

Original article:

## Percutaneous Needle Aspiration versus Percutaneous Catheter Drainage for Liver Abscess

<sup>1</sup>Siddharth P. Dubhashi, <sup>2</sup>Pallavi S. Kadam,<sup>3</sup>Shaunak Saha

<sup>1</sup>Professor and Head, Department of Surgery, All India Institute of Medical Sciences (AIIMS), Nagpur  
(Former Professor and Head, Dept. of Surgery, MGM Medical College, MGMIHS, Navi Mumbai)

<sup>2</sup>Senior Resident, Department of Surgery, MGM Medical College, MGMIHS, Navi Mumbai

<sup>3</sup>Junior Resident, Department of Surgery, MGM Medical College, MGMIHS, Navi Mumbai

**Corresponding Author:** Prof. Dr. Siddharth P. Dubhashi , Professor and Head, Department of Surgery, All India Institute of Medical Sciences (AIIMS), Nagpur

Email: spdubhashi@gmail.com



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### ABSTRACT:

**Background:** There has a paradigm shift in the treatment protocol of Liver Abscess with use of intravenous broad-spectrum antibiotics and image-guided Percutaneous Needle Aspiration (PNA) or Percutaneous Catheter Drainage (PCD), with a considerable decrease in the mortality rate. The objective of study was to compare the effectiveness of PNA and PCD in the treatment of Liver Abscess. with reference to evidence of clinical improvement, duration required for more than 50% resolution of abscess cavity as evaluated by ultrasound examination, duration required for total / near total resolution of abscess cavity as evaluated by ultrasound examination, duration of hospital stay, procedure related complications.

**Material and methods:** This was a prospective study of 50 cases of Liver Abscess over 18 months. A successful outcome was noted in 92% cases treated with PCD versus 60% cases treated with PNA. 16% patients in PNA group did not respond to three attempts. The difference in duration required for clinical improvement and >50% resolution of abscess cavity between two groups was statistically significant, the duration being less in the PCD group.

**Results and conclusion:** There was no statistically significant difference in duration required for total resolution of abscess cavity and hospital stay amongst the two groups. There were no procedure related complications and no mortality in the study. PCD is more efficient than PNA in the management of Liver Abscess as it provides continuous drainage, facilitates drainage of thick pus, prevents re-accumulation, obviates the need for repeated aspirations offers early clinical improvement. Both procedures are safe if performed properly.

**Key words:** Percutaneous Needle Aspiration; Percutaneous Catheter Drainage; Liver Abscess

### Introduction:

Liver abscess is a common clinical problem in Indian and other tropical countries [1, 2]. It could result as a sequelae of intra-abdominal infections or liver trauma [3]. The condition has a high mortality rate due to delay in detection and treatment [4]. The increase in incidence of

liver abscess may be to the availability of better diagnostic facilities or a consequence of increasing prevalence of predisposing factors. Management of liver abscess was exclusively surgical in the past. This was associated with significant mortality and morbidity rates (10-47%) [5]. There has a paradigm shift in the treatment protocol towards use of intravenous

broad-spectrum antibiotics and image-guided Percutaneous Needle Aspiration (PNA) or Percutaneous Catheter Drainage (PCD), with a considerable decrease in the mortality rate <sup>[6]</sup>.

#### **Aims and Objectives:**

To compare the effectiveness of Percutaneous Needle Aspiration and Percutaneous Catheter Drainage in the treatment of Liver Abscess. with reference to evidence of clinical improvement, duration required for more than 50% resolution of abscess cavity as evaluated by ultrasound examination, duration required for total / near total resolution of abscess cavity as evaluated by ultrasound examination, duration of hospital stay, procedure related complications.

#### **Materials and Methods:**

This was a prospective study of 50 cases of Liver Abscess conducted at a tertiary care health centre over 18 months. The study was approved by the Institutional Ethics Committee and written and informed consent was obtained from all patients before inclusion into the study. Inclusion Criteria comprised of all cases of liver abscess diagnosed clinically and radiologically and all patients in the age group of 18-70 years. Exclusion Criteria were uncertain diagnosis, uncorrectable coagulopathy, abscess cavity less than 5cm in their greatest dimension, concomitant biliary tract malignancy, ruptured liver abscess and prior intervention and treatment. Haemogram, Liver Function Tests, Stool culture, USG Abdomen & Pelvis (with or without CT), pus culture tests were done for all the cases. The first case was allotted to a group by lottery method and subsequently the cases were allotted alternately to each group (Group A – Needle Aspiration, Group B – Catheter Drainage). All patients were administered empirical treatment initially, which was modified based on culture sensitivity reports. In case the pus culture was sterile, the same treatment was continued (Inj. Ceftriaxone 1gm iv 12 hourly, Inj. Gentamycin 80mg iv 12 hourly, Inj. Metronidazole 750mg iv 8 hourly and Inj. Chloroquine 600mg in 2 divided doses

x 3 days followed by 300mg in 2 divided doses x 19 days). The intravenous antibiotic treatment was given for a minimum of 7 days (Metronidazole was given for 14 days) and until fever had subsided for minimum of 2 days. The intravenous antibiotic therapy was followed by 4 weeks of oral antibiotics. The percutaneous procedures were performed under local anaesthesia (2% Lignocaine) and I/V analgesia and sedation (if indicated), using continuous real-time USG guidance with Phillips HD15 and 11 ultrasound machine and 5 MHz curvilinear probe.

Post procedure for PNA Group, USG Abdomen was performed every 3 days and the size of abscess cavity was recorded. If there was no significant reduction of abscess cavity the aspiration was repeated. A maximum of 3 attempts were made. In case there was no satisfactory response after 3<sup>rd</sup> attempt, it was considered as a failure of the procedure. These patients were subjected to PCD were not included in this study. In the PCD Group, in case the total drainage from the catheter decreased to less than 10 ml/24 hours for 2 consecutive days, an ultrasound examination of the abdomen was performed. If there was no collection, catheter was removed. In case residual collection was noted, the catheter was flushed with saline and aspirated till the returning fluid was clear. Residual collections were managed with repositioning of the catheter and subsequent aspirations. A follow up ultrasound examination of abdomen was done after 2 days to re-assess the cavity and a decision was taken to remove the catheter.

With respect to the follow up, all the patients were assessed clinically and with laboratory tests until discharged from the hospital. The intervention was termed successful when the procedure provided adequate drainage of abscess to allow the infection to subside without the requirement for surgical drainage, and with the subsequent discharge of patient from hospital. Aspiration was repeated if the abscess cavity did not show a 50% reduction in size, irrespective of the clinical response. Failure of regression of

abscess cavity size to below 50% of its original value, or of clinical response, after the 3<sup>rd</sup> aspiration was taken as a failure of PNA. The patients were followed up weekly for a month, monthly for 3 months and at the end of 6 months for clinical and ultrasonographic evaluation. The Outcome parameters were clinical improvement, duration required to achieve 50% reduction in abscess cavity size, duration required to achieve total / near total resolution of abscess cavity, duration of hospital stay and procedure related complications.

The statistical analysis was done using *chi-square* test and independent *t-test*.

### Results :

Maximum patients were in the age group of 31-40 years with 92% males and 8% females. The commonest co-morbidity that existed amongst the included patients was Diabetes Mellitus (24%). Pain in the right hypochondriac region and fever were the common presenting features (27%). 64% of the abscesses were in the right lobe. 78 % were pyogenic in nature. 80% were single. Pus culture was positive in 58% of the cases. Polymicrobial infection was noted in 23% of patients and the commonest organism isolated in the study was *K. pneumoniae*.

**Table 1: Outcome Analysis**

Parameter	Needle Aspiration	Catheter Drainage
Successful outcome	21	25
• 1 <sup>st</sup> Attempt	15	23
• 2 <sup>nd</sup> Attempt	04	02
• 3 <sup>rd</sup> Attempt	02	-
<i>Chi-square, p&gt;0.05, not significant</i>		
Duration of clinical improvement (days)	Mean ± SD 5.36 ± 1.80 (3-11)	Mean ± SD 3.36 ± 1.29 (2-9)
<i>Independent t-test, p&lt;0.05, statistically significant</i>		
Duration for >50% resolution of the abscess cavity (days)	Mean ± SD 8.64 ± 3.52 (4-18)	Mean ± SD 5.28 ± 1.86 (3-10)
<i>Independent t-test, p&lt;0.05, statistically significant</i>		
Duration of total / near total resolution of abscess cavity (weeks)	Mean ± SD 12.32 ± 4.24 (7-24)	Mean ± SD 11.01 ± 2.95 (7-24)
<i>Independent t-test, p&gt;0.05, statistically insignificant</i>		
Duration of drainage (days)	NA	Mean ± SD 9.84 ± 3.74 (6-22)
Number of patients with	12	7

change of antibiotics after sensitivity reports		
Hospital Stay (days)	Mean ± SD 10.32 ± 3.36 (6-20)	Mean ± SD 11.04 ± 3.93 (7-22)
<i>Independent t-test, p&gt;0.05, statistically insignificant</i>		
Procedure Complications	Nil	Nil
Mortality	Nil	Nil

**Table 2: Statistical Analysis for Outcome Parameters**

Parameters	t-test	Df	p-value	Mean Difference
Improvement	4.519	48	0.00	2
Resolution (days)	4.218	48	0.00	3.36
Total / Near Total Resolution (weeks)	1.239	48	0.22	1.28
Hospital Stay (days)	-0.696	48	0.49	-0.72

4 patients (16%) in the Percutaneous Needle Aspiration group did not respond to three aspiration attempts. A successful outcome was noted in 92% patients treated with Percutaneous Catheter Drainage and in 60% patients treated with Percutaneous Needle Aspiration. There was no statistically significant difference related to number of attempts amongst the 2 groups. The difference in the duration required for clinical improvement and > 50% resolution of the abscess cavity between the groups was statistically significant, the duration being less in group managed by Percutaneous Catheter Drainage. Out of 25 patients in the Needle Aspiration Group, 20 patients reported for follow up at the end of 6 months, and amongst 25 cases in Catheter Drainage group, 21 reported at the end of 6 months. There was no statistically significant difference in the duration of total / near total resolution of abscess cavity and hospital stay among the 2 groups.

### Discussion:

The commonest age group and gender distribution in our study was comparable to other studies. The commonest comorbidity in our study was Diabetes Mellitus (24%). Thompson *et al* [7], have reported that diabetic

patients had 3.6 fold increased risk of experiencing pyogenic liver abscess, compared with population controlled subjects. Khan *et al* [8] found diabetes mellitus as a comorbidity in around 20% of cases in their study. Yu *et al* [9] found the same in 30% cases. Heneghan *et al* [10] found diabetes in 18% patients in their study.

**Table 3: Comparison of location of Abscess**

Study	Right Lobe (%)	Left Lobe (%)	Both Lobes (%)
Our study	64	22	14
Rajak <i>et al</i> [11]	68	14	18
Bansal <i>et al</i> [12]	82	12	06
Heneghan <i>et al</i> [10]	72	28	-
Khan <i>et al</i> [8]	74	14	12
Zerem and Hadzic <i>et al</i> [4]	55	40	05

**Table 4: Comparison of type of Abscess**

Study	Pyogenic	Amoebic	Indeterminate	Mixed
Our study	78	10	12	-
Rajak <i>et al</i> [11]	22	40	38	-
Bansal <i>et al</i> [12]	85	10	5	-

**Table 5: Comparison of Number of Abscesses**

Study	Single (%)	Multiple (%)
Our Study	80	20
Rajak <i>et al</i> [11]	76	24
Bansal <i>et al</i> [12]	12	88
Heneghan <i>et al</i> [10]	91	9
Yu <i>et al</i> [9]	88	12
Zerem and Hadzic <i>et al</i> [4]	93	07

**Table 6: Comparison of Success rates with other studies**

Study	PNA (%)	PCD(%)	Statistical Significance
Our study	84	100	Chi- square, p>0.05
	First Attempt 60	First Attempt 92	-
Cai <i>et al</i> [13]	77.8	96.1	P=0.041
Yu <i>et al</i> [9]	94	84	Fischer's, p=0.426
Rajak <i>et al</i> [11]	60	100	P<0.05
Bansal <i>et al</i> [12]	77	98	P<0.005

The overall success rates of our study were comparable with those reported in literature, indicating that PCD is superior to PNA in management of liver abscess. It is noted that even with repeat aspirations, the success rates are associated with subsequent aspiration attempts [14]. 4 patients in our study had a failure in needle aspiration. They were managed with PCD. However, these cases were not included in PCD group for analysis. 2 cases in PCD group did not show a good response in the first attempt due to extremely thick purulent collection. The catheter was repositioned and the patients responded in due course of time. A large abscess cavity produces a large amount of pus which needs to be drained continuously and is not suitable for PNA. Rajak *et al* [11] reported a larger mean volume of abscesses (425ml) in patients whom PNA failed, compared to those in whom PNA was successful (178ml) (p<0.005).

**Table 7: Comparison of duration of clinical improvement with other studies**

Study	PNA Mean $\pm$ SD (days)	PCD Mean $\pm$ SD (days)	Statistical Significance
Our study	5.36 $\pm$ 1.80 (3-11)	3.36 $\pm$ 1.29 (2-9)	t-test, p<0.05
Cai <i>et al</i> [13]	Longer in PNA group		P<0.05
Rajak <i>et al</i> [11]	1-10	1-15	p>0.05
Bansal <i>et al</i> [12]	5.5 $\pm$ 2.2	4.2 $\pm$ 1.7	P<0.05

The duration required for evidence of clinical improvement was significantly shorter in the PCD group as compared to PNA group. These results are comparable to other studies reported in literature.

**Table 8: Comparison of duration of >50% resolution of abscess cavity with other studies**

Study	PNA Mean $\pm$ SD (days)	PCD Mean $\pm$ SD (days)	Statistical Significance
Our study	8.64 $\pm$ 3.52	5.28 $\pm$ 1.86	t-test, p<0.05
Cai <i>et al</i> [13]	Longer in PNA group		P<0.05
Rajak <i>et al</i> [11]	1-35	2-14	p<0.05
Bansal <i>et al</i> [12]	7.5 $\pm$ 2.4	5.0 $\pm$ 1.3	p<0.005

The duration required for >50% resolution of abscess cavity was significantly less in the PCD group as compared to PNA group. This was comparable to other studies in the literature. PCD offers continuous drainage and facilitates quick evacuation of pus, thereby causing a faster rate of collapse of the abscess cavity in the initial period itself.

**Table 9: Comparison of total / near total resolution of abscess cavity with other studies**

Study	PNA Mean ± SD (days)	PCD Mean ± SD (days)	Statistical Significance
Our study	12.32 ± 4.24	11.04 ± 2.95	t-test, p>0.05
Rajak <i>et al</i> [11]	6-26 weeks	8-26 weeks	p>0.05
Bansal <i>et al</i> [12]	10.6 ± 3.5	10.1 ± 4.2	p>0.05

There is no statistical significance in the duration required for total / near total resolution in the abscess cavity. The findings are comparable with other studies. The total resolution of the abscess cavity may take 1-2 years. Small residual cavities are usually visible at the end of 6 months. A study by Singh and Kashyap [15], reports a faster and complete resolution of the abscess cavity in the catheter drainage group as compared to needle aspiration group.

**Table 10: Duration of Hospital stay**

Study	PNA Mean ± SD (days)	PCD Mean ± SD (days)	Statistical Significance
Our study	10.32 ± 3.36 (6-20)	11.04 ± 3.93 (7-23)	t-test, p>0.05
Cai <i>et al</i> [13]	No significant difference between the 2 groups		p>0.05
Rajak <i>et al</i> [11]	4-18	4-24	p>0.05
Bansal <i>et al</i> [12]	9.6 ± 4.5	10.8 ± 3.5	p>0.005
Zerem and Hadzic <i>et al</i> [4]	22.2	20.3	p = 0.08

The difference in the hospital stay between the 2 groups was statistically significant and the

results are comparable to other studies in the literature.

Cultures was negative in 12% of cases in our study, out of which 4 cases were in the catheter drainage group. Polymicrobial infections was noted in 23% of the cases. The commonest organism isolated was *Klebsiella pneumoniae* (27%). Yu *et al* [9] had negative pus cultures in 41% of cases, more in the catheter drainage group. They also reported *Klebsiella pneumoniae* as the commonest organism. Heneghan *et al* [10] found positive pus cultures in 64% cases, with Gram Positive cocci as the commonest organisms.

### Limitations of the Study

The study group was a heterogeneous one with both pyogenic and amoebic liver abscess being included. Hence, the results did not allow us to opine on the successful outcome based on the cause of abscess. We have not performed any pus cultures for detection of abscesses of fungal aetiology.

### Conclusions

Percutaneous Catheter Drainage helps in early clinical improvement and requires less duration for >50% reduction in abscess cavity, as compared to Percutaneous Needle Aspiration. It is more efficient than Percutaneous Needle Aspiration in the management of Liver Abscess as it provides continuous drainage, facilitates drainage of thick pus, prevents re-accumulation and obviates the need for repeated aspirations. PCD offers no advantage over PNA with reference to duration required for total resolution of the abscess cavity and hospital stay. Both procedures are safe if performed properly.

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