3 cm at discharge to 4.9 ± 2.7 cm at 2 weeks and further to 3.0 ± 1.7 cm at 1 month ($p < 0.001$).

No patients were lost to follow-up, and none showed an increase in abscess size after PCD removal. There were no catheter site-related complications, no rehospitalizations, and no deaths. No patient developed a percutaneous fistula after catheter removal, and no patient developed concomitant gastrointestinal (GI) bleeding. No patient required repeat drainage, catheter reinsertion, or surgical intervention at any point.

Discussion

Amebic liver abscess constitutes the predominant extraintestinal presentation of amebiasis.[13] In North India, the disease predominantly affects males from lower socioeconomic strata, with a strong association with chronic alcohol consumption.[14] Management of amebic liver abscess (ALA) is largely medical in nature, with treatment predominantly based on nitroimidazole therapy.[3,7] Recent studies indicate that, in uncomplicated amebic liver abscess, nitazoxanide demonstrates therapeutic effectiveness comparable to metronidazole, while being better tolerated and providing the additional advantage of concurrent luminal eradication, which may help lower recurrence rates.[15]

While the criteria for initiating percutaneous drainage in ALA are relatively well defined, there remains no consensus on the most appropriate timing for catheter removal or on how residual cavities identified on imaging should influence management decisions. Several earlier studies, largely involving patients with ALA, have proposed differing criteria to guide catheter removal. Rajak et al. proposed catheter removal only after patients demonstrated sustained clinical recovery, improvement in inflammatory parameters, persistently low drain output, and near-total radiological resolution of the abscess cavity. Using this approach, catheter duration ranged from 3 to 15 days, with hospitalization extending up to 24 days.[9]

Similarly, a comparative study from North India by Singh et al. advised maintaining catheter drainage until output had ceased for several days, with repeated ultrasonographic assessments guiding further management. Residual cavities prompted saline flushing, aspiration, and catheter manipulation when loculations were present, resulting in a mean time to clinical relief of more than 8 days and a mean hospital stay exceeding 20 days.[8] A study from Punjab and a large liver unit series by Jindal et al. adopted comparable drainage-based criteria, recommending catheter removal after sustained clinical improvement accompanied by minimal daily output.[12,16]

Table 2: Outcomes

Variables	*N = 40*
Time until the normalization of	
Fever (days)*	2.0 (1.0–3.0)
Abdominal pain (days)*	3.0 (2.0–5.0)
Quantity of fluid drained (mL)*	287.5 (75.0–752.5)
Time until the pigtail removal (days)*	3.0 (2.0–5.0)
Complications	
No complication seen, *n* (%)	38 (95.0%)
Moderate-to-severe pain at catheter site, *n* (%)	2 (5%)
Continuous bile leak, *n* (%)	1 (2.5%)
Catheter removal status at 72 hours	
Met predefined criteria for catheter removal, *n* (%)	36 (90%)
Did not meet criteria at 72 hours, *n* (%)	4 (10%)
Reasons for delayed eligibility	
Bile leak, *n* (%)	1 (2.5%)
Persistent fever with <50% volume reduction, *n* (%)	3 (7.5%)
Duration of hospitalisation (days)*	3.0 (2.0–7.0)
Residual abscesses	
At the time of pigtail removal, *n*/*N* (%)	38/40 (95%)
Follow-up at 2 weeks after discharge, *n*/*N* (%)	35/40 (87.5%)
Follow-up at 1 month after discharge, *n*/*N* (%)	33/40 (82.5%)

*Median (interquartile range)

Despite this, reported catheter duration and hospital stay remained longer than in the present study.[12,16]

More recently, a multicenter prospective study by Goyal et al. evaluated catheter removal using a composite of sustained clinical recovery and low drainage output, rather than complete radiological resolution.[17] Using this framework, catheter removal was achieved after a median of 5 days, even though residual cavities persisted in the majority of patients. This observation supports the broader principle that residual imaging abnormalities, in isolation, should not mandate prolongation of catheter drainage.[17]

In contrast, our study employed a simplified, clinically driven protocol that prioritized early symptomatic improvement combined with a predefined reduction in abscess volume, without requiring a minimum period of negligible drain output or radiological resolution. Using this approach, the median catheter duration was limited to only 3 days, which is substantially shorter than that reported in earlier studies.[8,9,12,16,17] In our experience, the majority of drainage occurs within the first few days of PCD placement, after which output declines sharply despite the persistence of residual cavities. This observation led us to question the physiological necessity of prolonged catheter retention and to systematically evaluate the safety and outcomes of an early catheter removal strategy.

This streamlined strategy translated into a markedly shorter median hospital stay of 3 days, compared with the 9–20 day range reported in the meta-analysis by Cai et al.[18] Early discharge was feasible because decisions regarding catheter removal and hospitalization were guided by clinical recovery rather than persistence of residual cavities on imaging, allowing safe transition to outpatient follow-up once patients stabilized.

Notably, none of the patients in our cohort required catheter manipulation or repositioning, even in the presence of multiloculated cavities. Prior studies have demonstrated that single-catheter drainage is often sufficient in multiloculated ALA, with internal septations representing necrotic inflammatory stroma rather than true compartmentalization.[19,20] Our observations further support this concept, indicating that aggressive interventional strategies are rarely necessary in uncomplicated disease.

Residual cavities were frequently observed in our cohort but proved to be clinically insignificant. Serial ultrasonography demonstrated progressive regression of these cavities without any increase in size or recurrence of symptoms. At 1-month follow-up, approximately 15% of patients showed complete radiological resolution, while the remaining 85% continued to demonstrate gradual reduction in cavity size. The mean abscess diameter decreased significantly from 6.5 ± 3.3 cm at discharge to 4.9 ± 2.7 cm at 2 weeks and further to 3.0 ± 1.7 cm at 1 month ($p < 0.001$). Some residual cavities may eventually evolve into simple hepatic cysts that can persist indefinitely.[21]

Importantly, support for using partial radiological resolution as a clinically meaningful endpoint also comes from earlier prospective observations on the natural history of amebic liver abscess. In a large longitudinal cohort, clinical and hematological recovery occurred rapidly, whereas sonographic resolution was substantially delayed and often incomplete for several months.[22] A subset of patients demonstrated an early reduction in cavity volume to approximately 50% of baseline, followed by a prolonged phase of slow radiological regression without relapses or the need for additional therapy. These findings indicate that once a critical reduction in abscess volume is achieved, subsequent cavity resolution follows a benign course, thereby providing biological justification for the 50% volume reduction threshold used in our protocol.

Given that ALA is predominantly a medically managed condition, the primary role of drainage is to accelerate clinical recovery and prevent complications such as impending rupture.[3,7] Complete radiological resolution is therefore not essential for successful management. In this context, the threshold of a 50% reduction in cavity volume used in our protocol was sufficient to ensure safety, particularly in patients with larger abscesses.

Key strengths of this study include its prospective design, exclusive inclusion of confirmed ALA cases, and complete follow-up, which minimized heterogeneity seen in earlier studies that included abscesses of mixed or uncertain etiology. In addition, catheter removal was guided primarily by clinical improvement rather than radiological resolution. Despite residual cavities in most patients, there was no need for rehospitalization, repeat drainage, or surgery, and hospital stay was short.

However, certain limitations must be acknowledged. The relatively small sample size and lack of a comparator group limit generalizability, as our protocol was not directly contrasted with alternative catheter management strategies. Additionally, as a tertiary referral center, many patients had received antibiotics prior to presentation, which may have influenced outcomes.[23] Larger multicenter randomized controlled trials are therefore required to validate the routine use of early catheter removal in the management of amebic liver abscess.

Conclusion

In conclusion, early removal of percutaneous catheters in patients with uncomplicated ALA was safe and effective in most cases, facilitated earlier discharge, and reduced the length of hospitalization. Residual cavities were frequently present at the time of catheter removal but followed a benign clinical course and did not require additional intervention.

Informed Consent

Informed consent was obtained prior to enrollment from the included patients.

Ethical Approval

Ethical approval was obtained from the institutional review board prior to initiation of patient enrollment.

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