

Comparison of the efficacy of percutaneous needle aspiration and pigtail catheter drainage for the treatment of liver abscess

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Abstract

Introduction: In recent years, image-guided percutaneous drainage has been increasingly used to treat liver abscesses with reported success rates ranging from 70-100%. Although percutaneous placement of an indwelling catheter is the method most widely preferred to drain liver abscesses, recent studies have claimed needle aspiration to be a simpler, less costly, and equally effective mode of treatment. **Aim:** To compare the efficacy of percutaneous needle aspiration and pigtail catheter drainage for the treatment of liver abscess. **Method:** This is a single centred prospective randomized comparative study in patients of liver abscess treated by needle aspiration & pigtail catheter drainage. A total no of 50 patient were included in the study which randomized into two groups; percutaneous needle aspiration (PNA) (n=25) and pigtail catheter drainage (PCD) (n=25). The effectiveness of either treatment was measured in terms of duration of hospital stay, days to achieve clinical improvement, 50% reduction in abscess cavity size and total/near total resolution of abscess cavity. Independent t-test was used to analyse these parameters. **Results:** Earlier clinical improvement (P=0.046) and 50% decrease in abscess cavity volume (P=0.0001) seen in the patients in PCD groups compared to those who underwent PNA. However, there was no significant difference between the duration of hospital stay or the time required for total or near-total resolution of cavity. **Conclusion:** Percutaneous catheter drainage is a better modality as compared to percutaneous needle aspiration especially in larger abscesses, which are partially liquefied or with thick pus.

Keywords: Liver Abscess, Percutaneous Catheter Drainage, Percutaneous Needle Aspiration

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Introduction

Liver abscess are the most common type of visceral abscess. A liver abscess occur when bacteria or protozoa entering directly from an injury through the blood vessels or by the way of the biliary ductal system & destroy hepatic tissue producing a cavity which fills with infectious organisms, liquefied liver cells and leucocytes. Necrotic tissues then wall off the cavity from rest of the liver.

Liver abscess is found more commonly in men between 20 and 40 years of age, but can occur at any age. Approximately 60% are solitary and mainly located in the right lobe of the liver, as a result of the streaming of portal blood flow secondary to the fact that the right lobe is predominantly supplied by the superior mesenteric vein, and because most of the hepatic volume is in the right lobe.

Liver abscesses, both amoebic and pyogenic, continue to be an important cause of morbidity and mortality in tropical countries. However, recent advances in interventional radiology, intensive care, progress in antibiotic therapy and liberal use of sonography and computerized tomography scanning of the abdomen have led to early diagnosis and treatment of patients with liver abscess, thus improving the patient outcome. Percutaneous drainage of liver abscess has been an important advancement in the treatment of pyogenic liver abscesses.

The primary mode of treatment of amoebic liver abscess is medical; however, as many as 15% of amoebic abscesses may be refractory to medical therapy[1]. Also, secondary bacterial infection may complicate 20% of amoebic liver abscesses[2]. In such patients and in patients with pyogenic liver abscesses, surgical drainage has been the

traditional mode of treatment[3]. However, operative drainage is associated with significant (10-47%) morbidity and mortality[4].

In recent years, image-guided percutaneous drainage has been increasingly used to treat liver abscesses with reported success rates ranging from 70-100%[5-7]. Although, percutaneous placement of an indwelling catheter is the method most widely preferred to drain liver abscesses[8]. recent studies have claimed needle aspiration to be a simpler, less costly and equally effective mode of treatment[9,10]. The aim of this study was to compare the efficacy of percutaneous needle aspiration and pigtail catheter drainage for the treatment of liver abscess.

Materials and method

This prospective study was conducted at Department of General Surgery, at VMMC and Safdarjung hospital, New Delhi. The study was approved by the institutional research and ethical committee. The study was conducted between February 2019 and November 2019. An informed and written consent was taken from the participating subjects prior to the commencement of the study.

A total no. of 50 patients were included in the study, which randomized into two groups; percutaneous needle aspiration (PNA) (n=25) and pigtail catheter drainage (PCD) (n=25).

Inclusion Criteria

Abscess cavity size > or = 5cm in its largest diameter.

Liquefied/partially liquefied content.

Single cavities or multiple communicating abscess cavities.

Unilocular abscess cavity.

Exclusion Criteria

Multiple abscess and ascites.

Multiloculated or septate abscess.

Coagulation disorder.

Other foci of intra-abdominal abscess required surgery.

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Liver abscess patients with suspected associated malignancy.

Pre-operative medication

All the patients initially treated empirically with injection Cefazolin 1g IV b.i.d. injection, Metronidazole 750mg IV every t.i.d. injection, Gentamicin 80mg IV b.i.d. and chloroquine 600mg for 2 days (600mg is total dose for a day which is given in 2 divided doses and not 600mg q.i.d.) followed by 300mg for 19 days (Given in 2 divided doses). According to the culture and sensitivity report the empirical treatment was revised. However, patients were put on the same treatment, in whom pus culture was sterile. The antibiotics and metronidazole were given for duration of 10 and 14 days respectively.

Percutaneous Needle Aspiration

The patient was subjected to USG of the abdomen and the characteristics of the abscess cavities were recorded. Local anesthesia was infiltrated at the proposed puncture site using a 18 G needle. Under real-time USG guidance using 18/20 G spinal needle the abscess cavity was entered and pus was aspirated till no more pus could be aspirated further. A sample of pus was sent for culture and sensitivity. A dressing was applied.

Percutaneous Catheter Drainage

Seldinger technique used for catheter drainage. Abscess localised by USG, The site of drainage marked under all aseptic condition where minimum depth from skin noted. The site infiltrated with 2% xylocaine and 4 mm skin incision made and through which 18G guide

Symptoms and Signs

It was observed that pain in the right upper quadrant of the abdomen was the most common symptom, found in 92% of the cases (Table 1).

SYMPTOMS	NO. OF PATIENT	PERCENTAGE %
Right upper quadrant pain	46	92
Weakness	44	88
Fever	43	86
Anorexia	41	82
Weight loss	26	52
Night sweats	25	50
Nausea/vomiting	17	34
Chills/rigors	15	30
Cough	12	24
Right shoulder pain	10	20
Diarrhea	6	12
Dyspnea	4	8

Laboratory Data : It was observed that 39 of 50 patients (78%) had leukocytosis. Elevation of serum alkaline phosphatase was also observed in 76% of the patients. Amoebic serology positivity (>0.90, EIA) was found in 58% of the patients (Table 2).

ETIOLOGY	AMOEBIC SEROLOGY RESULT	PUS CULTURE RESULT
AMOEBIC	+	-
PYOGENIC	-	+
AMOEBIC WITH SECONDARY INFECTION	+	+
INDETERMINATE	-	-

Pus Culture

Pus aspirated from all abscesses was sent for culture and sensitivity. Cultures were found to be positive in 14 of 50 (28%) of the cases. The rest were sterile (Table 3).

	AMOEBIC	PYOGENIC	MIXED	INDETERMINATE
PNA	16	4	1	4
PCD	13	7	2	3

Microbiology

wire introducer needle passed under USG guidance till it will reach the centre of cavity. A Guide wire introduced through the needle and position inside the cavity following which the needle removed keeping the guide wire in situ. Serial dilator then passed over the wire to dilate track up to 12 to 14 F sizes. A PCN MELECOTS catheter of size equal to the size of dilator passed over the wire and positioned in the center of cavity under USG guidance. The guide wire than withdrawn and PCN melecots catheter fixed to the skin with suture and connect with drainage bag and pus sent for cytology and bacteriology. Amount of pus drainage in 24 hours monitored and catheter flushed daily to prevent blockage with 10ml normal saline. The drainage catheter removed when drainage become less than 20ml to 30ml/24 hours.

The effectiveness of treatment was measured in terms of parameters like duration of hospital stay, days to achieve clinical improvement, days to achieve 50% reduction in abscess cavity size and days to achieve total/near total resolution of abscess cavity. The data was measured in numbers (percentage) and mean±SD.

Results

A total of 50 patients randomized into two groups of 25 each were included in the study. The following observations were made.

General Characteristics

The age of the patients ranging from 15 years to 65 years. Maximum no. of the patients falling within the age range from 31-40 years (24 patients). The second most common age group was 21-30 years (16 patients) and the number of patients was less in extremes of age. There were 43 male and 7 female patients with liver abscess involved in the study. The male to female ratio was 6:1.

Among the pus culture positive cases Escherichia coli was isolated most frequently i.e. 6 of 14 culture positive patients (Table 4).

MICROBIOLOGY		NUMBER	PERCENTAGE %
No growth		36	72
Cultural positive	Klebsiella spp.	4	8
	E coli	6	12
	Pseudomonas spp.	2	4
	S. aureus	2	4

Type of Abscess

Amoebic liver abscesses were encountered more frequently (58%) compared to pyogenic (22%), amoebic abscesses with secondary bacterial infection (6%) and abscesses of indeterminate etiology (14%) (Table 5 and 6).

ETIOLOGY	AMOEBIC SEROLOGY RESULT	PUS CULTURE RESULT
AMOEBIC	+	-
PYGENIC	-	+
AMOEBIC WITH SECONDARY INFECTION	+	+
INDETERMINATE	-	-

	AMOEBIC	PYGENIC	MIXED	INDETERMINATE
PNA	16	4	1	4
PCD	13	7	2	3

Location of the Abscess

The majority (about 82%) of the abscesses were located in the right lobe of liver, 10% in the left and 8% in both lobes.

Number of Abscess

Solitary liver abscess cavity seen in 72% cases, whereas the rest of the patients had multiple abscesses.

Volume of the Abscess

It was observed that the volume of the abscess cavities was mostly between 150-350mL with a range of 90cc to 780cc.

Interventions and their Results

Pigtail percutaneous drainage was successful in all the 25 cases. On the other hand, image-guided needle aspiration was successful only in 19 of 25 patients (P=0.006). Out of these 19 patients successfully treated, 6 patients required only one aspiration, 10 required two aspirations, and 3 required three aspirations. The 7 patients who did not show clinical improvement and/or decrease in cavity size despite 3 aspirations were taken as failures. In the PNA group, on comparing the cavity volumes the mean cavity volume in those who were successfully treated was 220cc, which was significantly less than those failing treatment; the mean volume being 403.6cc. Earlier

clinical improvement (P=0.046) and 50% decrease in abscess cavity volume (P=0.0001) seen in the patients in PCD groups compared to those who underwent PNA. However, there was no significant difference between the duration of hospital stay or the time required for total or near-total resolution of cavity (Table 8).

Pain in the right upper quadrant of the abdomen (92%) was the most common symptom followed by weakness (88%) and fever (86%).

Amoebic serology positivity (>0.90, EIA) was found in 58% of the patients. Pus aspirated from all abscesses was sent for culture and sensitivity. Cultures were found to be positive in 14 of 50 (28%) of the cases. The rest were sterile. Pus aspirated from all abscesses was sent for culture and sensitivity. Cultures were found to be positive in 14 of 50 (28%) of the cases. The rest were sterile. Among the pus culture positive cases Escherichia coli was isolated most frequently, i.e. 6 of 14 culture positive patients.

Amoebic liver abscesses were encountered more frequently (58%) compared to pyogenic (22%), amoebic abscesses with secondary bacterial infection (6%) and abscesses of indeterminate etiology (14%). It was observed that the volume of the abscess cavities was mostly between 150-350mL with a range of 90cc to 780cc.

Parameter	Treatment Group				P Value
	Pigtail Catheter Drainage (n=30)		Percutaneous Needle Aspiration (n=30)		
	No. of patients	Value (c.c.) Min-max Mean +/-	No. of patients	Value (c.c.) Min-max Mean +/-	
Volume of the largest cavity (c.c)	25	150-710 (328 +/- 122)	25	90-680 (269 +/- 123)	0.095
Success	25	100%	19	76%	0.006
Hospital Stay (days)	25	4-25 10.6 +/- 4.1	25	5-22 11.6 +/- 5.3	0.459
Clinical improvement	25	3-10 4.6 +/- 1.4	19	2-10 5.5 +/- 1.7	0.046
Time for 50% reduction in cavity size (days)	25	3-10 (4.9 +/- 1.6)	25	3-11 (8.1 +/- 2.3)	0.0001
Time for total or near total resolution of cavity (weeks)	25	8-24 10.9 +/- 4.1	25	8-24 (10.1 +/- 4.2)	0.498
Duration of drainage (days)	25	4-24 (9.4 +/- 4.0)	NA	NA	NA

Discussion

Liver abscesses, both amoebic and pyogenic continue to be an important cause of morbidity and mortality in the tropical countries. Patients usually present late when the liver abscess attains a large size. Percutaneous drainage (Either needle aspiration or catheter drainage) with systemic antibiotics has become the preferred treatment for the management of liver abscesses. In contrast for amoebic abscesses, the primary mode of treatment is medical; however, as many as 15% of these may be refractory to medical therapy, while 20% may be complicated by secondary bacterial infection. Such amoebic abscesses and those involving left lobe, or those with impending rupture also need to be drained. Although, PCD is a preferred method most widely used to drain liver abscesses.

Pyogenic liver abscess which used to be mainly tropical in location is now more common due to increased biliary interventions, stenting. The most frequently affected age group is in the third and fourth decade.

In our study clinical presentation of the patients are fever (86%), right upper quadrant pain and tenderness (92%) and hepatomegaly (76%). In the studies, 82% of the abscesses are located in the right lobe of liver and 72% of our patients had solitary abscesses. We encountered multiple liver abscesses in 28% of the patients.

The most frequently isolated bacteria on pus culture is *Escherichia coli* (42%) followed by *Klebsiella* species (28%). Many solitary and some carefully selected macroscopic multiple abscesses are amenable to percutaneous abscess drainage. Surgical drainage is usually reserved for patients who have failed percutaneous drainage, those who require surgery for management of underlying problems, and some patients with multiple macroscopic abscesses [12].

The major advantages of PNA over PCD are: 1) it is less invasive and less expensive; 2) avoids problems related to catheter care; and 3) multiple abscess cavities can be aspirated easier in the same setting [9,10]. The success rate of PNA in the literature varies from 79-100% [9,13]. In our study the success rate after single aspiration is 24%, after second aspiration 64% and after third aspiration it is 76%. Although, needle aspiration is a much simpler procedure when compared to catheter drainage repeated procedures are quite unpleasant and traumatic for the patients and may not be acceptable to many. Even after repeated aspirations the success rate is far from being 100%. Therefore, those patients who failed after a third aspiration attempt are offered catheter drainage.

In contrast to some of the earlier reports that show that the initial size of the abscess cavity did not affect the ultimate outcome [10,14], larger abscesses are more difficult to evacuate completely in one attempt, necessitating subsequent aspiration [15]. The average volume of the abscess in patients in whom PNA failed was significantly larger than the average volume of the abscess in patients who could be successfully treated with PNA.

Another important reason for failure of needle aspiration is the inability to completely evacuate the thick viscous pus that may be present in some of the abscesses. Rapid re-accumulation of pus in the abscess is another reason for failure of needle aspiration [16].

Placement of an indwelling drainage catheter addresses all three of these issues as it provides continuous drainage, drains thick pus because of wider caliber catheter and prevents re-accumulation. This explains the higher success rates of PCD [9,15,13,17]. The only reasons for failure of PCD as reported in some of the earlier series [18,19], have been either thick pus not amenable to percutaneous drainage (this can be overcome by placement of a wider bore catheter) or premature removal of drainage catheter. No recurrence occurred during the follow up period. However, both treatment modalities resulted in rapid clinical relief with most patients showing resolution of signs and symptoms within the first 3-4 days of the procedure. The time required for 50% reduction in the cavity size is significantly less in the PCD compared to PNA group (4.9 days and 8.1 days respectively); however, time required for total or near-total resolution of the abscess cavity did not show any significant difference. It can be concluded that the abscess cavities showed faster collapse during the initial period in the PCD group but

it did not have an advantage as far as total or near-total resolution of cavity is concerned. Similar observations were recorded by other investigators as well [8,15]. Complications such as hemorrhage, pleural effusion/empyema, persistent bile drainage, catheter displacement, sepsis, etc., have been reported with both PNA [8], and PCD. [20] Described the much lower incidence of complications with PNA than with PCD as one of the major advantages of needle aspiration over catheter drainage. Although secondary bacterial infection remains a possibility with indwelling drainage catheters this complication has been rarely reported in liver abscess. In our study we did not come through any of the above mentioned complications in patients of each group.

Conclusion

There was no significant advantage of catheter drainage over needle aspiration in terms of duration of hospital stay and time needed for total or near total resolution of abscess cavity.

Catheter drainage is better for large cavity while needle aspiration is better for small abscess cavity showing complete or near complete liquefied contents.

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