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Outcome Analysis of Conservative Management With Pigtail Catheter Insertion in Intraperitoneal Rupture of Liver Abscess: A Prospective Observational Cohort Study

SAGAR SARVAIYA

sagarmeet2410@gmail.com

Suamandeep Vidyapeeth University

ASHWANI TIWARI

Suamandeep Vidyapeeth University

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Abstract

Introduction

Ruptured liver abscess is a life-threatening condition traditionally managed with exploratory laparotomy and drainage. Despite improvements in surgical techniques, high mortality remains in moribund patients. Ultrasound-guided pigtail drainage with intravenous antibiotics presents a less invasive alternative, but its effectiveness in reducing mortality and improving patient outcomes has yet to be extensively studied.

Aims

To evaluate the effectiveness of “ultrasound-guided pigtail insertion, peritoneal drain insertion, and intravenous antibiotics” in the management of ruptured liver abscess.

Methods

This was a prospective, observational cohort study conducted over 18 months from 1st July 2023 to 31st December 2024 in department of general surgery, SBKS Medical Institute and Research Centre, Vadodara, Gujarat. The study involved 35 patients diagnosed with ruptured liver abscess who received ultrasound-guided pigtail drainage and intravenous antibiotics. Key variables, including age, sex, alcohol use, diabetes, abscess size, and microbial culture, were recorded. The study included predefined success (asymptomatic) and failure end-points (covert in to laparotomy and death), with outcomes tracked over a 6-month period. Statistical analysis was performed using SPSS® Version 27.

Results

A total 35 patients with intraperitoneal rupture of liver abscess were included. Conservative management using ultrasound-guided pigtail drainage with intravenous antibiotics resulted in a 91% clinical success rate, with only a 3% 30-day mortality, with male predominance 74% and mean age was 46 ± 13 years, 51% chronic alcoholic and 34% diabetic. Technical success of catheter placement was 100%. Early complications were seen in 17% of patients out of which in 9% catheter blockage ,secondary peritonitis in 6%, pleural effusion in 3%. While late complications occurred in 9% which include recurrence in 6% and incisional hernia 3%.

Conclusion

Ultrasound-guided pigtail drainage and intravenous antibiotics demonstrated high clinical success and low mortality,

Introduction

Liver abscesses are important cause of morbidity in hepatobiliary practice, particularly in tropical and developing regions. Although relatively uncommon, intraperitoneal rupture represents one of the most severe complications, occurring when the abscess breaches the hepatic capsule and releases purulent material into the peritoneal cavity. This can rapidly progress to secondary peritonitis, systemic inflammatory response, sepsis, and multi-organ dysfunction. Pyogenic liver abscesses, especially those caused by *Klebsiella pneumoniae* and *Escherichia coli*, have a greater tendency for rapid enlargement and spontaneous rupture. [1, 2]

Traditionally, ruptured liver abscesses have been managed by exploratory laparotomy with abscess drainage and peritoneal lavage to achieve definitive source control. However, surgical management is invasive, requires general anaesthesia, and is associated with considerable morbidity, particularly in critically ill or high-risk patients. With advances in imaging techniques and interventional radiology, minimally invasive approaches have increasingly challenged the conventional surgical paradigm. [3]

Percutaneous pigtail catheter drainage under ultrasound or CT guidance has emerged as an effective method for evacuating hepatic abscess cavities. This technique allows accurate localization and drainage while minimizing tissue trauma. When combined with appropriate broad-spectrum intravenous antibiotics, percutaneous drainage can provide adequate source control even in selected cases of ruptured liver abscess. [4]

In patients with significant intraperitoneal contamination, additional peritoneal drain placement may be required to evacuate free pus. Contrast-enhanced CT remains essential for diagnosis, assessment of rupture, procedural guidance, and follow-up. Despite limitations such as catheter blockage or incomplete drainage, conservative management has shown favorable outcomes in carefully selected patients. [5]

The aim of this study is to evaluate the effectiveness of ultrasound-guided pigtail catheter insertion, peritoneal drain placement, and intravenous antibiotic therapy alone in the management of ruptured liver abscess and novelty of this study is that it provides practical evidence supporting a minimally invasive, cost- effective treatment strategy, potentially reducing surgical morbidity, hospital stay, and healthcare burden.

MATERIAL & METHODS

This prospective, observational cohort study was conducted over an 18-month period from 1 July 2023 to 31 December 2024 in the Department of General Surgery at SBKS Medical Institute and Research Centre, Vadodara, Gujarat, a large tertiary referral centre with full interventional radiology, critical care, and microbiology support.

Inclusion criteria:

All consecutive adult patients (≥ 18 years) presenting with radiologically confirmed pyogenic liver abscess and overt intraperitoneal rupture were screened. Rupture was defined by hepatic capsule discontinuity with free intraperitoneal fluid on ultrasonography or contrast-enhanced CT. Patients who were hemodynamically stable or stabilized after initial resuscitation and who provided written informed consent were included.

Exclusion criteria:

Exclusion criteria included pregnancy or lactation, hepatobiliary malignancy, multiloculated abscesses larger than 10 cm with more than three non-communicating cavities deemed technically undrainable, decompensated cirrhosis, uncorrectable coagulopathy, prior upper abdominal surgery precluding safe percutaneous access, or inability to adhere to follow-up.

Consecutive sampling was employed to ensure enrolment of all eligible patients and reflect real-world clinical heterogeneity.

All patients received standardized initial management, including fluid resuscitation according to Advanced Trauma Life Support principles and empirical intravenous antibiotics (third-generation cephalosporin plus metronidazole) initiated within one hour of admission. After baseline laboratory investigations and urgent imaging, eligible patients underwent ultrasound-guided pigtail catheter drainage (8–12 Fr) under local anaesthesia, preferably via a transhepatic approach. Aspirated pus was sent for Gram stain, culture, and sensitivity testing. In cases with significant intraperitoneal contamination, a large-bore (36F) peritoneal drain was placed in the right iliac fossa. Catheter patency was maintained with sterile saline flushes. Antibiotics were adjusted according to culture results and administered intravenously for 14 days followed by 7 days of oral therapy. Criteria for catheter removal included drainage less than 10 mL/day for 48 hours, resolution of fever and pain, and at least 80% reduction in abscess cavity size on ultrasound. Patients without clinical or biochemical improvement within 72 hours were reviewed by a second consultant and considered for operative intervention.

Data were recorded in validated case record forms and entered into a secure REDCap database. Follow-up was conducted fortnightly for two months and monthly up to six months, including clinical assessment, laboratory tests, and ultrasound imaging. Outcomes assessed included complications, need for rescue laparotomy, hospital stay, mortality, and recurrence.

STATISTICAL ANALYSIS:

Statistical analysis was performed using IBM SPSS version 27. Descriptive statistics were used for analysis. Continuous variables were expresses as mean± standard deviation or median, and categorial variables were expressed as frequencies and percentages.

Ethical approval

was obtained from the Institutional Ethics Committee (***/2023/169).

RESULTS

The study cohort demonstrated a clear middle-age predominance. Ten patients (28.6%) were aged 40–49 years and nine (25.7%) were between 50–59 years. (Table 1).

Male predominance was evident, with 26 men (74.3%) compared to 9 women (25.7%).

Chronic alcohol consumption ≥ 40 g/day was reported by 18 patients (51.4%).

Diabetes mellitus was present in 12 patients (34.3%).

Fever (86%) and right-upper-quadrant pain (80%) were the most common presenting symptoms. (Table 2).

26 patients present within 7 days of symptoms onset (75%), Delayed presentation was observed in 9 patients (25%) who sought care more than seven days after symptom onset. This subgroup accounted for two of the three failures.

Laboratory evaluation showed leukocytosis > $12\times10^3/\mu L$ in 74% and hypoalbuminaemia in 40%, while hyperbilirubinaemia > 3.5 mg/dL occurred in 31%. Coagulopathy was uncommon, with INR > 1.2 in only six patients, supporting the safety of percutaneous access (Table 3).

Table 3
Key
Baseline
Laboratory
Values

Right-lobe involvement predominated observed in 27 patients (77%), reflecting portal flow dynamics, whereas left-lobe abscesses observed in 6 patients (17%)—despite a propensity for earlier rupture—resolved uneventfully with catheter drainage (Table 4).

Table 4
Lobar
Involvement

Single cavities were present in 23 patients (66%), while 12 patients (34%) had multiple cavities; only one multiloculated case failed conservative management.

21 patients had abscess size measured 5–9 cm (60%), while seven giant cavities (≥ 10 cm) demonstrated a higher failure tendency. (Table 5).

Table 5
Ultrasound-
Estimated
Volume

Klebsiella pneumoniae was the most common isolate (34%), followed by Escherichia coli (20%), while one-third showed no growth due to prior antibiotic exposure (Table 6).

Table 6
Pus
Culture
Isolates

Ten-French catheters were most frequently used in 20 patients (57%), balancing lumen adequacy and safety, with no size-related bleeding events.

Liver abscess was drained within 24 hours of admission in 30 patients (87%), while rest 5 (13%) drained between 24–48 hours after ICU admission and stabilization

Catheter removal within 14 days was achieved in 30 patients (86%), and median drain output was 430 mL, with outputs ≥ 600 mL in 31% (Table 7).

Table 7
Total
Volume
Drained

Fever resolved within six days in 86% patients. Early complications were limited to catheter blockage and secondary peritonitis (Table 8). At six months, 91% remained asymptomatic, with minimal late complications (Table 9). Overall clinical success was 91%, with one death (3%). (Table 10)

Table 8
Complications
≤ 14 Days

Table 9
Complications
≤ 6 Months

Table 10
Outcomes

In terms of hospitalization, 28 patients (80%) were discharged within 5–7 days, while the rest 7 patients (20%) stayed for 8–14 days. Median hospital stay is 5.28. This short duration underscores the minimally invasive nature and faster recovery associated with ultrasound-guided pigtail catheter drainage.

DISCUSSION

Liver abscess remains a major clinical problem in developing regions due to poor sanitation, alcoholism, and the increasing prevalence of diabetes mellitus.

The cohort demonstrated the characteristic middle-aged predominance of ruptured liver abscess, with 54% of patients in the fourth and fifth decades (40–49 years: 28.6%; 50–59 years: 25.7%) and a mean

age of 46 ± 13 years. This closely parallels findings by Jindal et al., who reported median ages of 45 years for amoebic and 50 years for pyogenic abscesses in a large Indian registry [8], and by Kumar et al., whose western Indian series showed a mean age of 42 ± 11 years [9] and by Anand AA et al., whose study showed 34% cases were between 31–50 years [12]. In contrast, Memon et al. reported a younger mean age of 38.7 ± 9.4 years in a Pakistani cohort, likely reflecting earlier environmental exposure [6]. Importantly, rupture was not confined to older patients, as 28.6% were under 40 years of age, consistent with Desai et al., who observed that one-third of ruptures occurred below 35 years [7].

Men constituted 74% (n = 26) of the cohort, reflecting the well-established male predominance in liver abscess. Comparable figures have been reported by Jindal et al. (82%) [8], Tailor et al. (79%) [10], Singh et al. (88%) [11], and Kumar et al. (93.8%) [9]. and Anand AA et al. (78%).[12] This imbalance likely reflects a combination of biological factors, including testosterone-mediated immune modulation, and behavioural risks such as alcohol consumption and occupational exposure, both of which were more common among men in this series (61% vs 22%).

Chronic alcohol intake (≥ 40 g/day) was present in 51% of patients and was associated with larger abscess cavities (mean diameter 7.9 cm vs 6.3 cm) and a higher rate of Klebsiella isolation (44% vs 26%). Similar associations have been documented by Singh et al. [11] and Jindal et al. [8], who linked alcohol use to more advanced disease and higher rupture rates. This mirrors findings from Memon et al. [6] and Desai et al. [7], both of whom demonstrated that early catheterisation mitigates alcohol-related risk. These results support Kumar et al.'s recommendation for early percutaneous drainage in large-volume abscesses, a threshold exceeded by most alcohol users in this study [9].

Diabetes mellitus was present in 34% of patients, comparable to prevalences reported by Jindal et al. (31.1%) [6] and Kumar et al. (28%) [9].

Abdominal pain and fever were the dominant presenting symptoms, occurring in 80% and 86% of patients, respectively, closely matching rates reported by Jindal et al. [8] and Singh et al. [11], Anand AA et al. [12]. Jaundice was observed in 20% of cases, slightly higher than in comparable series, likely reflecting volume-related biliary compression. Only 26% of patients presented within 72 hours of symptom onset, while 49% presented between four and seven days and 26% after one week.

Leucocytosis was present in 74% of patients, hypoalbuminaemia in 40%, and hyperbilirubinaemia in 31%, paralleling findings from large Indian series [8, 11, 12]. Right-lobe involvement predominated (77%), consistent with portal flow dynamics and previous reports [8, 11, 12].

Klebsiella pneumoniae was the most common isolate (34%), followed by Escherichia coli (20%), while 34% of cultures were sterile, likely due to prior antibiotic exposure. This microbiological profile mirrors Indian series, particularly the predominance of Klebsiella among diabetics and alcohol users [8, 10, 12].

Median hospital stay is 5.2 days in our case while Anand AA et al. reported mean hospital stay of 7.4 days [12].

Early complications occurred in 17% of patients and were predominantly minor catheter-related issues. No cases of bile peritonitis or major haemorrhage were observed. At six-month follow-up, 91% of patients remained asymptomatic. Two diabetics experienced minor recurrences, and one drain-site incisional hernia was noted, with no late biliary complications detected.

Overall clinical success with catheter drainage was 91%, with a mortality of 3%, substantially lower than historical surgical series and earlier conservative cohorts [6, 11, 12].

Conclusion

This prospective observational study demonstrates that early ultrasound-guided pigtail catheter drainage is a safe, effective, and practice-changing first-line treatment for intra-peritoneally ruptured liver abscess.

Declarations

Author Contribution

S.S.: HISTORY TAKING , SURGICAL TREATMENT, MANUSCRIPT PREPARATION, MANUSCRIPT EDITING, MANUSCRIPT REVIEWA.T. : HISTORY SEARCH, LITERATURE SEARCH , DATA AQUISITION

Acknowledgement:

NIL

Data Availability

All data supporting the findings of this study are available within the paper and it was directly collected from patients which admitted in our institution for treatment

References

1. Shubhankar G, Nagpal A, Anand G, Sharma D. Double pigtail to manage pericardial rupture of left lobe liver abscess. J Surg. 2021; 9:149.
2. Italiya HB, Shah P, Rajyaguru A, Bhatt J. A prospective study of USG-guided pigtail catheter drainage in management of liver abscess. Int J Res Med Sci. 2015;3(2):574–578.
3. Maharaul HH, Vora V, Shah K. Clinical profile and management of liver abscess with percutaneous pigtail catheter. Indian J Forensic Med Toxicology. 2021;15(2):150–154.
4. Parikh SG, Chaudhari RD, Oza AP. A study between percutaneous aspiration and pigtail drainage in 70 cases of liver abscess. Int J Sci Res (IJSR). 2022;11(2).

5. Jain B, Mantri N, Saraf R, Pole SM, Dahiphale D, Lahoti A. Image-guided percutaneous pigtail catheter drainage of liver abscess: technique and its outcome. Asian J Med Sci. 2021;12(5).
6. Memon A, Siddiqui F, Memon H, Ali SA. Management of ruptured amoebic liver abscess: 22-years experience. J Ayub Med Coll Abbottabad. 2010;22(2):96–99.
7. Desai N, Savani C, Soni D, Parmar N, Negi S. Management of ruptured liver abscess: a study of 54 cases. Int J Sci Res (IJSR). 2015.
8. Jindal A, Pandey A, Sharma MK, Mukund A, Vijayaraghavan R, Arora V, et al. Management practices and predictors of outcome of liver abscess in adults: a series of 1630 patients from a liver unit. J Clin Exp Hepatol. 2021;11(3):312–320.
9. Kumar S, Midha NK, Ahari K, Kumar D, Gopalakrishnan M, Kumar B, et al. Role of pigtail catheter drainage versus percutaneous needle aspiration in the management of liver abscess: a retrospective analysis. Cureus. 2021;13(12):e20528.
10. Tailor V, Bochiya G, Lad V. Different modalities of management of liver abscess. Int Surg J. 2023;10(4):559–563.
11. Singh A, Paruthy SB, Kuraria V, Dhawaria M, Khera D, MSH, et al. A comprehensive study on ruptured liver abscess in a tertiary care center. Cureus. 2024;16(7):e64526.
12. Ajaykumar A, Basavaraj JT, Palakuzhiyil N. Ultrasound-guided pigtail catheter drainage in liver abscess: a clinical study. J Contemp Clin Pract. 2025; 11(10):711–717.

Tables

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Supplementary Files

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