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Comparative Effectiveness of Conservative Management, Pigtail Catheter Placement, Percutaneous Drainage, and Laparotomy in Patients with Liver Abscesses: A Retrospective Cohort Study

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Abstract

Liver abscesses represent a significant clinical challenge due to their potential for severe complications if not managed promptly. This retrospective cohort study evaluated the outcomes of four treatment modalities—conservative management, percutaneous drainage, pigtail catheter placement, and laparotomy—based on abscess size, patient age, and sex. A total of 100 patients treated between 2020 and 2024 at a tertiary care hospital were analyzed, with equal distribution across the four treatment groups. The study found that percutaneous drainage and pigtail catheter placement were significantly more effective than laparotomy and conservative therapy, particularly for abscesses measuring 5–10 cm. Conservative management was suitable for abscesses <5 cm but showed increased morbidity in larger lesions. Laparotomy, reserved for refractory or >10 cm abscesses, had the highest complication rate and length of stay. Advanced age (≥60 years), male sex, and larger abscess size (>10 cm) were associated with poorer outcomes, underscoring the importance of early, individualized treatment planning. These findings support a preference for minimally invasive approaches in managing liver abscesses, tailored to specific patient and disease characteristics.

Keywords: Liver abscess; Percutaneous drainage; Pigtail catheter; Laparotomy; Conservative management; Abscess size

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Introduction

Liver abscesses are localized accumulations of pus within the liver caused by bacterial, parasitic, or fungal infections [1]. If untreated, these abscesses can lead to severe complications, including sepsis, multi-organ failure, and death [2]. Advances in imaging and minimally invasive procedures have changed the approach to liver abscess management, moving away from invasive surgeries to more conservative and less invasive methods. Current treatments include antibiotic therapy (conservative management), ultrasound-guided pigtail catheter placement, percutaneous aspiration, and laparotomy [3-5].

Each method has its advantages and challenges, but comparative data on clinical outcomes remain limited. Factors like abscess size (<5 cm, 5cm to 10 cm, >10 cm), patient demographics (e.g., age, sex), and comorbidities may influence outcomes but are not well-documented. This study aims to address these knowledge gaps by evaluating the efficacy and safety of different liver abscess management strategies in a retrospective cohort.

Methods

Study design

This retrospective cohort study was conducted at a tertiary care hospital from 2020 to 2024. Eligible patients were identified through clinical and imaging records (ultrasound or CT).

Inclusion criteria

Patients with a confirmed diagnosis of liver abscesses of any etiology and complete medical records were included.

Exclusion criteria

Patients were excluded if they had incomplete records, multiple concurrent infections, or

abscesses secondary to systemic conditions such as malignancy.

Study population

A total of 100 patients were included and divided into four groups:

1. Conservative management group (n=25): Treated with combination antibiotics.

2. Percutaneous drainage group (n=25): Underwent needle aspiration guided by imaging with aseptic precautions

3. Pigtail catheter group (n=25): Managed with ultrasound-guided catheter placement for continuous drainage.

4. Laparotomy group (n=25): Underwent open surgical drainage for large or refractory abscesses.

Data Collection and Outcome Parameters: Demographics (age, sex, comorbidities), abscess size (<5 cm, 5 cm to 10 cm, >10 cm), and treatment outcomes were documented. Outcomes included:

- Morbidity: Recurrence, sepsis, or organ dysfunction.
- Length of Stay (LOS): Total days of hospitalization.
- Complications: Bleeding, secondary infections, or organ injury.

Statistical analysis

Descriptive and inferential statistical methods were used. Chi-square tests were applied for categorical data, and t-tests or ANOVA were used for continuous variables. A p-value of <0.05 was considered statistically significant.

Results

Patient Demographics and Abscess Characteristics: The cohort included 70 males (70%) and 30 females (30%), with a median age of 45.6 years (range: 25-75). Common comorbidities included diabetes mellitus (35%) and alcoholism (25%). Abscess sizes were categorized as follows:

- <5 cm: 15 patients (15%).
- 5-10 cm: 40 patients (40%).
- >10 cm: 45 patients (45%).

Comparison of management strategies

1. Conservative management

o Length of stay: 8 days.

o Morbidity rate: 40%.

o Complication rate: 28%.

o Conservative management was more effective for smaller abscesses (<5 cm) but less effective for larger abscesses (>10 cm), where it showed limited success due to high complication rates.

2. Percutaneous drainage

o Length of stay: 6 days.

o Morbidity rate: 28%.

o Complication rate: 16%.

o Percutaneous drainage was particularly effective for abscesses sized 5 cm to 10 cm and even larger abscesses (>10 cm). It had faster recovery and lower complication rates compared to other strategies.

3. Pigtail Catheter Placement:

o Length of stay: 7 days.

o Morbidity rate: 24%.

o Complication rate: 12%.

o This approach showed excellent outcomes for abscesses ≤10 cm and offered a viable alternative to percutaneous drainage.

4. Laparotomy

o Length of stay: 12 days.

o Morbidity rate: 36%.

o Complication rate: 32%.

o Laparotomy was generally reserved for abscesses >10 cm or those unresponsive to less invasive approaches. Its higher complication rates reflect the invasiveness of the procedure.

Impact of Abscess Size

- <5 cm: best outcomes with minimal complications; conservative management was effective.
- 5 cm to 10 cm: Both percutaneous drainage and pigtail catheter placement showed excellent results with faster recovery.
- >10 cm: These abscesses were associated with poorer outcomes, requiring more invasive interventions like laparotomy.

Impact of age

Older patients (≥60 years) demonstrated slower recovery rates and higher morbidity across all treatment groups. Younger patients (<40 years) had better outcomes, with shorter hospital stays and fewer complications, likely due to better overall health and fewer comorbidities.

Impact of sex

Male patients showed worse outcomes, including higher morbidity (35% *vs*. 25%) and complications (20% *vs*. 15%), potentially due to higher rates of comorbidities such as diabetes and alcoholism.

Discussion

This study provides evidence that minimally invasive techniques, such as percutaneous drainage is best followed by pigtail catheter placement, offer superior outcomes compared to conservative management and laparotomy. Percutaneous drainage was particularly effective for abscesses sized 5 cm to10 cm, demonstrating faster recovery and fewer complications. The findings are consistent with previous studies [6-8] that highlight the safety and efficacy of minimally invasive approaches.

For abscesses ≤5 cm, conservative management remains a reasonable option. However, its limited utility for larger abscesses (>10 cm) was evident, with higher morbidity and longer hospital stays. Laparotomy, while effective in select cases, should be reserved for refractory or severe abscesses due to its invasiveness and associated complications.

Abscess size remains a critical factor influencing outcomes. Larger abscesses (>10 cm) were linked to higher morbidity, consistent with findings from earlier research [9]. Age also played a significant role, with older patients experiencing slower recovery and increased

complications, emphasizing the need for tailored interventions based on patient demographics.

Limitations

The retrospective design and single-center setting may limit generalizability. The small sample size further restricts the robustness of statistical analysis. Larger, prospective, multicenter studies are needed to validate these findings and refine guidelines for liver abscess management.

Conclusion

This study confirms that minimally invasive methods, particularly percutaneous drainage is best followed by pigtail catheter placement, are highly effective in managing liver abscesses, especially for abscesses sized ≤10 cm. Larger abscess size (>10 cm), male sex, and older age were associated with poorer outcomes. These findings highlight the importance of personalized treatment strategies based on patient and disease characteristics to optimize clinical outcomes while minimizing complications.

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Ethical Guidelines

The study was approved by the Institutional Ethics Committee.

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