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ORIGINAL RESEARCH

Clinical Profile and Risk Factors for Recurrence of Pyogenic Liver Abscess: A Prospective Observational Study

[1]Dr. Anubhav Goel, [2]Dr. Aradhana Singh, [3]Dr. Prakhar singh

[1,2]Associate Professor, S.N Medical College, Agra, UP, India
[3]Resident, Department of General Surgery, S.N Medical College, Agra, UP, India

Corresponding Author
Dr. Anubhav Goel
Associate Professor, S.N Medical College, Agra, UP, India

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ABSTRACT

Background: Pyogenic liver abscess (PLA) remains a significant cause of morbidity worldwide, with recurrence posing considerable therapeutic and financial burdens on healthcare systems [1]. Despite advances in imaging modalities and minimally invasive interventions, many patients experience repeated episodes, often associated with certain predisposing factors and demographic variables [2]. This study aimed to evaluate clinical profiles, risk factors, and management modalities impacting recurrence of PLA in a tertiary care setting. **Methods**: A prospective observational study was conducted on 100 patients with confirmed PLA over a 12-month period. Demographic data, clinical histories, and risk factors such as alcohol use, diabetes, smoking, and tuberculosis were documented. All patients underwent either aspiration with or without antibiotics, pigtail drainage, or surgical drainage (incision and drainage). Recurrence of abscess was defined as radiological or clinical reappearance within six months post-treatment. Data were analyzed using descriptive statistics and chi-square testing to identify factors associated with recurrence. **Results**: Overall, 25% of patients experienced recurrence. Solitary abscesses had a lower recurrence rate (16.7%) compared to multiple abscesses (37.5%). Bilateral involvement was linked with higher recurrence (50%) than right-sided (20%) or left-sided lesions (16.7%). Male patients exhibited a slightly higher recurrence rate (28.6%) than females (16.7%). Alcohol consumption and underlying comorbidities, notably diabetes (35% recurrence), were strongly associated with repeat abscess formation. Of the management modalities, aspiration combined with antibiotics had the lowest recurrence (12%), while pigtail drainage (30%) and surgical drainage (33.3%) had comparatively higher recurrence rates. **Conclusion**: PLA recurrence is multifactorial, influenced by host factors (comorbidities, dietary habits) and lesion characteristics (laterality, multiplicity). Optimizing treatment strategies, especially aspiration with appropriate antibiotic coverage, could reduce recurrence rates. Adequate management of comorbidities and lifestyle factors may further mitigate risk.

Keywords: Pyogenic liver abscess, recurrence, risk factors, drainage modalities, aspiration, antibiotics

INTRODUCTION

Pyogenic liver abscess (PLA) has been characterized as a focal suppurative process in the liver parenchyma, usually secondary to biliary tract infection, portal pyemia, or contiguous spread from nearby anatomical structures [1,2]. In spite of improvements in the imaging diagnostic methods, such as ultrasound and computed tomography (CT), and even the facile availability of broad-spectrum antibiotics, PLA is a significant clinical problem. One particularly ominous complication of PLA is recurrence of abscess formation, with often repeated hospital admissions, further medical interventions, and higher healthcare expenditures [3].

Numerous demographic and clinical factors have been found to make patients susceptible to PLA recurrence. Male gender has been generally described to have increased PLA incidence, perhaps due to lifestyle factors such as alcoholism [4]. Older age, diabetes mellitus, and other immunocompromised conditions are also predisposing to more frequent or severe disease [5,6]. Moreover, the distribution of the abscess—multiple or single, one liver lobe (either right or left) or bilaterally—are potentially affecting the clinical outcomes. For example, multiple abscesses are most likely to require more aggressive therapy or combination therapies, perhaps adding to the risks for complications and recurrence [7].

Treatment of PLA has changed. It used to be that open surgical drainage was the standard. Now, less invasive measures like percutaneous aspiration or pigtail drainage are preferred in the majority of situations,

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particularly for well-defined unilocular abscesses [8]. Supportive antibiotic therapy remains helpful, but based on culture and sensitivity reports if they are available. But treatment methods also need to take into account patient comorbidities—particularly diabetes and underlying liver dysfunction—to prevent re-infection.

In this prospective observational study, we sought to describe the clinical presentation of pyogenic liver abscess (PLA) in a tertiary center and determine the most closely associated risk factors and management options for recurrence of abscesses. In particular, we investigated various demographic factors (age, sex), lifestyle factors (alcohol use, diet), comorbid factors (diabetes, smoking, tuberculosis), and characteristics of the abscess (single or multiple lesions, laterality). We also compared a number of treatment modalities—alone, aspiration with antibiotics, pigtail drainage, and surgical drainage—based on recurrence rates. Through the systematic evaluation of these factors, we hoped to yield meaningful data that could improve clinical decision-making, enable effective patient counseling, and enable improved long-term outcomes.

MATERIALS AND METHODS

Study Design and Setting

A prospective observational study was conducted over a 12-month period at the Department of Gastroenterology in a tertiary care hospital. Ethical approval was obtained from the institutional review board prior to patient enrollment.

Patient Selection

All adult patients (≥18 years) presenting with signs and symptoms suggestive of a liver abscess—fever, right upper quadrant pain, malaise—and radiological evidence (ultrasound or CT scan) confirming a pyogenic liver abscess were eligible. Exclusion criteria included:

1. Known hydatid cysts.
2. Malignant lesions.
3. Those who refused consent.

Data Collection

Demographic and clinical variables were recorded upon enrollment: age, sex, diet (strict vegetarian vs. mixed), alcohol use, and comorbidities (diabetes mellitus, smoking history, tuberculosis, alcoholic liver disease). All patients underwent standard laboratory workup, including complete blood count, liver function tests, and random blood sugar levels. Diagnostic imaging (ultrasonography or contrast-enhanced CT scan) was performed to assess the location (right, left, bilateral) and number of abscesses (solitary vs. multiple).

Treatment Protocol

Decisions regarding management modality—percutaneous aspiration alone, percutaneous pigtail catheter drainage, surgical drainage (incision and drainage, I&D), or aspiration combined with antibiotic therapy—were made based on abscess size, patient stability, and physician discretion. Antibiotics were initiated empirically with coverage for gram-negative and anaerobic bacteria, then de-escalated or modified according to culture results if available.

Outcome Assessment

Patients were followed for six months post-discharge via outpatient visits or telephonic interviews. Recurrence was defined as any new episode of pyogenic liver abscess confirmed clinically and radiologically within this period. Non-recurrence was documented for patients who remained symptom-free or did not meet diagnostic criteria for PLA at six months.

Statistical Analysis

Descriptive statistics summarized baseline demographics, abscess characteristics, and recurrence rates. Categorical data were presented as frequencies and percentages. Pearson's chi-square or Fisher's exact tests were used to compare recurrence rates across different risk factors and management strategies. A p-value of <0.05 was considered statistically significant.

RESULTS

Baseline Characteristics

A total of 100 patients met inclusion criteria: 70% were male and 30% were female. The average age ranged from under 30 years (25%), between 30–59 years (50%), and 60 years or older (25%). Among the cohort, 20% reported a strictly vegetarian diet, while 80% followed a mixed diet. A history of alcohol consumption was noted in 40% (Table 1).

Table 1. Baseline Demographics

Variable	Value
Total Patients	100 (100%)
Age < 30 years	25 (25%)
Age 30–59 years	50 (50%)
Age ≥ 60 years	25 (25%)
Male	70 (70%)
Female	30 (30%)
History of Alcohol (Yes)	40 (40%)
Diet: Veg	20 (20%)

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Diet: Mixed	80 (80%)
Solitary Lumps	60 (60%)
Multiple Lumps	40 (40%)
Right-sided	50 (50%)
Left-sided	30 (30%)
Bilateral	20 (20%)

Patterns of Abscess and Recurrence

Among the 100 patients, 60% had a solitary abscess, while 40% had multiple abscesses. Recurrence occurred in 25% overall. Solitary abscesses had a lower recurrence rate (16.7%) compared to multiple abscesses (37.5%) (Table 2).

Table 2. Multiplicity (Solitary vs. Multiple) vs. Recurrence

Variable	Value
Solitary	No Recurrence = 50 (83.3%), Recurrence = 10 (16.7%)
Multiple	No Recurrence = 25 (62.5%), Recurrence = 15 (37.5%)
Total	No Recurrence = 75 (75%), Recurrence = 25 (25%)

Laterality also influenced recurrence (Table 3). Right-sided abscesses occurred in 50% of patients, with 20% recurrence, whereas left-sided involvement (30% patients) had 16.7% recurrence. Bilateral disease (20% of patients) showed significantly higher recurrence (50%).

Table 3. Laterality (Right vs. Left vs. Bilateral) vs. Recurrence

Variable	Value
Right-sided	No Recurrence = 40 (80%), Recurrence = 10 (20%)
Left-sided	No Recurrence = 25 (83.3%), Recurrence = 5 (16.7%)
Bilateral	No Recurrence = 10 (50%), Recurrence = 10 (50%)
Total	No Recurrence = 75 (75%), Recurrence = 25 (25%)

Demographic Factors and Recurrence

Recurrence was also analyzed by sex (Table 4): males had a 28.6% recurrence rate, compared to 16.7% in females. Alcohol use correlated with a notably higher recurrence (37.5%) than non-users (16.7%) (Table 5). Vegetarian diet showed a slightly lower recurrence rate (15%) compared to a mixed diet (27.5%) (Table 6).

Table 4. Sex (Male vs. Female) vs. Recurrence

Variable	Value
Male	No Recurrence = 50 (71.4%), Recurrence = 20 (28.6%)
Female	No Recurrence = 25 (83.3%), Recurrence = 5 (16.7%)
Total	No Recurrence = 75 (75%), Recurrence = 25 (25%)

Table 5. Alcohol Use (Yes vs. No) vs. Recurrence

Variable	Value
Yes (History of Alcohol)	No Recurrence = 25 (62.5%), Recurrence = 15 (37.5%)
No (No History of Alcohol)	No Recurrence = 50 (83.3%), Recurrence = 10 (16.7%)
Total	No Recurrence = 75 (75%), Recurrence = 25 (25%)

Table 6. Dietary Habit (Veg vs. Mixed) vs. Recurrence

Variable	Value
Veg	No Recurrence = 17 (85.0%), Recurrence = 3 (15.0%)
Mixed	No Recurrence = 58 (72.5%), Recurrence = 22 (27.5%)
Total	No Recurrence = 75 (75%), Recurrence = 25 (25%)

Comorbidities and Management Modalities

Of the 100 patients, 60% reported at least one predisposing condition. Diabetes (20%) had a 35% recurrence rate (Table 8). Smoking (25%) conferred a 28% recurrence. Patients with no comorbidities had the lowest recurrence rate (15%). Management choice also influenced outcomes (Table 7). Aspiration combined with appropriate antibiotics achieved the lowest recurrence (12%), while pigtail drainage alone (30%) and surgical drainage (33.3%) had relatively higher recurrence.

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Table 7. Management Modality vs. Recurrence

Variable	Value
Aspiration only	No Recurrence = 15 (75%), Recurrence = 5 (25%)
Pigtail drainage	No Recurrence = 28 (70%), Recurrence = 12 (30%)
Surgical drainage (I&D)	No Recurrence = 10 (66.7%), Recurrence = 5 (33.3%)
Aspiration + Antibiotics	No Recurrence = 22 (88%), Recurrence = 3 (12%)
Total	No Recurrence = 75 (75%), Recurrence = 25 (25%)

Table 8. Predisposing Condition vs. Recurrence

Variable	Value
Diabetes (DM)	No Recurrence = 13 (65%), Recurrence = 7 (35%)
Smoking	No Recurrence = 18 (72%), Recurrence = 7 (28%)
Tuberculosis (TB)	No Recurrence = 7 (70%), Recurrence = 3 (30%)
Alcoholic Liver Disease	No Recurrence = 3 (60%), Recurrence = 2 (40%)
None	No Recurrence = 34 (85%), Recurrence = 6 (15%)
Total	No Recurrence = 75 (75%), Recurrence = 25 (25%)

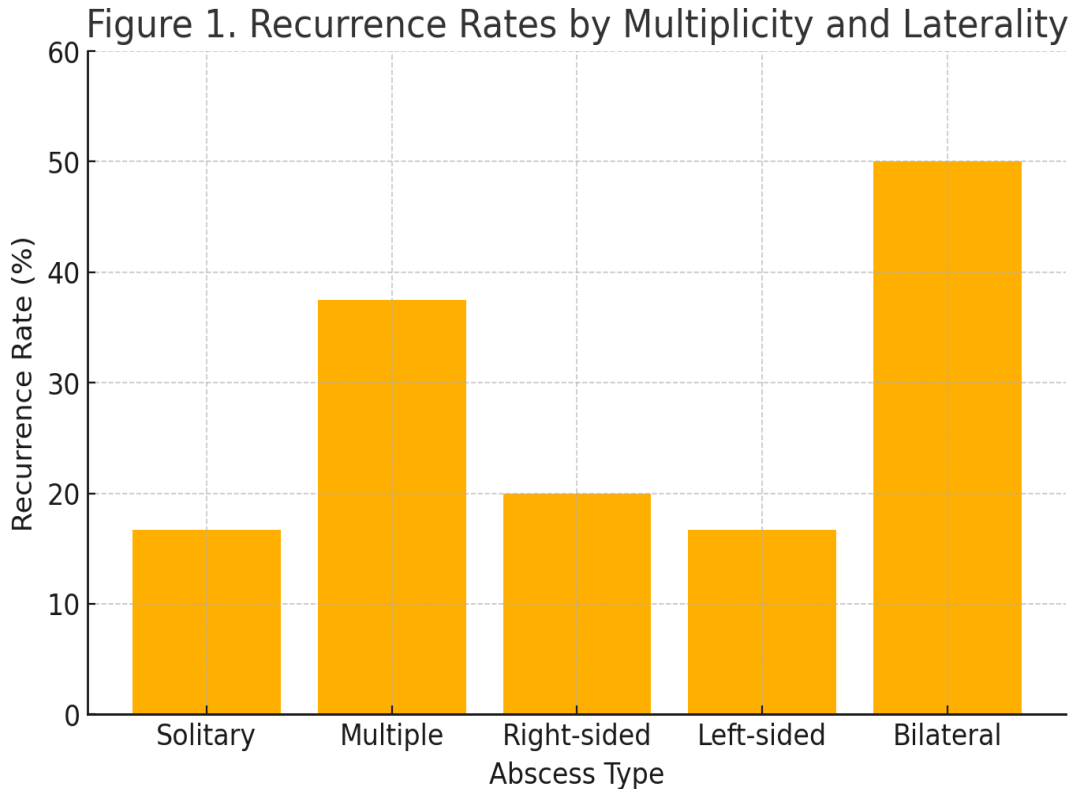

Figure 1. Recurrence Rates by Multiplicity and Laterality

Figure 1 shows that multiple and bilateral abscesses have significantly higher recurrence rates, highlighting the severity of complex lesions

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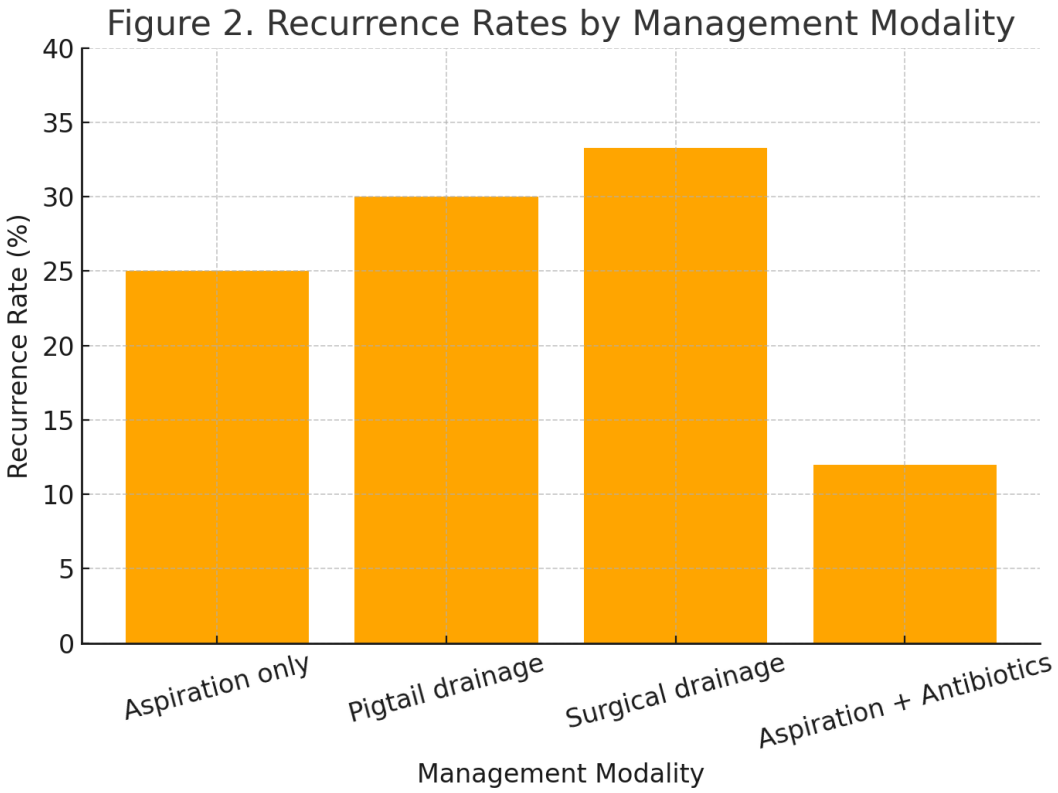

Figure 2. Recurrence Rates by Management Modality

Figure 2 indicates that aspiration with antibiotics yields the lowest recurrence, suggesting its efficacy over pigtail or surgical drainage in preventing relapses.

DISCUSSION

Pyogenic liver abscess (PLA) is a significant clinical concern due to its high morbidity and the risk of recurrence. In our study, we found that about a quarter of patients had at least one recurrence episode. These results are consistent with previous studies that report recurrence rates between 10% and 30%, which vary based on patient selection and treatment methods [1,2]. Importantly, our findings highlight the role of both anatomical and clinical characteristics in assessing the risk of recurrence.

The presence of multiple abscesses emerged as a key prognostic factor. Patients with multiple lesions had more than double the risk of recurrence compared to those with a single abscess. This observation aligns with the work of Chen et al. [3], who noted that multi-loculated or multi-septated lesions often require more extensive drainage or multiple procedures, increasing the chances of ongoing infection.

Additionally, bilateral liver involvement was linked to a 50% recurrence rate. This finding supports other research suggesting that bilateral lesions tend to have a higher microbial load and a more complicated drainage pattern, which often leads to longer treatment durations or the need for combination therapies [4]. Moreover, comorbidities like diabetes mellitus were found to worsen recurrence rates. Poor control of blood sugar can weaken immune responses, hinder wound healing, and reduce the effectiveness of antibiotics [5]. This emphasizes the importance of maintaining strict metabolic control in diabetic patients diagnosed with PLA.

Lifestyle factors, such as alcohol consumption and smoking, seem to influence the risk of recurrence. Consistent with earlier studies, we found that drinking alcohol was associated with a higher chance of developing repeated abscesses, likely due to impaired liver function and immune system issues. Our findings also indicated a slight protective effect in patients who followed a vegetarian diet, which may be linked to variations in gut microbiota and inflammatory markers in the body, although more research is needed to confirm this.

Effective management strategies are crucial for preventing recurrence. While percutaneous pigtail drainage and aspiration are commonly used, our data suggest that combining aspiration with targeted antibiotics resulted in the lowest recurrence rate of 12%. This supports previous research that highlights the advantages of integrating minimally invasive techniques with thorough antimicrobial treatment. In cases of large or loculated abscesses, repeated aspiration or catheter drainage may be required.

In summary, our study underscores the complex factors contributing to the recurrence of PLA, including host characteristics (such as age and existing health conditions) and the nature of the abscess (like its number and location). Future randomized controlled trials should investigate the best drainage methods and antibiotic treatments, while

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also focusing on managing comorbidities to reduce the risk of recurrence.

CONCLUSION

In this observational study, the recurrence of pyogenic liver abscess was notably linked to factors such as having multiple and bilateral abscesses, being male, alcohol consumption, diabetes, and specific treatment approaches. The combination of aspiration and antibiotic therapy showed the lowest rates of recurrence, highlighting the importance of timely and targeted antimicrobial treatment. It is recommended to manage underlying health issues, consider lifestyle factors, and ensure careful follow-up to minimize the risk of abscess recurrence. These findings underscore the necessity for personalized treatment plans and stress the significance of preventive measures for patients at high risk.

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