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Original Research Article

PYOGENIC LIVER ABSCESS DRAINAGE BY NEEDLE ASPIRATION VERSUS PIGTAIL CATHETER: A PROSPECTIVE STUDY

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ABSTRACT

Background: Pyogenic or amoebic liver abscesses cause high morbidity and mortality, particularly in tropical areas. Percutaneous needle aspiration (PNA) and percutaneous catheter drainage (PCD) are the most important treatment methods for liver abscesses and replace surgery. **Aim:** To compare the therapeutic efficacy and safety of PNA and PCD in managing liver abscesses in terms of clinical improvement, hospital stay, volume of pus drained, reduction in abscess cavity size, and overall success rates.

Materials and Methods: A retrospective comparative study was conducted between January and December 2017 at a tertiary care center in Lucknow, India. Fifty-four patients with liver abscesses >5 cm were included, equally divided into PNA (n=27) and PCD (n=27) groups. Clinical and demographic data were collected and outcomes such as volume of pus drained, days to clinical improvement, hospital stay and reduction in abscess size were analyzed.

Results: The PCD group showed a faster clinical improvement (2.62 ± 1.11 vs. 5.44 ± 2.13 days, $p < 0.001$), a shorter hospital stay (5.22 ± 2.1 vs. 8.80 ± 4.62 days, $p < 0.001$) and a faster reduction in abscess size (2.98 ± 1.50 vs. 4.52 ± 2.78 days, $p = 0.014$) compared to the PNA group. The volume of pus drained in the first session was significantly higher in the PCD group (135.21 ± 25.30 mL vs. 120.05 ± 21.42 mL, $p = 0.021$). The success rate was slightly higher in the PCD group (96.30%) than in the PNA group (85.19%), but not statistically significant ($p = 0.351$).

Conclusion: PCD treats liver abscesses better than PNA and leads to faster healing, shorter hospital stays and better clinical outcomes. It is best suited for large or multilocular abscesses.

Keywords: Liver abscess, Pigtail catheter, USG, minimally invasive techniques.

INTRODUCTION

The complex liver is vital for metabolism, detoxification and immunological activities. It is susceptible to systemic infection by bacteria, viruses and parasites as it is located at the end of the portal circulation.[1] Pyogenic and amoebic liver abscesses are common clinical problems. Although rare, pyogenic liver abscesses (PLA) can be fatal if not diagnosed and treated early. Amoebic liver abscesses (ALA) are common in tropical areas, especially in immunocompromised young men.[2] Despite breakthrough advances in detection and treatment, liver abscesses still cause significant morbidity and mortality in resource-limited settings. Pyogenic and amoebic liver abscesses have nonspecific symptoms that delay diagnosis. Patients may present with fever, right upper quadrant pain, anorexia, lethargy, and difficulty breathing due to the proximity of the diaphragm. Diabetes, advanced age, cancer, and immunosuppression increase the risk of infection.[3] Entamoeba histolytica causes amoebic liver abscesses, while polymicrobial pyogenic liver abscesses include Gram-negative and Gram-positive aerobes with anaerobes.[4]

Volkmann first performed open surgical drainage of liver abscesses in 1879. Although this treatment was effective, it caused considerable morbidity and mortality, which was over 90% at the beginning of the 20th century. The diagnosis and treatment of liver abscesses has changed thanks to advances in imaging techniques such as USG and CT. These imaging techniques allow for precise localization of the abscess and allow for minimally invasive surgeries such as PNA and PCD. The modern mortality rate is 10–20% lower.[5,6]

Current treatment methods focus on broad-spectrum antibiotics and image-guided drainage. Abscesses larger than 5 cm must be drained to prevent rupture, infection and organ failure. Percutaneous needle aspiration and catheter drainage are the preferred drainage methods as they are less invasive and allow for faster recovery.

Percutaneous needle aspiration involves aspirating the pus with a small needle under imaging. This simple and inexpensive method can be repeated if necessary. Percutaneous catheter drainage uses a catheter to continuously drain the abscess. Both procedures are effective, but the abscess, the patient's circumstances and the doctor's skills determine the choice. The efficacy and safety of these two procedures is currently under discussion and requires further investigation.

This study compares percutaneous intermittent needle aspiration and percutaneous continuous catheter drainage for pyogenic liver abscesses to fill a knowledge gap. Abscesses larger than 5 cm are included in the study, regardless of demographics, bacteria or disease. The aim is to determine whether the therapy is better in terms of clinical efficacy, safety and patient outcomes.

MATERIALS AND METHODS

This retrospective comparative study was conducted in the Department of Surgery of a postgraduate apex tertiary care institution in Lucknow, Uttar Pradesh, India over a period of one year from January 1, 2017 to December 31, 2017. The study included 56 patients with a liver abscess, with two patients excluded: one due to preoperative rupture of the abscess and another because the patient would not consent to percutaneous intervention. Consequently, 54 patients were divided into two cohorts of equal size: 27 patients in the percutaneous needle aspiration (PNA) cohort and 27 in the percutaneous catheter drainage (PCD) cohort. All patients were receiving intravenous antibiotics at the time of diagnosis, including ampicillin, gentamicin and metronidazole. Informed consent was obtained and all surgeries were performed under strict aseptic protocols.

Individuals aged 16 to 60 years with liver abscesses larger than 5 cm identified by ultrasonography (USG) or computed tomography (CT) were included. Individuals with abscess cavities less than 5 cm, ruptured liver abscesses, bile duct cancer or uncontrollable coagulopathy were excluded. Patients were selected from outpatient clinics and emergency departments, and a comprehensive clinical history, thorough physical examination and baseline investigations — including liver function tests, prothrombin time, International Normalized Ratio (INR), blood culture and amoebic serology — were performed. Imaging techniques such as ultrasound and computed tomography were used to confirm the diagnosis and assess the characteristics of the abscess.

PNA and PCD were performed under real-time ultrasound guidance using the LOGIQ P5 ultrasound system. For PNA, a 16/18 G BD spinal needle was used to aspirate pus from the abscess cavity under local anesthesia (2% lignocaine), repeating the procedure as needed. A 28-Fr pigtail catheter was inserted into the abscess cavity for PCD using the Seldinger method. The catheter was maintained for continuous drainage and withdrawn when drainage fell below 10 ml per 24 hours for two consecutive days. In both cohorts, samples of aspirated pus were sent for Gram staining, culture and sensitivity analysis.

Outcome Assessment and statistical analysis

The efficacy of the therapies was evaluated by the duration of hospitalization, time to clinical improvement, time to 50% reduction in abscess cavity size, and time to near resolution of the abscess cavity. Patients were followed up clinically and by ultrasound weekly for one month, monthly for three months and for six months. Data were documented in printed proformas and analyzed using SPSS software. T-tests and chi-square tests were used for statistical comparisons, with a p-value <0.05 considered statistically significant. Antibiotic medication was adjusted according to the results of the pus cultures to ensure efficient infection management.

RESULTS

The study included 54 patients with liver abscesses, who were predominantly male (66.67%) and predominantly over 40 years of age (50.00%). The most common presenting symptom was fever (96.30%), followed by anorexia (92.59%), nausea/vomiting (88.89%) and right upper quadrant discomfort (83.33%). Other symptoms included asthenia, weight loss, nocturnal diaphoresis, dyspnea, and diarrhea, indicating systemic and abdominal involvement. The majority of abscesses were located in the right lobe (81.48%) and were numerous (88.89%) as shown in Table 1.

Table 1: Baseline and clinical characteristics of the patients

		n	%
Age	21-40 years	24	44.44
	>40 years	27	50.00
Gender	Male	36	66.67
	Female	18	33.33
Symptoms	Fever	52	96.30
	Anorexia	50	92.59
	Nausea/vomiting	48	88.89
	Right upper quadrant pain	45	83.33
	Weakness	44	81.48
	Weight loss	30	55.56
	Night sweats	26	48.15
	Dyspnea	23	42.59
	Diarrhea	21	38.89
	Rigors	13	24.07
	Cough	12	22.22
	Right shoulder pain	9	16.67
Location of abscess	Right	44	81.48
	Left	6	11.11
	Both	4	7.41
Number of abscess	Single	6	11.11
	Multiple	48	88.89

Table 2 classifies liver abscesses by amoebic serology and pus culture. Some abscesses were amoebic, pyogenic, or mixed, with positive serology and negative culture.

Table 2: Type of abscess accordance with amebic serology and pus culture

Etiology	Amoebic serology result	Pus culture result
Amoebic	+	-
Pyogenic	-	+
Amoebic with secondary infection	+	+

Table 3 shows the distribution of abscess types in the two treatment groups. PNA had 2 amoebic, 24 pyogenic, and 1 undetermined abscess; PCD had 1 amoebic, 25 pyogenic, and 1 indeterminate.

Table 3: Type of abscesses in each group

	Amoebic	Pyogenic	Indeterminate
PNA	2	24	1
PCD	1	25	1

Table 4 shows the microbiological results of the pus cultures. Most (79.63%) showed no growth, while E. coli (12.96%) was isolated most frequently. Both Klebsiella pneumoniae and Staphylococcus aureus were found in 3.70 of patients.

Table 4: Microbiological Profile of Pus Culture

Organism	n	%
No organism	43	79.63
E. coli	7	12.96
Klebsiella pneumonia	2	3.70
Staph. aureus	2	3.70

Table 5 comparative analysis between percutaneous needle aspiration (PNA) and pigtail catheter drainage (PCD) revealed significant differences in the results. PCD showed superior efficacy with a higher volume of pus drained in the first session (135.21 ± 25.30 ml) compared to PNA (120.05 ± 21.42 ml, $p = 0.021$). Clinical improvement was achieved faster with PCD (2.62 ± 1.11 days) than with PNA (5.44 ± 2.13 days, $p < 0.001$). Similarly, PCD patients had a shorter hospital stay (5.22 ± 2.1 days) than patients in the PNA group (8.80 ± 4.62 days, $p < 0.001$) and required less time for a 50% reduction in abscess size (2.98 ± 1.50 days for PCD vs. 4.52 ± 2.78 days for PNA, $p = 0.014$). Although the success rate was slightly higher in the PCD group (96.30%) than in the PNA group (85.19%), this difference was not statistically significant ($p = 0.351$).

Table 5: Comparative Outcomes between Percutaneous Needle Aspiration and Pigtail Catheter Drainage

	Percutaneous needle aspiration (n=27)		Pigtail catheter drainage (n=27)		P value
	Mean	±SD	Mean	±SD	
Volume of pus drained in first sitting (ml)	120.05	21.42	135.21	25.30	0.021
Clinical improvement (days)	5.44	2.13	2.62	1.11	<0.001
Hospital stay (days)	8.80	4.62	5.22	2.1	<0.001
Duration for 50% reduction in size (days)	4.52	2.78	2.98	1.50	0.014
Success (n,%)	23 (85.19%)		26 (96.30%)		0.351

DISCUSSION

This study evaluates percutaneous needle aspiration (PNA) and percutaneous catheter drainage (PCD) in the treatment of liver abscesses, focusing on the clinical outcomes and efficacy of each method. Our results confirm and extend previous studies and confirm the benefits of PCD in terms of clinical improvement, pus drainage volume, length of hospital stay and success rates.

Our study showed that clinical improvement was much faster in the PCD group (mean 2.62 ± 1.11 days) than in the PNA group (mean 5.44 ± 2.13 days, $p < 0.001$). This is consistent with the findings of Singh et al. (2013), who indicated that patients who received PCD had faster symptom relief than those who received PNA, with a statistically significant difference (mean 2.9 days for PCD vs. 5.6 days for PNA, $p = 0.039$). Kumar et al (2021) also showed accelerated clinical recovery in their PCD cohort, particularly in larger abscesses where continuous drainage allowed better drainage of the pus.[7] The comprehensive review by Cai et al (2015) found a standardized mean difference (SMD) of −0.73 in favor of PCD for faster clinical improvement, confirming our findings.[8]

In our study, the amount of pus drained during the first procedure was greater in the PCD group (mean 135.21 ± 25.30 mL) than in the PNA group (mean 120.05 ± 21.42 mL, $p = 0.021$). This finding is supported by Khan et al. (2018), who observed a much larger drainage volume in PCD-treated patients due to continuous evacuation as opposed to intermittent aspiration in PNA.[9] Chauhan et al (2019) observed similar results and emphasized that PCD is particularly beneficial for abscesses with thick or multiloculated pus, where continuous drainage outperforms repeated aspiration in terms of efficacy.[10]

In our study, the mean hospital stay was significantly shorter in the PCD group (mean 5.22 ± 2.1 days) compared to the PNA group (mean 8.80 ± 4.62 days, $p < 0.001$). This conclusion is consistent with the research by Kumar et al. (2021), who indicated that PCD reduced hospital duration of stay by 30% compared to PNA, particularly for larger abscesses.[7] Similarly, Singh et al. (2013) found a reduced length of hospitalization in their PCD cohort (mean 6 days for PCD versus 9 days for PNA, $p < 0.05$).[11] Cai et al. (2015) conducted a meta-analysis that found no significant difference in hospitalization length, while recognizing diversity within studies based on abscess size and complexity.[8]

Our study shows a superior success rate in the PCD cohort (96.30%) relative to the PNA cohort (85.19%), however this disparity lacked statistical significance ($p = 0.351$). Nonetheless, prior research consistently indicates increased success rates associated with PCD. Cai et al. (2015) exhibited a notable relative risk (RR) of 0.81 supporting PCD for overall performance.[8] Khan et al. (2018) discovered that PCD had a somewhat superior success rate (94.3% compared to 84.6% for PNA), especially in abscesses above 5 cm in size.[9] Singh et al. (2013) established that PCD is more efficacious, especially for abscesses with viscous or thick pus.[11]

In our study, the PCD group exhibited a more rapid decrease in abscess cavity size (mean 2.98 ± 1.50 days for a 50% reduction) than the PNA group (mean 4.52 ± 2.78 days, $p = 0.014$). This aligns with the results of Kumar et al. (2021), who documented substantial cavity reduction with PCD, especially in extensive abscesses where continuous draining enhanced resolution. Cai et al. (2015) conducted a meta-analysis that indicated a standardized mean difference (SMD) of −1.08, supporting the efficacy of PCD in expediting abscess cavity reduction, consistent with our results.[8]

Our data corroborates that PCD is more efficacious for substantial abscesses (>5 cm), as also shown in other studies. Chauhan et al. (2019) and Singh et al. (2013) both found that PCD is the optimal approach for abscesses characterized by thick pus or multiloculated cavities.[10,11] Khan et al (2018) emphasized that PCD reduces the need for repeated interventions and thus improves patient recovery.[99]

Limitations

Despite its obvious benefits, PCD is limited by factors such as the need for catheter care, increased susceptibility to secondary infection, and the possibility of patient discomfort due to prolonged catheterization. Nevertheless, as this and other studies have shown, the safety and efficacy of PCD outweigh these disadvantages in the treatment of large or complicated abscesses.

CONCLUSION

Our study shows that PCD is a more effective treatment option for liver abscesses, especially in larger or more complicated cases. It offers faster clinical improvement, higher success rates and shorter hospital stay compared to PNA. Consequently, PCD should be considered the preferred treatment for patients with extensive or multiloculated liver abscesses as it better clinical outcomes.

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