Original Research Article

A dilemma over percutaneous catheter drainage or percutaneous needle aspiration as first-line management of liver abscess

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Abstract

Background: The aim of the study was to evaluate the clinical presentation and to investigate the effectiveness of percutaneous catheter drainage in comparison to needle aspiration in the treatment of liver abscesses of size more than 5 cm in diameter. **Material and Methods:** This was a prospective randomized comparative study of 60 patients, presented in outpatient and admitted at the hospital, randomized equally into two groups, percutaneous needle aspiration and percutaneous catheter drainage. The effectiveness of either treatment was measured in terms of duration of hospital stay, days to achieve clinical improvement and total/near total resolution of abscess cavity. Independent t- test was used to analyze these parameters. **Results:** Percutaneous catheter drainage was successful in all the 30 cases. On the other hand, USG guided percutaneous needle aspiration was successful only in 24 of 30 patients (P=0.005). Out of these 24 patients successfully treated, 6 patients required only one aspiration, 12 required two aspirations, and 6 required three aspirations. The 6 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 200 ml which was significantly less than those failing treatment; the mean volume being 400 ml. The patients in PCD group showed earlier clinical improvement (P=0.043) and decrease in abscess cavity volume (P=0.001) as compared to those who underwent PNA. In the present study, the success rate was significantly better in percutaneous catheter drainage group (P=0.005) than needle aspiration. The patients in percuaneous catheter drainage group showed earlier clinical improvement (P=0.043) as compared to those who underwent percutaneous needle aspiration. **Conclusion:** In the present study, percutaneous catheter drainage is found to be more effective than percutaneous needle aspiration for large liver abscesses of size 5 cm or more in diameter. The clinical improvement is also faster in PCD group than PNA group of the present study.

Keywords: Liver abscess, Catheter drainage, Needle aspiration

Introduction

Liver abscesses are common hepatic problems in India. They are mostly amoebic or pyogenic. But most of these patients present late with large and multiple liver abscesses. The classical triad of fever, right upper quadrant pain and tender hepatomegaly is not seen frequently. The clinical signs and symptoms and the frequency of any particular sign and symptom varies widely among reports [1]. Due to the late presentation and less availability of imaging modalities, surgical drainage was the exclusive management for liver abscess in the past.

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But in recent era, the treatment has shifted toward conservative management with IV broad-spectrum antibiotics and less invasive image guided percutaneous needle aspiration (PNA) or percutaneous catheter drainage (PCD) and surgical drainage is reserved for patients who fail to respond to such less invasive treatment or who develop complications. Though both PNA and PCD have been shown to be effective and safe, but still the first line treatment of liver abscess is debatable [2-8].

Several studies had shown that combination of broad spectrum parenteral antibiotics with image guided percutaneous modality of treatment has excellent results

in both amebic and pyogenic liver abscesses but still which is better, percutaneous catheter drainage or percutaneous needle aspiration remains debatable.

In previous studies, the preferred and most commonly used method to drain liver abscesses was PCD, but in recent studies, the result of PNA was found to be equally effective, safe and less costly [3-7].

Therefore a prospective study was conducted in the Rohilkhand region to compare the effectiveness and outcome of PCD and PNA in the management of liver abscesses both amoebic and pyogenic.

Materials and Methods

Study design/Type of study- This was a prospective randomized comparative study conducted in the department of surgery at Rohilkhand medical college and hospital, Bareilly, U.P

Sample size & duration of study- A total of 60 patients randomized into two groups of 30 each were included in the study who were admitted in surgical wards for a period of one year from august 2016–august 2017

Inclusion & exclusion criteria: The patients were selected from the outpatient department and admitted at the hospital. All the patients who were admitted in the hospital with diagnosis of liver abscess clinically and radiologically either by ultrasonography (USG) and/ or CT scan with size more than 5 cm were included in this study.

Exclusion Criteria were age less than 18 years, pregnant women, liver abscess with a known intra-abdominal source that requires surgery or with concomitant biliary tract malignancy, abscesses that required transpleural drainage, multiple abscesses and ruptured abscesses.

Data collection procedure: Written consent, bood investigations including coagulation profile, and correction of coagulopathy were performed prior to the procedure. Percuataneous aspiration or percutaneous catheter drainage of liver abscess were done under ultrasound guidance. Lignocaine 2 per cent was infiltrated at the site of aspiration and along the tract for local anaesthesia.

Percutaneous aspiration were performed using spinal needle of size 18 or 20 Gauge. Needle was placed in abscess cavity under ultrasound monitoring pus was aspirated until no more pus could be aspirated. Needle was removed after that. Percutaneous drainage were performed using self-locking pig-tail catheters of size range 10 or 12 French. Under USG guidance, the catheter was placed within the abscess cavity using the modified Seldingers technique.

Aspiration of the abscess material was then performed until no more pus could be aspirated. The catheter was secured to the skin for continuous external drainage.

Surgical procedures done: A procedure was considered successful if there was no change in the initial procedure from needle aspiration to catheter drainage or vice-versa, or subsequent surgery and successful drainage of the abscess allowing for clinical discharge.

Procedural-related complications were noted independently but were not considered as a reason for failure of treatment.

Follow-up: Imaging were performed in patients who were not improved clinically and before removal of catheter. Dislodged catheters were either repositioned or removed with subsequent percutaneous aspiration being performed if required. Procedure details including technique, and number and size of needle and catheter were recorded. Patients who subsequently requires PA, PCD, or surgery after the initial procedure were also documented.

The clinical response (temperature and pan in right upper abdomen) and laboratory parameters [total leukocyte count (TLC), liver function test (LFT), etc.] were recorded on a daily basis. 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 patients were followed up weekly for a month, monthly for three months and at the end of six months, for clinical evaluation and USG assessment of abscess cavity until complete resolution of the abscesses was achieved. Data was collected and recorded in the printed proforma by the investigator.

Data analysis: The various statistical techniques i.e. the mean, standard deviation and test of significance (t-test and chi-square-test) were used for drawing valid conclusions. Statistical analysis done using student t-test. SPSS 13.0 software was used to calculate p value.

Ethical approval: Taken

Evaluation of the response to intervention:

Results

A total of 60 patients randomized into two groups of 30 each were included in the study. The following observations were made:

Table-1: Patient demography

Parameter	PNA	PCD
Age (Mean)	40	42
Sex (Male:Female)	27:3	24:6

The age of the patients varied from 18 years to 58 years with most of the patients falling within the age range from 31-40 years (20 patients) and the number of patients was less in extremes of age. The mean age in PNA group was 40 years while in PCD group is 42 years. There were 51 male and 9 female patients with liver abscess involved in the study. The male to female ratio was 7:1.

Table-2: Symptoms and Signs

Symptoms	No of patient	Percentage
Anorexia	45	75
Right upper quadrant pain	57	97
Hepatomegaly	45	75
Fever	48	80
Nausea/vomiting	15	25
Cough	12	20
Diarrhea	3	05
Right pleural effusion	6	10

It was observed that pain in the right upper quadrant of the abdomen was the most common symptom, found in 97% of the cases. Fever (80%) and anorexia (75%) were other frequently presenting symptoms. Cough was present in 20% of the patients.

Only 05% of the patients gave a history of diarrhea prior to illness. In this study, hepatomegaly was found to be present in 45 of 60 patients (75%) whereas pleural effusion was found in 6 of 60 patients (10%).

Table-3: Laboratory data

	Percutaneous needle aspiration (n=30)	Percutaneous catheter drainage (n=30)
Hemoglobin (g %)	9.3 (6.2-12.5)	9.5 (6.6-12.8)
Total leukocyte count (/L)	13.6 (3.8-22.2)	14.3 (3.3-23.4)
PT/INR	1.9 (1.0-2.5)	1.65 (0.9-2.4)
Bilirubin (mg %)	1.8 (0.6-2.4)	2 (0.6-2.5)
Aspartate aminotransferase (AST)(IU/L)	45 (23-68)	47 (18-72)
Alanine aminotransferase (ALT)(IU/L)	51 (27-74)	47 (22-69)
Serum alkaline phosphatase (IU/L)	188 (72-266)	194.5 (55-260)
Total protein (g %)	5.75	5.5

It was observed that 44 of 60 patients (73%) had leukocytosis. Elevation of serum alkaline phosphatase was also observed in 75% of the patients.

Table-4: Microbiology culture report

Microbiology	Microbiology	number	Percentage
No growth	no growth	12	50
Culture positive	Klebsiella	05	20.8
	E. coli	04	16.6
	Pseudomonas	02	8.3
	S. aureus	01	4.1

Table-5: Abscess Characteristics

Characteristics	PNA	PCD
Site		
Right lobe	24	26
Left lobe	06	04
Size		
Diameter in cm	6.5	7.4
Volume	200	350
Amoebic	36	
Pyogenic	24	

The majority (about 83%) of the abscesses were located in the right lobe of liver and rest in left lobe of liver. Volume of the abscess It was observed that the volume of the abscess cavities was 200 ml in PNA group while 350 ml in PCD group.

Table-6: Interventions and their results

Criteria for response	Percutaneous needle aspiration	Percutaneous catheter drainage	p value
Duration of intravenous antibiotics (days)	12	10	0.062
Clinical relief attained (days)	10.2	8.1	0.043
Time for total or near total resolution of cavity (weeks)	20	16	0.001
Duration of hospital stay (days)	15 (2.0)	12 (2.4)	0.601
Success rate	24/30 (80%)	30/30(100%)	0.005

A total of 60 patients underwent either of the two percutaneous procedures randomly and their response to treatment was recorded and analyzed (Table 5). Percutaneous catheter drainage was successful in all the 30 cases. On the other hand, USG guided percutaneous needle aspiration was successful only in 24 of 30 patients (P=0.005). Out of these 24 patients successfully treated, 6 patients required only one aspiration, 12 required two aspirations, and 6 required three aspirations. The 6 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 200 ml which was significantly less than those failing treatment; the mean volume being 400 ml. The patients in PCD group showed earlier clinical improvement (P=0.043) and decrease in abscess cavity volume (P=0.001) as compared to those who underwent PNA. However, there was no significant difference between the duration of hospital stay or the time required for total or near-total resolution of cavity.

Statistical analysis- After getting the required information, the collected data were coded, tabulated and analyzed. The various statistical techniques i.e. the mean, standard deviation and test of significance (t-test and chi-square-test) were used for drawing valid conclusions. Statistical analysis was done using student t-test. SPSS 13.0 software was used to

calculate p value. P<0.05 was taken as statistically A descriptive analysis was done on all variables to obtain a frequency distribution. The mean + SD and ranges were calculated for quantitative variables. Continuous variables were compared by the Student t test. Proportions were analyzed with the chi-square test.

Discussion

Liver abscesses are still a commonly encountered liver disease leading to significant morbidity and mortality in India. However, in recent years, the line of management had shifted towards a more conservative approach due to advancement in diagnostic modalities, newer broad spectrum antibiotics and use of USG and CT guided interventions, which has been proven by several studies.

Several studies had shown that combination of broad spectrum parenteral antibiotics with image guided percutaneous modality of treatment has excellent results in both amebic and pyogenic liver abscesses but still which is better, percutaneous catheter drainage or percutaneous needle aspiration remains debatable. In previous studies, the preferred and most commonly used method to drain liver abscesses was PCD, but in recent studies, the result of PNA was found to be equally effective, safe and less costly [3-7].

Yu SC, Ho SS et al did a prospective randomized comparison of catheter drainage and needle aspiration for treatment of pyogenic liver abscess. This study aimed to compare the therapeutic effectiveness of continuous catheter drainage versus intermittent needle aspiration in the percutaneous treatment of pyogenic liver abscesses.

The needle aspiration group was associated with a higher treatment success rate, a shorter duration of hospital stay and a lower mortality rate, although this did not reach statistical significance. In conclusion, this study suggests that intermittent needle aspiration is probably as effective as continuous catheter drainage for the treatment of pyogenic liver abscess. Due to the additional advantages of procedure simplicity, patient comfort and reduced price, needle aspiration deserves to be considered as a first-line drainage approach [8].

Rajak and colleagues in 1997 had compared the efficacy of percutaneous needle aspiration and PCD in a randomized study, involving 50 patients with liver abscess and concluded that PCD was more effective than percutaneous needle aspiration limited to two attempts. But Yu and colleagues in their study over 64 patients with pyogenic liver abscess concluded that intermittent needle aspiration was probably as effective as continuous PCD, although further proof with a large-scale study is necessary.

In previous studies, the reason for inferior results of PNA might be due to limitation of only two attempts of needle aspiration. In the present study, three attempts of PNA was tried and third unsuccessful attempt at percutaneous needle aspiration was considered as a failure of treatment [4, 8].

Thomas J et al investigated image-guided percutaneous hepatic abscess drainage .This retrospective study was conducted to determine the incidence of sepsis after percutaneous drainage of a hepatic abscess. After placement of a percutaneous drainage catheter in a hepatic abscess, there is a significant risk (26%) of post procedure sepsis. Although it appears to be a random and unpredictable event in our small series, interventional radiologists and referring physicians should be aware of the risk of sepsis after percutaneous drainage of hepatic abscess [9, 10].

Singh S et al did a prospective randomized comparison of catheter drainage and needle aspiration in treatment of liver abscess. The aim of the study was to evaluate the clinical presentation, and to investigate the effectiveness of continuous catheter drainage in comparison to needle aspiration in the treatment of liver abscesses. The success rate was significantly better in catheter drainage group (P=0.006).

The patients in pigtail catheter drainage group showed earlier clinical improvement (P=0.039) and 50% decrease in abscess cavity volume (P=0.000) as compared to those who underwent percutaneous needle aspiration. They like us also concluded that percutaneous catheter drainage is a better modality as compared to percutaneous needle aspiration especially in larger abscesses which are partially liquefied or with thick pus [11, 12].

In 13 years of experience in percutaneous needle aspiration with USG guidance, Giorgio A, Tarantino L et al did study with purpose to determine the efficacy of percutaneous needle aspiration (PNA) with antibiotic therapy in treatment for pyogenic liver abscess (PLA). They performed three hundred one PNAs were performed (range, 1-4 per patient; mean, 2.2 per patient). A single puncture was sufficient in 57 patients. Cure (normalization of clinical and laboratory parameters and resolution of hepatic lesions) was

achieved in 113 patients (98.3%). They also concluded that USG-guided PNA with antibiotic therapy in treatment for PLA is a valid alternative to prolonged catheter drainage [13, 14].

Chou FF studied single and multiple pyogenic liver abscesses and their clinical course, etiology, and results of treatment. Males were predominantly affected by this disease. Abdominal pain was more frequent with the single abscess than with multiple abscesses, and jaundice was more frequent with multiple abscesses.

The single abscess was usually larger than 5 cm, and the multiple abscesses were usually smaller than 5 cm. The single abscess was always located on the right side (72%) and the multiple abscesses always on the right or both sides. Single abscesses mainly had a cryptogenic origin (58.9%) and multiple abscesses a biliary origin (45.0%) [15].

Wang JH, Liu YC et al studied primary liver abscess due to *Klebsiella pneumoniae* in Taiwan. Pyogenic liver abscess is an uncommon complication of intra-abdominal or biliary tract infection and is usually a polymicrobial infection associated with high mortality and high rates of relapse. They reviewed 182 cases of pyogenic liver abscess during 6 years; 160 of these cases were caused by *K. pneumoniae* alone, and 22 were polymicrobial.

When patients with *K. pneumoniae* liver abscess were compared with those who had polymicrobial liver abscess, the authors found higher incidences of diabetes or glucose intolerance and metastatic infections and lower rates of intra-abdominal abnormalities. Liver abscess caused by *K. pneumoniae* is a new clinical syndrome that has emerged as an important infectious complication in diabetic patients in Taiwan [16].

Seeto RK, Rockey DC et al studied Pyogenic liver abscess with respect to changes in etiology, management, and outcome. Percutaneous drainage combined with intravenous antibiotics was the most common therapeutic modality In this study, percutaneous catheter drainage (PCD) appeared to result in a higher cure rate than percutaneous needle aspiration (PNA) but comparative studies are required to further address and determine their relative efficacies.

Intravenous antibiotics alone are an important option in carefully selected patients. Surgical intervention as a primary mode of therapy has been almost completely replaced by less invasive approaches such as PCD/PNA, but remains an important consideration in patients who fail these therapies [17].

Clinical course, treatment, and multivariate analysis of risk factors for pyogenic liver abscess was also studied by Pérez JA, González JJ et al. Pyogenic liver abscess is a threatening condition. The purpose of this study was to audit the clinical behavior and to analyze the risk factors.

This study concluded that the treatment of pyogenic liver abscesses should be tailored to each patient; however, the majority of them can be successfully treated with antibiotics and percutaneous methods. Those with signs of organ failure or septicemia should preferably be managed in the intensive care unit. In the present study, failure of PNA was more in larger abscesses which is in contrast to some of the earlier reports that show that the initial size of the abscess cavity did not affect the ultimate outcome.

Larger abscesses are more difficult to evacuate completely in one attempt, necessitating subsequent aspirations. Rapid re-accumulation of pus in the abscess is another reason described for failure of needle aspiration [18].

Modern treatment of pyogenic liver abscess was studied by Stain SC, Yellin AE et al. Historically, open surgical drainage has been the treatment of choice for pyogenic liver abscess. The records of 54 patients with pyogenic liver abscess were reviewed to determine whether earlier diagnosis with current imaging tests and definitive treatment with antibiotics, aspiration, or catheter drainage was an effective alternative to open drainage.

The results of this study confirm that pyogenic liver abscess can be successfully treated with broad-spectrum antibiotics and aspiration or percutaneous catheter drainage. Open surgical drainage is reserved for patients in whom treatment fails or who require celiotomy for concurrent disease [19].

Saraswat VA, Agarwal DK et al studied percutaneous catheter drainage of amoebic liver abscess. The indications for the drainage included lack of response to medical therapy; imminent rupture in five cases; ruptured liver abscesses in three; enlarging abscesses after hospitalization in three; persistent symptoms in two and large left lobe abscesses in two. When multiple abscesses and associated subdiaphragmatic collection were present, each was drained separately.

The catheters were removed (mean 7 days, range 3–20 days) when patients became afebrile, catheter drainage was less than 10 ml in 24 h and cavitogram showed a negligible cavity (mean residual volume 5.5 ml, range 3–15 ml). Their experience suggests that catheter drainage of amoebic liver abscesses in selected cases is safe and effective, and results in prompt and early resolution of the abscess cavity with restoration of normal parenchyma [20].

Catheter drainage versus needle aspiration in management of large (> 10 cm diameter) amoebic liver abscesses was studied by Gupta SS et al. PNA was successful in 32 (80%) patients (one aspiration in 4, two in 18 and three in 10 patients), while PCD was successful in 38 (90.5%) patients. Durations to attain clinical relief and parenteral antibiotics required were significantly lesser in the PCD group. Hospital stay, although did not differ significantly, was lesser for PCD group.

The only procedure-related complication due to PCD was rupture of abscess in two cases, leading to sepsis and death of one patient. Complications of PNA included pleural injury in one patient, and haemorrhage leading to subcapsular hematoma in another [21].

Similar study was also done by Bertel CK et al who compared treatment of pyogenic hepatic abscesses by surgical vs percutaneous drainage. This was a retrospective review of 39 patients with pyogenic hepatic abscess treated from 1977 through 1984 included 23 patients who were surgically treated and 16 who underwent percutaneous drainage. It was concluded that percutaneous drainage with computed tomography probably should be the initial drainage procedure in patients with pyogenic hepatic abscesses in whom no concomitant surgical procedure is planned. Regardless of treatment, the morbidity and mortality remain high [22].

Placement of an indwelling drainage catheter perctaneously addresses all 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 the present study and several previous studies.

The only reasons for failure of PCD as reported in some of the earlier series have been either thick pus not amenable to drain percutaneously which can be overcome by placement of a wider bore catheter. No recurrence were documented in any of our cases during the follow up period. However, both treatment modalities resulted in rapid clinical relief with most patients showing improvement of signs and symptoms within the first 5 days of the procedure [20-22].

In recent trends, Van Sonnenberg E et al studied percutaneous drainage of abscesses and fluid collections worked on different techniques, results and applications. A combination of computed tomography, ultrasonography, and fluoroscopy was utilized to guide percutaneous catheter drainage of 58 abscesses and fluid collections in 51 patients. Cavities were evacuated in 53 cases, with surgery avoided in 44 of these. There were two failures and six recurrences.

The mean duration of catheter drainage was seven days. Five complications occurred, including a small bowel fistula and a lacerated mesenteric vessel. Based on this experience, guidelines for drainage are presented, as well as principles for the critical step of access route planning. Double-lumen sump drainage catheters and the irrigation procedure have simplified and improved drainage [23].

In the present study, it was observed that PCD had better results in abscess of size 5 cm or more in longest diameter than percutaneous needle aspiration. Although percutaneous needle aspiration is much simpler, less expensive and less invasive procedure as compared to catheter drainage but needs to be repeated in most of the cases. The success rate of PNA varies in different studies and ranges from 60 to 100 percent and the success of PNA improved with more number of aspirations.

Limitations

1. Small sample size
2. Chances of bias
3. Single center trial

Conclusion

Percutaneous catheter drainage is found to be more effective than percutaneous needle aspiration for large liver abscesses of size 5 cm or more in diameter. The clinical improvement is also faster in PCD group than PNA group of the present study.

What this study adds to existing knowledge?

The results of the present study together with previous findings contribute to answering the dilemma over percutaneous catheter drainage or percutaneous needle aspiration as a first-line management of liver abscess.

Author's contribution

Dr. Atul Kumar: Concept and Data collection
Dr Shivani Sinha: Microbiology and Culture part
Dr. Praveen Singh Baghel: Data Analysis and Discussion

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