EFFICACY OF PERCUTANEOUS CATHETER DRAINAGE IN MANAGEMENT OF LIVER ABSCESES COMPARED WITH NEEDLE ASPIRATION

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ABSTRACT

BACKGROUND

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.

METHODS

This is a prospective randomized comparative study of 30 patients, presented in outpatient and emergency department 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, 50% reduction in abscess cavity size and total/near total resolution of abscess cavity.

RESULTS

The success rate was significantly better in catheter drainage group. The patients in percutaneous catheter drainage group showed earlier clinical improvement and 50% decrease in abscess cavity volume as compared to those who underwent percutaneous needle aspiration.

CONCLUSION

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.

KEYWORDS

Percutaneous Drainage, Needle Aspiration, Liver Abscess.

HOW TO CITE THIS ARTICLE: Hanumanthappa BN, Hebsur NI, Kabadi NY, et al. Efficacy of percutaneous catheter drainage in management of liver abscesses compared with needle aspiration. J. Evolution Med. Dent. Sci. 2016;5(28):1418-1422,

DOI: 10.14260/jemds/2016/334

INTRODUCTION

Liver abscess has been recognized since Hippocrates (Circa 400 B.C.) who speculated that the prognoses of the patients were related to the type of fluid within the abscess cavity.^[1]

The primary mode of treatment of amoebic liver abscess is medical; however, as many as 15% of amoebic abscesses may be refractory to medical therapy.^[2] Also, secondary bacterial infection may complicate 20% of amoebic liver abscesses.^[3]

In such patients and in patients with pyogenic liver abscesses, surgical drainage has been the traditional mode of treatment.^[4] However, operative drainage is associated with significant (10-47%) morbidity and mortality.^[5] In recent years, image-guided percutaneous drainage has been increasingly used to treat liver abscesses with reported success rates ranging from 70-100%.^[6,7,8]

Although, percutaneous placement of an indwelling catheter is the method most widely preferred to drain liver abscesses.^[9] recent studies have claimed needle aspiration to be a simpler, less costly and equally effective mode of treatment.^[10,11]

MATERIALS AND METHODS

Study Design

This was a single-centre prospective randomized comparative study conducted by the Departments of Surgery and Radiology.

A total of 30 patients were included in the study, randomized into two groups; percutaneous needle aspiration (PNA) (n=15) and percutaneous catheter drainage (paediatric ICD tube) (PCD) (n=15). The patients were studied from November 2012 till November 2013. Informed consent was obtained from all participants.

Participants

The patients were selected from those attending the outpatient department and emergency department at the hospital. The age of patients varied from 16 to 58 years with most of the patients falling within the range from 31-40 years. All the patients diagnosed to have liver abscess clinically and radiologically [On ultrasonography (USG) and/or CT scan] were included in the study. Exclusion criteria were: all abscess cavities smaller than 5 cm in their greatest

Financial or Other, Competing Interest: None.

Submission 15-02-2016, Peer Review 14-03-2016,

Acceptance 19-03-2016, Published 05-04-2016.

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DOI: 10.14260/jemds/2016/334

dimension; prior intervention; ruptured liver abscess; uncertain diagnosis; concomitant biliary tract malignancy; and uncorrectable coagulopathy.

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 haemogram; liver function tests; prothrombin time; international normalized ratio; imaging-CXR; abdominal USG with or without CT scan of the abdomen. An informed consent was obtained from the participating patients and all the consenting patients were started on medical treatment.

All the patients empirically received injection Metronidazole 1 g IV every t.i.d., injection Ceftriaxone 1 g IV b.i.d. The empirical treatment was revised based on the culture and sensitivity report. However, patients in whom pus culture was sterile continued on the same treatment. The antibiotics and metronidazole were given for duration of 7-14 days.

Once a participating subject gave valid consent, the pre-determined intervention was carried out as follows: The percutaneous procedures were carried out under local anaesthesia (2% lignocaine) with IV analgesia and sedation if required. The procedures were carried out under continuous real-time USG guidance.

PNA

The patient was subjected to USG of the abdomen and the characteristics of the abscess cavity (ies) were recorded. Local anaesthesia was infiltrated at the proposed puncture site using a 23G needle. Under real-time USG guidance and using 18G BD spinal needle the abscess cavity was entered and pus was aspirated till no more pus could be aspirated further. A sample of pus was sent for Gram stain, culture, sensitivity and wet mount for *Entamoeba histolytica* trophozoites. A dressing was applied at the needle puncture site.

PCD

The PCD was accomplished by placing a No. 12-14 paediatric ICD tube in the abscess cavity under USG guidance. The patient was subjected to USG of the abdomen and the characteristics of the abscess cavity (ies) were recorded. Local anaesthetic was infiltrated in the proposed area of puncture. Using a No. 11 blade a small stab was made on the anesthetized skin. A No. 12-14 paediatric ICD tube with stylet was used for drainage. Under real-time sonographic guidance paediatric ICD tube with stylet was inserted through the skin stab and guided to the center of the abscess cavity. The stylet was taken out and pus was aspirated to reconfirm the position and the aspirated pus was sent to the lab for testing and the tube was fixed to the skin using 1-0 Silk suture. The catheter was attached to a collecting bag via the supplied connector.

Evaluation of the response to intervention

The clinical response (Temperature), tenderness and laboratory parameters [Total leukocyte count (TLC)] 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 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 drainage tube was made when the total drainage from the catheter decreased to less than 10 mL/24 h. The patient was administered oral antibiotics for 7 days at the time of discharge.

Followup

The patients were followed up weekly for a month, monthly for three months and for clinical evaluation and USG assessment of abscess cavity until complete resolution of the abscesses was achieved.

Statistical Analysis

The effectiveness of either treatment was measured in terms of duration of hospital stay; days to achieve clinical improvement; days to achieve 50% reduction in abscess cavity size; and days to achieve total/near total resolution of abscess cavity.

RESULTS

A total of 30 patients randomized into two groups of 15 each were included in the study. The following observations were made.

General Characteristics

The age of the patients varied from 20 years to 60 years with most of the patients falling within the age range from 31-40 years (12 patients). The second most common age group was 41-50 years (10 patients) and the number of patients was less in extremes of age. There were 26 male and 4 female patients with liver abscess involved in the study.

Symptoms and Signs

It was observed that pain in the right upper quadrant of the abdomen and fever was the most common symptom found in all the cases. Nausea and vomiting seen in 60% of patients. Jaundice is seen in 10% of patients and diarrhoea seen in 3.3% of cases. In this study, hepatomegaly was found to be present in 27 of 30 patients (90%), whereas pleural effusion was found in 1 of 30 patients (3.3%).

Symptom	No. of Patients	Percentage (%)
Fever	30	100
Right upper quadrant pain	30	100
Nausea/vomiting	18	60
Jaundice	3	10
Diarrhoea	1	3.3
<i>Symptoms in order of decreasing frequency</i>		

Laboratory Data

It was observed that 24 of 30 patients (80%) had leukocytosis. Altered LFT seen in 3 of 30 cases (10%) and stool for ova and cyst was negative in all cases.

Pus culture: Pus aspirated from all abscesses was sent for culture and sensitivity. Cultures were found to be positive in 9 of 30 (30%) of the cases. The rest were sterile.

Microbiology

Among the pus culture positive cases *Escherichia coli* was isolated most frequently, i.e. 6 of 9 culture positive patients. It was closely followed by *Klebsiella* spp. which was isolated in 2 cases. *Staphylococcus aureus* isolated in 1 patient.

Location of the Abscess

The majority (About 80%) of the abscesses were located in the right lobe of liver, 10% in the left and 10% in both lobes.

Number of Abscess

Three quarters of the cases studied (75% cases) were found to have solitary liver abscess cavity, whereas the rest of the patients had multiple abscesses.

Volume of the Abscess

It was observed that the volume of the abscess cavities was mostly between 150-600 mL.

Volume of Cavity (mL)	Number of Patients
100-150	2
151-200	3
201-250	3
251-300	2
301-350	3
351-400	3
401-450	6
451-500	2
501-550	3
551-600	3

Interventions and their Results

A total of 30 patients underwent either of the two percutaneous procedures randomly and their response to treatment was recorded and analysed. Percutaneous catheter drainage was successful in all the 15 cases. On the other hand, image-guided needle aspiration was successful only in 10 of 15 patients.

Out of these 10 patients successfully treated, 3 patients required only one aspiration, 5 required two aspirations and 2 required three aspirations. The 2 patients who did not show clinical improvement and/or decrease in cavity size despite 3 aspirations were taken as failures.

	PCD	PNA
Clinical Improvement (days)		
1-2	2	1
3-4	7	1
5-6	4	2
7-8	3	6
9-10	0	5
Time for 50% reduction of cavity		
3-4	3	3
5-6	7	3
7-8	3	5
9-10	2	4

Time for total or near total resolution of cavity (weeks)	4-8	4-10
Total drainage time	8-12 days	NA*
Total hospital stay (days)	8-15 days	10-18 days
Complications	nil	nil

*NA -Not applicable

The patients in PCD group showed earlier clinical improvement and 50% decrease in abscess cavity volume 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.

DISCUSSION

Liver abscess is a major tropical disease of the gastrointestinal system.^[12,13] The liver abscess is mainly classified into amoebic and pyogenic. Pyogenic liver abscess which used to be mainly tropical in location is now more common due to increased biliary interventions, stenting, cholecystitis, cholangitis, etc. Liver abscess is 3 to 10 times more common in men.^[14] It can be said that in recent years image-guided percutaneous treatment (Needle aspiration or catheter drainage) has replaced surgical intervention as the primary treatment for liver abscess. 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. The success rate of PNA in the literature varies from 79-100%.^[10,15] In our study, we found that males were predominantly involved. The most frequently affected age group was in the third and fourth decade, which is comparable with other studies.^[15]

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 (100%), right upper quadrant pain and tenderness (100%) and hepatomegaly (90%). These clinical manifestations are similar to those described in previous studies.^[16,17] In our study, 80% of the abscesses were located in the right lobe of liver similar to previous studies.^[18] and 73.3% of our patients had solitary abscesses, similar to a previous report.^[19] We encountered multiple liver abscesses in 26.6% of the patients, similar to the 20-25% incidence of multiple liver abscesses reported by Sharma et al.^[20]

The most frequently isolated bacteria on pus culture was *Escherichia coli*, closely followed by *Klebsiella* species. *Escherichia coli* has been reported to be the organism most frequently grown in western series.^[8,21] However, Asian series have reported *Klebsiella* to be the most frequently isolated bacteria.^[22,23,24] We performed image-guided percutaneous intervention in 30 patients with uncomplicated liver abscess and obtained good results. 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.^[19,25,26-27] any solitary and some carefully selected macroscopic multiple abscesses are amenable to percutaneous abscess drainage. Surgical drainage is usually reserved for patients

who have failed percutaneous drainage, those who require surgery for management of underlying problems and some patients with multiple macroscopic abscesses.^[28]

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.^[15] In our study, we treated 15 patients with PNA along with systemic antibiotics. Of these 15 patients, 10 (66.6%) were successfully treated with 3 requiring only one aspiration, 5 requiring a second aspiration and 2 patients requiring a third aspiration as well; 5 of these 15 patients failed to improve clinically and did not show significant decrease in abscess cavity even after 3 aspirations. Rajak et al.^[29] 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, haematological and radiological improvement was taken as failure of therapy. Of 5 patients who did not respond to PNA, 3 improved on PCD and 2 were lost to followup. But these patients were not included in the PCD group as success. It can be said that in recent years image-guided percutaneous treatment (Needle aspiration or catheter drainage) has replaced surgical intervention as the primary treatment for liver abscess.^[6-9]

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.^[10,11] However, in our study we had a success rate which was significantly lower than with catheter drainage. There are some problems with catheter drainage like nuisance to the patient, pain, cellulites at the insertion site and sometimes catheter dislodgement. The success rate of PNA in the literature varies from 79-100%.^[10,14] The success rate in our study after single aspiration was 30%, after second aspiration 50% and after third aspiration it was 66.6%. 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.

In our study volume of the abscess cavities were between 150 and 600 mL, more were between 401 and 450 mL. Some of the earlier reports shows that the initial size of the abscess cavity did not affect the ultimate outcome.^[11,26] Larger abscesses are more difficult to evacuate completely in one attempt, necessitating subsequent aspirations.^[29] Another important reason for failure of needle aspiration is the inability to completely evacuate the thick viscous pus that may be present in some of the abscesses. Rapid re-accumulation of pus in the abscess is another reason described for failure of needle aspiration.^[14] Placement of an indwelling drainage catheter addresses all three 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.^[10,29,30]

The only reasons for failure of PCD as reported in some of the earlier series.^[30,31] have been either thick pus not amenable to percutaneous drainage (This can be overcome by placement of a wider bore catheter) or premature removal of drainage catheter. No recurrence occurred in any of our

cases during the followup period. However, both treatment modalities resulted in rapid clinical relief with most patients showing resolution of signs and symptoms within the first 3 days of the procedure.

The time required for 50% reduction in the cavity size was significantly less in the PCD compared to PNA group. However, time required for total or near-total resolution of the abscess cavity did not show any significant difference in the two groups. 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 investigators as well.^[9,26]

Complications such as haemorrhage, pleural effusion/empyema, persistent bile drainage, catheter displacement, sepsis, etc. have been reported with both PNA (4% in series of Baek et al.).^[10] and PCD (12% in the series of Lambiasi et al.).^[27] Baek et al. and Giorgio et al. described the much lower incidence of complications with PNA than with PCD as one of the major advantages of needle aspiration over catheter drainage. However, in our study and some recent studies (Rajak et al. 1998.^[29] Yu et al. 2004.^[32] S. Singh et al. 2013.^[15]), both the procedures were found to be safe if performed properly with minimal complications. There was no mortality in either of the study groups.

CONCLUSION

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. Significantly earlier clinical improvement and less time for 50% reduction in abscess cavity in the percutaneous catheter drainage group and the chances of failure of percutaneous needle aspiration increased with the increase in size of abscess cavity to be aspirated.

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