

A Study of Outcome and Demographics of Ultrasound Guided Catheter Drainage of Liver Abscesses

Sohini Sengupta¹, Barindra Nath Mallick², Mainak Ghosh³, Sanjay Kumar Bhagat⁴

¹Associate Professor, Department of Radiology, IPGME & R and SSKM Hospital, Kolkata, West Bengal.

²Associate Professor, Department of Radiology, Murshidabad Medical College and Hospital, West Bengal.

³Assistant Professor, Department of Pharmacology, Murshidabad Medical College and Hospital, West Bengal.

⁴Consultant Radiologist, Sonoscan Healthcare Private Limited, Kolkata, West Bengal.

ABSTRACT

BACKGROUND

Liver abscess is a serious medical condition with high mortality if left untreated and known to respond favourably to surgical drainage with appropriate antimicrobial therapy. With advancements in imaging, percutaneous ultrasound-guided aspiration and drainage has emerged as a less invasive modality for abscess management. We wanted to study the clinical improvement, complications and duration of hospital stay after catheter drainage of liver abscess under ultrasound guidance, re-assess the size of abscess cavity and determine the aetiology of liver abscess wherever possible.

METHODS

Data was collected from 30 patients with liver abscesses attending a tertiary care hospital with inputs from the departments of Radiology, Surgery and Medicine. The patients were subjected to ultrasound guided catheter insertion for pus aspiration and drainage after written informed consent was obtained and pre-procedure workup was medically acceptable. The patients were followed up in hospital till they were cured, or they developed complication necessitating further care.

RESULTS

Liver abscess was more common in young adult age group (21-40 yrs.) with a male to female ratio of 28:2. Right lobe of liver was more frequently involved compared to left lobe. Fever was the most common presenting symptom followed by pain. Most of the cases did not show growth of any microorganism, either due to empirical antimicrobial therapy or due to amoebic aetiology. Among the positive cases, *E. coli* was the most common causative organism. Volume of the abscess cavity ranged from 400 to 2000 cc with a mean of 805 cc. Catheter blockage and dislodgement were rarely reported in our patients. The mean duration of drainage was 14 days (range 7-29 days). No death occurred during treatment or follow up with a success rate of 93%. The non-availability of microbiological confirmation of amoebic and anaerobic aetiology in our institution during our study period was a limitation.

CONCLUSIONS

Ultrasound guided percutaneous pigtail catheter drainage is a safe, cost-effective and radiation-free mode of treatment of both amoebic and pyogenic liver abscesses with low morbidity and high success rate. This therapy should be the first line of management in liquefied moderate to large sized liver abscesses.

KEYWORDS

Liver Abscess, Catheter Drainage, Ultrasound Guided

Corresponding Author:

*Dr. Barindra Nath Mallick,
Associate Professor,
Department of Radiology,
Murshidabad Medical College and
Hospital, Berhampore, West Bengal.
E-mail: drbarinm@gmail.com*

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BACKGROUND

Liver abscess is a solitary or multiple collection of pus within liver, usually associated with systemic manifestations of toxemia and clinical signs of disease in the right upper quadrant of abdomen. It has been described since the time of Hippocrates (400 B.C.) with the first published review by Bright in 1936. In 1938, Ochsner's classic review heralded surgical drainage as the definitive therapy but the mortality rate remained at 60-80%.¹ The development of new radiologic techniques and advancement of drainage techniques, improved supportive care and microbiologic identification have decreased mortality rate to 5-30% while the prevalence of liver abscess has remained relatively unchanged.² 80% of the liver abscess are pyogenic, mostly polymicrobial while 10% are due to amoeba and fungi respectively.³

Appendicitis was the major cause of liver abscess in past but with improved diagnosis and treatment of this condition, it accounts for 10% cases now. 60.6% of current abscesses can be attributed to biliary tract infection while 23.8% are cryptogenic. Hematogenous spread accounts for 14.7% of cases and direct extension, secondary infection of other space occupying lesions, direct extension are the other minor causes.⁴ Pyogenic liver abscess is uniformly fatal if left untreated. Antibiotics and drainage procedures have currently brought down mortality to 5-30% in various case series. The most common causes of death include sepsis, multi-organ failure and hepatic failure.⁵

The clinical presentation of liver abscess with fever, right upper abdominal pain, enlarged liver, weight loss, jaundice and pleural effusion or night sweats mean that all signs and symptoms may not be present in one patient, making clinical diagnosis unreliable and conservative treatment required antimicrobial therapy was with a median duration of 42 days.⁶ Bacterial infections are more commonly due to *E.coli* and *Klebsiella* spp. Standard diagnostic workup includes complete blood counts, coagulation profile, liver function tests, blood cultures and enzyme immunoassay for *Entamoeba histolytica* when appropriate.⁷ The surgical management of liver abscess with appropriate broad antimicrobial coverage was standardized to reduce the duration of antimicrobial therapy and improve outcome before onset of minimally invasive approaches.⁸

Beginning with increased accuracy of imaging modalities, Imaging-guided aspiration of liver abscess to reduce liver damage and load of infective material was promulgated. Computed tomography initially provided enough accuracy for placement of needle percutaneously into the abscess cavity.^{9,10} Localization of infection to the liver was also successfully performed with Gallium, technetium and Indium based scintigraphic or radionuclide scanning.¹¹ The problem with these techniques were twofold, namely risk of radiation exposure and lack of real time assessment while performing the procedure. These could be avoided with superior image detail and quick ability of changing the plane of imaging once better resolution ultrasonographic scan became available. (Image 3) This

quickly became the preferred modality for percutaneous drainage of liver abscess with a sensitivity of 80-90%.¹² Drainage procedures are broadly divided into needle aspiration and indwelling catheter drainage with regular irrigation of catheter. With cavity size above 5 cm, catheter drainage and maintaining drain till output of 10 mL/day is attained, with follow-up weekly ultrasonographic scan is preferred.¹³ Lower morbidity compared to surgical procedure in well-chosen patients (unilocular abscess, stable coagulation, no concomitant biliary pathology) has made catheter drainage the preferred procedure.² India being a large country with diverse populations, there is need for a study to find the results of ultrasound-guided catheter drainage of liver abscesses.

We wanted to study the clinical improvement, complications and duration of hospital stay after catheter drainage of liver abscess under ultrasound guidance, re-assess the size of abscess cavity and determine the aetiology of liver abscess wherever possible.

METHODS

This study was conducted on inpatients with diagnosed liver abscess as a hospital based prospective interventional study.

Inclusion Criteria

- Patients of either sex age 5-75 years diagnosed to have liver abscess by USG or CT scan.
- Abscess unresponsive to medical treatment for 72 hours.
- Abscess size more than 5 cm in any one dimension or volume more than 250 mL in right lobe of liver.
- Abscess of any size in the left lobe of liver.

Exclusion Criteria

- Age of patient less than 5 years or more than 75 years.
- Multiple or ruptured abscess.
- Abscess with thick organized pus.
- Abnormal bleeding or coagulation profile with Prothrombin time more than 4 seconds prolonged than the control.
- Malignancy of biliary origin or hepatic metastasis.
- Abscess size less than 5 cm or volume less than 250 mL in right lobe of liver.

The study was conducted from February 2009 to July 2010 at the Department of Radiology, IPGME&R hospital, Kolkata in collaboration with the Department of Gastroenterology, Medicine and Surgery. All patients fulfilling the inclusion and exclusion criteria were enrolled in the study during this period. A total of 30 (thirty) patients were included in this study. A disposable 8.5 Fr pigtail catheter with dedicated trocar and cannula was used for all patients. (Image 1 & 2) Informed written consent was obtained from each patient.

Clinical Endpoints

- Time to defervescence of fever to 37.5 °C or less for 2 consecutive days.
- Secondary procedure was defined as repeated procedure linked to progression or persistence of sepsis, recurrence of liver abscess or related to the underlying cause of the abscess.
- Failure of treatment was defined as deterioration of clinical status, requirement of additional procedures during the same admission related to liver abscess or death.
- Mortality was defined as death within 30 days or within the same hospital admission.
- Length of hospital stay defined as number of days from the day of hospital admission.

Parameters Studied

- Age and sex distribution of the patients with liver abscess
- Number, size and locations of cavities
- Any associated subphrenic or subhepatic collection
- Any complication arising due to procedure
- Duration of hospital stay
- Causative organism of liver abscess.

Technique

After pre-procedure counselling, the patient was placed supine or in left lateral decubitus. Abscess cavity was localized and a safe drainage route was planned with skin surface marking avoiding bowel and costophrenic recess. (Image 3) Antiseptic dressing and draping were performed. Local anaesthesia was done with infiltration of 2% Lignocaine solution throughout the planned tract up to the hepatic capsule without injecting any drug into the hepatic parenchyma. A small stab incision was given on the skin the skin wound is deepened using artery forceps to split the muscle layer for easy passage of trocar with cannula. The catheter with trocar was introduced in the abscess cavity, the cannula was used to see if pus is present, then trocar was withdrawn a bit. The catheter was further advanced till the tip was in the centre of abscess cavity. (Image 4) The trocar and cannula was removed, a syringe was attached to the catheter for aspiration, pus sampling done and was replaced with a closed drainage bag (ROMO-10). A stay suture was applied to secure the catheter at the site to prevent dislodgement. Gentle lavage with Normal saline (0.9% NaCl) was used for viscous pus. All collected pus was drained at the time of insertion and gravity drainage was maintained. The patients were followed up every 3 days with appropriate antimicrobial. Catheter removal and successful therapy was decided upon based on the following-

- Resolution of symptoms and signs.
- Decrease in catheter output to less than 10 mL per day.
- Closure of cavity on follow-up USG with size less than 3 cms and no relapse or recurrence on follow-up.
- Normalization of leucocyte count.

The study utilized a ultrasound machine (Toshiba, XARIO, sector transducer of broadband frequency 2.8-4.4 MHz), Pigtail catheter sets – 30 such (8.5 Fr, 22 cm, Devon Innovation) and drainage bag (ROMO-10).

RESULTS

The study on 30 patients with liver abscess discussed here includes all solitary lesions. The age ranged from 12 to 65 years with a mean of 34 years. Most patients belonged to the age group of 21-30 years and 31-40 years, each representing 30% of the patients. The age distribution is shown in Table 1. 28 patients were male (93.3%) and remaining two were female. In terms of frequency of chief complaints, fever was the commonest (90%) while pain was a close second (86.6%) while only 20% patients had jaundice. 25 patients had involvement of the right lobe of liver (83.3%). In three patients, the abscess was involving both lobes due to its large size. Two patients (6.6%) had solitary left lobe abscess.

The present study showed that liver abscess cavity volume had mean value of 805 mL (range 400-2000 mL). 18 (60%) patients had liver abscess volume between 401-800 mL. (Table 2). The pus aspirated was sent for bacterial culture. The culture report was not available with 5 patients. From the rest, 21 showed no bacterial growth (70%). *Escherichia coli* was the commonest bacteria isolated (Table 3). The commonest complication was catheter block followed by catheter displacement, documented in 6(20%) and 3 (10%) patients respectively. The complications are shown in Table 4.

Mean duration of catheter drainage was 14 days (range 6-29 days). 10 patients (33.3%) needed drainage for 11-15 days while another 9 (30%) for 6-10 days. The distribution of drainage duration is shown in Table 5. The duration of hospital stay was 11-17 days for 17 patients (56.6%) with the distribution shown in Table 6. The present study showed that out of 30 patients, 28 could be successfully treated with percutaneous catheter drainage (93%).

Age Group (Years)	No. of Patients	%
0-10	0	0
11-20	5	16.67
21-30	9	30
31-40	9	30
41-50	4	13.33
51-60	1	3.33
61-70	2	6.67

Table 1. Age Distribution of Patients

Abscess Volume (mL)	No. of Patients	%
0-400	1	3.33
401-800	18	60
801-1200	8	26.67
1201-1600	1	3.33
1601-2000	2	6.67

Table 2. Abscess Volume of Patients

Report of Culture	No. of Patients	%
<i>E. coli</i>	3	10
<i>K. pneumonia</i>	1	3.33
No growth	21	70
Report not available	5	16.67

Table 3. Bacterial Culture of Pus Drained from Liver Abscess

Complications	No. of Patients	%
Catheter block	6	20
Catheter dislodgement	3	10
Infection at insertion site	2	6.67
Tract pain	1	3.33
Biliary fistula	1	3.33

Table 4. Complications During Hospital Stay after Abscess Drainage

Days	No. of Patients	%
0-5	0	0
6-10	9	30
11-15	10	33.33
16-20	6	20
21-25	4	13.33
26-30	1	3.33

Table 5. Duration of Pus Drainage with Catheter In-Situ

Days	No. of Patients	%
0-10	0	0
11-20	17	56.67
21-30	10	33.33
31-40	3	10

Table 6. Duration of Hospital Stay



Image 1.
A Set of Instrument for Pigtail Catheter Drainage



Image 2.
The Tip of Pigtail Catheter with Trocar and Side-Vents (Straight) and Trocar Withdrawn (Curled)



Image 3.
A Large Abscess (A) in the Right Lobe of Liver on Two-Dimensional Ultrasonography



Image 4.
A Liver Abscess Showing the Curled Tip of the Pigtail Catheter (Left) and The Rest of the Catheter (Right)

DISCUSSION

The mean age of patients suffering with liver abscess has increased over time.^{13,14} While recent studies showed there

is a shift of the age distribution from the fourth to the sixth decade of life, the present study showed mostly young male adults are affected. This may be due to increased incidence of Amoebic liver abscess which the present study could not differentiate from the bacterial causes. Amoebic liver abscess is less common in most developed societies. Previous authors have noted that liver abscess is more common in the right lobe of liver, which may be due to dual blood supply from superior mesenteric and portal veins. It also contains a denser network of biliary canaliculi and accounts for larger part of the hepatic mass.

The symptoms of liver abscess are well described and it is notable that 4 patients had right sided pleural effusion which spontaneously subsided after catheter drainage within 48-72 hours. Jaundice subsided within 7-10 days after catheter placement in the 5 patients presenting with it. The use of empirical antimicrobials before therapeutic catheter drainage may cause less bacterial isolation in the present study. As serological test for amoeba (*Entamoeba histolytica*) was not done, anaerobic culture was also not performed and 5 patients could not show their pus culture report, the present study is inconclusive about the predominant aetiology of liver abscess.

The complications encountered in this study during catheter placement were pain and respiratory distress in one patient and mild respiratory distress in another. These subsided with assurance and analgesics. Catheter blockage and dislodgement were the commonest complications after catheter placement. The catheter could be flushed every 8 hours with sterile normal saline solution to prevent blockage but risk of reintroduction of infection is present. In this study, once catheter was blocked, it was managed by saline irrigation and repositioning of catheter. Reinsertion was attempted if these failed to remove catheter blockage. Infection at insertion site was satisfactorily managed with antimicrobials and tract pain responded favourably to analgesics.

One patient developed biliary fistula, documented by passage of bile through catheter. It resolved spontaneously after catheter removal but required longer duration of catheterization. There was no deaths in the course of this study. 28 out of 30 patients were successfully treated, only 2 required surgical drainage after they worsened with overwhelming infection.

CONCLUSIONS

The present study showed that in India, carefully selected patients can be quickly and satisfactorily treated with catheter drainage for liver abscess but serological confirmation of amoebic liver abscess should be attempted universally. The empirical antimicrobial regimen should provide adequate coverage for Enterobacteriaceae like *E. coli*. Anaerobic organisms should be considered if the patient is not improving and facility for anaerobic bacterial culture should be available. The study also showed that a larger longitudinal study is required involving multiple centres to

better delineate the aetiology and demographics of liver abscess patients.

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