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DIFFERENT MODALITIES ON MANAGEMENT OF LIVER ABSCESS

General Surgery

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ABSTRACT

Introduction: Liver abscess is a serious condition **common** in tropical regions, primarily caused by pyogenic or amoebic infections. Prompt diagnosis and treatment are vital to prevent complications such as rupture, which can lead to high mortality. Modern imaging and minimally invasive treatments have improved outcomes significantly, but optimal management depends on abscess size, site, liquefaction, and rupture status. **Aim & Objective:** To evaluate the effectiveness of various liver abscess treatment modalities including conservative medical management, percutaneous drainage (needle aspiration or pigtail catheterization), laparoscopic drainage, and open surgical drainage. **Methodology:** A prospective observational study was conducted at Santosh Medical College Hospital, Ghaziabad over 1.5 years including 73 patients with radiologically confirmed liver abscess. Patients were treated with a single modality based on clinical and imaging findings. Data were analyzed using appropriate statistical tests to compare the effectiveness of different treatments. **Result:** USG-guided pigtail catheterization was the most frequently used method (56.2%), particularly effective for liquefied and non-ruptured abscesses. Medical therapy (13.7%) was limited to small, unruptured abscesses. Surgical drainage was mostly needed for ruptured or large abscesses (>1000 ml). The right lobe was the most commonly affected site (82.2%). **Conclusion:** Treatment choice was guided by abscess size, liquefaction, and rupture status. USG-guided pigtail catheterization proved most effective in uncomplicated cases, while ruptured and large abscesses required laparoscopic or open surgical intervention.

KEYWORDS

Liver abscess, USG-guided pigtail catheterization, percutaneous drainage, laparoscopic drainage, open surgical drainage, medical management, liquefied abscess, ruptured abscess, abscess size, right lobe involvement, tropical infections, ultrasonography.

INTRODUCTION

Liver abscesses are a significant health problem, particularly in tropical regions where their prevalence is higher due to increased exposure to infectious agents. These abscesses result from microbial invasion of hepatic tissue, spreading via the bloodstream, biliary tract, or by direct extension from nearby structures. Pyogenic and amoebic infections are the most common causes.[1] Clinical symptoms are often nonspecific and may include fever, abdominal pain, nausea, vomiting, hepatomegaly, and weight loss. In amoebic liver abscesses, the onset can sometimes be abrupt, with severe abdominal pain, fever, and leukocytosis. Complications such as rupture into the peritoneal, pleural, or pericardial cavities can occur in 2–17% of cases and may result in mortality rates as high as 50%, underscoring the importance of early intervention.

Recent advances in imaging and treatment have significantly reduced the mortality rate to about 2.5%. Medical therapy is the first-line treatment for amoebic abscesses, but large abscesses (>5 cm) or those with secondary bacterial infections often require percutaneous needle aspiration (PNA) or percutaneous catheter drainage (PCD).[2] Surgical drainage is now rarely needed and is typically reserved for cases refractory to percutaneous methods. Amoebic liver abscesses are commonly found in tropical climates, with Entamoeba histolytica being the causative organism in 3–9% of amoebiasis cases.[3] These abscesses more frequently affect younger males, while pyogenic abscesses occur equally among sexes and are generally found in older individuals. The liver's strong reticuloendothelial defense usually prevents infections, but the right lobe remains more vulnerable due to its larger blood supply and volume. Approximately 90% of right lobe abscesses are solitary, while left lobe involvement is less common.

The diagnosis primarily depends on ultrasonography, although CT scans are more sensitive, especially for small lesions. Amoebic abscesses are confirmed through serological testing, while pyogenic abscesses require pus culture and sensitivity testing. Treatment options vary and include drug therapy, ultrasound-guided aspiration, percutaneous drainage, laparoscopic drainage, and open surgery.[4] Choosing the appropriate approach depends on abscess size, location, etiology, and patient condition. In one study involving 54 patients, various aspects were analyzed including demographics, abscess characteristics, and outcomes after different treatments.[5] Key evaluation criteria included reduction in abscess size, hospital stay duration, need for additional procedures, complications, and recovery rates, providing valuable insight into optimal management strategies for liver abscesses.

AIMS AND OBJECTIVES

To evaluate effectiveness of various management strategies in the management of liver abscess,

- conservative medical treatment,
- percutaneous drainage,
- laparoscopy drainage,
- open surgical drainage (laparotomy, thoracotomy, incision and drainage)

MATERIAL AND METHOD

This observational study was conducted at Santosh Medical College Hospital, Ghaziabad, over a period of 1.5 years from July 2023 to January 2025. A total of 73 patients diagnosed with liver abscess were included based on a predetermined sample size calculation formula: n = (DEFF+Np(1−p))/\[(d²/Z²×(N−1)+p(1−p))]. The study population comprised patients admitted to Santosh Hospital with a confirmed diagnosis of liver abscess through ultrasonography (USG) or CT scan. Inclusion criteria involved patients presenting to the emergency or outpatient department with imaging-confirmed liver abscess, managed using a single treatment modality (either percutaneous needle aspiration or percutaneous catheter drainage), and those who provided informed consent for intervention when required. Patients with cavitary liver lesions not confirmed as liver abscesses on USG or CT, those lacking a definitive diagnosis, and patients needing both needle aspiration and catheter drainage were excluded.

During the study, each patient underwent thorough clinical evaluation, with data collected on medical history, clinical presentation, diagnostic imaging, and laboratory findings. Ultrasonography played a key role in assessing the site, size, volume, and degree of liquefaction of the abscess, aiding in the choice of the most suitable intervention. Treatment modalities included conservative medical management,

percutaneous needle aspiration, percutaneous catheter drainage, and surgical drainage. The choice of intervention was guided by radiological and clinical features. The study emphasized how the location, size, and liquefaction of abscesses influenced treatment decisions and clinical outcomes, offering insights into the efficacy of each treatment approach in varying clinical scenarios.

Data management involved collecting comprehensive demographic and clinical data, organized in a secure digital system with validation protocols to ensure accuracy. Descriptive statistics summarized patient characteristics and abscess features. Comparative analysis was performed using ANOVA or t-tests for normally distributed data, and non-parametric tests like the Kruskal-Wallis test for skewed distributions. Time-to-event analyses were employed to assess recovery times, and logistic regression or multivariate models were used to account for confounding variables such as age and comorbidities. Subgroup analyses helped explore the performance of different treatment modalities across varied patient categories. For data analysis, software like SPSS, R, or SAS was used. Results were interpreted with reference to existing literature, and study limitations were considered to offer well-supported clinical recommendations

RESULTS

Table:1 Different Treatment Modalities

Treatment Modality	Yes (Count)	Yes (% of Total)	No (Count)	No (% of Total)
Medical Management	10	13.70%	63	86.30%
USG Guided Needle Aspiration	4	5.50%	69	94.50%
USG Guided Pigtail Catheterization	41	56.20%	32	43.80%
Laparoscopic Drainage	10	13.70%	63	86.30%
Open Drainage	8	12.30%	65	87.70%

1. Medical Management:
- A majority of patients (63 out of 73, 86.3%) did not receive medical management.
- Only 10 patients (13.7%) were treated with this approach.

2. USG Guided Needle Aspiration:
- This treatment was the least utilized, with only 4 patients (5.5%) receiving it.
- Most patients (69 out of 73, 94.5%) did not undergo this procedure.

3. USG Guided Pigtail Catheterization:
- This was the most frequently used treatment, with 41 patients (56.2%) undergoing the procedure.
- However, 32 patients (43.8%) did not receive this intervention.

4. Laparoscopic Drainage:
- Only 10 patients (13.7%) underwent laparoscopic drainage.
- The majority, 63 patients (86.3%), did not receive this treatment.

5. Open Drainage:
- A total of 8 patients (12.3%) received open drainage.
- Most patients (65 out of 73, 87.7%) did not undergo this procedure.

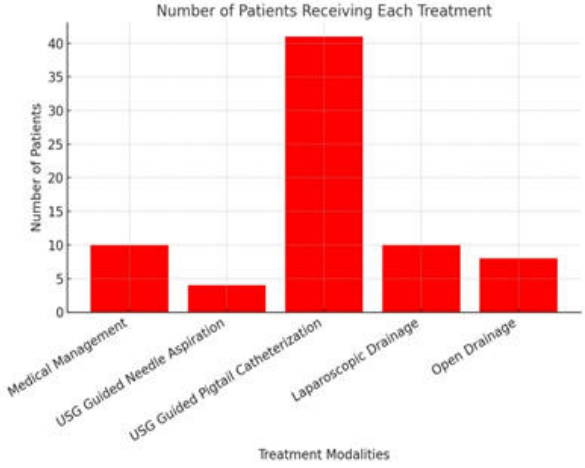


Table:2 Correlation Between Treatment Modalities And Presence Of Liquefied Abscess In Patients

"Modalites of treatment"	"Liquified abscess"	Counts	% of Total	P
USG Guided pigtail catheterization	No	2	2.7 %	< .001
	Yes	39	53.4 %	
	Partial	0	0.0 %	
Open drainage	No	2	2.7 %	
	Yes	4	5.5 %	
	Partial	2	2.7 %	
USG Guided aspiration	No	1	1.4 %	
	Yes	3	4.1 %	
	Partial	0	0.0 %	
Laparoscopic drainage	No	2	2.7 %	
	Yes	8	11.0 %	
	Partial	0	0.0 %	
Medical Management	No	10	13.7 %	
	Yes	0	0.0 %	
	Partial	0	0.0 %	
	Yes	0	0.0%	
	Partial	0	0.0 %	

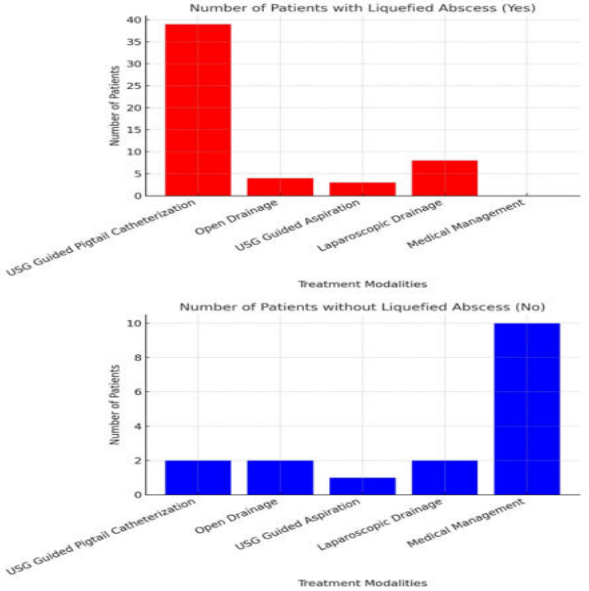
USG Guided Pigtail Catheterization:
- This was the most commonly used treatment for patients with liquefied abscess (39 patients, 53.4%).
- A very small number of patients (2, 2.7%) did not have a liquefied abscess.
- No patients showed partial liquefaction.

Open Drainage:
- A total of 4 patients (5.5%) had a liquefied abscess and were treated with open drainage.
- 2 patients (2.7%) did not have a liquefied abscess, while another 2 patients (2.7%) showed partial liquefaction.

USG Guided Aspiration:
- 3 patients (4.1%) had a liquefied abscess and received this treatment.
- 1 patient (1.4%) did not have a liquefied abscess.
- No patients had partial liquefaction.

Laparoscopic Drainage:
- 8 patients (11.0%) with liquefied abscess underwent laparoscopic drainage.
- 2 patients (2.7%) did not have a liquefied abscess.
- No cases of partial liquefaction were reported.

Medical Management:
- 10 patients (13.7%) did not have a liquefied abscess and were managed medically.
- No patients had a liquefied abscess (Yes = 0%).
- No cases of partial liquefaction were reported



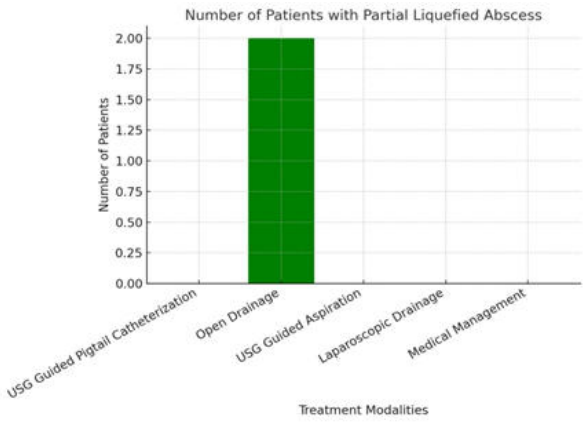


Table:3 Association Between Treatment Modalities and Ruptured Status in Patients with Intra-Abdominal Collections

	"Ruptured"				
"Modalities of treatment"		No	Yes	Total	P
USG Guided pigtail catheterization	Observed	41(69.5 %)	0(0.0 %)	41(56.2 %)	< .001
Open drainage	Observed	2(3.4 %)	6(42.9 %)	8(11.0 %)	
USG Guided aspiration	Observed	4(6.8 %)	0(0.0 %)	4(5.5 %)	
Laparoscopic drainage	Observed	2(3.4 %)	8(50.0 %)	10(12.3 %)	
Medical Management	Observed	10(16.9 %)	0(0.0 %)	10(13.7 %)	
Total	Observed	59(100.0 %)	14(100.0 %)	73(100.0 %)	

In this study USG Guided Pigtail Catheterization was used in 41 patients (69.5%) under the No category, while none were in the Yes category. This treatment accounted for 56.2% of the total cases.

Open Drainage was performed in 8 patients (11.0%), with 2 patients (3.4%) in the No category and 6 patients (42.9%) in the Yes category, indicating a higher proportion in the Yes group.

USG Guided Aspiration was observed in 4 patients (5.5%), all of whom were in the No category (6.8%), with none (0.0%) in the Yes category.

Laparoscopic Drainage was utilized in 10 cases (12.3%), with 2 patients (3.4%) in the No category and 8 patients (50.0%) in the Yes category, showing that this method was predominantly used in the Yes category.

Medical Management was recorded in 10 cases (13.7%), with all 10 patients (16.9%) in the No category and none in the Yes category (0.0%).

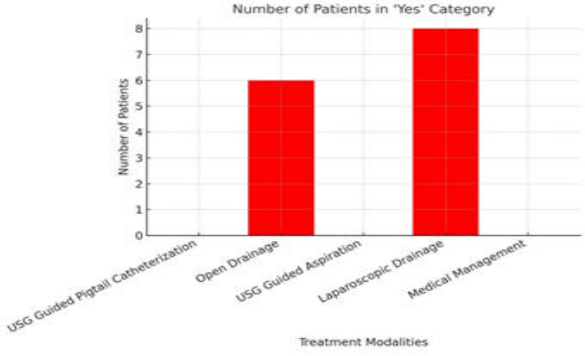


Table:4 Distribution of Treatment Modalities According to Abscess Size in Patients with Liver Abscess

		"Modalities of treatment"							
"Abscess Size (ml)"		**USG Guided pigtail catheterization**	**Open drainage**	**USG Guided aspiration**	**Laparoscopic drainage**	**Medical Management**	**Laparoscopic drainage, Open drainage**	**Total**	**P**
<100	Observed	0(0.0 %)	0(0.0 %)	0(0.0 %)	0(0.0 %)	7(70.0 %)	0(0.0 %)	7(9.6 %)	< .001
101-200	Observed	0(0.0 %)	0(0.0 %)	4(100.0 %)	0(0.0 %)	2(20.0 %)	0(0.0 %)	6(8.2 %)	
201-300	Observed	5(12.2 %)	0(0.0 %)	0(0.0 %)	0(0.0 %)	1(10.0 %)	0(0.0 %)	6(8.2 %)	
301-400	Observed	12(29.3 %)	0(0.0 %)	0(0.0 %)	1(11.1 %)	0(0.0 %)	0(0.0 %)	13(17.8 %)	
401-500	Observed	10(24.4 %)	1(12.5 %)	0(0.0 %)	1(11.1 %)	0(0.0 %)	0(0.0 %)	12(16.4 %)	
501-600	Observed	7(17.1 %)	0(0.0 %)	0(0.0 %)	0(0.0 %)	0(0.0 %)	1	8(11.0 %)	
601-700	Observed	3(7.3 %)	1(12.5 %)	0(0.0 %)	2(22.2 %)	0(0.0 %)	0(0.0 %)	6(8.2 %)	
701-800	Observed	3(7.3 %)	1(12.5 %)	0(0.0 %)	2(22.2 %)	0(0.0 %)	0(0.0 %)	6(8.2 %)	
801-900	Observed	0(0.0 %)	0(0.0 %)	0(0.0 %)	2(22.2 %)	0(0.0 %)	0(0.0 %)	2(2.7 %)	
901-1000	Observed	1(2.4 %)	0(0.0 %)	0(0.0 %)	0(0.0 %)	0(0.0 %)	0(0.0 %)	1(1.4 %)	
>1000	Observed	0(0.0 %)	5(62.5 %)	0(0.0 %)	1(11.1 %)	0(0.0 %)	0(0.0 %)	6(8.2 %)	
Total	Observed	41(100.0 %)	8(100.0 %)	4(100.0 %)	9(100.0 %)	10(100.0 %)	1(100.0 %)	73(100.0 %)	

The above table illustrates that out of the total study participants, for abscess sizes less than 100 ml, 70% were treated with medical management. In the 101-200 ml category, 100% were treated with USG-guided aspiration. For abscesses between 201-300 ml, 12.2% underwent USG-guided pigtail catheterization. In the 301-400 ml group, 29.3% received USG-guided pigtail catheterization, while 11.1% were treated with laparoscopic drainage. Among those with abscess sizes ranging from 401-500 ml, 24.4% underwent USG-guided pigtail catheterization, and 12.5% required open drainage. For abscesses between 501-600 ml, 17.1% were treated with USG-guided pigtail catheterization. In the 601-700 ml and 701-800 ml ca2tegories, 7.3% and 7.3% received USG-guided pigtail catheterization, respectively, with some treated with laparoscopic drainage. For abscesses between 801-900 ml, 22.2% received laparoscopic drainage. In the >1000 ml group, 62.5% were treated with open drainage, and 11.1% with laparoscopic drainage. The total number of participants across all groups was 73.

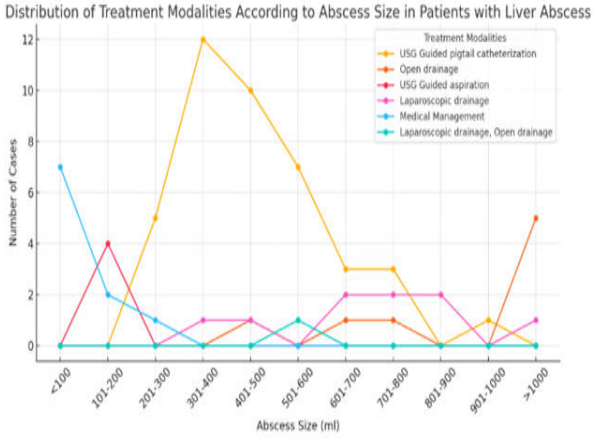


Table:5 Distribution Of Treatment Modalities Based On Site Of Liver Involvement

		"Site"				
"Modalities of treatment"		**Right Lobe**	**Left Lobe**	**Both**	**Total**	**P**
USG Guided pigtail catheterization	Observed	36(60.0 %)	5(55.6 %)	0(0.0 %)	41(56.2 %)	0.015
Open drainage	Observed	5(8.3 %)	0(0.0 %)	3(75.0 %)	8(11.0 %)	
USG Guided aspiration	Observed	4(6.7 %)	0(0.0 %)	0(0.0 %)	4(5.5 %)	
Laparoscopic drainage	Observed	8(11.7 %)	2(22.2 %)	0(0.0 %)	10(12.3 %)	
Medical Management	Observed	7(11.7 %)	2(22.2 %)	1(25.0 %)	10(13.7 %)	
Total	Observed	60(100.0 %)	9(100.0 %)	4(100.0 %)	73(100.0 %)	

In this study USG Guided Pigtail Catheterization was the most commonly used treatment, with 36 cases (60.0%) affecting the Right Lobe, 5 cases (55.6%) in the Left Lobe, and no cases in Both Lobes. This made up 41 cases (56.2%) of the total treatments.

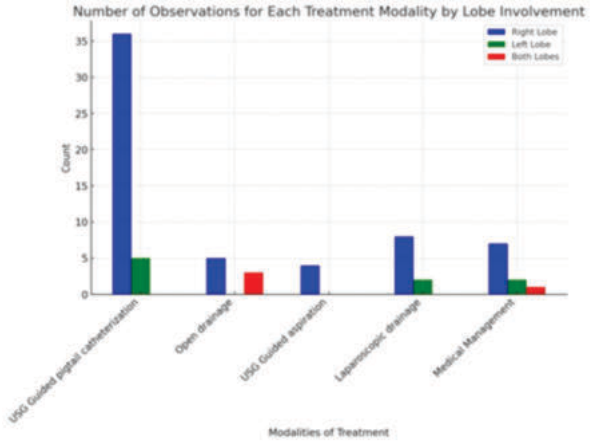
Open Drainage was observed in 8 cases (11.0%), with 5 cases (8.3%) involving the Right Lobe, none in the Left Lobe, and 3 cases (75.0%) affecting Both Lobes, indicating that this treatment was more commonly used when both lobes were involved.

USG Guided Aspiration was performed in 4 cases (5.5%), all of which were in the Right Lobe (6.7%), with no cases in the Left Lobe or Both Lobes.

Laparoscopic Drainage accounted for 10 cases (12.3%), with 8 cases (11.7%) involving the Right Lobe, 2 cases (22.2%) in the Left Lobe, and none in Both Lobes.

Medical Management was observed in 10 cases (13.7%), with 7 cases (11.7%) affecting the Right Lobe, 2 cases (22.2%) in the Left Lobe, and 1 case (25.0%) affecting Both Lobes.

Overall, the Right Lobe was the most commonly affected area (60 cases, 82.2%), followed by the Left Lobe (9 cases, 12.3%), while Both Lobes were involved in only 4 cases (5.5%).



DISCUSSION

The present study demonstrated that USG-guided pigtail catheterization was the most commonly used and effective management strategy for liver abscesses, especially in patients with liquefied abscesses and abscesses measuring between 301–600 ml. This approach accounted for 56.2% of the treatment methods employed, with statistically significant correlation to liquefied abscess presence ($p < 0.001$) and non-ruptured status (69.5%) among patients. These findings align closely with the conclusions drawn by Wadhera et al,[5] who emphasized the superior efficacy of percutaneous drainage techniques, particularly over conservative treatment modalities. Their analysis reinforced the clinical shift towards interventional radiology techniques, particularly in resource-adequate settings, due to improved patient outcomes and reduced morbidity.

Additionally, the present study reported that medical management alone was employed in only 13.7% of patients, primarily in those with smaller abscesses (<100 ml) and non-liquefied collections, with none of the patients in this group exhibiting rupture or requiring surgical intervention. These results resonate with the clinical stance of Akhondi and Sabih et al,[6] who underlined the necessity of early and aggressive intervention, especially in the context of rising mortality with delayed treatment. Their emphasis on accurate evaluation, timely diagnosis, and rapid escalation to drainage procedures is supported by the poor outcomes and limited effectiveness observed with conservative therapy in our study.

In regard to laparoscopic and open surgical drainage, their usage was observed predominantly in larger abscesses (>700 ml), ruptured abscesses, and those involving both lobes of the liver. Laparoscopic drainage was used in 12.3% of cases, while open drainage accounted for 11%, with both modalities being significantly associated with ruptured intra-abdominal collections ($p < 0.001$). These observations reflect the clinical scenarios described by Sayek and Onat et al,[7] who highlighted that surgical interventions remain indispensable for complicated cases—particularly those with rupture, sepsis, or failed percutaneous drainage. Their insights into the changing etiologies, with biliary diseases now outpacing hematogenous spread, also correspond with our finding that multiple-lobe involvement and larger abscesses necessitate more aggressive treatment approaches.

Moreover, in our study, site-specific preferences for intervention were evident, with right lobe abscesses being predominantly treated with pigtail catheterization (60%) and bilateral lobe involvement often necessitating open surgical approaches (75%). This aligns with the anatomical and radiological challenges cited in prior reviews, where right-lobe dominance in abscess formation necessitates careful procedural planning, especially for larger or multiloculated abscesses, as discussed by Wadhera et al[6] and Akhondi and Sabih et al.[7]

In summary, this study supports the evolving clinical paradigm wherein minimally invasive image-guided procedures like pigtail catheterization are the mainstay of liver abscess management in liquefied, moderate-sized, non-ruptured abscesses, while surgical drainage is reserved for complex, ruptured, or massive abscesses**.** These findings corroborate the evidence-based recommendations discussed in contemporary literature, advocating early detection, appropriate categorization, and stratified intervention to minimize morbidity and mortality associated with liver abscesses.

CONCLUSION

In this study, USG-guided pigtail catheterization was the most commonly used treatment (56.2%), especially effective in cases with liquefied abscesses and non-ruptured collections, showing a strong statistical association ($p < 0.001$). Medical management was used in 13.7% of patients, mainly for small abscesses (<100 ml) that were non-liquefied and unruptured, indicating limited use in complicated cases. USG-guided needle aspiration, used in only 5.5% of patients, was reserved for small abscesses (101–200 ml) and was not associated with rupture or multiloculation. Laparoscopic drainage (12.3%) and open surgical drainage (11%) were mainly used in ruptured abscesses and larger collections. Laparoscopy was common in abscesses between 601–900 ml, while open drainage was preferred for abscesses >1000 ml or when both liver lobes were involved. Ruptured abscesses were not managed conservatively; most required laparoscopic or open surgery. Abscess size significantly influenced treatment: smaller abscesses were treated non-invasively, while larger ones required pigtail, laparoscopy, or surgery. Right lobe involvement was most frequent (82.2%) and mostly treated with pigtail catheterization. Bilobar abscesses often needed open drainage.

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