Section: General Surgery

Original Research Article

COMPARATIVE STUDY OF ULTRASOUND GUIDED NEEDLE ASPIRATION AND CATHETER DRAINAGE IN MANAGEMENT OF LIVER ABSCESS

Tarunima Bhanja[1], Partha Sarathi Dutta[2]

[1]Senior Resident, Department of General Surgery, Sarat Chandra Chattopadhyay Government Medical College and Hospital, Uluberia, Howrah, West Bengal, India
[2]Associate Professor, Department of General Surgery, Bankura Sammilani Medical College, P.O. Kenduadihi, Bankura, West Bengal, India

Received *: 15/06/2026*
Received in revised form *: 04/08/2026*
Accepted *: 19/08/2026*

Corresponding Author:
Dr. Partha Sarathi Dutta,
Associate Professor, Department of General Surgery, Bankura Sammilani Medical College, P.O. Kenduadihi, Bankura, West Bengal, India.
Email:drpsd11@gmail.com

DOI: 10.70034/ijmedph.2026.3.543

Source of Support: Nil,
Conflict of Interest: None declared

Int J Med Pub Health
2026; 16 (3); 3471-3475

ABSTRACT

Background: Liver abscess is a serious infection caused by bacterial, parasitic, or fungal organisms, most commonly bacteria. Risk factors include diabetes, immunosuppression, and biliary disease. Diagnosis relies on imaging and aspiration, while treatment involves source control, drainage or aspiration, and broad-spectrum antibiotics. This study aims to compare ultrasound-guided needle aspiration and catheter drainage for liver abscess treatment by evaluating therapeutic efficacy, safety, feasibility, effectiveness, clinical outcomes, complications, and procedural limitations to determine the more effective intervention for patient management.

Materials and Methods: This prospective, open-label observational study included 110 patients with liver abscess admitted to the Male and Female Surgical Downwards, Department of General Surgery, Bankura Sammilani Medical College and Hospital, between March 2023 and November 2024, comparing ultrasound-guided needle aspiration and catheter drainage.

Results: Pigtail catheter drainage showed faster clinical improvement than PNA ($p<0.05$), with lower residual cavity size (4.38±1.34 vs 5.04±1.79 cm), fewer re-aspirations (10 vs 45 patients), and shorter hospital stay (5.64±1.51 vs 6.20±1.53 days), indicating better efficacy.

Conclusion: Middle-aged alcoholic males commonly presented with right lobe liver abscess. Imaging guided diagnosis and treatment. Small abscesses responded to antibiotics, whereas larger abscesses required intervention. Pigtail catheter drainage proved more effective than needle aspiration, with both procedures demonstrating safety and minimal complications.

Keywords: Liver abscess, Ultrasonography, Aspiration, Catheterization, Drainage, Efficacy, Complications.

INTRODUCTION

Microbial contamination of the liver leading to a liver abscess continues to occur at a fairly constant rate of approximately 1/5000 hospital admissions. The incidence of causative organisms varies and reflects changes in aetiology and geographical distribution. Bacterial, parasitic and fungal organisms can cause liver abscess but, worldwide, bacteria remain the most common; although infection is usually polymicrobial Klebsiella, Escherichia coli and the Streptococcus milleri group are the usual organisms identified. There is an increased incidence in the elderly, those with diabetes and the immunosuppressed and presentation is usually with anorexia, fever, malaise and right upper quadrant discomfort. The overall mortality has declined because of improved imaging and effective antimicrobial therapy and the outcome is increasingly dependent on the underlying cause and the presence of comorbidities.[1] Biliary tract pathology is the most common source (35%), followed by portal spread from the gastrointestinal tract, including diverticulitis and appendicitis (20%). Other unusual aetiologies include contiguous spread from subphrenic or intra-abdominal collections, bacteraemia secondary to trauma or infected cysts and necrotic tumours following chemotherapy. The cause is not identified

in 10% of cases and a number of liver abscesses become recurrent (12–38% depending on whether the responsible organism is identified and whether the patient has diabetes. Pyogenic abscess is largely a disease of people in their 20s and 30s, mostly the result of acute appendicitis. With marked change in patient care it is now mostly seen in 50s and 60s.[2] There is no significant gender, ethnic or geographic differences in disease frequency, male: female ratio is 1.5:1. Comorbid condition associated with pyogenic abscess are cirrhosis, diabetes, chronic renal failure and history of malignancy. Amoebic Abscess is caused by Entamoeba histolytica in endemic area of Mexico, India, Africa. WHO estimated that 40-50 million people suffer amoebic colitis and amoebic liver abscess worldwide, resulting in 40,000 to 1,00,000 deaths each year.[3] Before this, estimates of amebiasis were unreliable because E. histolytica (the pathogenic form) was not differentiated from Entamoeba dispar (the non-pathogenic form). Male homosexuals with diarrhoea previously thought to harbour E histolytica, were actually found to be infected with E. dispar, which requires no treatment. In contrast to pyogenic abscess, patients with amoebic liver abscess tend to be Hispanic men, 20-40 years of age, with history of travel to endemic area. Poverty and cramped living conditions are associated with higher rates of infection. A male preponderance of more than 10:1 has been reported in almost all studies. Heavy alcohol consumption is commonly reported and render the liver more susceptible to amoebic abscess.[4] The diagnosis is suggested by the finding of a multiloculated cystic mass on ultrasonography or CT scan and is confirmed by aspiration. Treatment of liver abscesses initially requires identification of the source, if possible, aspiration of the lesion for microbiology and culture (repeated aspirations may be required) and treatment with appropriate antibiotics. Simple cysts containing debris, hydatid cysts, necrotic tumours and non-infected haematomas (after unrecognised or occasional trivial trauma) can all be mistaken for abscesses. Antibiotic treatment using a combination of two or more antibiotics is recommended. Metronidazole and clindamycin provide wide anaerobic coverage and excellent penetration into the abscess cavity. Third-generation cephalosporins and aminoglycosides are very effective against most Gram-negative organisms.

MATERIALS AND METHODS

Study design: Prospective observational study.
Place of study: This study will be carried out in Male Surgical Down, Female Surgical Downward: Dept of General Surgery of Bankura Sammilani Medical College and Hospital from March 2023 to November 2024.

Period of study: From June 2023 to November 2024
Study Population: All the patients with diagnosis of liver abscess coming in OPD and emergency and getting admitted in surgery ward of Bankura Sammilani Medical College and Hospital, fulfilling inclusion and exclusion criteria will be considered as study population.
Sample size: 110 patients.
Inclusion Criteria:

1. Patients diagnosed with liver abscess based upon clinical examination, radiological imaging findings, pus characteristics, serology, biochemical tests.
2. Abscess size more than or equal to 5 cm will be enrolled for the study.
3. In patients with multiple abscesses, only abscesses $\geq$ 5 cm will be considered for intervention.

Exclusion criteria:

1. >2 abscess in the same or different lobe irrespective of the diameter of the abscess.
2. Rupture of abscess before intervention.
3. Prior intervention: patients who had already been subjected to aspiration/drainage before presenting to us were excluded from the study.
4. Uncorrectable coagulopathy.
5. Concomitant biliary tract malignancy.
6. Toxic patients (secondary infection).
7. Ascites.

Study Variable:
Socio-demographic and Clinical Variables

- Age
- Sex
- Occupation
- Socioeconomic status
- Marital status
- Education
- Residency status (Permanent/Immigrant)
- Religion
- Presence of malignancy (Yes/No)
- Preoperative duration

Statistical Analysis: For statistical analysis, data were initially entered into a Microsoft Excel spreadsheet and then analyzed using SPSS (version 27.0; SPSS Inc., Chicago, IL, USA) and GraphPad Prism (version 5). Numerical variables were summarized using means and standard deviations, while Data were entered into Excel and analyzed using SPSS and GraphPad Prism. Numerical variables were summarized using means and standard deviations, while categorical variables were described with counts and percentages. Two-sample t-tests were used to compare independent groups, while paired t-tests accounted for correlations in paired data. Chi-square tests (including Fisher's exact test for small sample sizes) were used for categorical data comparisons. P-values ≤ 0.05 were considered statistically significant.

RESULTS

Table 1: distribution of study population according to clinical improvement in days (in terms of pyrexia, abdominal tenderness and falling trend of TLC)

Clinical Improvement	3	4	5	6	7	8	9	10	Total
PIGTAIL	1	12	17	11	8	4	0	2	55
PNA	3	6	8	11	16	9	2	0	55
TOTAL	4	18	25	22	24	13	2	2	110
	Value			**df**				**P**	
X2	14.8			7				0.038	
N	110								

Table 2: distribution of study population on the basis of subjects who underwent pna and pigtail and the size of abscess cavity post aspiration.

	Group	**Residual Cavity**
N	PIGTAIL	55
	PNA	55
Mean	PIGTAIL	4.38
	PNA	5.04
Median	PIGTAIL	4
	PNA	5
Standard deviation	PIGTAIL	1.34
	PNA	1.79
Minimum	PIGTAIL	2
	PNA	2
Maximum	PIGTAIL	8
	PNA	9

Residual Cavity	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**Total**
PIGTAIL	3	13	15	11	11	1	1	0	55
PNA	3	7	15	12	4	8	4	2	55
Total	6	20	30	23	15	9	5	2	110
	Value				**df**			**P**	
X2	14.4				7			0.045	
p	110								

Table 3: distribution of study population according to clinical improvement and type of intervention they underwent

Clinical Improvement	Pigtail (n=55)	PNA (n=55)	Total (N=110)
Yes (Y)	54	43	97
No (N)	1	12	13
Total	55	55	110

Chi-square test: $\chi^2 = 10.6$, df = 1, p = 0.001.

Table 4: distribution of study population based on the requirement of reaspiration for those who underwent aspiration.

Reaspiraton	PIGTAIL	PNA	Total
No	55	10	65
Yes	0	45	45
Total	55	55	110
	Value	**df**	**P**
X2	76.2	1	<0.01
N	110		

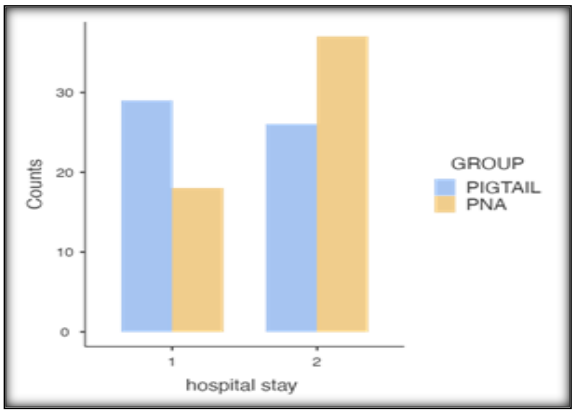

Figure 1: distribution of subjects based on hospital stay.

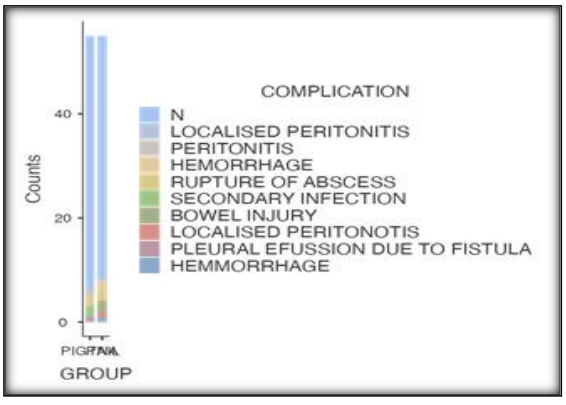

Figure 2: association of complication and the type of intervention they underwent

The above table depicts lesser time required for clinical improvement among the people treated with pigtail catheter than PNA which is statistically significant with p< 0.05. [Table 1]

The above plot depicts the post aspiration size of the abscess cavity in the patient's undergoing pigtail, according to the data, maximum subjects had a considerable reduction in the size of abscess cavity to 4cm or less. There is also statistically significant association between PNA and pigtail residual cavity by tests with p value < 0.05. Mean residual abscess cavity of pigtail group was 4.38 with standard deviation of 1.34 and PNA group was 5.04 with standard deviation of 1.79.[Table 2]

The above table depicts that clinical improvement in pigtail group was more than the PNA group. In PNA group 12 patients did not have clinical improvement, which is statistically significant with p<0.05. [Table 3]

The above data shows the requirement of re-aspiration is seen more among PNA group (45 out of 55 patients).It further shows a statistically significant correlation between two groups with p<0.05. [Table 4]

The above table depicts a hospital stay of patients who treated with PNA were more than pigtail catheter drainage patients depicting the high efficacy of pigtail drainage in the management which is statistically significant also with p <0.05. Mean duration of hospital stay in PNA group is 6.20 with standard deviation 1.53 and pigtail is 5.64 with standard deviation 1.51. [Figure 1]

Showing no statistical significance between pigtail and PNA group with p value>0.05. [Figure 2]

DISCUSSION

Liver abscess remains an important cause of morbidity and mortality, particularly in developing countries. Appropriate diagnosis, prompt initiation of antimicrobial therapy, and timely drainage are the cornerstones of successful management. Lee SS et al,[5] reported that advances in imaging techniques and percutaneous drainage have significantly improved the prognosis of pyogenic liver abscess over the past few decades. Although fungal liver abscess is comparatively uncommon, it should be considered in immunocompromised individuals as highlighted by Agarwal R et al.[6] The anatomical location and segmental distribution of the liver are important in understanding the spread and localization of hepatic abscesses, as described by Singh V.[7]

Percutaneous management of liver abscess has evolved considerably since the pioneering work of McFadzean AJ et al,[8] who demonstrated the effectiveness of closed needle aspiration combined with antibiotic therapy. Subsequently, Huang CJ et al,[9] reported changing trends in the management of pyogenic liver abscess, with increasing use of image-guided drainage techniques and improved clinical outcomes. Similarly, Mohsen AH et al,[10] observed that percutaneous drainage has become the standard treatment for most uncomplicated liver abscesses because of its high success rate and low morbidity. Chou FF et al,[11] further demonstrated that catheter drainage is associated with higher treatment success, especially in large or multiloculated abscesses.

In the present study, patients treated with pigtail catheter drainage showed significantly earlier clinical improvement than those managed with percutaneous needle aspiration (PNA) (p<0.05). Continuous drainage through the catheter probably resulted in more effective evacuation of purulent material, leading to earlier resolution of fever, pain, and systemic manifestations. These findings are consistent with the observations reported in Cahill M et al,[12] and, who described better clinical outcomes following catheter drainage.

The present study also demonstrated that the mean residual abscess cavity was significantly smaller in the pigtail catheter group (4.38 ± 1.34 cm) than in the PNA group (5.04 ± 1.79 cm) (p<0.05). Continuous drainage through the catheter allows gradual collapse of the abscess cavity and prevents re-accumulation of pus. Similar findings were described in Alvarez J et al,[13] who emphasized that image-guided catheter drainage provides better radiological resolution than repeated needle aspiration.

Clinical improvement was significantly better in the pigtail catheter group, whereas twelve patients in the PNA group failed to show satisfactory improvement. The need for repeat aspiration was also considerably higher among patients managed with PNA, indicating the limitations of intermittent aspiration in completely evacuating thick purulent collections. Comparable observations have been reported in Ralls PW,[14] and Lok KH et al,[15] who concluded that catheter drainage reduces treatment failure and the need for repeated interventions.

The mean duration of hospital stay was significantly shorter in patients treated with pigtail catheter drainage compared with those undergoing PNA. Earlier clinical recovery and continuous drainage contributed to earlier discharge and reduced hospital burden. Similar findings have been documented in Fung CP et al,[16] which reported shorter hospitalization following successful catheter drainage.

Pyogenic liver abscess may occasionally be associated with serious metastatic and systemic complications. Reported endogenous bacterial endophthalmitis as a rare but severe complication, while described cardiac tamponade secondary to liver abscess. Petri WA et al,[17] these reports emphasize the importance of early diagnosis and adequate drainage in preventing life-threatening complications. Furthermore, highlighted the increasing global importance of Klebsiella pneumoniae liver abscess and its association with metastatic infections.

Although pyogenic liver abscess constituted the majority of cases in the present study, amoebic liver

abscess continues to be an important health problem in endemic regions. Mansour N et al,[18] emphasized the global disease burden of amoebiasis, whereas Castanon-Sanchez C et al,[19] described its epidemiological variation in endemic and non-endemic regions. Hung CC et al,[20] further reported an increased risk of invasive Entamoeba histolytica infection in HIV-seropositive individuals, highlighting the importance of early diagnosis and prompt treatment in susceptible populations.

CONCLUSION

Middle-aged alcoholic males with right lobe liver abscess constituted the majority of cases, while females were less commonly affected. Imaging, particularly USG and CECT, was essential for diagnosis and intervention planning. Small abscesses (<5 cm) responded well to antibiotics, whereas larger abscesses required intervention. Pigtail catheter drainage was more effective than percutaneous needle aspiration, resulting in better clinical improvement, shorter hospital stay, fewer re-aspirations, and minimal complications. Only one patient required open surgical drainage following pigtail failure.

REFERENCES

1. Bailey, Henry, and R. S. Love. Bailey & Love's Short Practice of Surgery. 28th ed., CRC Press, 2020.
2. Cameron, John L., and Andrew M. Cameron. Sabiston Textbook of Surgery: The Biological Basis of Modern Surgical Practice. 21st ed. Philadelphia: Elsevier, 2021.
3. Salles JM , Salles MJ, Moraes LA et al. Invasive amebiasis: an update on diagnosis and management. Expert Rev Anti Infect Ther.2007;5:893-901
4. Srinivasan, V., & Krishna, S. (2015). "Amoebic liver abscess: Diagnostic and therapeutic strategies." World Journal of Gastroenterology, 21(30), 8767-8777.
5. Lee, S. S., et al. (2008). "Pyogenic liver abscess in the East: An overview of 40 years' experience in Taiwan." Journal of Hepatology, 49(5), 703-710.
6. Agarwal, R., et al. (2007). "Fungal liver abscesses in immunocompromised patients." Journal of Clinical Gastroenterology, 41(8), 728-734.
7. Singh, Vishram. Textbook of Anatomy.5th ed.,Elsevier,2021.
8. McFadzean AJ, et al: Solitary pyogenic abscess of the liver treated by closed aspiration and antibiotics; a report of 14 consecutive cases with recovery, Br J Surg 41:141–152, 1953.
9. Huang CJ, et al: Pyogenic hepatic abscess: changing trends over 42 years, Ann Surg 223:600–607, 1996.
10. Mohsen AH, et al: Liver abscess in adults: ten years experience in a UK centre, QJM 95:797–802, 2002.
11. Chou FF, et al: Single and multiple pyogenic liver abscesses: clinical course, etiology, and results of treatment, World J Surg 21:384–388, discussion 388- 389, 1997. Chou FF, et al: Single and multiple pyogenic liver abscesses: clinical course, etiology, and results of treatment, World J Surg 21:384–388, discussion 388- 389, 1997.
12. Cahill M, et al: Bilateral endogenous bacterial endophthalmitis associated with pyogenic hepatic abscess, Br J Ophthalmol 84:1436, 2000. Vong SC, et al: Cardiac tamponade secondary to pyogenic liver abscess, J Clin Gastroenterol 41:635–636, 2007.
13. Alvarez J, et al: Pyogenic liver abscesses: a comparison of older and younger patients, HPB (Oxford) 3:201–206, 2001a.
14. Ralls PW: Inflammatory disease of the liver, Clin Liver Dis 6:203–225, 2002.
15. Lok KH, et al: Pyogenic liver abscess: clinical profile, microbiological characteristics, and management in a Hong Kong hospital, J Micro biol Immunol Infect 41:483–490, 2008.
16. Fung CP, et al: A global emerging disease of Klebsiella pneumoniae liver abscess: is serotype K1 an important factor for complicated endophthalmitis?, Gut 50:420–424, 2002.
17. Petri WA, et al: Estimating the impact of amebiasis on health, Parasitol Today 16:320–321, 2000.
18. Mansour N, et al: Amebiasis in schistosomiasis endemic and nonendemic areas in Egypt, J Egypt Soc Parasitol 27:617–628, 1997.
19. Castanon-Sanchez C, et al: Entamoeba histolytica: a unicellular organism containing two active genes encoding for members of the TBP family, Protein Expr Purif 70:48–59, 2009.
20. Hung CC, et al: Increased risk for Entamoeba histolytica infection and invasive amebiasis in HIV seropositive men who have sex with men in Taiwan, PLoS Negl Trop Dis 2:e175, 2008