

Review article:

A comparative study of percutaneous catheter drainage versus percutaneous needle aspiration in the treatment of liver abscess

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Abstract:

Introduction: With the current increasingly aggressive and successful approach to the treatment of appendicitis, biliary tract disease has become the most frequent cause of pyogenic liver abscess. The incidence of multiple hepatic abscesses also has increased.

Materials and methods: This clinical study was conducted in the Department of General Surgery at Basaveshwar Teaching and General Hospital, Gulbarga between December 2012 and September 2014. Clearance was obtained from the hospital ethical committee. During this period 40 patients diagnosed to have liver abscess who satisfied inclusion and exclusion criteria were included in this study

Results: It was observed that pain in the right upper quadrant of the abdomen was the most common symptom, found in 92.5% of the cases. Fever (82.5%) and anorexia(80%)were other frequently presenting symptoms. Approximately half of the patients had symptoms of nusea&vomitting. Only 12.5% of the patients gave a history of diarrhea prior to illness.

Conclusion: Percutaneous catheter drainage is a better modality as compared to percutaneous needle aspiration in terms of overall success rate, especially in larger abscesses. There is no statistically significant difference in terms of complications associated with PCD and PNA of liver abscess. We the authors conclude PCD as first-line treatment option but consider PNA as an alternative in small abscesses.

Introduction

Among the intra-abdominal organs liver is the organ most subjected to development of abscess. Liver abscess constitutes 3% of all abscesses, and 48% of all visceral abscesses. Liver abscess particularly with amoebic infestation is more common in tropical countries like India because of poor sanitation. The entity of liver abscess is known to be an old disease, recognized as early as in the era of Hippocrates (460-370 BC).^[1]

With the current increasingly aggressive and successful approach to the treatment of appendicitis,

biliary tract disease has become the most frequent cause of pyogenic liver abscess. The incidence of multiple hepatic abscesses also has increased.

The liver abscess though categorized into amoebic and pyogenic, mixed variety is also common. Pyogenic abscess accounts for 80% of hepatic abscess cases in developed countries. Globally, amoebic abscess is more common than pyogenic liver abscess. Failure of treatment of pyogenic liver abscess invariably leads to a fatal outcome with mortality rate as high as 80-100%. Although successful results were reported in recent years with

medical treatment, surgical drainage has been the regular method of treating pyogenic liver abscess.

In recent years, with the development of imaging techniques like ultrasonography, CT scan and fluoroscopy, image guided percutaneous drainage has been increasingly used to treat the liver abscesses, with reported success rates ranging from 70% to 100%. Although, needle aspiration of liver abscess is easier, less costly, the important reason for failure of needle aspiration is its inability to completely evacuate the pus. In contrast to needle aspiration, percutaneous placement of an indwelling catheter provides continuous drainage, hence the problem of incomplete evacuation and re-accumulation are not associated with catheter drainage, accounting for higher success rates. The role of surgical therapy in liver abscess is reduced. But surgical therapy is indicated where there is complication, associated other abdominal pathology and multiloculated, thick-walled abscess cavity with viscous pus.

Objectives

1. To compare and correlate the therapeutic effectiveness of percutaneous catheter drainage with percutaneous needle aspiration in the treatment of liver abscess.
2. To identify and compare the morbidity associated with both the procedures.

Materials and methods

Study design

This clinical study was conducted in the Department of General Surgery at Basaveshwar Teaching and General Hospital, Gulbarga between December 2012 and September 2014. Clearance was obtained from the hospital ethical committee. During this period 40 patients diagnosed to have liver abscess who satisfied inclusion and exclusion criteria were included in this study. Patients included in the study, randomized into

two groups; percutaneous needle aspiration (PNA) (n=20) and pigtail catheter drainage (PCD) (n=20). All the required data were collected from patients during their stay in the hospital, during follow up at regular intervals and from medical records.

Inclusion criteria

All patients clinically and radiologically diagnosed to have liver abscess.

Exclusion criteria

1. Patients with already ruptured liver abscess.
2. Very small (<5cms in maximum dimension)
3. Multiple abscesses.
4. Patients below 12 year of age.

Methods

All the subjects satisfying the inclusion criteria were carefully worked up in terms of a detailed history and clinical examination. Lab and imaging investigations included complete hemogram; liver function tests; prothrombin time; international normalized ratio; activated partial thromboplastin time; blood culture; amebic serology; imaging- CXR; abdominal USG with or without CT scan of the abdomen; and other investigations as per specific indications in different patients.

An informed consent was obtained from the participating patients and all the patients were started on medical treatment as per our protocol. After admission, the patients were resuscitated with fluids. All the patients empirically received injection Amoxicillin-clavulanate 1.2 g IV b.i.d, injection Metronidazole 750 mg IV every t.i.d , injection Gentamicin 80 mg IV b.i.d, which covers both aerobic and anaerobic organisms. Later antibiotics changed according to culture&sensitivity report. The percutaneous procedures were carried out under local anesthesia (2% lignocaine) with IV analgesia and

sedation if required. The procedures were carried out under continuous real-time USG guidance.

Percutaneous needle aspiration:

Under aseptic precaution parts painted and draped. Skin infiltrated with 2% xylocaine after test dose. Aspiration was done using 18G lumbar puncture needle under USG guidance. (Figure:i usg showing the hyperechoic spinal needle no:18 tip in abscess cavity measuring 10cms x 8cms right lobe of liver,Figure:iii percutaneous aspiration usg guided in the right 7th intercostal space showing anchovy sauce aspirate).Pus sent for culture and sensitivity. No major complications were encountered during or after the procedure.

Percutaneous catheter drainage:

Under aseptic precautions skin was infiltrated with 2% xylocaine after test dose. Small incision made over the ultrasonographically marked site, a 12 Fr multi-sidehole pigtail catheter with trocar introduced under real time usg guidance. Figure:v pig tail stillette insertion under usg guidance. Once in the abscess cavity,(figure:iv ultrasound showing pig tail catheter being introduced in liver abscess cavity)the trocar is with drawn and catheter connected to urobag and fixed in place with skin sutures.

Evaluation of the response to intervention

The clinical response (temperature,pain,fever) and laboratory parameters total leukocyte count (TLC), liver function test (LFT) were recorded . In the patients undergoing PNA, USG was repeated after a gap of two days and aspiration repeated if the cavity size was still found to be greater than 5 cm. The same procedure was repeated after a gap of another two days and aspiration repeated if needed.

The failure of clinical improvement in terms of fever, abdominal pain and tenderness and leukocytosis or decrease in size of the abscess cavity after a third

attempt of aspiration was taken as failure of needle aspiration. These patients underwent PCD but were not added to the PCD group.

In patients who underwent PCD, besides recording the clinical and laboratory parameters of the patient every day, daily output of the catheter was measured and the catheter was flushed with 20 cc of normal saline (this volume was deducted from the total drainage). A decision to remove the pigtail catheter was made when the total drainage from the catheter decreased to less than 10 mL/ 24 h for two consecutive days. The patient was administered Tab. Diloxanide Furoate 500 mg p.o.b.i.d. for 10 days at the time of discharge.

Follow up

The patients were followed up weekly for a month, once in two weeks for three months and at the end of six months, for clinical evaluation and USG assessment of abscess cavity until complete/near total resolution of the abscesses was achieved. Data was collected and recorded in the printed proforma.

Statistical analysis

The effectiveness of each method of treatment was measured in terms of: days to achieve clinical improvement; days to achieve 50% reduction in abscess cavity size; duration of hospital stay; and days to achieve total/near total resolution of abscess cavity. Independent t- test and χ^2 test were used to analyze these parameters. The level of significance was set at $P < 0.05$. Volume of abscess cavity and duration of drainage (applicable to PCD group only) were also analyzed and range and mean values were calculated for both the parameters.

Results

General characteristics

The age of the patients varied from 16 years to 75 years with most of the patients falling within the age

range from 41-50 years (11 patients). The second most common age group was 31-40 years (10 patients). There were 30 male and 10 female patients with liver abscess involved in the study. The male to female ratio was 4:1.(Table :I Patient Characteristics & Symptoms).

Symptoms and signs

It was observed that pain in the right upper quadrant of the abdomen was the most common symptom, found in 92.5% of the cases. Fever (82.5%) and anorexia(80%)were other frequently presenting symptoms. Approximately half of the patients had symptoms of nusea&vomitting. Only 12.5% of the patients gave a history of diarrhea prior to illness.

Table :I

	PNA group		PCD group		Total		t-test, χ^2 & p-value
	Yes	No	Yes	No	Yes	No	
Age in years	45.71±13.97		47.72±14.27		46.715±14.13		t=0.4464, p>0.005, NS
Male to Female ratio	3.5:1		4:1		3:1		$\chi^2=0.533$ p>0.05
Right upper quadrant pain	20 (100%)	0 (0.0%)	17 (85%)	3 (15%)	37 (92.5%)	3 (7.5%)	$\chi^2 =3.14$ p>0.05, NS
Fever	17 (85%)	3 (15%)	16 (80%)	4 (20%)	33 (82.5%)	7 (17.5%)	$\chi^2 =0.073$ p>0.05, NS
Anorexia	16 (80%)	4 (20%)	16 (80%)	4 (20%)	32 (80%)	8 (20%)	$\chi^2 =0.00$ p>0.05, NS
Nausea & vomitting	10 (50%)	10 (50%)	8 (40%)	12 (60%)	20 (50%)	20 (50%)	$\chi^2 =0.404$ p>0.05, NS
Dysentry	3 (15%)	17 (85%)	2 (10%)	18 (90%)	5 (12.5%)	35 (87.5%)	$\chi^2 =0.228$ p>0.05, NS

Laboratory data

It was observed that 20 of 40 patients (73.2%) had leukocytosis. Elevation of serum alkaline phosphatase was also observed in 75% of the patients

[2]. Amebic serology positivity (>11, ELISA) was found in 30% of the patients. Table :II Distribution of lab parameters among PNA and PCD groups

Table :II

LAB PARAMETERS	PNA MEAN±SD	PCD MEAN±SD	t-test & P-value
TLC	12885±5220.2	13470±7619.6	t=0.287 p>0.05, NS
S.BILIRUBIN	1.5265±0.891	1.695±1.269677	t=0.492 p>0.05, NS
ALP	215.75±155.7987	174.5±94.11611	t=1.02 p>0.05, NS

Pus culture

Pus aspirated from all abscesses was sent for culture and sensitivity. Cultures were found to be positive in 17 of 40 (42.5%) of the cases. The rest were sterile.

Microbiology

Among the pus culture positive cases Escherichia coli was isolated most frequently i.e. 7 of 17 culture positive patients, followed by Klebsiella spp. which was isolated in 5 cases.

Staphylococcus aureus were isolated in 3 patients. Pseudomonas spp. and Steptococcus spp in 1 patient each.

Type of abscess

Pyogenic liver abscesses were encountered more frequently (67.5%) compared to Amebic (32.5%), amebic abscesses with secondary bacterial infection in 1 patient.

Location of the abscess

The majority (about 75%) of the abscesses were located in the right lobe of liver, 17% in the left and 8% in both lobes.

Interventions and their results

A total of 40 patients underwent either of the two percutaneous procedures randomly and their response to treatment was recorded and analyzed. (Table No : III Clinical Variables and success rates of PNA and PCD Groups).Catheter drainage was successful in all the 20 cases. On the other hand, image-guided needle aspiration was successful only in 15 of 20 patients (P<0.05). Out of these 15 patients successfully treated, 5 patients required only one aspiration, 7 required two aspirations, and 3 required three aspirations. The 5 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 317.4 cc which was less than those failing treatment; the mean volume being 485.0cc .The time required for 50% decrease in abscess cavity volume (t=3.035,P<0.05) was significantly less compared to those who underwent PNA. However, there was no significant difference noted in clinical improvement, the duration of hospital stay or the time required for total or near-total resolution of cavity.

Table No : III Clinical Variables and success rates of PNA and PCD Groups

	PNA GROUP MEAN±SD	PCD GROUP MEAN±SD	t-test & p-value
VOLUME OF ABSCESS CAVITY	359.25±177.3213	431.3158±196.2131	t=1.219 p>0.05,NS
HOSPITAL STAY IN DAYS.	11.25±5.118336	10.95±3.531438	t=0.212 p>0.05,NS
CLINICAL IMPROVEMENT IN DAYS.	4.25±2.048748	3.55±1.848897	t=1.15 p>0.05,NS
TIME FOR 50% DECREASE IN SIZE OF ABSCESS CAVITY IN DAYS.	5.8±1.852452	4.15±1.843195	t=3.035 p<0.05, SIGNIFICANT
TIME FOR TOTAL/NEAR TOTAL RESOLUTION OF CAVITY IN WEEKS.	10.25±3.338373	11.2±2.984169	t=0.98 p>0.05,NS
DURATION OF IV ANTIBIOTICS IN DAYS.	9.15±2.960708	9.55±2.625282	t=0.478 p>0.05,NS
SUCCESS RATE	15(75.0%)	20.0(100%)	$\chi^2=5.714$, P<0.05
COMPLICATIONS	0	2(20%)	$\chi^2=2.102$, p>0.05, NS

Discussion

Liver abscess is 3 to 10 times more common in men^[3]. In our study we found the male to female ratio to be 4: 1. The most frequently affected age group was in the fourth and fifth decade.

The clinical presentation of the patients studied in our series was similar to the descriptions in previous reports. The common symptoms and signs of liver abscess in our study were fever (82.5%), right upper quadrant pain and tenderness (92.5%). These clinical manifestations are similar to those described in previous studies^[4,5].

In our study, 75% of the abscesses were located in the right lobe of liver, similar to previous studies^[6,7].

The type of abscess was determined on the basis of amebic serology and pus culture reports [22]. In our study we found 32.5% of the abscesses to be amebic in etiology, 67.5% to be pyogenic. The use of serological testing for diagnosis of amebic liver abscesses can occasionally lead to either false negative results early in the course of the disease, due to delay in rise of antibody titer, or to false positives due to background subclinical amebic infections. Consideration of high titers for diagnosis may help exclude these false positives^[8].

The pus cultures were negative in 23 of 40 patients. Aerobic cultures were declared negative after 48 h of incubation.

The most frequently isolated bacteria on pus culture was *Escherichia coli* (41.1%) closely followed by *Klebsiella* species (29.4%). *Escherichia coli* has been reported to be the organism most frequently grown in western series^[9,10]. However, Asian series have reported *Klebsiella* to be the most frequently isolated bacteria^[11,12].

There was no mortality or any major complication requiring any treatment. Several researchers have

employed both the modalities, i.e. PNA as well as PCD with varying degrees of success. Several groups have documented that significant number of patients can be managed with a combination of systemic antibiotics and percutaneous drainage with excellent results^[13-16].

Giorgio *et al* performed on an average 2.2 aspirations in 115 patients and reported resolution of symptoms and hepatic lesions in 98% of the patients^[17]. In our study we treated 20 patients with PNA along with systemic antibiotics. Of these 20 patients, 15 were successfully treated with 5 requiring only one aspiration, 7 requiring a second aspiration and 3 patients requiring a third aspiration as well. 5 of these 20 patients failed to improve clinically and did not show significant decrease in abscess cavity even after 3 aspirations. Thus, 15 patients who were successfully treated with aspiration required an average of 2.1 aspirations. The mean duration of time taken for clinical improvement was 4.25 days in this modality of treatment. Rajak *et al*^[18] reported a success rate of 60% with needle aspiration. However, in their study only two attempts of aspiration were made and failure to attain clinical, hematological and radiological improvement was taken as failure of therapy. Of 5 patients who did not respond to PNA, all improved on PCD. But these patients were not included in the PCD group as success.

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^[18,19]. However, in our study we had a success rate which was significantly lower than with catheter drainage (75% versus 100%, $\chi^2=5.714$, $P<0.05$).

The success rate of PNA in the literature varies from 79-100%^[19,20]. The success rate in our study after

single aspiration was 25%, after second aspiration 60% and after third aspiration it was 75%. 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 was far from being 100%. Therefore, those patients who failed after a third aspiration attempt were offered catheter drainage. The average size of abscess in our study was 431.31 mL and 359.25 mL for the PCD and PNA group respectively, comparable to the study reported by Rajak *et al* (335 mL and 221 mL respectively) [18]. The success rate achieved by Rajak *et al* was 60%, comparable to the success rate after the second aspiration in our study, i.e. 60%. Subsequent aspirations seem to improve the success rate of therapy.

The average volume of the patients in whom PNA failed was larger than the average volume of the patients who could be successfully treated with PNA (485.0 mL and 317.3 mL) respectively. Another important reason for failure of needle aspiration is the inability to completely evacuate the thick viscous pus that may be present in the early forming abscesses. Rapid re-accumulation of pus in the abscess is another reason described for failure of needle aspiration [20].

Placement of an indwelling drainage catheter addresses all 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 (100%) observed in our study and several previous studies [18,19,21,22].

However, time required for total or near-total resolution of the abscess cavity did not show any significant difference in the two groups (PCD=11.2

weeks, PNA=10.25 weeks, $P>0.05$). 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 studies as well [18,23].

In this study, no complications were met with PNA group while 2 patients in the PCD group had complications related to catheter placement; one with bile leak and other developed localized peritonitis due to catheter displacement into peritoneal cavity. There is no statistically significant difference between the two groups. Baek *et al*¹⁹ and Giorgio *et al*¹⁷ described the much lower incidence of complications with PNA than with PCD. However, in our study and some recent studies Rajak *et al*¹⁸, Yu *et al*²⁴, both the procedures were found to be safe if performed properly with minimal complications. There was no mortality in either of the study groups.

The main *reasons for failure of PNA* is inability to completely evacuate the thick viscous pus that may be present in the early forming abscesses. Rapid re-accumulation of pus in the abscess is another reason described for failure of needle aspiration. In this study we noted that the drainage of liver abscess in PCD group is intermittent with periods of drainage followed by periods of absent flow for 1- 2 days.

Conclusion

Percutaneous catheter drainage is a better modality as compared to percutaneous needle aspiration in terms of overall success rate, especially in larger abscesses. There is no statistically significant difference in terms of complications associated with PCD and PNA of liver abscess. We the authors conclude PCD as first-line treatment option but consider PNA as an alternative in small abscesses.



Figure 1 usg showing the hyperechoic spinal needle no:18 tip in abscess cavity measuring 10cms x 8cms right lobe of liver.



Figure 2 collapse of the abscess cavity in the same patient immediately after aspiration.



Figure 3 percutaneous aspiration usg guided in the right 7th intercostal space showing anchovy sauce aspirate.



Figure 4 ultrasound showing pig tail catheter being introduced in liver abscess cavity.



Figure 5 Pig Tail Stillette Insertion Under Usg Guidance.

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