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Bile Leak After Pigtail Catheter Drainage Of Liver Abscess: Incidence And Clinical Impact.

Dr. Brijesh Shiroya[1], Dr.Pramod Yadav[1], Dr.Ankit Garg[2], Dr.Ratna Chopra[2],
(Department Of Surgery, Hindu Rao Hospital, New Delhi, India)
(Department Of Surgery, Hindu Rao Hospital, New Delhi, India)

Abstract:
Background*: Liver abscess is an important clinical problem in tropical countries and accounts for a significant number of hospital admissions. It may be amoebic or pyogenic, solitary or multiple. Percutaneous drainage using a pigtail catheter under*
ultrasonographic (USG) guidance along with antibiotic therapy is currently considered the treatment of choice. However, pigtail catheter drainage is associated with potential complications, one of which is bile leak. This complication is clinically important as it prolongs hospital stay and increases patient morbidity.
Materials and Methods*: This was an analytical prospective observational study conducted over a period of one year at Hindu Rao Hospital. A total of 21 patients with liver abscess of volume greater than 300 ml who underwent USG-guided percutaneous pigtail catheter drainage were included. The percentage of patients who developed bile in the drain on any post-procedural day was recorded as the incidence of bile leak. Post-procedure outcome parameters included presence of bile in the drain, mean duration of hospital stay, mean duration of pigtail catheter in situ, and the proportion of patients requiring octreotide therapy and endoscopic retrograde cholangiopancreatography (ERCP) with stenting. These outcomes were compared between bile-leak and non-bile-leak groups.*
Results*: Out of 21 patients, 17 had amoebic liver abscess and 3 had pyogenic liver abscess. Clinical, ultrasonographic, and biochemical parameters were comparable between the two groups and were not statistically significant. Seven patients developed bile leak, giving an incidence of 33%. The mean duration of hospital stay and mean duration of pigtail catheter in situ were significantly higher in the bile-leak group compared to the non-bile-leak group. Overall, bile leak was associated with prolonged hospitalization, longer catheter duration, increased morbidity, and the need for additional interventions.*
Conclusion: *Patients who developed bile leak following pigtail catheter drainage of liver abscess had significantly prolonged hospital stay and longer catheter duration, leading to increased morbidity. Selective use of ERCP and octreotide therapy in patients with persistent or high-output bile leaks highlighting their clinical importance in complexity of management.*
Key Word*: Liver abscess; Pigtail catheter drainage; Bile leak; Percutaneous drainage; ERCP; Octreotide; Amoebic liver abscess; Pyogenic liver abscess*

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I. Introduction

Liver abscess is an important clinical problem in tropical country accounting for a high number of hospital admissions. it can be amoebic or pyogenic,;solitary or multiple abscesses.Standard care of management is either by open surgery or USG guidance percutaneous catheter drainage(PCD).Percutaneous drainage by pigtail catheter along with antibiotic therapy are presently considered as the treatment of choice now days[1].PCD is efficacious,very convenient compare to open surgery ,still it having many complication such as pain ,discomfort at catheter entry site,dislodgement,bile leak.Bile leak complication has reported incidence of 5 to 27 %[2] in literature. this study highlighting its importance because it prolongs the hospital stay and increases morbidity of patient.

II. Material And Methods

Patients with liver abscess who underwent USG guided percutaneous drainage in the time period of 1/10/2024 to 30/9/2025 in Hindu Rao Hospita, New Delhi, India.

Study Design: Analytical Prospective observational study.

Study Location: This was a tertiary care teaching hospital based study done in Department of General Surgery, Hindu Rao Hospital,New Delhi,110007

Study Duration: 1/10/2024 to 30/9/2025

Sample size: 21 patients.

Sample size calculation: This prospective observational case series included all consecutive patients fulfilling the inclusion criteria during the study period; therefore, no formal sample size or power calculation was performed.

Subjects & selection method: This analytical prospective observational study was conducted at Hindu Rao Hospital over a one-year period from 1 October 2024 to 30 September 2025. All consecutive patients diagnosed with liver abscess on the basis of clinical evaluation and ultrasonography (USG) of the whole abdomen were assessed for eligibility.

Before the procedure, all patients underwent baseline investigations including complete blood count, blood sugar levels, prothrombin time, renal function tests, liver function tests, serum electrolytes, and chest X-ray.

Patients with liver abscess having a cavity volume greater than 300 ml who underwent ultrasound-guided percutaneous drainage using a 16F pigtail catheter were included in the study. Pus aspirated during the procedure was sent for culture and sensitivity to classify abscesses as amoebic or pyogenic.The following parameters were evaluated: clinical profile (age, sex, and presenting symptoms), ultrasonographic characteristics (site, number, and volume of abscess cavities), biochemical parameters (CBC, TLC, total and direct bilirubin, serum alkaline phosphatase, and serum albumin)

Post-procedure, daily monitoring of the volume and color of the drain output was performed. Drain fluid was analyzed for bilirubin levels to confirm bile in suspected cases. The presence of bile in the drain on any post-procedural day was recorded, and the proportion of such patients was reported as the incidence of bile leak. A bile output of more than 100 ml per 24 hours persisting for more than two weeks was defined as "persistent bile leak".

Patients with persistent bile leak were initially managed with octreotide injection (50 micrograms/day for three days). Failure of medical management, defined as non-decreasing bile output after octreotide therapy, was managed with endoscopic retrograde cholangiopancreatography (ERCP) and biliary stenting.

Criteria for removal of the pigtail catheter included drain output less than 20 ml per 24 hours for two consecutive days and/or ultrasonographic evidence of abscess cavity volume less than 50 cc.[14]

Patients were categorized into two groups based on the presence or absence of bile leak. post-procedure outcomes, including mean duration of hospital stay, duration of pigtail catheter in situ, and requirement of octreotide therapy or ERCP with stenting. The need for additional interventions was considered a marker of complexity of management.

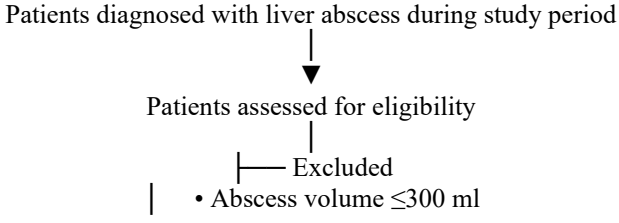
Inclusion criteria:

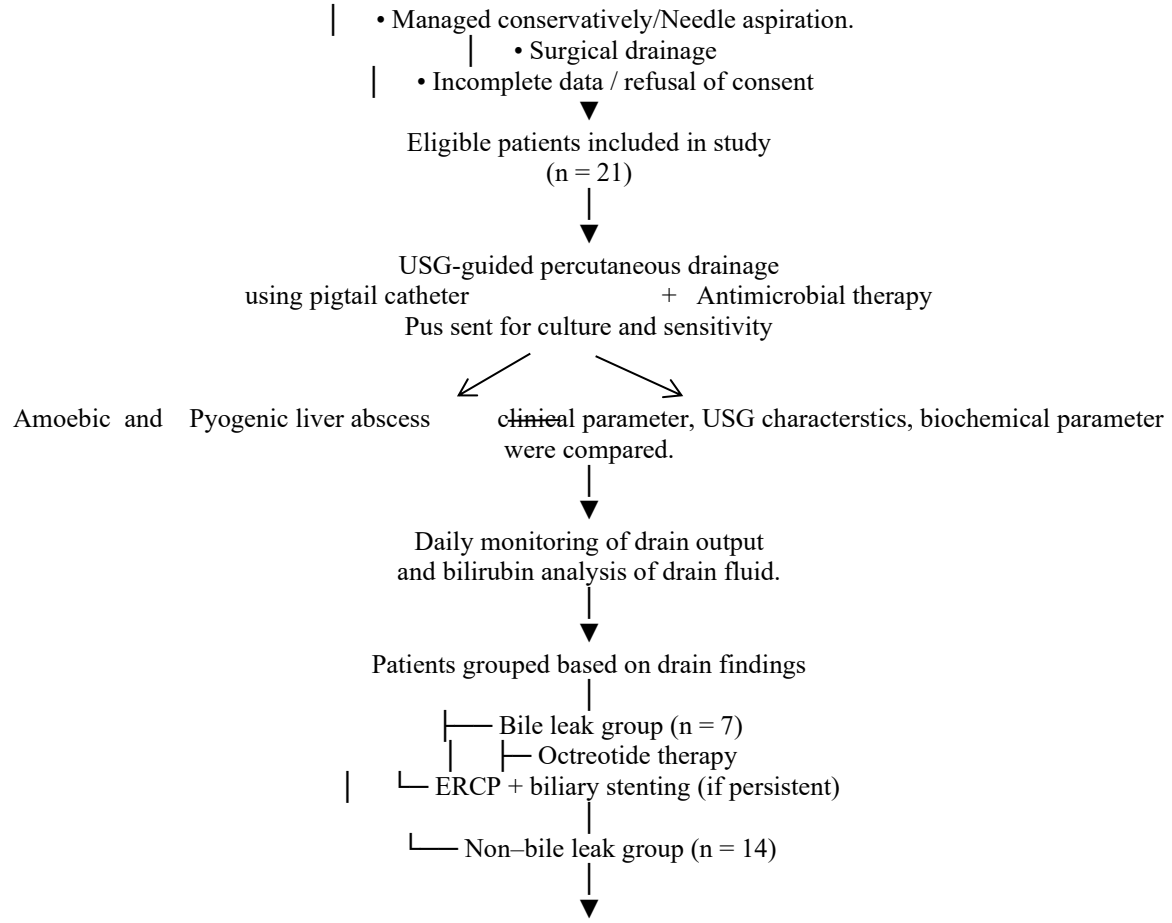
1. Patients diagnosed with liver abscess by clinical examination and USG whole abdomen.
2. Abscess cavity volume greater than 300 ml
3. Patients undergoing USG-guided percutaneous pigtail catheter drainage
4. Patients who provided written informed consent

Exclusion criteria:

1. Liver abscess with cavity volume 300 ml or less
2. Patients managed conservatively or needle aspiration.
3. Patients who underwent open or laparoscopic surgical drainage.
4. Patients who refused consent or were lost to follow-up

Procedure methodology:





Statistical analysis:

Data were entered in Microsoft Excel sheet and analyzed using JASP statistical software(version 0.95.4). Continuous variables were expressed as mean ± standard deviation (SD) as appropriate. Categorical variables were expressed as frequencies.Comparisons between the bile-leak and non–bile-leak groups were performed using the independent t-test for normally distributed continuous variables and the Mann–Whitney U test for non-normally distributed variables. Categorical variables were compared using the Chi-square test or Fisher's exact test, as applicable.A p-value < 0.05 was considered statistically significant.

III. Result

A total of 21 patients diagnosed with liver abscess underwent ultrasound-guided percutaneous pigtail catheter drainage during the one-year study period. Of these, 17 patients had amoebic liver abscess and 3 patients had pyogenic liver abscess. Comparison of clinical profile, USG findings, and biochemical parameters between amoebic and pyogenic liver abscess groups not showed statistically significant difference.

For post-procedural outcome analysis, patients were divided into bile-leak and non–bile-leak groups. Seven patients (33%) developed bile leak following pigtail catheter drainage. The mean duration of hospital stay and mean duration of pigtail catheter in situ were significantly higher in the bile-leak group compared to the non–bile-leak group ($p < 0.05$).[2]

Among the seven patients who developed bile leak, four patients developed persistent bile leak. These patients were initially managed with octreotide therapy. Of these, two patients required endoscopic retrograde cholangiopancreatography (ERCP) with biliary stenting due to persistent high-output bile drainage, indicating a targeted therapeutic response. No patient in the non–bile-leak group required octreotide therapy or endoscopic intervention.

Table1. The baseline demographic and clinical characteristics of patients with amoebic (n = 17) and pyogenic (n = 4) liver abscess are summarized in Table 1. The mean age of patients in the amoebic group was 34 ± 16 years, while in the pyogenic group it was 43 ± 16 years, with no statistically significant difference between the two groups.Male predominance was observed in both groups. Comparison of sex distribution showed no statistically significant difference between amoebic and pyogenic liver abscess patients ($p = 0.241$).

Common presenting symptoms including abdominal pain, fever, diarrhea, and vomiting were observed in both groups, with abdominal pain and fever present in nearly all patients. There was no statistically significant difference in the distribution of clinical symptoms between the two groups.

Table1. The baseline demographic and clinical characteristics of patients

Variable	Amoebic (n = 17)	Pyogenic (n = 4)	Statistical Test	p-value
Age (years) (mean ± SD)	34 ± 16	43 ± 16	Independent t-test	0. 362
Sex			Fisher's exact test	0.241
Male	16	3		
Female	1	1		
Pain in abdomen (Yes)	17	4	Not applicable*	—
Fever (Yes)	16	4	Not applicable*	—
Diarrhea (Yes)	9	1	Fisher's exact test	0.59
Vomiting (Yes)	7	1	Fisher's exact test	1.00

Table2. Biochemical parameters of Liver lobe abscess patients.

parameters*	Type of liver absce ss	Mean	Std. Deviation	p- value
Haemoglobin(mg/dl) (day 1)	amoebic	10.118	1.728	.890
	pyogenic	10.500	3.873	
TLC count(day 1)	amoebic	15835.294	5366.323	.501
	pyogenic	19050.000	9930.592	
Total bilirubin(day 1)	amoebic	1.306	0.611	.820
	pyogenic	2.950	3.785	
Direct bilirubin(day1)	amoebic	0.618	0.417	.892
	pyogenic	1.550	2.258	
Serum ALP	amoebic	212.412	114.508	.698
	pyogenic	265.500	126.979	
Serum albumin	amoebic	2.776	0.317	.471
	pyogenic	2.650	0.719	
PT(sec)	amoebic	16.471	1.940	.414
	pyogenic	17.500	2.380	
*=independent t-test	P-value >0.05=statistically not significant.			

Values are expressed as mean ± standard deviation. Independent samples t-test was used for comparison between 2 groups.

Table2. shows Baseline biochemical parameters on Day 1 were compared between patients with amoebic and pyogenic liver abscess using the independent t-test. There was no statistically significant difference between the two groups with respect to hemoglobin levels (p = 0.890), total leukocyte count (p = 0.501), total bilirubin (p = 0.820), direct bilirubin (p = 0.892), serum alkaline phosphatase (p = 0.698), serum albumin (p = 0.471), and prothrombin time (p = 0.414).

Table.3 (Bile leak vs non bile leak)

bile in drain (yes/no)	amoebic	pyogenic	Total	p
no	12	2	14	.432*
yes	5	2	7	
Total	17	4	21	

*Categorical variables were compared using Fisher's exact test. A p-value <0.05 was considered statistically significant.

Table3. shows The incidence of bile in the drain was compared between patients with amoebic and pyogenic liver abscess. Bile leak was observed in 5 of 17 (29.4%) patients with amoebic liver abscess and 2 of 4 (50%) patients with pyogenic liver abscess. The difference in incidence of bile leak between the two groups was not statistically significant (p = 0.432)

Table.4(Number of abscess cavity)

	Multiple	Single	Total	P-value
Amoebic	1	16	17	0.08
Pyogenic	2	2	4	
Total	3	18	21	

Table.4, shows The distribution of number of abscess cavities (single versus multiple) was compared between patients with amoebic and pyogenic liver abscess using Fisher's exact test. Multiple abscess cavities were observed in 2 of 4 (50%) patients with pyogenic liver abscess compared to 1 of 17 (5.9%) patients with amoebic liver abscess. Although multiple abscesses were more frequently seen in the pyogenic group, the difference did not reach statistical significance (p ≈ 0.08).

Picture 1. shows bilious output in drain.

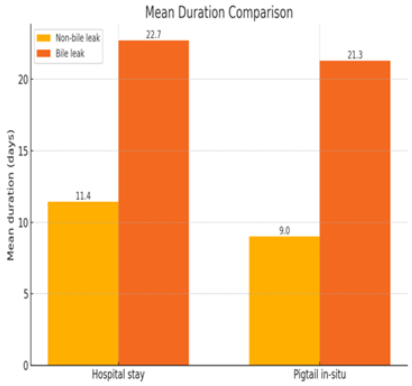
Table5.Post procedure outcome parameters

parameters	Bile leak (yes/no)	N	Mean	SD	p-value
1.duration of hospital stay(days) *	no	14	11.429	3.736	0.02#
	yes	7	22.714	10.356	
2.duration of pigtail insitu(days)*	no	14	9.000	3.903	<0.01#
	yes	7	21.286	10.657	
3. bile leak stop after pigtail catheter(da s)$ (days)	no	-	-	-	
	yes	7	19.833	9.867	
3.serum ALP*	no	14	202.500	125.796	0.272
	yes	7	262.571	86.342	
4.volume of abscess(ml)*	no	14	400.214	116.993	0.494
	yes	7	440.143	136.919	
5.ERCP and stenting	no	14	-		
	yes	7	2		
6.octreotide theraphy	no	14	-		
	yes	7	4		
#=statistically significant ,*-independent t-test					

Values are expressed as mean ± standard deviation. Independent samples t-test was used for comparison. # p-value < 0.05 considered statistically significant.

Table.5 shows Post-procedural outcome parameters were compared between patients with bile leak and without bile leak.The mean duration of hospital stay was significantly longer in patients with bile leak compared to those without bile leak (22.7 ± 10.4 vs 11.4 ± 3.7 days; p = 0.02). Similarly, the mean duration of pigtail catheter in situ was significantly higher in the bile-leak group (21.3 ± 10.7 vs 9.0 ± 3.9 days; p < 0.01).Among patients with bile leak, the mean duration for cessation of bile drainage was 19.8 ± 9.9 days. There was no statistically significant difference between bile-leak and non-bile-leak groups with respect to serum alkaline phosphatase levels (p = 0.272) and abscess volume (p = 0.494).Endoscopic intervention (ERCP with biliary stenting) was required in 2 patients, and octreotide therapy was administered in 4 patients in the bile-leak group, whereas no such interventions were required in patients without bile leak. Overall, bile leak was associated with prolonged hospitalization, longer pigtail catheter duration, and increased complexity of management.

***Graphical Representation of Outcomes**



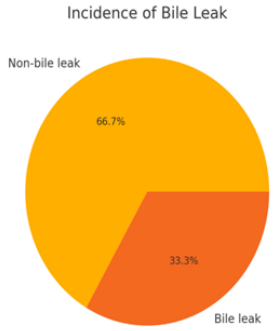


Figure 1: *Comparison of mean duration of hospital stay and pigtail catheter in situ between bile-leak and non-bile-leak groups.*

Figure 2: *Incidence of bile leak following percutaneous pigtail catheter drainage of liver abscess.*

IV. Discussion:

Liver abscess remains a common clinical problem in tropical countries,most of them respond favorably to antimicrobial therapy; however, large abscess cavities and associated biliary communication significantly alter the disease course.[3] In the present study, patients undergoing ultrasound-guided percutaneous pigtail catheter drainage frequently had large abscess volumes and prolonged duration of illness, and a substantial proportion developed bile leak.

In the present study, bile leak was observed in approximately one-third of patients undergoing pigtail catheter drainage(33.33%). This incidence is comparable to previously reported rates of abscess–biliary communication in patients requiring catheter drainage.[2] The occurrence of bile leak was associated with significantly prolonged hospital stay and longer duration of catheter placement, highlighting its impact on morbidity and healthcare utilization.[4]

Several poor prognostic factors include serum bilirubin >3.5 mg/ dL, hypoalbuminemia (<2 g/dL), low hemoglobin (<8 g/dL), large abscess (>500 mL), multiple abscesses, encephalopathy, pleural effusion and diabetes mellitus.[5,6] In this study, all patients had long duration of illness and large abscess(>300 mL), anemia and/or hypoalbuminemia; none had encephalopathy, pleural effusion or diabetes.

The management of bile leak following liver abscess drainage remains challenging. Conservative measures, including continued catheter drainage and supportive care, are often effective in low-output leaks. In our study, octreotide was used as an pharmacological therapy in selected patients with persistent bile leak. Evidence supporting octreotide in biliary fistula primarily originates from several studies, which demonstrate reduced bile flow and decreased fistula output following administration. These findings provide biological plausibility for its use.[7,8]

Endoscopic biliary intervention emerged as a decisive treatment modality in patients with persistent bile leak.[4] ERCP with biliary stenting resulted in rapid reduction of bile output and facilitated early removal of the pigtail catheter,this may have prevented complications of prolonged percutaneous drainage like secondary infection, fistula formation and loss of bile. Further, it reduced the need for antibiotics and hence treatment costs.[9,10]

Studies have shown that percutaneous needle aspiration is a safe approach, and accelerates resolution and having no complications compare to percutaneous drainage.[11,12,13] In our study, 7patients had no reduction in drain output even 2 weeks after percutaneous drainage. Saraswat *et al*[14] found that the percutaneous catheter could be removed after a mean period of 7 days (range 3-20), when the patient was afebrile, catheter drainage had come down to <10 mL/day and USG showed a negligible cavity size. Agarwal *et al*[2] showed presence of abscess-biliary communication in 27% of cases requiring percutaneous catheter drainage; this subgroup had more frequent jaundice, longer duration of illness, and larger lesions, and required catheter drainage for longer periods (median 17 vs 6.5 days) The present study has certain limitations. The observational design, small sample size, and absence of a control group limit the ability to draw definitive conclusions regarding predictors of bile leak or the independent efficacy of octreotide therapy and ERCP and stenting procedure.

V. Conclusion

Patients with bile leak demonstrated prolonged hospitalization and significantly longer pigtail catheter duration which ultimately increase hospital stay and morbidity. Early recognition and stepwise management, including selective use of adjunctive medical therapy and endoscopic intervention, are essential. Percutaneous needle aspiration may be considered an alternative approach in selected patients, particularly in smaller abscesses without biliary communication. Future prospective studies with larger cohorts are required to identify early predictors of biliary communication and to establish standardized management algorithms.

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