

## Comparison of the role of Percutaneous Needle Aspiration and Percutaneous Pigtail Drainage in management of liver abscess

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**Abstract:** The traditional treatment of intra-abdominal liver abscess has been operative drainage as originally described by Volkmann in 1879. But during the last few decades, with the invention of newer radiological techniques like computed tomography (CT) and ultrasonography (USG), which are not only useful for accurate localization but also helpful in their safe aspiration and drainage of these abscess thus obviating the need for surgical intervention. The recent trend in management of liver abscesses has been shifted strongly toward nonsurgical methods. Several study have shown that a large proportion of patients can be treated with excellent results with a combination of parenteral (I/V) antibiotics and image-guided percutaneous treatment. Whether to perform percutaneous catheter drainage or intermittent needle aspiration is better, remains controversial. This study aims to compare the therapeutic effectiveness and safety of 'Percutaneous Needle Aspiration' versus 'Percutaneous Pigtail Drainage'. in the cases of Large sized liver abscess ( $\geq 5$ cm). This prospective randomized study includes total of 50 patients admitted with the diagnosis of liver abscess of size  $\geq 5$ cm by ultra-sonography, from a period of November 2015 to April 2017. 25 patients were randomly distributed in each group (PCD & PNA). Intermittent needle aspiration will be done with 18G disposable needle and repeated if needed up to a maximum of three times. Different variables such as success rate of procedure, No. of times procedure required, Duration of hospital stay, volume of abscess aspirated, failure to resolve, and complications were recorded. There was No statistically significant difference seen in the procedure outcome measures in either group of patients. PNA had 96 % (24/25) success rate as compare to 84%(22/25) in PCD group. Failure to resolve was lower in patients with PNA group(1pt.) as compare to PCD group(3pt.) because PNA procedure had multiple sitting of aspiration (3 times in 8 and twice in 3) and 3 patient with PCD underwent Pigtail catheter insertion second time. Complications such as hemorrhage, septicemia was higher in patients with PCD group as compare to PNA group. Our study concluded that both the procedure is equally effective and safe and it is justifiable to undertake a multicentre study on the subject to provide a definitive answer.

**Keywords:** Liver abscess, Percutaneous Needle Aspiration (PNA), Percutaneous Pigtail Catheter Drainage(PCD), Ultrasonography Guided Procedures, Antibiotic Therapy.

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### I. Introduction

Liver abscess is a disease of frequent occurrence which figures prominently in the differential diagnosis of upper abdominal and right lower respiratory tract diseases. Even with the advent of good diagnostic investigation like USG, the diagnosis is still delayed because of the nonspecific manifestations of disease and therefore the suspicion of the diagnosis is important. Liver abscess has been described since the time of Hippocrates (400 BCE), with the first published review by Bright appearing in 1936. The traditional therapy of intra-abdominal liver abscess has been operative drainage as originally described by Volkmann in 1879. The reduction in mortality from 90% at the turn of century to the estimated 10-20% today cannot be ascribed to surgery alone. During the last few years, the sophistication of newer radiological techniques namely computed tomography (CT) and ultrasonography (USG) has not only prescribed tools for accurate localization of these abscess but has also created the possibility for their safe aspiration and drainage in certain instances obviating the need for surgical intervention.<sup>1</sup> Currently, there are 2 alternative methods for drainage of pus from a large liver abscess. Percutaneous therapeutic procedures have been increasingly performed compared with open

surgical drainage (SD). This study aims to compare the therapeutic effectiveness and safety of 'Percutaneous Needle Aspiration' versus 'Percutaneous Pigtail Drainage'.

The three major forms of liver abscess, classified by etiology, are as follows:

- *Pyogenic abscess*, which is most often polymicrobial, and accounts for majority of cases in the developed world
- Amoebic abscess due to *Entamoeba histolytica* which is the usual form in most developing countries including India, due to high prevalence of unhygienic food habits.
- Fungal abscess, most often due to *Candida* species is least common and more often associated with immunocompromised state.

A majority of patients with liver abscess respond rapidly to treatment with drugs but the remaining especially with complications will eventually require intervention in the form of needle aspiration or pigtail catheter drainage. The objective of this study was to compare the two methods in cases of large sized liver abscess ( $\geq 5$ cm) which are uniloculate.

## II. Material And Methods

It's a prospective randomized study with total of 50 patients admitted with the diagnosis of liver abscess (25 patients in each group distributed randomly) in department of gen. surgery in Peoples College of Medical Science and Research Centre, This study was conducted from a period of November 2015 to April 2017. Diagnosis of liver abscess was made on the basis of clinical and imaging findings with ultrasound.

**Inclusion criteria:** This study includes patients admitted with the diagnosis of liver abscess of size ( $\geq 5$ ) cm by ultra-sonography.

**Exclusion Criteria:** All abscesses with cavities smaller than 5 cm in their greatest dimension; multiple or multiloculate abscesses, prior intervention; ruptured liver abscess; uncertain diagnosis; concomitant biliary tract malignancy and uncorrectable coagulopathy were excluded from the study. Abscesses that were amenable to only surgical drainage (SD), like rupture or concomitant surgical pathology requiring urgent surgical exploration, were excluded from the study.

Further, complete work up in terms of a detailed history and clinical examination, Lab investigations including hemogram, liver function tests(LFT), prothrombin time(PT),International normalized ratio(INR), activated partial thromboplastin time(APTT) and imaging, Chest X-ray and abdominal USG was done. Written consent of the patient/guardian (if the patient is a minor) was taken with a brief overview of the procedure and the associated risks and complications.

**Materials:** The various equipment's and other materials used in this study are as described below:

1. Ultrasound unit - All the procedures were performed with real time ultrasound guidance with Curvilinear transducer that ranges from 2.5-3.75 MHz.
2. Aspiration Needles 18 G disposable needle; 18G spinal needle.
3. Pigtail catheter set (with trocar, dilators and guide wire) (14 Fr).
4. Surgical Tray with all basic surgical material for assisting the procedure.

### Techniques

#### **(A) For needle aspiration**

Depending upon the abscess to be drained, the patient was given appropriate position.

- Intravenous line was set up
- The appropriate part of the abdomen and lower chest was cleaned thoroughly with Spirit and Betadine. The cleaned part was then draped. The transducer probe was covered with sterile gloves.
- The abscess cavity was located and dimensions and aspirability status was confirmed.
- The shortest path that causes minimal liver parenchyma trauma was chosen.
- Depth of abscess from skin, appropriate angle of the approach and exact site of puncture was determined.
- Local anesthesia with 2% xylocaine was given so as to raise small wheal.
- The patient was asked to hold his breath and the 18G needle was passed towards the abscess cavity with predetermined angle and up to the predetermined depth.
- Presence of needle in the abscess cavity was confirmed by a giving way sensation, scanning needle tip echo and the free flow of pus
- Syringe was applied on the 18G needle and aspirated. Pus sample as collected in a sterile specimen bottle was send for microscopy and culture sensitivity and the pus was drained till the cavity collapsed (as confirmed by ultrasound) or till no more pus is aspirated, even after manipulating the needle

- Intermittent needle aspiration will be done with 18G disposable needle and repeated if needed up to a maximum of three times.

**(B) Pigtail catheter drainage**

- The same procedure as described above was done until local anesthesia injected and a nick was given over marked site of skin.
- Thereafter, Salinger technique was used. Trocar of pigtail set was slowly inserted until it reaches in abscess cavity (confirmed by ultrasound), then a guide wire was passed through it, and then over guide wire trocar was removed
- With the help of dilators (provided with pigtail catheter set), the tract was dilated by serially passing the dilators (of increasing caliber) over the guide wire and then a Pigtail catheter drain was kept in abscess cavity
- The draining catheter was properly secured in its place and connected to a collecting system. At this point first USG is done and if abscess cavity is completely resolved, catheter is removed. If a residual cavity is still present, catheter is flushed with normal saline which is aspirated back, and catheter is left in situ

The antibiotics therapy was adjusted according to the results of culture and sensitivity of pus aspirated at the time of the drainage procedure. <sup>[5, 6]</sup>

**Patient follow-up and outcome measures:**

The criteria of successful percutaneous intervention will be taken as adequate drainage of abscess to allow resolution of infection without the need for surgical drainage and subsequent discharge of patient from the hospital.

**III. Result**

A total of 50 patients who met the inclusion criteria and gave consent were included and randomly divided into two groups of 25 patients for undergoing percutaneous needle aspiration (PNA) and Percutaneous pigtail Catheter drainage (PCD).

A total of 33 out of 50 were pyogenic liver abscess and rest was amoebic. Out of the 33 pyogenic ones, 18 belonged to the PNA group and 15 treated by PCD.

**Table 1: Incidence of Pyogenic and Amoebic Liver Abscesses in Both Treatment Modalities.**

	PNA		PCD	
	Frequency	Percent	Frequency	Percent
<b>Amoebic</b>	7	28.0	10	40.0
<b>Pyogenic</b>	18	72.0	15	60.0
<b>Total</b>	25	100.0	25	100.0

Liver abscesses were more commonly affect the male sex (80%) as compare to female (20%). Male cases were 20 out of 25 in each group and female were 5 out of 25 in each group (PNA & PCD).

**Table 2: Comparison between Sex Wise Distributions in the Both Groups.**

	PNA		PCD	
	Frequency	Percent	Frequency	Percent
<b>Male</b>	20	80.0	20	80.0
<b>Female</b>	05	20.0	05	20.0
<b>Total</b>	25	100.0	25	100.0

Right lobe of liver was most commonly involved in liver abscesses, account for 20 out of 25 (80%) in each group (PNA & PCD) and left lobe involvement was found in 1(4%) case in PNA and 2(8%) in PCD group and both lobes were involved in 4(16%) cases in PNA and 3(12%) cases in PCD.

**Table 3: Anatomic Distribution of Abscess.**

	PNA		PCD	
	Frequency	Percent	Frequency	Percent
<b>Both</b>	4	16.0	3	12.0
<b>Left lobe</b>	1	4.0	2	8.0
<b>Right lobe</b>	20	80.0	20	80.0
<b>Total</b>	25	100.0	25	100.0

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There was no statistically significant difference found in patient characteristics like age, sex, religion, co morbidities etc. between two groups.

**Table 4:** Mean and Standard Deviation of Pt. Characteristics between PNA and PCD.

	PNA	PCD
Age (in years)	42.92	40.04
TLC (/CuMM)	14836	12012
Haemoglobin (gm %)	10.5	10.1
Alkaline Phosphate	378	480.4
Total Bilirubin (mg/dl)	4.48	3.26
Transaminases	65.04	55.3
Volume of the aspirate(ml.)	419.63	316.87
Duration Of Stay(Days)	13.8	12.1

Among the signs and symptoms, Right hypochondrial pain was the most common symptom present in 41 out of 50 (82% patients) And tenderness and Hepatomegaly were universal signs, seen in all the 50 patients. Fever was present in 39 out of 50 (78%), anorexia in 20% (10 out of 50), and diarrhea in 22% (11 out of 50). Interestingly, there wasn't significant difference in the incidence of blood and pus culture positivity, with 25 positive blood cultures in comparison to 30 pus cultures.

**Table 5:** Sign & Symptoms

Sign and Symptoms	PNA		PCD	
	Frequency	Percent	Frequency	Percent
Right hypochondrial pain	21	84.0	20	80.0
Tenderness	25	100.0	25	100.0
Hepatomegaly	25	100.0	25	100.0
Fever	20	80.0	19	76.0
Anorexia	06	24.0	04	16.0
Diarrhea	06	24.0	05	20.0
Blood culture	11	44.0	04	16.0
Pus culture	16	64.0	14	56.0
<b>Total</b>	25	100.0	25	100.0

Comparison of success rates of the two procedures was statistically insignificant with 88% (22 out of 25) success in PCD as against 96% (24 out of 25) in PNA.

**Table 6:** Success Rate of Procedures.

Success Rate of Procedures	PNA	PCD
Frequency	24	22
Percent	96	88
<b>Total</b>	25	25

While 11 out of 25 patients required multiple sittings of aspiration (3 times in 8 and twice in 3), 3 with PCD underwent Pigtail catheter insertion second time.

**Table 7:** Frequency of Procedures.

No of times procedure required	PNA	PCD
3	8	0
2	3	3
1	14	22
<b>TOTAL</b>	25	25

In terms of complications, the incidence was significantly higher in PCD as compared to PNA. Failure of resolution of abscess and hemorrhage due to intervention was seen in 3(12%) cases each in PCD as compared to 1(4%) in PNA, Sepsis occurred in 2(8%) PCD cases as opposed to 1(4%) in PNA while transpleural puncture was seen in 1(4%) case in each.

**Table 8:** Complications

Complication	Frequency in PNA	Frequency in PCD
Failure to resolve	1	3
Hemorrhage	1	3
Sepsis	1	2
Tran pleural Puncture	1	1
Total	25	25

#### IV. Discussion

Following study was done at Peoples Hospital, Bhopal over a period of one and half year. It was a prospective study in which 50 cases were taken based on inclusion and exclusion criteria. Cases were investigated and drainage was done either by PNA or by PCD.

Liver abscess both amoebic and pyogenic continue to be an important cause of morbidity and mortality in the tropical countries.<sup>[1,2]</sup> Patients usually present late when the liver abscess attains a large size. For amoebic liver abscesses (ALAs), the primary treatment is medical; however, 15% of amoebic abscesses may be refractory to medical therapy and 20% of ALAs may be complicated by secondary bacterial infection.<sup>[3,4]</sup>

Image guided percutaneous drainage (either needle aspiration or catheter drainage) with systemic antibiotics has become the preferred treatment for the management of liver abscesses.<sup>[5,6,7,8]</sup>

Surgical drainage is now used only in cases which fail to respond to percutaneous drainage. Although PCD is a preferred method most widely used to drain liver abscesses, recent studies have shown PNA to be simpler, less costly, and equally effective. Usually, needle aspiration is preferred for small abscesses and catheter drainage is done in larger ones. But no clear-cut guidelines have been laid. **Three previous prospective randomized studies have compared PNA with PCD. All these studies included abscesses of all sizes.**

The conclusions of the five RCTs differ. Yu *et al.*<sup>[9]</sup> Rajak *et al.*<sup>[10]</sup> conclude that PCD is more effective than PNA. Zerem and Hadzic, recommend PNA only in patients with liver abscess cavities of < 5 cm in diameter. Singh *et al.*<sup>[11]</sup> and Singh *et al.*<sup>[12]</sup> hold the view that PCD represents a better treatment option than PNA for large liver abscesses ( $\geq 10$  cm in diameter). Therefore, in the setting of diametric conclusions meta-analytical techniques may provide evidence as to which treatment option is superior.

Yu *et al.* included only pyogenic abscesses and showed no significant difference between the two techniques and recommended PNA as a first-line approach because the procedure is simple, facilitates patient comfort, and is of low cost.<sup>[9]</sup>

Rajak *et al.* found that percutaneous catheter drainage was better in terms of success rate while percutaneous needle aspiration reported the lowest success rate (PNA:60%) because they limit the number of aspirations to two attempt. and Yu *et al.* did not limit the number of attempts made and achieved the highest rate of success (PNA:97%). This may be a reason for lower success rate of percutaneous aspiration in this study. In addition, PCD was achieved highest success rates (97.2–100%) in most of the study except in the Yu *et al.* study where PCD success rate was (84.7%), in which the deaths of four (12.5%) patients with underlying malignancies decreased the success rate.

**The second reason for the low rate of success achieved by PNA relates to the size of the liver cavity or the volume of the abscess. In smaller abscesses, the amount of pus produced per day may be small and can be completely evacuated by PNA. However, a larger abscess cavity produces a larger quantity of pus, which needs to be drained continuously and is not suitable for PNA.**

**In the study by Zerem and Hadzic, the mean + SD longest diameter of the abscess cavity in the PNA group was significantly greater in patients in whom PNA was unsuccessful (97x42 mm) than in patients in which it was successful (62x35 mm).** Zerem and Hadzic included 60 patients of pyogenic liver abscess only, and found PCD to be more efficacious. They recommended PNA for simple abscesses of 5 cm or smaller in size. We compared these two treatment options exclusively in liver abscesses.

Few reports suggest that the initial size of the abscess cavity does not affect the final outcome, while Rajak *et al.* believed that large abscesses are more difficult to evaluate completely in a single attempt, this may be the reason why many centers prefer PNA for abscesses < 5 cm, and PCD for larger abscesses and also in amoebic abscess as pus in amoebic abscess is thick.

Both these techniques have certain disadvantages. Multiple attempts of PNA needed for large abscesses may be uncomfortable and perceived as more traumatic by the patient. Also, during the period between two aspirations, pus may get re-accumulated. For smaller abscesses, daily production of pus may be small, but a larger abscess cavity may produce large quantity of pus, which needs to be drained continuously. PCD has this obvious advantage over PNA, which may have accounted for quicker clinical recovery, lesser duration of parenteral antibiotics, and lesser failure rate among patients treated with PCD. On the other hand, placing a catheter needs more expertise followed by nursing care. Singh and Kashyap also reported faster and more complete resolution of abscess cavities after PCD, while Rajak *et al.* found that the time needed for total

resolution is similar after PCD and PNA. Thus, PCD and PNA are equally effective in the management of large liver abscesses. Our study corresponds with their findings.

In our study males were more commonly affected than female, male: female ratio was 4:1. 80% liver abscess was found in right lobe of liver and 14% and 6% were located in both lobes and left lobe respectively. All these things are similar to most of the previous study. The clinical presentation of the patients studied in our Series was similar to the descriptions in previous reports. A sample size of 50 from one and half year of data collection would seem reasonable. 96 % (24/25) was success rate of PNA as against 84 % (22/25) in PCD. No statistically significant difference was seen in the main procedure outcome measures in either group of patients. Different authors tended to have favored either continuous catheter drainage or intermittent needle aspiration, while others left the choice of drainage method to the radiologist who performed the procedure. Most established institutions have advocated the use of intermittent aspiration in combination with intravenous antibiotics as the first line treatment for small liver abscesses, and catheter drainage in large liver abscess and catheter drainage in amoebic liver abscess those which are refractory to medical management. The current study adds further support to this management strategy.

Some procedure related complications such as hemorrhage, septicemia, and failure to resolve etc were higher in patients with PCD group as compare to PNA group. While PNA procedure had multiple sitting of aspiration (3 times in 8 and twice in 3) and 3 with PCD underwent Pigtail catheter insertion second time. The main disadvantage of the needle aspiration technique is that multiple sessions may be required, but even the use of continuous catheter drainage does not guarantee a single session successful outcome. The current study and previous work have shown no significant increase in morbidity or mortality from repeated aspiration sessions.

## V. Conclusion

This study suggests that both techniques are equally effective and safe and further implies that it would of course be ideal to recruit a large enough population to detect small differences that may exist between the 2 techniques and it is justifiable to undertake a multicentre study on the subject to provide a definitive answer.

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