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Percutaneous Catheter Drainage vs Percutaneous Needle Aspiration for Liver Abscesses Which is Better: A Prospective Study

Dr. Abdul Razack. Dr Praveen Kumar K H

Abstract: ***Objective: The purpose of this study was to determine the effectiveness of percutaneous catheter drainage (PCD) and to compare PCD with percutaneous needle aspiration in the management of liver abscess. Subjects and Methods: Sixty patients with pyogenic liver abscess were randomly assigned to two groups in a prospective study. One group was treated with USG guided PCD and the other group with repeated percutaneous needle aspiration. Percutaneous needle aspiration was attempted a maximum of two times. Lack of response to the second aspiration was considered failure of treatment; these patients were treated with PCD but were not included in the PCD group for analysis. Patient demographics, duration of hospitalstay, treatment outcome, and complications were analysed. Results: Percutaneous needle aspiration was successful in 20 (67%) of the 30 patients after one (n = 12), two (n = 7), or three (n = 1) aspirations. PCD was curative in all 30 patients after one (n = 24) or two (n = 6) procedures. All abscesses 50 mm or less in longest diameter were successfully managed, 10 by percutaneous needle aspiration and 12 by PCD. None of patients in the percutaneous needle aspiration group with multiloculated abscesses (n = 5) was successfully treated. Hospital stay did not differ significantly between the groups. There were no complications related to the procedure. Conclusion: PCD is more effective than percutaneous needle aspiration in the management of liver abscess. Percutaneous needle aspiration can be used as a valid alternative for simple abscesses 70 mm in diameter or smaller.***

Keywords: Percutaneous Catheter drainage, Percutaneous needle aspiration, liver abscesses

1. Introduction

Liver abscess, both amoebic and pyogenic continue to be an important cause for morbidity and mortality in tropical countries ([1]).

In India, however, most patients present with large abscess cavities and toxic features needing frequent aspirations of abscess cavities. Prior to the availability of percutaneous drainage, pyogenic liver abscess used to carry a high mortality despite medical treatment and surgical drainage [(2-3)].

Image guided percutaneous drainage has gained increasing acceptance as an integral part of treatment. The combination of systemic antibiotics and percutaneous drainage has become the treatment of choice for the management of pyogenic liver abscess in most centres [(4)].

Surgical intervention is still indicated for inaccessible abscess, multiple lesions that cannot be effectively managed percutaneously and abscess that do not respond to less invasive methods [(4-5)].

Continuous catheter drainage is widely accepted and in combination of antibiotics is considered a safe and effective method of management of liver abscess [(6-7)].

2. Subjects and Methods

Patients

Sixty with pyogenic liver abscess/Amoebic liver abscess who were admitted to our hospital between February 2018 and March 2020 were considered candidates for the study. A patient was enrolled if he or she had symptoms and signs of pyogenic liver abscess i.e. Clinically and the liver abscess was confirmed at sonographic or CT examination. The indications for percutaneous interventions were non-response to medical therapy and imminent rupture of abscess, patients who did not respond to medical therapy included 22 patients who did not show any signs of clinical improvement or those patients who showed clinical signs of deterioration like increase in pain and tenderness and increase in abscess cavity on serial ultrasonography. Patients with imminent rupture of abscess cavity were 28 patients in whom ultrasonography showed a thin rim of <1cm of hepatic parenchyma or no hepatic parenchyma around any part of circumference of abscess. We excluded patients with coexisting malignant disease of biliary origin, which is the leading cause of death from liver abscess, regardless of the type of percutaneous treatment. We also excluded patients who were on anticoagulants, on corticosteroids, immune compromised and patients with ruptured liver abscess. All patients gave written informed consent, and the study was approved by the local ethics committee.

Patients were randomly assigned to undergo either percutaneous catheter drainage (n=30) or percutaneous needle aspiration (n=30) along with appropriate antibiotic therapy. The patient population includes 47 male patients and 13 female patients who were 18-72 years old (mean age of 54 years).

The two groups of patients were similar in all aspects except for the volume of abscess i.e. for those with catheter drainage were 410cc and for aspiration was 210cc.

Amoebic liver abscess was diagnosed in 20 of 60 patients based on positive indirect hemaglutination test (titre≥1:128), pyogenic live abscess were diagnosed in 11 of 60 patients as suggested by the aspirated pus, the specific organisms cultured were staphylococcus aureus in 6 patients and E.coli, klebsiella pneumonia, alpha haemolytic streptococcus, acinetobacter anitratus and enterococcus faecalis in rest one of each patients.

Remaining 29 of 60 patients showed grossly pus on visual inspection on abscess cavity aspirates and showed polymorphonuclear leukocytes on cytological examination with no organisms isolated and findings of both pus culture and amoebic serology negative hence cause of these abscess could not be identified.

At presentation, all patients had been treated with intravenous ceftriaxone, 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. Antibiotics adjustment was done immediately when the sensitivity test was available. Patients with negative culture results were continuously treated with a combination of ceftriaxone and metronidazole. The antibiotic regime was not changed for patients with poor treatment response; follow-up sonography and repeat aspiration or drainage were provided to these patients. Intravenous antibiotic therapy was continued for a minimum of 7 days and until fever had subsided for at least 48 hours. The patients were then put on the appropriate oral antibiotics for a total treatment period of 6 weeks.

3. Methods

Prothrombin time/International normalized ratio was done for all patients before performing the procedure to rule out any bleeding diathesis, 3 patients with deranged PT/INR ratio were treated with inj. Vit K intravenous for 5 days along with appropriate blood products for correction of coagulopathy and normalization of PT/INR ratio. The procedures were performed under local anaesthesia (2% xylocaine).

Needle Aspiration

Evacuation of pus from an abscess was performed with an 18-gauge disposable trocar needle. The needle tip was inserted into the various locules of a multi-loculated abscess for complete pus removal. 3 patients in this group showed multiple abscesses, with 4 patients showed multiloculated abscesses, sonography was performed every 3 days, and the size of the abscess cavity was recorded. If there was no significant reduction in the abscess cavity oncontrol examination or who did not improve clinically and who had persistently elevated leukocytosis, aspiration was repeated. Repeated aspiration was attempted a maximum of twice for each patient not responding; lack of response to a second aspiration attempt was considered failure of treatment.

Percutaneous Catheter Drainage

The drainage technique was a trocar method with an 22-French multiple-side hole pigtailcatheter introduced into the abscess cavity. In patients with multiple abscesses each abscess was drained with a separate catheter, 2 catheters were used in 2 patients. Careful localization of the abscess and proper selection of the entry site were required. The optimal route of access traversed the least possible amount of liver tissue and avoided bowel and pleura. Aspiration was performed with the catheter until no more pus was removed. The catheter then was secured to the skin for continuous external drainage and was left in place. Daily estimate of amount, colour, and consistency were recorded. When patients showed signs of clinical improvement in terms of symptoms and normalization of leucocytosis and when catheter output was<10ml/24hrs for 2 consecutive days, and follow-up sonography showed negligible residual cavity, the catheter was removed. If a residual cavity was present, the catheter was flushed with saline and aspirated until the return was clear or were managed by catheter repositioning and aspiration or by introduction of a new catheter in case of multloculated abscesses. A final sonogram was performed2 weeks later to exclude recurrence.

Follow-Up and Outcome

All patients underwent clinical follow-up and monitoring during daily rounds until they were discharged from the hospital. Criteria for successful treatment were clinical subsidence of infection like improvement symptomatically and normalization of leucocytosis and sonographic evidence of abscess resolution, such as disappearance or marked decrease in the abscess cavity (More than 50% reduction of longest diameter before treatment), and when no evidence of recurrence and relapse were seen on follow up. After discharge from the hospital, patients underwent follow-up evaluations in the outpatient clinic at least once a week for 1 month and once in 2 weeks until6 months from the beginning of the treatment.

4. Results

Between June 2016 – May 2017, 60 patients were assessed for the eligibility criteria for participation in the study, none was lost to follow-up or had their treatment discontinued.

There was no statistically significant difference in patient demographics and underlying comorbidities between the two groups however the most common co existing disease was diabetes which was present in 28.3% of the patients (n=17). The clinical characteristics and laboratory results of 60 patients at inclusion were studied (table 1). There were no statistically significant differences between the 2 groups identified. Frank pus was yielded from abscesses in all 60 patients.

Before admission patients had symptoms for a mean of 5.9$\pm$2.9 days (range 2-14 days). Percutaneous needle aspiration was successful in 67% of patients (n=20 of 30), 12 patients (40%) responded to single aspiration and rest of the 8 patients needed 2nd aspiration 3-7 days after the 1st aspiration due to persistent symptoms of fever, pain and leucocytosis and reaccumulation of pus in abscess cavity on follow up ultrasonography, only 8 of 10 patients responded to reaspiration.33% of patients (n=10) treatment by percutaneous needle aspiration was considered unsuccessful as they failed to improve clinically or radiologically after 2nd aspiration, in 2 patients needle aspiration failed to evacuate the cavity due to thick viscid pus, rapid reaccumulation of pus in abscess cavity was seen in 8 patients of 10 within 3-7 days after 2nd aspiration.

However subsequently all the 10 patients with failed aspiration were treated successfully with percutaneous catheter drainage and were not included in percutaneous catheter drainage group.

It was noted that the average volume of pus in failed percutaneous needle aspiration intervention group of 10 patients was higher than 450cc than those patients who were treated successfully with one or two aspirations i.e. 15 patients average volume of pus was 180cc with p value <0.05.

Catheter drainage was successful in 100% of patients (n=30). The average total duration of catheter drainage varied from 3 – 15 days (mean of 7 days). In 4 patients with multiloculated abscess cavity on ultrasonography, catheter drainage was performed twice because drainage was inadequate in 1st attempt. On final control examination, 6 months after the beginning of treatment abscess cavity were absent in all successfully treated patients. Neither group of patients had any procedure related complications such as bleeding of any degree or septicaemia.

Table 1: Characteristics of patients with Pyogenic Liver Abscess

Characteristics	PCD (n=30)	PNA (n=30)	'P' Value
1.Age (y)a	56.3±5.4	53.1±3.4	0.63
2.Sex			
Male	23	24	1
Female	7	6	
3.No. of patients with Temp >37.5 ° Celsius	24 (80)	21 (70)	0.55
4.No. of patients with Right Upper Quadrant Tenderness	16 (53)	15 (50)	0.8
5.WBC count ($\times 10^9$/L)a	12.8±2.6	12.0±3	0.53
6.Neutrophile count ($\times 10^9$/L)a	10±2.6	9.5±2.6	0.55
7.C- Reactive Protein a	49.3±49.4	73.3±72.4	0.14
8.Total Bilirubina	27.2±19.8	34.5±60.8	0.53
9.Alkaline Phosphatasea	136.5±60.0	160±90.2	0.21
10.Prothrombin Time (Sec)a	15.0±3.0	15.0±3.5	0.81
11.Alanine Aminotransferase (U/L)a	75.2±45.9	56.5±30.7	0.11
12.Aspartate Aminotransferase (U/L)a	40.0±21.6	35.4±17.0	0.47
13.Hemoglobin (gm/L)	10.5±2.0	10.4±2.2	0.59

Table 2: Characteristics of Liver Abscess managed with Percutaneous Catheter Drainage and Needle Aspiration

Characteristic	PCD (n=30)	PNA (n=30)	P Value
1.Diameter of Abscess (mm) Mean±SD Range	70.5±45.2 30.0-180	65-9±39.3 31.0-90	0.99
2.Volume of Pus drained in 1st treatment (ml) Mean±SD Range	150.9±120.9 15.0-500	110±80.4 15-220	0.70
3.Site of Abscess Right lobe Left lobe Both lobes	 16 13 1	 17 11 2	0.77
4.No. of Abscess Single Multiple Multiloculated	 28 2 6	 28 3 4	Not Significant
5.Causes of Abscess Biliary disease Portal disease Cryptogenic fever	 15 9 6	 14 8 8	0.83

Table 3: Clinical outcomes among patients with Liver Abscesses treated with PCD and Needle Aspiration

Result	PCD (n=30)	PNA (n=30)	'P' Value
1.No. of patients with successful treatment Total 1st procedure 2nd procedure	 30 (100) 28 (80) 6 (20)	 20 (67) 12 (40) 8 (27)	 <0.001
2.Rate of success of treatment of patients with abscesses ≤50 mm in longest diameter	12/12	10/10	1.0
3. No. of patients with disappearance of abscesses at the end of treatment	16/30 (53)	9/20 (45)	0.77
4. No. of patients with ≥50% decrease in abscess at the end of treatment	14/30 (47)	11/20 (55)	0.77
5. Total hospital stay (days) Median	7.5	9.0	0.98a

Mann Whitney U test; Z=0.02; P=0.98

5. Discussion

In recent years image guided percutaneous treatment (needle or catheter drainage) has replaced surgical intervention as the primary treatment of liver abscess [9] [10-11]. The main advantage of needle aspiration over catheter drainage includes: less invasiveness and less expensive, it also avoids problems related to follow-up catheter care requiring less medical and nursing care and multiple cavities can be aspirated in the same session [12-13].

However in our study, needle aspiration, if limited to 2 attempts has a significantly lower success rate than catheter drainage (67% vs 100%) Rajak and colleagues compared percutaneous needle aspiration and percutaneous catheter drainage in a randomized study involving 50 patients with liver abscess; they concluded that percutaneous catheter drainage was more effective than percutaneous needle aspiration was a failure of treatment hence similar to our study.

In our study the success rate after 1 aspiration was only 40%, it increased to 67% after 2 aspirations, a higher success rate would likely have been achieved if multiple repeated aspirations were attempted, however subjecting the patients to multiple needle aspirations over a short period is traumatic and unpleasant experience and even multiple attempts do not guarantee a 100% cure rates [12-14].For the above stated reasons we preferred to subject the patients to percutaneous catheter drainage after failure by 2nd attempt.

Yu and colleagues [16] performed a randomized trial involving 64 patients with pyogenic liver abscess; percutaneous needle aspiration was repeated if there was either lack of clinical improvement or lack of reduction in size of abscess cavity. Yu and colleagues concluded that percutaneous needle aspiration was probably as effective as percutaneous catheter drainage. They recommended percutaneous needle aspiration as a first line approach because of procedure simplicity, comfort and economic and suggested a multi-centre study to provide a definitive answer.

But in our study we considered a 2nd unsuccessful attempt at percutaneous needle aspiration failure of treatment, our study confirmed that repeated percutaneous aspiration and percutaneous catheter drainage are equally efficient for abscesses 50 mm or less in longest diameter, percutaneous needle aspiration of all multi loculated abscesses failed and percutaneous catheter drainage was necessary.

The average hospital stay was 7 days in our study as there were no predisposing conditions such as diverticulitis, gallstones or gall bladder carcinoma were diagnosed in study participants. Complications have been reported with both catheter drainage (12% in Lambiase et al [15] series and needle aspiration (4% in series of Baek et al [12])but in our study no complications were reported.

Staph aureus was the most commonly isolated organism in our study. However one limitation which was faced in our study was that the patients formed a heterogeneous group of both amoebic and pyogenic causes existing in both groups and many abscesses were of indeterminate cause (n=14), probably because as our institution is a referral hospital of the state many patients were treated in the peripheries with antibiotics and antiprotozoal drugs before referring to us hence accounting for the negative pus culture and for abscess of indeterminate cause in our study.

In our conclusion both percutaneous catheter drainage and needle aspiration are safe methods for non-surgical management of liver abscesses we found catheter drainage to be more superior or effective than needle aspiration, which if limited to 2 attempts, it is associated with high failure rates, especially in large abscesses and in abscesses with thick pus. Intermittent percutaneous needle aspiration is a valid alternative for abscesses 70 mm or less and is associated with more successes rates. Percutaneous catheter drainage is more effective in multi loculated abscesses.

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