Original Research Article

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Liver abscess drainage by needle aspiration versus pigtail catheter: a prospective study

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ABSTRACT

Background: Liver abscess is a disease of frequent occurrence which figures prominently in the differential diagnosis of upper abdominal and right lower respiratory tract diseases. These includes a recent increase in incidence reflecting more accurate diagnostic techniques especially after 1965 with the advent of radioisotopes scan and later on ultrasonography and CT scan. The reduction in mortality from 90% at the turn of century to the estimated 10-20% today cannot be ascribed to surgery alone.

Methods: The study was conducted on 65 patients of liver abscess. Two compared modalities of percutaneous treatment of liver abscess were (1) needle aspiration and (2) pigtail catheter aspiration. All interventions were performed under ultrasonographic guidance. Only those patients having liver abscess/abscesses greater than 5 cm in at least one dimension, liquified & drainable were included in this study.

Results: Amoebic liver abscess (63.33%) were more common than pyogenic liver abscess (26.67%). Clinical recovery was significantly earlier in catheter group (average 5 days) than in needle aspiration group (average 6.29 days) (p value 0.001). Average duration of i.v. antibiotic is significantly shorter in catheter group (6.4 days) than in needle aspiration group (9.5 days) (p value 0.002).

Conclusions: Thus, our study concluded that in view of greater volume of pus drained in first sitting, early clinical recovery, shorter duration of hospital stay and slightly more success rate continuous catheter drainage is effective percutaneous treatment modality than intermittent needle aspiration.

Keywords: CT scan, Liver abscess, Pigtail catheter, USG

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. 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 year, 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. 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 continuous catheter drainage' versus 'Percutaneous

intermittent needle aspiration' in the percutaneous group of treatment for liver abscesses.

Modern treatment has shifted the treatment of liver abscess toward IV broad-spectrum antibiotics and imaging-guided percutaneous needle aspiration or percutaneous catheter drainage (PCD).^{2,3} This study includes all the patients with diagnosis of liver abscess>5cm in size by sonography irrespective of their demographics, size of liver abscess, causative pathogen, clinical presentation, pretreatment LFT's and other blood investigations and concurrent illness for their treatment by 'percutaneous intermittent needle aspiration' or 'percutaneous continuous catheter drainage' and to assess the relative effectiveness and need of either one of these two techniques.⁴

METHODS

Patient inclusion criteria

This study includes all the patients coming to the Gandhi Medical college Bhopal surgery OPD with the diagnosis of liver abscess of size >5cm by ultra-sonography, from a period of June 2014 to June 2016. Thus, this study is a prospective one. Abscesses that were amenable to only surgical drainage (SD), like rupture or concomitant surgical pathology requiring urgent surgical exploration, were excluded from the study according to our criteria listed. Diagnosis of liver abscess will be made on the basis of clinical and imaging findings with ultrasound.

Materials

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

1. Portable ultrasound unit

All the procedures were performed with real time ultrasound guidance; Curvilinear transducer PVG-3.75 MHz; Curvilinear transducer ranges from 2.5-3.75 MHz.

2. Aspiration Needles

18 G disposable needle; 18G, 20G, 21G spinal needle

3. *Pigtail catheter set* (with trocar, dilators and guide wire) (6 to 14 F)

4. Trolley settings

- Towel, sponge holder
- 50 ml syringe
- Sterile gloves
- Kidney tray
- Scalpel blade with Bard Parker handle
- Iodine, spirit for cleaning local parts
- Injection lignocaine 2% (LA)

• Sterile pads and gauze pieces.

In all the cases the abscess was located by USG. The patients were subjected to routine hematological investigations. Blood samples were taken for culture and sensitivity. Chest x-rays were done to note any pulmonary complication in terms of position of diaphragm and any effusion in pleural cavity.

Only those patients in whom the abscesses were liquefied were taken for aspiration. While the others where the abscess was uniquified, even liquefied but of single small size (<5cm), multiple small size, abscess near the porta hepatis, only antibiotics were given.

The diagnosed patients with liver abscesses were included in the study irrespective of the causes.

Pre-aspiration procedures

- Written consent of the patient/guardian (if the patient is a minor)
- Base line investigation like haemogram, liver function test
- Coagulation profile of the patient (BT, CT, PT, platelet count) Setting up of IV lines.
- Availability of emergency tray
- Premedication.
 - Inj. Vitamin K i.m.
 - Inj. Atropine 0.02mg/kg i.m.
 - Inj. Diazepam 0.1 mg/kg i.m.
 - Inj. Hydrocortisone 2mg/kg i.v.
 - Xylocaine sensitivity test.

Monitoring of vital signs prior and during the procedure was done.

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 Salon, Spirit and Betadine. The cleaned part was then draped. The transducer probe was covered with sterile gloves
- The abscess cavity was located, and appropriate route decided to avoid important structures (bowel and costophrenic recess)
- The shortest path that causes minimal liver parenchymal trauma was chosen
- Depth of abscess from skin, appropriate angle of the approach and exact site of puncture was determined
- Local anaesthesia with 2% xylocaine was given so as to raise small wheal and then at the site of puncture a

- small nick was given on the skin with the help of scalpel
- 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. Aspiration will be repeated if there is either no clinical improvement or no reduction in size of the abscess cavity/cavities. Aspiration is done up to maximum of three times

(B) Pigtail catheter drainage

- The same procedure as described above was done until local anaesthesia induced 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, 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. From this point USG is done every third day until abscess cavity disappears, decreases in size or remains static compared with previous USG and catheter is removed if it was not draining for last 24 hours.

Postoperative precautions

- The patients were kept NBM (Nil by Mouth) for further 6 hours
- Intravenous fluids
- Watch for signs of peritonitis
- TPR/BP charting
- Systemic antibiotics
- Analgesic SOS

Follow up ultrasound after three days for size of abscess cavity (Residual volume) and echogenicity of abscess cavity was performed. Follow-up was kept in all cases. The required data was obtained as per the attached proforma.



Figure 1: Marking of liver abscess drain site.



Figure 2: Pigtail insertion.

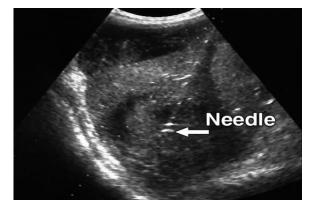


Figure 3: Needle insertion in abscess cavity.

Antibiotics policy

At presentation, all patients had been treated with intravenous ampicillin, gentamycin, and metronidazole. The antibiotics therapy was adjusted according to the results of culture and sensitivity test of pus aspirated at the time of the drainage procedure. ^{5,6}

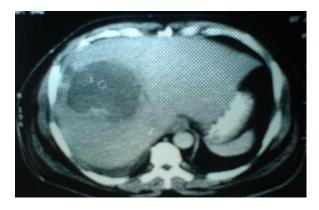


Figure 4: Abscess cavity in liver in CT scan.



Figure 5: USG of liver abscess.



Figure 6: Site of abscess in USG.

Antibiotics adjustment was done immediately when the sensitivity test was available.⁷ Patients with negative culture results were continuously treated with same combination.⁸

The antibiotic regime was not changed for patients with poor treatment response. Intravenous antibiotic therapy was continued for a minimum of 7 days in all patients. The patients were then put on the appropriate oral antibiotics for a total treatment period of 4 weeks. A sample of pus was routinely taken and sent for

microbiological analysis including microscopy, culture, and antibiotic sensitivity tests.

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. Patient outcomes will be recorded on the basis of:

- Duration to attain clinical relief
- Duration of hospital stay
- Treatment success and failure rates
- Death.

Criteria for discharge of the patient

The patients will be discharged from hospital:

- When the infection had subsided clinically
- Sonographic evidence of abscess resolution such as disappearance of abscess cavity or static or decrease in size of abscess cavity.

RESULTS

The study was conducted on 65 patients of liver abscess. Out of 65 patients, 4 were excluded because of pretreatment of rupture of abscesses and one because of negative consent of patient for any percutaneous intervention. Remaining 60 patients were divided into two groups consists of 30 patients in each needle aspiration group and pigtail catheter group. In all patient's *iv* ampicillin, gentamycin and metronidazole were started, as soon as diagnosis was made. Well informed consent was taken from patients. All interventions were performed after taking strict aseptic measures.

There was no statistically significant difference found in patient characteristics like age, sex, religion, comorbidities etc., between two groups. It was observed that:

- Commonest age group for occurrence of liver abscess was between 21 to 40 years (46.67%)
- Liver abscess occur more commonly in males (76.66%) than in females (23.33%)
- Commonest comorbidity in both groups was gall bladder/common bile duct calculi (22.66%)
- Commonest symptom in both groups was fever (81.66%)
- Solitary abscesses (86.66%) were more common than multiple abscesses (13.33%)
- Right lobe abscesses (86.66%) were more common than left lobe abscesses (3.73%) where as both lobes were involved in (13.33%) cases

- Amoebic liver abscess (63.33%) were more common than pyogenic liver abscess (26.67%)
- Volume of pus drained in first sitting by catheter group was significantly more than needle aspiration group (p value 0.0011)
- Clinical recovery was significantly earlier in catheter group (average 5 days) than in needle aspiration group (average 6.29 days) (p value 0.001). Average duration of i.v. antibiotic is significantly shorter in catheter group (6.4 days) than in needle aspiration group (9.5 days) (p value 0.002)
- Duration of hospital stay is significantly shorter in catheter group than in needle aspiration group (p value 0.001)
- 29 patients out of 30 were successfully treated by catheter group (95%) whereas 27 patients out of 30 were successfully treated by needle aspiration group (90%) p value 0.045 i.e. catheter drainage was slightly more successful.

DISCUSSION

As per Mukhopadhya and Balaji et. al. liver abscess is very common clinical problem in India, which if not taken seriously carries high mortality. ^{10,11} First published review of liver abscess was done by Bright in 1936.

Berger and Osborne reported improvement after needle aspiration in 15 patients only two require more than two aspirations. ¹² This study is a prospective trial comparing percutaneous needle aspiration and percutaneous catheter drainage in the percutaneous treatment outcome.

While performing this prospective study it is observed that patient suffering from liver abscess are also simultaneously suffering from other diseases. These comorbidities includes gall bladder/common bile duct calculi, cholecystitis, diabetes mellitus, cholangitis, colitis, appendicitis etc. 14

The most common comorbidity 22.66% (60) among both group in our study is found to be gall bladder/common bide duct calculi (15) (in aspiration group 26.66% and catheter group 20%). Among numerous studies, most common comorbidities are described in (Table 1).

Table 1: Among numerous studies, most common comorbidities are described as below.

Study	Comorbidity	Incidence
Rajak's et al (1998)	GBC/CBD calculi	17%
Yon Back et al (2000)	Cholecystitis	19%
Simon Yu's et al (2003)	Diabetes mellitus	22%
Zarem and Hadzek et al 2006)	Cholecystitis	27%
Present study (2010)	GBC/CBD calculi	22.66%

In over study most, common complaint 81.66% (49) was found to fever i.e. 80% (24) in aspiration group while 83.33% (25) in catheter group (Table 2).

Table 2: Comparative finding of most common symptom among different studies are as below.

Study	Most common symptom	%
Rajak's et al (1998)	Right hypochondrial pain	96%
Simon Yu's et al (2003)	Fever	83%
Zarem and Hadzek et al (2006)	Right hypochondrial pain	93.22%
Present study (2010)	Fever	81.66%

A study conducted on Public Hospital Hongkong in 2003 on common symptoms and signs of liver abscess by HAUS-IORG mischances which was also published in world journal of surgery also favors our result. A comparative finding of most common symptom among different studies shown in Table 2.

Also, there was no significant statistical difference found in abscess characteristics in the two groups, including the number of abscess in each group. In our study it was observed that solitary abscesses were more common 86.66% (52) as compare to multiple liver abscess (90%, (27) in catheter group and 833.33% (25) in aspiration group). On applying chi-square test, chi-square value is 2.10 and p-value is 0.147 which (>0.05) non-significant implying that solitary and multiple abscesses are similarly distributed in both groups.

There are three types of liver abscesses namely amoebic, pyogenic and fungal. ¹⁶ In present perspective study we found no positive case of fungal abscess. Amoebic abscesses are more common (average 63.33%) finding in our study 66.66% in aspiration group and 60% in catheter group. Pyogenic abscess is found in 36.65% in aspiration group and 40% in catheter group.

On comparing two groups by chi-square test p-value is 0.30 (>0.05) which is non-significant i.e. there is no statistical difference in distribution of type of liver abscess between two groups exist. Standard text book of General Surgery- quote's that "in United States pyogenic hepatic abscess constitute over 80% of liver abscesses rest being amoebic in nature". 17 Another standard textbook of General Surgery -quote's that "Pyogenic liver abscess are more common in Eastern countries. 18 It has an increased incidence in elderly, diabetics and the immunosuppressed patients who usually present with anorexia, fever and malaise accompanied by right upper quadrant discomfort". It also text that "Entamoeba histolytica is endemic in many part of the world mainly eastern countries which accounts for more incidence of amoebic liver abscess in these countries probably because of poor sanitation". 19 Over all incidence of amoebic liver abscess are more common in world as compare to pyogenic liver abscess. ²⁰ Rajak in his study conducted at Post Graduate Institute of Chandigarh in 1998 also found that incidence of amoebic liver abscess were more common i.e. 80% (20 patients out of 25).

On further studying there were no statistically significant difference found between the patients of two groups when white blood cell count, bilirubin level, serum level of alkaline phosphatase, which is commonly elevated in patient with liver abscess, serum protein level and prothrombin time were analyzed. 61% of total patient had leukocytosis (TLC >11,000/cu/mm3), where as in Rajak's and Simon's study the figures were 83% and 89% respectively.

Prothrombin time: INR was raised above 2 in around 38% of total cases, and total serum bilirubin was more than 2.0 in over 46.66% of cases although clinical jaundice was evident only in 23.33%. Volume of pus drained at first sitting among numerous studies is shown in (Table 3).

Table 3: Volume of pus drained at first sitting among various studies is shown as below (ml).

Study	Treatment group	Average volume of pus (ml)
Simon Yu et al 2004	Aspiration	38.5
	Catheter	37.5
Zerem and Hadzic et al 2006	Aspiration	139
	Catheter	150
Present study 2010	Aspiration	135
	Catheter	280

The average duration of i.v. antibiotic given in Simon Yu et al. was 8.5 days in aspiration group and 12 days in catheter group where as in present study it is 9.5 days in aspiration group and 8.4 days in catheter group.

Average duration of i.v. antibiotic needed in different study are as shown in (Table 4).

Table 4: Average duration of i.v. antibiotic needed in different studies.

Study	Treatment group	Average duration of i.v. antibiotic (days)
Simon Yu et al 2004	Aspiration	8.5
	Catheter	12
Present study 2010	Aspiration	9.5
	Catheter	6.4

In present study success rate between aspiration group is 90% (27 patients) and catheter group is 95% (29 patients) although catheter group is slightly more successful as on applying chi-square test p-value is $0.045 \cong 0.05$.

Simon YU's et al. in 2003 done on 64 patients of liver abscess cases to compare these two treatment modalities concluded both these techniques equally effective and safe for treatment as for as hospital stay, clinical relief, morbidity, mortality, success rate etc. are concerned while because of easier procedural technique, less time consuming and cost effectiveness the intermittent needle aspiration techniques deserve to be considered as first line drainage approach for liver abscess.

CONCLUSION

Thus, our study concluded that in view of greater volume of pus drained in first sitting, early clinical recovery, shorter duration of hospital stays and slightly more success rate continuous catheter drainage is effective percutaneous treatment modality than intermittent needle aspiration. Although because of small no. of patient studied (60 patients) in shorter duration (2 years) and a human error is always possible, result may vary in different studies.

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