

Comparative Study of Catheter Drainage versus Needle Aspiration in Management of Liver Abscess

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ABSTRACT

Background: Liver abscess is a common condition in India and it has the 2nd highest incidence of liver abscess in the world. Pyogenic abscess accounts for three quarters of hepatic abscess in developed countries while amoebic liver abscess causes two third of liver abscess in developing countries. Amoebiasis is presently the third most common cause of death from parasitic disease. The world health organisation reported that *Entamoeba histolytica* causes approximately 50 million cases and 1,00,000 deaths annually. Liver abscess continues to be a disease with considerable mortality in India. Liver abscess has an increasing incidence rate in United States and Europe. Modern treatment has shifted towards IV broad spectrum antibiotics and image guided percutaneous needle aspiration or percutaneous catheter drainage and surgical drainage. Treatment of liver abscess has improved significantly with the introduction of ultrasound and computed tomography.

Methodology: This was a retrospective observational study conducted in Department of Surgery, GMC Bhopal, from March 2012 to march 2018. 651 patients were included in this study with the diagnosis of liver abscess.

Results: Out of 651 patients, 297 ultrasound guided needle aspirations were done and 246 (83%) responded to it; 354 ultrasound guided pigtail catheter placements were done and 334 (94.3%) responded to it. Most common symptoms were pain in abdomen (n=559), fever (n= 558), nausea and vomiting (n = 455) and weight loss (n= 286). Among the successfully treated patients, early alleviation of symptoms, early resolution of abscess cavity, mean hospital stay and average time for clinical improvement were better among catheter drainage group.

Conclusion: Majority of patients with un-ruptured liver abscess can be managed without conventional surgical drainage with Percutaneous catheter drainage is a better modality as compared to percutaneous needle aspiration

Key words: liver abscess, percutaneous needle aspiration (PNA), percutaneous catheter drainage (PCD), surgical drainage, amoebic liver abscess, pyogenic liver abscess

INTRODUCTION

A liver abscess occurs when bacteria or protozoa destroy hepatic tissue, producing a cavity, which fills with infectious organisms, liquefied liver cells and leukocytes. Necrotic tissue then walls off the cavity from the rest of the liver. Differential diagnosis of liver abscess includes amoebic liver abscess, pyogenic

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liver abscess, fungal liver abscess, necrotic adenoma and echinococcal cyst.

Up to 40% of patients develop complications from pyogenic liver abscesses, the most common being generalized sepsis. In addition to sepsis, morbidity can include pleural effusion, empyema and pneumonia. Abscesses may undergo intra-peritoneal rupture, which is frequently fatal. Usually, however, the abscess does not rupture, but develops a controlled leak resulting in a peri-hepatic abscess. Pyogenic abscesses can cause hemobilia and hepatic vein thrombosis (1). Amoebic liver abscess (ALA) is a common infection caused by parasite *Entamoeba histolytica* which is capable of invading virtually every organ in the human body (2). ALA is the third leading cause of death due to parasitic diseases after malaria and schistosomiasis (3). 10% of the world's population is infected with *E. histolytica* (4). 40 million develop invasive disease and 40,000 deaths occur annually.

From 1950 to 1990, mortality rates varied from as low as 11% to as high as 88% (2). The high mortality rates result from delay or failure to diagnose the abscess, failure to detect smaller intrahepatic abscesses, ineffective drainage, lack of source control, associated malignancy, immune insufficiency or other major comorbidities.

No general consensus has been achieved regarding risk factors due to the variability of the patient population being studied and the presence of malignancy in the population.

Complications from liver abscesses occur secondary to rupture of the abscess into the peritoneum, pleural cavity or pericardium. Ruptured liver abscesses occur in 2–17% of patients and are associated with mortality rates between 12% and 50% according to literature (5).

Currently, patients are treated with antibiotics along with percutaneous needle aspiration (PNA), percutaneous catheter drainage (PCD) or surgical drainage which is reserved for patients who fail to respond to conservative treatment or percutaneous drainage. This study aims to evaluate the outcomes associated with different treatment strategies of liver abscess.

METHODOLOGY

This retrospective observational study was carried out in the Department of Surgery, Gandhi Medical College and Associated Hamidia Hospital, Bhopal (M.P.), India from March 2012 to March 2018. 651 patients with the diagnosis of liver abscess admitted in the surgery wards were included in this study. Patients with the following symptoms and signs were selected for

screening of liver abscess: fever, abdominal pain, diarrhoea, weight loss, anorexia, nausea, vomiting, history of chronic alcoholism or smoking, tender hepato-megaly, jaundice. These patients were subjected to an ultrasound of the abdomen (*fig. 1*). All the liver lesions suggestive of liver abscess were examined in detail. Computed tomography was also used as an alternative to ultrasound (*figs. 2, 3, 4*).

Detailed morphology of liver abscess was examined including size of abscess cavity, number of abscesses, lobe involved, volume of abscess cavity. X-ray upper abdomen and chest were done (*fig. 5*). Routine blood investigations were done like complete blood count, random blood sugar, liver function tests, renal function tests, coagulation profile, pus for culture/sensitivity and microscopy, urine examination and stool examination.

After history, clinical examination and radiological investigations, all the patients diagnosed with liver abscess who required hospitalization were admitted. Patients were given third generation cephalosporin and metronidazole therapy. Depending on the size of abscess cavity, ultrasound guided needle aspiration or percutaneous needle aspiration was done. In cases of ruptured liver abscess, emergency laparotomy was done. For smaller abscesses responding to drug therapy, conservative management was done.

Techniques of percutaneous needle aspiration

The patient was made to fast for six hours. To counteract vagal shock, atropine was injected in a dose of 0.6 mg half an hour before the procedure. The site of aspiration was determined. The selected area was



Figure 1 - Sagittal abdominal ultrasound demonstrating a pyogenic liver abscess. The lesion appears as a low-density collection with small internal echo's

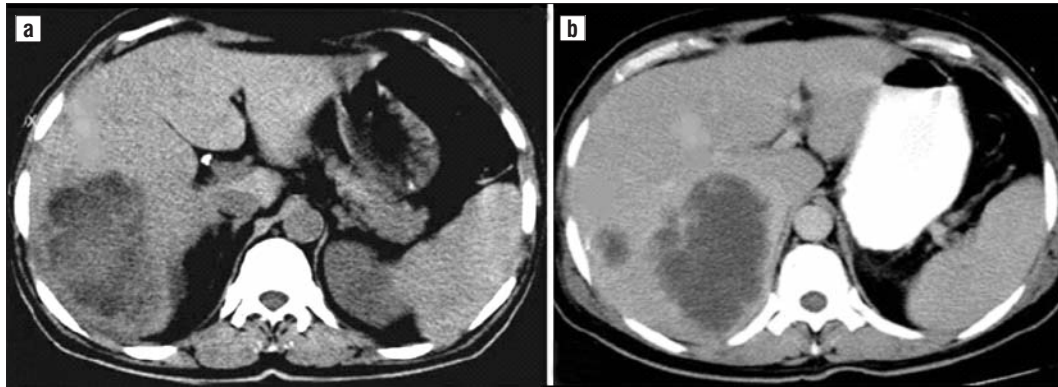


Figure 2 - Liver abscess. (a) Non-contrast and (b) Contrast-enhanced CT scan demonstrates a large, lobulated, well-defined cystic mass in the right hepatic lobe

infiltrated with 4-5 ml of 2% xylocaine using a 4 inch 24 G needle. A small puncture with stab knife may be made in the skin at the site of needle puncture. Percutaneous aspiration may be done with a large bore cannula (No. 18) or lumbar puncture needle. The patient was asked to take shallow breaths throughout the procedure and hold breath during insertion or withdrawal of the needle, to minimize liver trauma and hemorrhage. The puncture wound was sealed and covered with dressing. Analgesics and intravenous antibiotics or amoebicidal should be given as necessary, if not given at the beginning of the procedure. For the first 12-24 hours a half hourly watch was kept on the temperature, pulse, respiration, and abdominal girth so that signs of hemorrhage or peritonitis would not be missed.

Techniques of pigtail catheterization

Catheter drainage was performed using the Seldinger technique as described in the literature. Injectable atropine 0.6 mg was given intramuscularly



Figure 3 - Abdominal CT demonstrating multiple pyogenic abscesses which are of low-density with characteristic peripheral rim enhancement

half an hour before the procedure. Abscess was localized by USG and a safe drainage route was planned to avoid bowel loop and costo-phrenic recess. Under all antiseptic precautions, the site was marked and

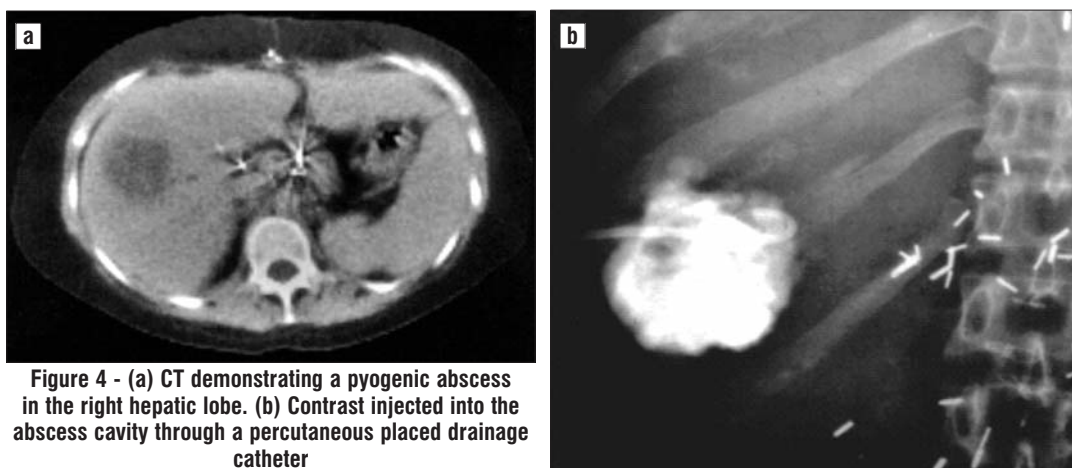


Figure 4 - (a) CT demonstrating a pyogenic abscess in the right hepatic lobe. (b) Contrast injected into the abscess cavity through a percutaneous placed drainage catheter

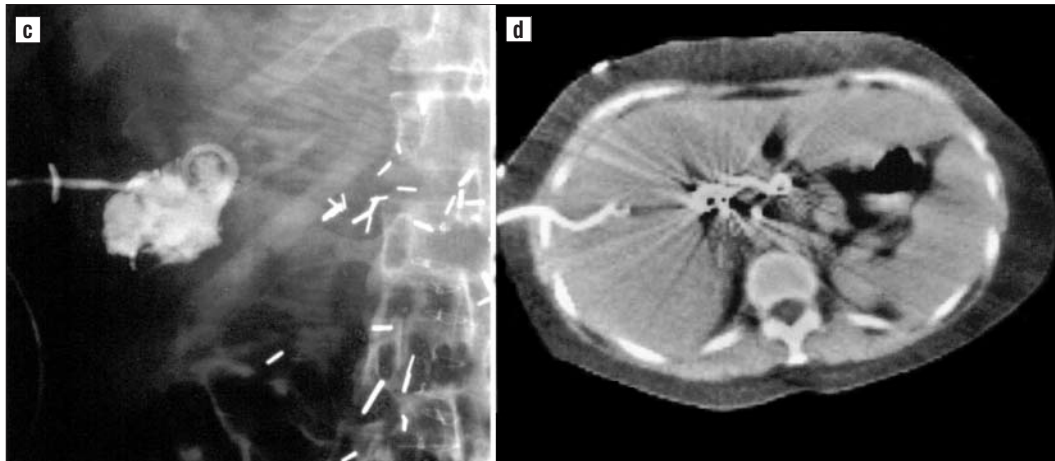


Figure 4 - (c) Sino-gram performed 2 weeks later revealing a decrease in the size of the abscess cavity. (d) CT after 4 weeks demonstrating complete resolution of the abscess.

infiltrated with 2% lignocaine. A 4 mm stab incision was made through which an 18 G guide wire introducer needle was passed under ultrasound guidance till it reached the centre of the cavity. A guide wire was then introduced through the needle and positioned inside the cavity following which the needle was removed keeping the guide wire in situ. Serial dilators were then passed over the wire to dilate the tract. The tract was dilated to an adequate size depending upon the viscosity of the pus. A pigtail catheter of size smaller than the last dilator was passed over the wire and positioned in the centre of the abscess cavity under ultrasound guidance. The guide wire was then withdrawn and the pigtail catheter was connected to a closed drainage bag and fixed to the skin. Sterile dressing was applied. The pus was sent for aerobic culture (*fig. 6*).

Catheter care and follow up

The daily output was monitored. The catheter was flushed daily with 10 ml of normal saline to prevent its blockage with debris. Alternate day USG studies were done to monitor the cavity size and volume and to confirm the position of tip of the catheter. The pigtail catheter was removed when drainage became serous and it either ceased or was minimal (<10 ml in 24 hours); and USG was suggestive of reduced size/collapsed cavity without any residual pus.

On removal of the catheter, sterile dressings were applied. All patients were called for monthly follow up where clinical and ultrasound assessment was done (*fig. 4*).



Figure 5 - Plain film of a barium enema with a large gas-filled abscess located in the right hepatic lobe

Inclusion criteria

1. All cases of liver abscess diagnosed clinically as well as ultrasonographically or using computed tomography;
2. All cases of diagnosed liver abscess being referred to our hospital;
3. Patients older than 12 years;



Figure 6 - U.S.G. Guided Pigtail Insertion

4. Hospitalized and outpatient patients of both genders;
5. Patients who completed treatment and who came for follow up as advised.

Exclusion criteria:

1. Abdominal neoplastic antecedents
2. Age group < 12 years
3. Congenital cysts
4. Abdominal or biliary surgery antecedents
5. Patients with ruptured liver abscess
6. Patients lost in early follow up

RESULTS

- Incidence of liver abscess was more in the 20-40 year group and the mean age of presentation was 38 years. Out of 651 patients, 599 were males (90.8) and 52 were females (9.2). Male to female ratio was 11:1 (*table 1*);
- History of regular alcohol intake was present in 347 patients (54.4%), while 114 patients (45.6) gave no history of alcohol intake or history of occasional alcohol intake (*table 1*);
- Right Lobe of liver was most commonly involved i.e. 482 patients (74%) followed by both lobes in 120 patients (18.4%) and left lobe in 49 patients (7.5%). Solitary abscess was found in 508 patients i.e. 78% and multiple liver abscesses were found in 143 patients i.e. 22% (*table 1*);
- Amoebic liver abscess (452 patients i.e. 69.6 %) was more common than pyogenic liver abscess (199 patients i.e. 30.6%). 4.9% of the amoebic liver abscess had secondary bacterial infection.
- Amoebic liver abscess was seen predominantly in patients from the rural areas. Pyogenic and fungal liver abscess was seen predominantly in patients from the urban areas;
- 383 patients presented with acute onset of symptoms (< 7 days). Sub-acute presentation (between 7 days to 2 months) was noted in 238 patients. Chronic duration of onset (> 2 months) was seen in 30 patients;
- Most common presenting symptoms in amoebic liver abscess were abdominal pain (94.8%), fever (88.5%) and nausea/vomiting (78.1%). Most common presenting symptoms in pyogenic liver abscess were fever (81%), pain (68.9%) and weight loss (58%) (*table 1*);
- Following derangements in the routine blood investigation were noted: Total leucocyte count > 10000 /mm³, increased alkaline phosphate level, decreased serum albumin, haematocrit <36%, raised serum bilirubin > 2 mg/dL, deranged prothrombin time (*table 1*);
- Average size of abscess at the time of presentation was 400- 500 ml;
- Abscess culture was positive for growth in 62.3% patients. Klebsiella, E.coli and bacteriodes were the most common organism (*graph 1, table 1*);
- Diabetes mellitus and cirrhosis were the most common predisposing factors. Chronic pancreatitis, peptic ulcer disease, inflammatory bowel disease, jaundice, unsanitary environment and immunodeficiency were other predisposing causes;
- Most common complications associated with amoebic liver abscess were sepsis 36.2% and pleural effusion 10.3%. Most common complica-

Table 1 - Comparison of demographic features, clinical features and investigations with previous studies

	Hyo Min Yoo et al (23)	Khee Siang, Ching Ming (21)	Shyam Mathur (20)	Rajak et al (17)	Satish chritopher et al(22)	Present Series Amoebic	Pyogenic
Mean Age	-	47.6 years	33 years	-	-	38 years	
Sex							
Male	-	-	90%	76%	91%	90.8%	
Female	-	-	10%	24%	9%	09.2%	
Clinical Features							
Pain In Abdomen	85.0%	57.0%	80.0%	100%	95.7%	94.8%	68.9%
Fever	71%	97.2%	70.0%	92%	84%	88.5%	81%
Diarrhea	13%	-	7.0%	-	4.28%	68.3%	9.4%
Nausea / Vomiting	-	-	-	-	25.71%	78%	52.7%
Weakness	-	-	-	-	-	68.9%	74%
Weight Loss	-	-	-	-	-	38.5%	58%
Alcoholism	-	-	70%	-	74.3%	54.4%	
Laboratory Investigations							
Increased Alkaline phosphatase (> 115 IU/L)	78.0%	-	-	-	84.28%	87.8%	
Leukocytosis (>10x10 ³ /L)	55%	-	-	-	90%	71.6%	
Albumin (<3.0 gm/dl)	68%	-	-	-	82.85%	64.8%	
Hematocrit <36%	-	-	-	-	-	58.1%	
Prothrombin Time (>20 sec)	14%	-	-	-	-	31.0%	
Bilirubin >2 mg/dl	-	-	-	-	72.85%	28.3%	
Pus Culture							
Klebsiella pneumoniae	28%	82.3%	-	-	-	24.1%	
E. coli	63%	2.5%	-	-	-	20.96%	
Enterococcus	09%	-	-	-	-	06.4%	
Bacteriodes Species	-	-	-	-	-	19.3%	
Ultrasound Findings							
Solitary Abscess	89%	-	-	-	58.6%	78.0%	
Right lobe	69%	-	-	-	82.9%	74%	
Left lobe	20%	-	-	-	8.6%	7.5%	
Multiple Abscesses	11%	-	-	-	41.4%	18.4%	
Size of Abscess							
< 5 cm	45%	-	-	-	-	46.4%	
> 5 cm	55%	-	-	-	-	53.6%	

tion associated with pyogenic liver abscess were sepsis 40.5% and pleural effusion 32.4%;

- Treatment modalities used were ultrasound guided aspiration with antibiotics in 297 patients and ultrasound guided Pigtail with antibiotics in 354 patients (*table 2*);

- Persistence of liver abscess was seen in 78 (11.98%) cases. 47 (7.2%) patients underwent ultrasound guided aspiration with antibiotics and 31 (4.7%) patients underwent ultrasound guided pigtail insertion with antibiotics;
- 70.4% patients required percutaneous aspiration

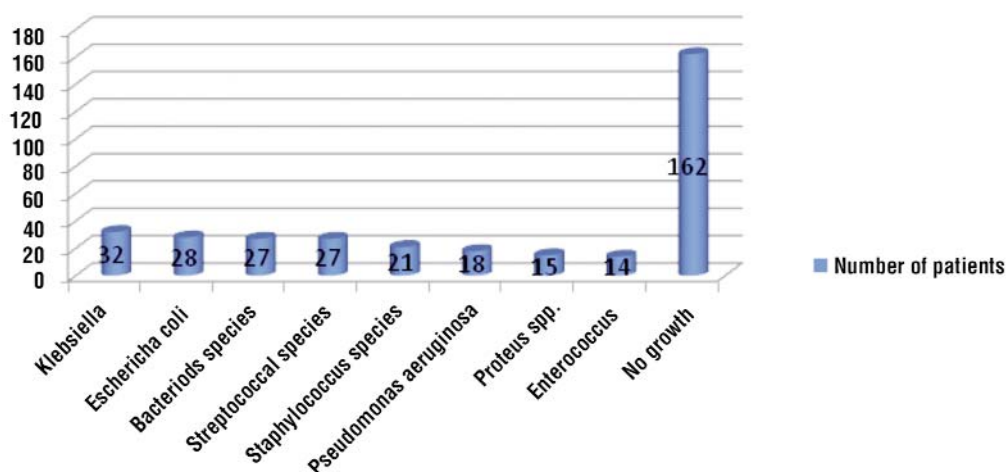
**Graph 1 - Pus culture analysis**

Table 2 - Comparison of treatment modalities, recurrence and mortality with previous studies

Treatment Modality	Hyo Min Yoo et al(23)	Satish Christopher et al(22)	Khee-Siang, Chin Mint et al(21)	Present Series
Treatment Modality				
Open Laparotomy	21.0%	-	-	-
Percutaneous needle Aspiration + Antibiotics	79.0%	21.4%	-	45%
Pigtail Catheter Drainage + Antibiotics	-	38.57%	-	55%
Antibiotics alone	-	40%	-	-
Recurrence	9%	-	-	8.4%
Mortality	11%	-	6.5%	00%

only once for resolution of the abscess. 10.4 % patients required 2 aspirations and 4.2 % patients require three aspirations. Persistence of abscess was seen in 47 % patients;

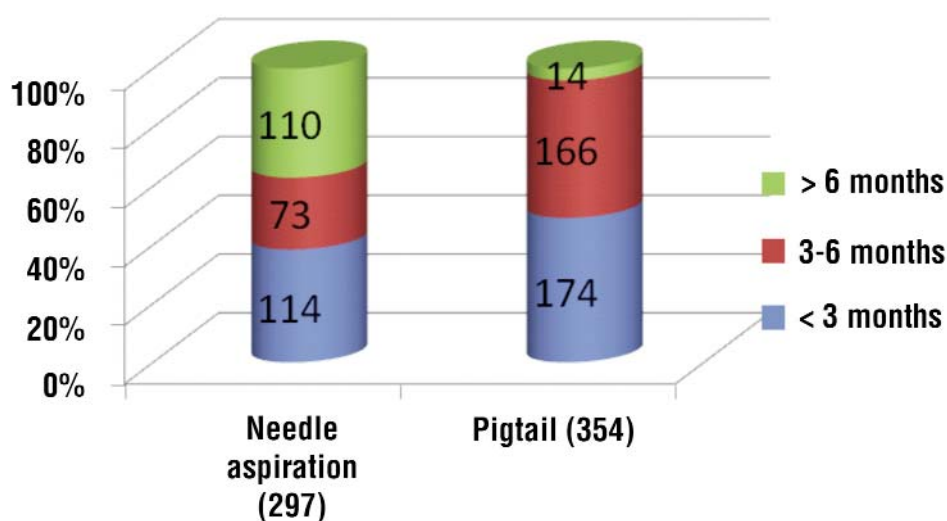
- With pigtail catheter drainage, 64.4% of cases had early resolution as shown on follow up ultrasound, compared to 35.9% who had complete resolution after percutaneous needle aspiration (*graph 2*);
- There was no significant difference in duration of hospital stay in different modalities.
- Recurrence of liver abscess occurred in 55 cases (8.4%) (*graph 3, table 2*).

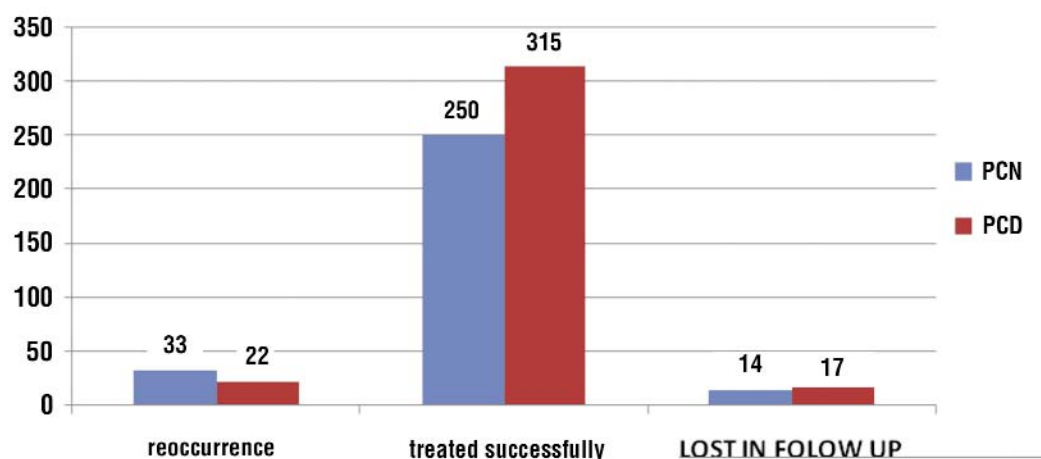
DISCUSSION

Percutaneous treatment (needle aspiration or catheter drainage) is now the standard management for liver abscesses (7-10). It has replaced surgical exploration, which now has very limited indications. Needle aspiration is less expensive, avoids problems related to

catheter care and long-term hospital care. Multiple abscesses can be aspirated through different tracts in the same sitting. However, needle aspiration has lower success rates than catheter drainage (5-9). Another problem with aspiration is that repeated needle aspirations (average number per patient ranging from 1.4 to 5) may be required in a single patient over a short period (from 5 to 14 days) (11). This may be painful and unpleasant for the patients and hence may not be acceptable to them. To avoid these problems associated with needle aspiration, percutaneous pigtail catheter drainage is now used as the first tool in the management of liver abscesses. The advantage of catheter drainage is that it provides a continuous outlet to the pus and hence the problems of incomplete and repeated evacuations are not encountered. Therefore this procedure has a high success rate reported in the earlier studies and also in this present series (95%).

The cause of failure of this procedure as reported by earlier studies (11,12) has been thick and viscid pus, which cannot be easily drained by percutaneous

**Graph 2 - Resolution time of abscess cavity**



Graph 3 - Outcome

drainage, or premature withdrawal of the catheter. These problems can be avoided by using adequate sized pigtail catheters depending on the viscosity of pus (5 Fr. to 12 Fr.) and following a strict protocol of catheter flushing and removal. One of the major problems is prolonged duration of the catheter placement. This led to some authors considering this procedure as slow (15). Ultrasound resolution of an abscess cavity following this procedure may occur at any time between 2 weeks to 6 months (13,14). Small residual cavities may persist indefinitely. 40 % of our patients had small residual cavities (< 2 cm) at 6 months of follow up.

Percutaneous catheter drainage is a safe procedure with very few reported complications (15-17). which include hemorrhage, perforation of hollow viscera, peritoneal spillage, catheter displacement or blockage and septicemia. But recent studies show very low complication rates (6,18,19). Our study did not have any major complication although the incidence of minor complications was 36%.

CONCLUSION

Our study concluded that there is early clinical recovery in view of greater volume of pus drained in first sitting. Percutaneous pigtail catheter drainage is a safe and effective mode of treatment of liver abscesses, both amoebic and pyogenic. It results in an early relief of symptoms and faster resolution of abscess cavity. The low morbidity and high success rate in treating liver abscesses, which otherwise would have a fatal outcome if untreated, by this minimally invasive method suggests that this therapy should be the first line of

management in liquefied moderate to large sized liver abscesses.

Conflict of interest

All author declare that they have no conflict of interest.

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