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Percutaneous Drainage of Pyogenic Liver Abscess: A Case Series

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ABSTRACT
Liver abscess is a serious life threatening condition if left untreated. The objective of the present study was to evaluate the clinical presentation, associated risk factors and efficacy of catheter drainage as a mode of treatment in pyogenic liver abscess. This study was conducted prospectively in the Department of Surgery, Assam Medical College and Hospital, Dibrugarh for a period of 1(one) year from June 2017 to May 2018. A total of 36 patients were included in the study excluding paediatric patients below 12 years of age. All patients were diagnosed on the basis of clinico-radiological findings and subjected to percutaneous catheter drainage and their outcome were studied. Male preponderance was noticed with a M:F ratio of 5:4. The most common predisposing factor was hepatobiliary diseases and E-coli, the most common etiological agent. Percutaneous catheter drainage was found to be an effective method of treatment with a 100% success rate. Percutaneous catheter drainage under USG guidance with antibiotic coverage is an excellent, reliable, safe and effective mode of treatment for the pyogenic liver abscess.

INTRODUCTION

Liver abscess is potentially a life-threatening condition resulting from the invasion and multiplication of microorganisms either directly from bloodstream or hepatobiliary infection. Cryptogenic hepatic abscess is a relatively uncommon lesion with a high mortality rate because of delayed detection and treatment[1]. The classical presentation of fever, right upper quadrant pain, and tender hepatomegaly is unusual[2]. The frequency of any particular symptom varies widely among reports. Kupffer cells act as a filter for the clearance of microorganisms in the liver. These organisms reach the liver through the bloodstream, biliary tree, or direct extension. Abscess occur when normal hepatic clearance mechanisms fail or the system is overwhelmed. Parenchymal necrosis and hematoma secondary to trauma, obstructive biliary processes, ischemia and malignancy also promote invasion of microorganisms. In order to appropriately treat the abscess, source control is required. Six distinct categories have been identified as potential sources.

bile ducts, causing ascending cholangitis portal vein, causing pylephlebitis from appendicitis or diverticulitis direct extension from a contiguous disease trauma due to blunt or penetrating injuries hepatic artery due to septicemia cryptogenic[3,4].

Pyogenic liver abscess affected 5-13 patients per 100, 000 admissions before 1970 and accounts for approximately 15 cases per 100, 000 admissions today. Diagnostic confirmation of a pyogenic liver abscess involves aspiration of the abscess itself and obtaining blood cultures that are positive. Abscess cultures are positive for growth in the majority (80-97%), whereas blood cultures are positive in only 50-60% of cases2,5 Escherichia coli, Klebsiella species, enterococci and Pseudomonas species are the most common aerobic organisms cultured in recent series, whereas Bacteroides species, anaerobic streptococci and Fusobacterium species are the most common anaerobes[6].

Most of the patients have fever (92%) and 50% have abdominal pain, but only half have pain in the right upper quadrant. Diarrhea occurs in less than 10% of patients. The liver may be tender (65%) and enlarged (48%) and the patient may appear jaundiced (54%). Other complaints include malaise, anorexia and nausea. If the diaphragm is involved, pleuritic chest pain, cough, or dyspnea may occur. If the abscess ruptures, peritonitis and sepsis may be the presenting features.

USG abdomen is quite helpful in differentiating pyemic from amoebic liver abscess. USG Findings of amoebic liver abscess have irregular outline and have peripheral halo surrounding an echogenic content, whereas pyogenic hepatic abscess have smooth outline and are usually multiple in number.

Management of pyogenic liver abscess was exclusively surgical in the past. Modern treatment has shifted towards IV broad-spectrum antibiotics and image guided percutaneous needle aspiration or percutaneous catheter drainage. Surgical intervention is still indicated for inaccessible abscesses, multiple lesions that cannot be effectively managed percutaneously and abscesses that do not respond to less invasive methods.

MATERIALS AND METHODS

This prospective study was conducted in the Department of Surgery, Assam Medical College and Hospital, Dibrugarh for period of 1 year from June 2017 to May 2018. All the patients above 12 years of age who were diagnosed with sign and symptoms of pyogenic liver abscess with radiological confirmation were included in the study. All confirmed cases were treated with percutaneous drainage under USG guidance with proper antibiotics prophylaxis. In all the cases, routine and special consent for percutaneous catheter drainage of the abscess were taken. Shaving and antiseptic dressing of the abdomen was done with savlon, spirit and povidone iodine solution prior to the intervention.

Catheter drainage was performed using Seldinger technique. The abscess was localized by USG and a safe drainage route planned to avoid injury to the bowels. Under all antiseptic precautions, the site was marked and infiltrated with 2% lignocaine. A 4 mm stab incision was made through which an 18 G guide wire introducer and Vygon needle (Vygon company) was passed under sonographic guidance till it reaches the center of the cavity. A AUS (Amplatz Ultra-Stiff, Cook Company) guide wire (80cm) was then introduced through the needle and positioned inside the cavity, following which the needle was removed keeping the guide wire in situ. Coons dilators (Cook Company) of sizes 10F, 12F 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 (Devon Company) of size smaller than the last dilator, i.e. 10F and 12F was passed over the wire and positioned in the center of the abscess cavity under sonographic guidance. The guide wire was then withdrawn and the pigtail catheter was connected to a Uro bag and fixed to the skin. Sterile dressing was applied and pus sample sent for culture and sensitivity. Later on specific Antibiotics were administered to the patient as per the culture and sensitivity reports of the pus.

Patients were regularly monitored with alternate day USG to check for cavity size and any complication

regarding catheter misplacement, hematoma formation, rupture of abscess, residual volume etc. The daily output was monitored and the catheter was flushed daily with 10 ml of normal saline to prevent its blockage with debris. The pigtail catheter was removed when drainage become serous and minimal (<10 ml in 24 hrs) or if USG was suggestive of reduced size / collapsed cavity without any residual pus.

Statistical analysis of collected data was done on Microsoft Excell Spreadsheet 2007.

RESULTS AND DISCUSSIONS

In this study the patients comprised of ages from 20-79 years and most of the patients with PLA were in the range of 40-49 years, followed by 20-29 and 30-39 years(equal in later groups). For study purpose, the study groups were divided into 8 groups each having range of 10 years i.e.

<20, 20-29, 30-39, 40-49, 50-59, 60-69, 70-79 and >80 years. Oldest patient was of 79 years and youngest one aged 19 years. Other hand, the incidence of Pyogenic liver abscess was found to be more common in males (52.77%) as compared to females (42.77%).

Associated Conditions and Predisposing Factors: In this study, the most common association was found to be hepatobiliary disease @ 61.11% (n=22) patients followed by diabetic patients 19.44% (n=7) and in 19.44% (n=7) patients no specific etiology was detected i.e. cryptogenic origin. Alcohol was an assosciated contributory factor with other diseases and maximum association was noticed in hepatobiliary disease i.e. 8 patients out of 22 hepatobiliary disease. Out of 7 diabetic patients 1 had alcohol intake history whereas in cryptogenic patients alcohol intake history was positive in 3 patients.

Clinical Presentation: The right hypochondrial pain and tenderness were the most common presenting features @ (n=35) 97.22%, followed by fever as the main presenting feature @ (n=83.33% of the patients. Jaundice was present in (n=8)22.22% of the patients

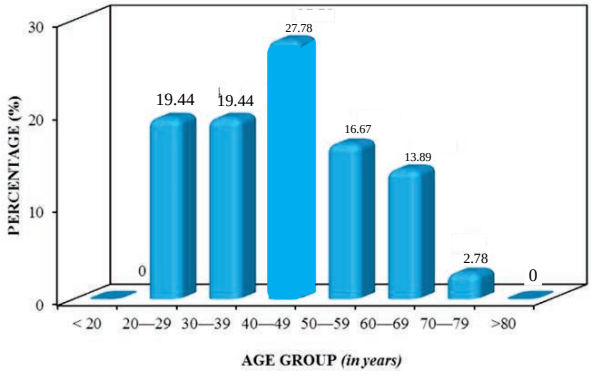

Fig. 1: AGE wise distribution

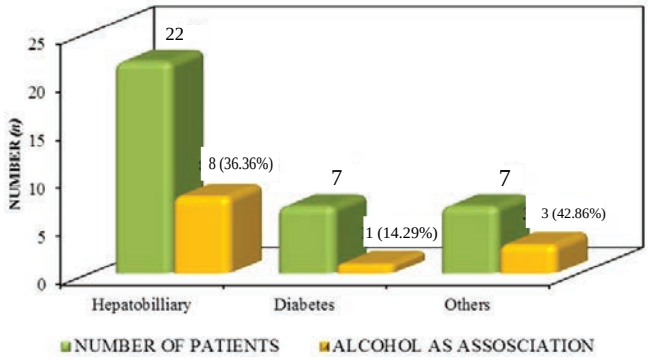

Fig. 2: Associated conditions and predisposing factors

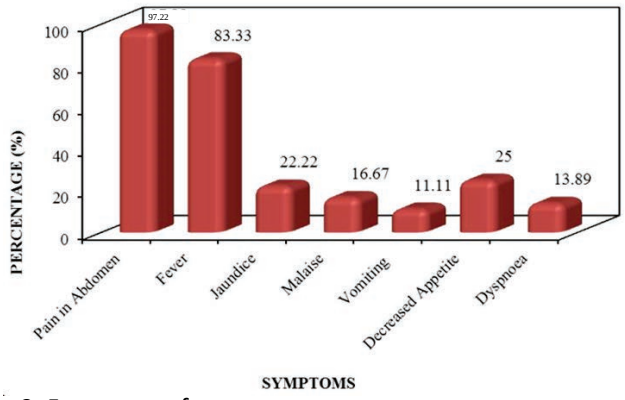

Fig. 3: Frequency of symptom

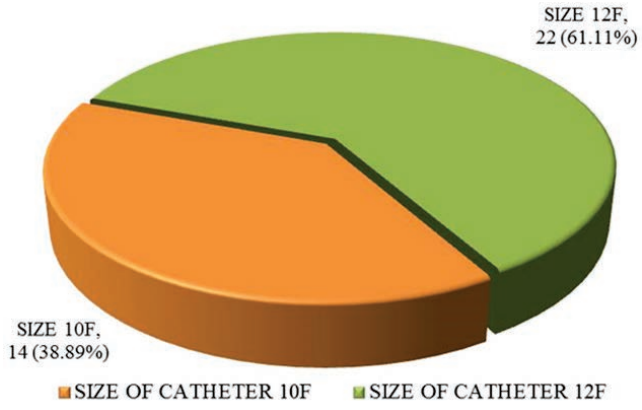

Fig. 4: Sizes of catheter

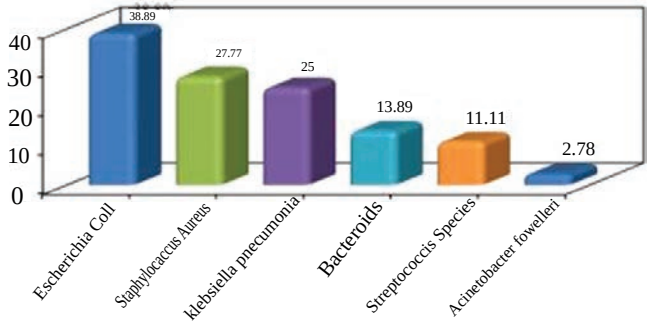

Fig. 5: Causative organism

Table 1: Cavity size before catheter drainage

Average cavity size before catheter drainage (in cc)	72 hours	7th day	14th day
415	230	85	10

Table 2: Cavity size (Ml) on USG

Case No	Cavity size (Ml) on USG	
	Before Cathotor Drainage	After Cathotor Drainage
1	410	16
2	460	18
3	450	14
4	410	13
5	410	13
6	420	13
7	400	14
8	400	15
9	450	12
10	380	20
11	440	15
12	430	15
13	420	5
14	380	7
15	430	18
16	400	15
17	420	12
18	430	12
19	450	16
20	390	16
21	420	14
22	420	14
23	400	13
24	380	14
25	410	16
26	380	2
27	420	20
28	380	17
29	420	20
30	440	19
31	390	10
32	410	10
33	400	17
34	440	11
35	470	14
36	390	11
Mean±SD	415.28±24.32	13.92±3.92
Range	380-470	2-20
Medim	415	14

Table 3: Culture

Number of patients	Percentage (%)	
Sterile	10	27.77
Mono- Microbial	10	27.77
Poly-Microbial	16	44.44

Table 4: Complications

Complications	Number of patients	Percentage (%)
Pain in Shoulder	9	25.00
Rupture of Abscess	0	0.00
Liver Hematoma	1	2.78
Guide wire Penetration of Liver	0	0.00
Catheter Blockage	2	5.56
Catheter Displacement	0	0.00

Table 5: Comparative Study on age group

Study	Year	AGE group (in years)
Haresh B. Italiya	2015	30-50
Sathish Christopher	2016	30-60
Present Study	2017–18	40-50

Table 6: Comparative Study on sex ratio

Study	Year	SEX Ratio
(Male : Female)		
Branum *et al.*	2000	1.08:1
Haneghan *et al.*	2011	1.14:1
Sayeed Majid Malik *et al.*	2015	13.5: 1
Present Study	2017-18	1.12:1

Table 7: Comparative Study on range of catheter

Study	year	range of catheter drainage(in days)	average of catheter draianage (in days)
Rajak *et al.*	1998	3-15	7
Malik sm *et al.*	2015	7-26	7.2
Present study	2017-18	7-22	10

which was assosciated with choledocholithiasis. Other symptoms were malaise (n=6)16.67%, vomiting (n=4) 11.11%, decreased appetite (n=9)25% and dyspnoea (n=5)13.89%. One patient presented with hemoptysis, subdiaphragmatic abscess(430ml) and pleural effusion. Fig 4 shows various symptoms present in the present study.

Treatment Modality: In the current study series, all 36 patient were treated with the pig tail catheter drainage under USG guidance and under local anesthesia. In four (4) patients the prothrombin time was raised which was corrected prior to the procedure by administration of Injection vitamin K and fresh frozen plasma transfusion. The average hospital stay of the patients treated with percutaneous catheter drainage was in the range of 7-22 days (average 10.02 days). Catheter sizes were selected on the basis of viscosity of pus, 10F catheter was used in 14 patients and 12F catheter was used in 22 patients for the drainage of pus from the abscess cavities. Drainage were monitored through regular USG initially every alternate day to check the residual size of abscess cavity and position of the catheter inside the cavity. Patients were discharged after removal of catheter and put on oral antibiotics as per culture reports for a total period of two weeks.

Abscess Cavity Size Before and After Drainage: In our study, the average size of cavity(capacity) before catheter drainage was found to be 415.28±24.32 ml. Catheter was removed after regular monitoring of the patient clinically and USG follow up when size of cavity was below 20 ml or when there was serous discharge from the catheter or when the flow rate of pus was <10cc per day. We found that the average size of the cavity after catheter drainage was 13.92±3.92 ml at the time of catheter removal. The largest abscess cavity was of the size of 470 cc and the smallest cavity size was 380cc at the time of presentation. In 29 patients, there was single abscess cavity and in 7 patients there were multiple abscess cavities which were communicating in nature. Hence single catheter served the purpose of abscess drainage in all the cases.

Causative Organisms: After placement of the catheter in the abscess cavity, the pus sample was sent for culture and sensitivity test. Culture was found to be sterile in 30.55% of the cases, whereas positive culture

reports were observed in 69.44% of the cases. In culture positive patients, most common organsism found was E.Coli in 38.89%, S.aureus in 27.77% followed by K.Pneumoniae in 25% of the cases. Bacteroids were found in 13.89% of the cases and streptococci was found to be causative organism in 11.11% of the cases. We observed that Klebsiella species was more common in diabetic patients. In one case, Acinetobacter fowelleri was found to be the causative agent.

In our study, majority of patients culture showed polymicrobial growth as showen below.

Complain and Complications after Catheter Drainage: All patients were closely monitored in ward and depending on the questionare plus observations, we found that pain was the most common complain @ 9 patients in the study series. Complications after catheter drainage were liver hematoma in 1 patient, which was managed conservatively and catheter blockade in two (2) patients which were managed effectively by irrigation of the catheters with normal saline solution.

Age Distribution: In this study most of the patients with PLA were in the range of 30-49 years. Only one patient was found above 70 years of age. This study is comparable with the study conducted by Dr. S K Sharmila *et al.,* where they found the peak incidence in the age range of 44-63 years[7]. Haresh B. Italiya *et al.,* in 2015 found the peak incidence of PLA in age group 30-50 years in their study[8]. Sathish Christopher et al., in 2016 found that the peak age group in patients of PLA was 30-60 years with maximum patients being in age group of 40-50 years[9].

Sex Distribution: Different authors have found variable results with regards to sex ratio but incidence is always more common in males. In our study too, the pyogenic liver abscess was found to be more common in males (52.78%) as compared to females (47.22%) with M:F ratio of 1.12:1.

Associated Conditions and Predisposing Factors: Historically, liver abscess develops in young, otherwise healthy patients with an intro-abdominal infection[11]. Different authors have found variability among the associated and predisposing factors of the pyogenic liver abscess. In our study we found more alcohol intake history in hepatobiliary patients as a causative factor of PLA. In our present study of 36 patients, the most common cause was hepatobiliary disease found in 61.11% (n=22) patients, followed by diabetic patients 19.44% (n=7) and in 19.44% (n=7) patients no etiology was confirmed i.e. Cryptogenic in origin. Alcohol was an associated contributory factor with other diseases and was found to be maximally associated with hepatobiliary disease i.e. in 8 patients out of 22. Out of 7 diabetic patients 1 was having alcohol intake history whereas in cryptogenic patients alcohol intake history was positive in 3 patients.

Rahimian *et al.,* 2004 in their study on PLA found that the most common underlying or concomitant conditions were biliary disease in 43% (n=34), hypertension in 17.7% (n=14), intra-abdominal infection in 17.7% (n=14) and diabetes in 15.2% (n=12) patients. Other underlying diseases included malignancy (12.7%), cardiovascular disease (12.7%), alcohol abuse (2.5%) and cirrhosis, diverticulitis and inflammatory disease (1.3% each)[10].

Dhaval *et al.,* 2012 in their study quoted that about 56% of the total abscesses were cryptogenic in origin, while 15.5%, 15% and 13.5% were of biliary, portal, and hematogenous in origin respectively. Khan et al., 2018 in their study on liver abscess found that the most common comorbidity (22.66%) is gall bladder/common bide duct calculi (in aspiration group 26.66% and catheter group 20%)[12].

Therefore it can be concluded that hepatobiliary cause is the main predisposing factor for pyogenic liver abscess and our study strongly supports this view.

Frequency of Symptoms: Different authors have found variable presentation of symptoms in their studies.

Srivastava *et al.,* in 1990 found the presentation of pyogenic liver abscess in the following sequence: fever in 90%, anorexia 72%, abdominal pain in 55%, rigors in 53%, RUQ pain in 49%, nausea/vomiting in 47%, weight loss in 47% malaise in 45% hepatomegaly in 38% chest signs in 32 % and jaundice in 21% of the patients.

Rahimian *et al.,* in 2004 observed fever in 89.6%, RUQ pain in 72.2%, chills in 69%, nausea and vomiting in 43.2% and 32.3% respectively. They found jaundice in 21.4%, headache in 17.5%, myalgia in 11.9% and diarrhoea in 10.7% of the patients[10].

Dhaval *et al.,* in 2012 found that Majority of patients 390 (97%) presented with upper abdominal pain in their study. High-grade fever was noted in 296 (74%) patients, vomiting and nausea in 200 (50%) patients, while loss of appetite in 198 (49.5%) patients. On examination, right hypochondrial tenderness was the predominant sign (95%) followed by localized guarding (47%), whereas 26% patients were presented with hepatomegaly. About 4.5% patients presented with signs of toxaemia[11].

Malik SM *et al.,* 2015 found pain in the hypochondrium in 90.47%, fever in 74.60%, weight loss in 66.66%, anorexia in 42.85%, diarrhoea in 28.75% and cough as

presenting feature in 26.98% of the patients[13].

In our study, right hypochondrial pain was the most common presenting feature, found in (n=35) 97.22% of the patients followed by fever in (n=30) 83.33% patients. Jaundice was one of the associated feature in (n=8) 22.22% of the patients resulting from choledocholithiasis (Obstructive jaundice). Other symptoms of infectious etiology like malaise (n 1.6) 16.67%, vomiting (n=4)11.11%, decreased appetite(n = 9)25% and dyspnoea were present in (n=5) 13.89% of the patients.

Since our present series had small sample size, the variability of symptoms were less. However, our study match with other studies in most of the symptoms and differ in few.

Treatment Modality: In our study, all 36 patients were treated with pig tail catheter drainage under USG guidance and under local anesthesia after checking the coagulation profile of the patients. Four (4) patients in whom prothrombin time was raised were corrected prior to the procedure by administration of Injection vitamin K and fresh frozen plasma transfusion. Size of catheter were selected on the basis of viscosity of pus, 10F catheter was used in 14 patients and 12F catheter was used in 22 patients. In our study the hospital stay of the patients were in the range of 7-22 days average being 10 days, which match with other studies done on PLA with percutaneous catheter drainage as the treatment modality.

Rajak *et al.,* 1998 Catheter drainage was successful in all 25 patients (100%). In their series, 24 out of 25 patients required catheter drainage time ranging from 3-15 days (average 7 days). The duration was prolonged (35 days) in only one patient., where a cavitogram revealed communication with the biliary system. This patient and three more patients were discharged with catheters in situ when they became clinically stable but had persistent drainage from the catheter., the patients attended the outpatient department on alternate days until catheter removal[14].

Abusedera MA *et al.,* 2015 found that the total duration of catheter drainage for each patient in the drainage group ranged from 7-33 days with a mean of 8.3±6.4 days[15].

Malik SM *et al.*, 2015 he found that the average period of continuous catheter drainage was around 7.2 days (7-26 days). Average duration of hospital stay is 2.45 days (2-21 days). They observed prolonged hospital stay in patients who had large abscess (1200-1500ml), that took long time to drain. The patient had symptomatic recovery from fever, pain and intercostal tenderness etc. in 48-72 hours[13].

Causative Organisms: In the present study, pus culture was found to be sterile in 30.55% of the cases, and positive culture reports in 69.45% of the cases. Out of the positive culture, most common organsism was E.Coli in 38.89%. S.Aureus was detected in 27.77% followed by K.Pneumoniae in 25% of the cases. Bacteroids were found in 13.89% of the cases, and streptococci was found to be causative organism in 11.11% of the cases. Klebsiella species was found to be more common in diabetic patients. In one case we also found Acinetobacter fowelleri as the causative agent. Our findings were at par with other studies where other authors also observed Escherchia coli and Klebsiella species as the most common microbiological agents responsible for the pyogenic liver abscess.

Srivastava *et al.*, in 1990 found that the most common organisms, expressed as a percentage of patients were E. Coli (38%), Klebsiella (30%), B. Fragilis (28%), Streptococci (22%), Proteus (14%), Pseudomonas (14%), Bacteroids (13%) and Microaerophillic streptococci(13%) in of the cultures[16].

Alom Siddhique *et al.* observed that in PLA cultures, the isolated bacteria were E.coli 50%, proteus 25% and pseudomonas 17%. Other organisms were Staphylococcus (9%), Bacteroides (9%) and Citrobacter (5%)[17].

Dhaval *et al.,* 2012 found that only 44 reports came with positive microbial reports out of 264 cases. Here, 45% cases were positive for Klebseilla and 32% shown Escherichia coli[16].

Culture Types: In our study we observed 27.77% sterile samples, 27.77% mono-microbial cultures and 44.44% poly-microbial cultures. Different authors recorded similar bacteriological findings as shown below:

Rahimian *et al.,* 2004 found that Fifty-four patients had >1 organism recovered from the abscess. Eighteen (33.3%) of the infections were polymicrobial., Six (6) of these included anaerobes. In 2 cases, anerobes were the only bacterial isolate[10].

Peris *et al.,* 2017 in their study on PLA came to know that the main microbiological diagnostic procedures were cultures of PLA tissue samples and blood cultures, which were both performed in 42.9% of the cases, followed by blood culture alone. Cultures were positive in 67.7% of the PLA tissue samples and 33.9% of the blood cultures. The main microorganism isolated as the cause of the PLA was E. coli (16.3%), followed by Streptococcus anginosus group (13.3%). E. coli was significantly more frequent in the older group (OR 6.0; 95% CI 1.3, 28.4). Four gram-negative bacteria were identified as producers of beta-lactamases (two E. coli and two K. pneumonia): two in the older group (3.4%) and two in the younger group (5.0%)[18].

Cristina Serraino, MD, in 2018 observed blood or pus-culture study in 99 cases of which only 53 cases (53.5%) came with positive microbial reports. Culture from aspirate of liver abscess was positive in 25 of 62 patients who underwent percutaneous aspiration of liver abscess (positive rate, 40.3%). The most common organism identified was E coli (26.5%), followed by Streptococcus species(13.2%) and anaerobics (13.2%). Other organisms were Enterococcus species(11.3%) and Staphylococcus (7.5%)[19].

Acute Complications after Catheter Drainage: Different studies found different complications associated with the percutaneous catheter drainage. Most of the complications associated with the percutaneous drainage were minor and they resolve of their own. In our study, the main complications encountered were liver hematoma in 1 patient, which was diagnosed USG and treated conservatively and catheter blockade in two (2) patients where blocks were dislod through irrigation of the catheter with normal saline solution. No major complications were encountered in our study.

Sumit kapadia *et al.*, 2004, in their study get to know that Percutaneous catheter drainage is a safe procedure with very few reported complications which includes hemorrhage, perforation of hollow viscera, peritoneal spillage, catheter displacement or blockage and septicemia[20].

Haresh B. Italiya, 2015 quoted that one of the major problem is prolonged duration of the catheter. This led to some authors considering this procedure as slow. Percutaneous catheter drainage is a safe procedure with very few reported complications[8]. Complications of PLA include haemorrhage, perforation of hollow viscera, peritoneal spillage, catheter displacement or blockage and septicemia[23]. But recent studies show very low complication rates. Our study did not have any major complication although the incidence of minor complications was 40% (10 patients)[8].

Malik *et al.,* 2015 in there study found that common problems encountered were local pain or discomfort due to catheter, peri-tubal leak in few cases and local wound infection[13].

Since our present study was limited by time period and number, more study need to be done involving large sample size and longer duration of study to arrive at a definitive conclusion.

Hospital Staty: In our study of 36 patients of pyogenic liver abscess, the average hospital stay was 10.02±3.58 days. In comparison to other studies, our duration of hospital stay were quite low. Different authors found different range of hospital stay in their studies.

Simon C.H. Yu *et al.,* 2004 found that the total duration of catheter insertion for each patient in the catheter drainage group ranged from 4-52 days, with a median of 13 days and an average of 16.9±11.3 days[21].

Gupta Uma Shankar *et al.,* 2015 in their study found that average hospital stay in percutaneous drainage group was 17.3±5.3 days[22].

Cristina Serraino, MDa, 2018 found the mean hospital stay was 24 days (SD:±12.8) in their study on pyogenic liver abscess[19].

CONCLUSIONS

The following conclusions were drawn from this study: Pyogenic liver abscess is more common in the right lobe of liver with male preponderance. Usual presentation is fever with right hypochondrial pain, nausea, vomiting and jaundice. Majority of patients are found in 4th decade of life. Associated hepatobiliary disease and diabetes are common predisposing factors. The most common causative organisms are gram negative in nature. Percutaneous catheter drainage under USG guidance and antibiotics cover is an excellent, safe and effective treatment modality for the pyogenic liver abscess.

Ethical Approval: The study was approved by the Institutional Ethics Committed

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