

SUCCESS RATE OF IMAGE-GUIDED PERCUTANEOUS DRAINAGE OF INTRA ABDOMINAL FLUID COLLECTIONS / ABSCESES AT A TERTIARY CARE HOSPITAL

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Abstract

Objective: To determine the frequency of successful image guided percutaneous drainage among patients with intra-abdominal fluid collections and abscesses at tertiary care hospital.

Study Design: cross-sectional Study.

Study Setting: Department of General Surgery, Jinnah Post Graduate Medical Centre, Karachi

Study Duration: January to June 2025.

Methodology: Total 177 cases aged 20-75 years of either gender with imaging evidence of intra-abdominal fluid collections requiring drainage were enrolled. All pregnant females, with coagulopathy, cardiac disease, or who refused the procedure were excluded from this trial. After obtaining informed consent, demographic and clinical data were recorded and image-guided percutaneous drainage was performed under local anesthesia and aseptic precautions using ultrasound or CT guidance. Following diagnostic aspiration, a catheter (12F–16F) was inserted via the Seldinger technique for continuous drainage. Samples were analyzed microbiologically, and antibiotics were adjusted according to sensitivity results. Patients were monitored clinically and radiologically until recovery. Procedural success was defined as complete resolution without surgical intervention.

Results: Of 177 patients, the mean age was 44.46 ± 11.10 years (range 20–75), with most (72.9%) aged 20–50 years. Males constituted 57.1% of cases. The overall procedural success rate was 85.9%, while 14.1% required surgical drainage. No significant association was found between demographic or clinical factors and procedural success except for diarrhea ($p = 0.004$), which was linked to lower success rates.

Conclusion: Image-guided percutaneous drainage proved to be a safe, effective, and minimally invasive technique with an 85.9% success rate. Its efficacy, independent of clinical or demographic factors, underscores its value as a first-line option for intra-abdominal collections, especially in low-resource settings.

INTRODUCTION

Intra-abdominal collections, which include abscesses forming inside the peritoneal cavity, behind the peritoneum, or within organ tissues, are among the leading complications contributing to illness and death after gastrointestinal surgery.¹ The use of image-guided drainage has become a cornerstone in modern interventional radiology due to its wide range of clinical applications. It is particularly recommended for pleural and intra-abdominal collections to prevent complications commonly associated with blind drainage techniques.² Abscess detection relies on imaging modalities such as ultrasonography, CT, MRI, and nuclear scintigraphy.^{3, 5} Combined with appropriate antimicrobial therapy, early drainage significantly improves patient outcomes.⁶ Studies have shown that percutaneous image-guided catheter drainage offers a safe and highly effective approach for managing intra-abdominal abscesses, especially postoperative collections, with low morbidity and complication rates. Predictors of successful outcomes include elevated leukocyte counts, limited prior antibiotic use.⁷ Situ-La Casse E, et al. concludes that ultrasound-guided percutaneous drainage or aspiration of abnormal fluid collections is becoming standard of care in current clinical practice. Ultrasound guidance has led to reduced morbidity and mortality and decrease in length of stay and healthcare costs. Ultrasound-guided percutaneous drainage is minimally invasive and relatively inexpensive and has several advantages over CT including real-time guidance and lack of radiation.⁸ The success rate also varies based on the type of collection such as 50% for intrahepatic abscesses, 80% for post-operative collections, 90% for primary abscesses and 100% for cholecystitis.⁹ A national survey observed the overall success rate to be 68.3% which after secondary percutaneous drainage, improved to 73.0%.¹⁰ An international study of Wani RA, et al. showed that around 90% of intra-abdominal collections in their study consisted of liver abscesses, postoperative collections and peri-pancreatic collections following acute pancreatitis. Overall success rate of percutaneous drainage (PCD) is 92% and it serves

as complete cure in around 85% cases and as temporarizing measure in 8% patients, most of them being critically-ill. Image-guided percutaneous drainage is the least invasive drainage procedure for intraabdominal collections/abscesses with a fairly good success rate.¹¹

The main purpose of our study is to determine the success rate of image-guided percutaneous drainage of intra-abdominal collections or abscesses which stated as the choice for majority of cases in previous international researches regardless of etiology. The data in our part is scarce and limited therefore it is imperative that more such studies continue to be performed so that it guides the clinicians that either this procedure is technically easy, reproducible and cost-effective with the advantage of being performed under local anesthesia.

METHODOLOGY:

This cross-sectional study was conducted in the Department of General Surgery, Liaquat National Hospital, Karachi, over a period of six months following approval of the synopsis by the IRB and CPSP (Ref No: CPSP/REU/SGR-2022-192-13738). A total of 177 patients were included in the study, and the sample size was calculated using the WHO sample size calculator by considering the prevalence of successful percutaneous drainage as 92%, with a 95% confidence level and a 4% margin of error. Non-probability consecutive sampling was used for patient selection. Both male and female patients aged between 20 and 75 years, presenting with abdominal pain with or without fever, and having imaging evidence of intra-abdominal fluid collection suspected to be infected or warranting drainage, were included in the study. Pregnant women, patients with significant coagulopathy or chronic cardiac disease, and those who refused the procedure were excluded. All patients fulfilling the inclusion criteria and presenting to the Department of General Surgery with a clinical suspicion of intra-abdominal abscess or collection were enrolled after obtaining informed written consent. Ethical approval was taken from the institutional review board and the

College of Physicians and Surgeons Pakistan. Demographic details and clinical history including age, gender, height, weight, body mass index (BMI), abdominal pain, nausea, vomiting, fever, constipation, diarrhea, and comorbid conditions such as diabetes, hypertension, and smoking status were recorded on a predesigned proforma.

The procedure was performed under aseptic precautions and local lidocaine anesthesia with image guidance using either ultrasonography or computed tomography. Initially, diagnostic aspiration was performed with an 18 or 20-gauge needle to confirm the presence of pus, and about 5 ml of the collection was aspirated to avoid premature collapse of cavity walls. A flexible introducer guide wire (0.035 inch) was then passed through the needle, and the tract was serially dilated with dilators ranging from 6F to 14F, depending on the required catheter size. After dilatation, the guide wire was exchanged for a catheter (12F-16F, either pigtail or Malecot type) using the Seldinger technique. Once the catheter was secured and attached to a drainage bag, samples from the aspirated material were sent for Gram staining, culture sensitivity, and biochemical and cytological analysis. Broad-spectrum injectable antibiotics were administered empirically and later adjusted according to culture sensitivity results. The volume of drainage was recorded daily, and response to treatment was assessed both clinically and radiologically through serial ultrasound examinations. Irrigation with normal saline was performed whenever required. Patients were discharged upon clinical improvement, when they were ambulatory, tolerating diet, and continued oral antibiotics. The procedure was considered successful if the patient was cured without the need for surgical drainage. Data were recorded by the principal investigator on a structured proforma, and confounding factors were minimized by stratification.

Statistical analysis was carried out using SPSS version 25. Frequencies and percentages were calculated for qualitative variables such as gender, symptoms, comorbidities, and procedural success. Quantitative variables including age, height, weight, BMI, drain volume, catheter duration, and

hospital stay were presented as mean $\pm$ standard deviation or median (interquartile range), depending on data distribution.

RESULTS:

In our study, 177 cases were selected undergoing image-guided percutaneous drainage for intra-abdominal collections. The age range of our study population was 20-75 years with the mean age as 44.46 $\pm$ 11.10 years, 20-50 years age group was in majority by calculating 72.9% whereas older age was consists of 27.1% of the cases. Female subjects were slightly lower than male cases i.e. 42.9%. Regarding clinical symptoms, most frequent complaint i.e. 80.2% was abdominal pain followed by nausea in 41.8%, fever was 40.1% and the vomiting was 26%. Diarrhea was reported in 23.7% and constipation in 15.8% cases, whereas hypertension in 31.1%, diabetes mellitus in 26.6% and smokers were recorded as 18.1%. The mean drain volume was 321.65 $\pm$ 86.20 ml, the mean catheter duration was 3.10 $\pm$ 1.36 days, and the mean hospital stay was 5.05 $\pm$ 2.02 days.(Table 1).

The most common type of collection drained was liver abscess (31.6%), followed by postoperative collections (26.0%), peripancreatic collections (23.7%) and pelvic or deep collections (8.5%). Post-procedural wound infection occurred in 9.0% of patients, while leak formation was observed in 4.0%. The procedure was successful in 85.9% of cases, while 14.1% required further surgical intervention due to failure of percutaneous drainage. (Table 2)

Table 3 summarizes the association between various demographic and clinical variables and the success of image-guided percutaneous drainage in 177 patients. The Chi-square test was applied to variables with adequate expected cell counts, while the Fisher's Exact Test was used where any expected cell count was <5 . No statistically significant association was found between age, gender, abdominal pain, nausea, vomiting, fever, constipation, diabetes mellitus, hypertension, smoking status, type of collection, guidance method, wound infection, or leak formation and the success of drainage ($p > 0.05$). However, diarrhea showed a statistically significant

relationship with procedural success ($p = 0.004$, Fisher's Exact Test), indicating that the presence of diarrhea was associated with lower success rates. Overall, the majority of associations were non-significant, demonstrating that the effectiveness of

image-guided drainage was largely independent of baseline demographic or clinical factors in this study population.

Variable	Category	Frequency (n)	Percentage (%)
Age (years)	20-50	129	72.9
	>50-75	48	27.1
Gender	Male	101	57.1
	Female	76	42.9
Abdominal pain	Yes	142	80.2
	No	35	19.8
Nausea	Yes	74	41.8
	No	103	58.2
Vomiting	Yes	46	26.0
	No	131	74.0
Fever	Yes	71	40.1
	No	106	59.9
Constipation	Yes	28	15.8
	No	149	84.2
Diarrhea	Yes	42	23.7
	No	135	76.3
Diabetes mellitus	Yes	47	26.6
	No	130	73.4
Hypertension	Yes	55	31.1
	No	122	68.9
Smoker	Yes	32	18.1
	No	145	81.9

TABLE 1: DEMOGRAPHIC AND CLINICAL CHARACTERISTICS OF PATIENTS (N = 177)

Variable	Category / Statistic	Frequency (n)	Percentage (%)
Type of collection	Liver abscess	56	31.6
	Postoperative collection	46	26.0
	Peripancreatic	42	23.7
	Pelvic/deep	15	8.5
Wound infection	Yes	16	9.0
	No	161	91.0
Leak	Yes	7	4.0
	No	170	96.0
Successful drainage	Yes	152	85.9
	No	25	14.1

TABLE 2: TYPE OF COLLECTION AND POST-PROCEDURAL OUTCOMES (N = 177)

Variable	Category	Success Yes n (%)	Success No n (%)	p-value (Chi-Square / Fisher Exact)
Age (years)	20-50	110 (72.4)	19 (76.0)	0.705*
	>50-75	42 (27.6)	6 (24.0)	
Gender	Male	89 (58.6)	12 (48.0)	0.323*
	Female	63 (41.4)	13 (52.0)	
Abdominal pain	Yes	120 (78.9)	22 (88.0)	0.418**
	No	32 (21.1)	3 (12.0)	
Nausea	Yes	61 (40.1)	13 (52.0)	0.282**
	No	91 (59.9)	12 (48.0)	
Vomiting	Yes	40 (26.3)	6 (24.0)	1.000**
	No	112 (73.7)	19 (76.0)	
Fever	Yes	61 (40.1)	10 (40.0)	1.000**
	No	91 (59.9)	15 (60.0)	
Constipation	Yes	25 (16.4)	3 (12.0)	0.770**
	No	127 (83.6)	22 (88.0)	
Diarrhea	Yes	30 (19.7)	12 (48.0)	0.004**
	No	122 (80.3)	13 (52.0)	
Diabetes mellitus	Yes	40 (26.3)	7 (28.0)	0.860*
	No	112 (73.7)	18 (72.0)	
Hypertension	Yes	48 (31.6)	7 (28.0)	0.720*
	No	104 (68.4)	18 (72.0)	
Smoker	Yes	27 (17.8)	5 (20.0)	0.782**
	No	125 (82.2)	20 (80.0)	
Type of collection	Liver abscess	47 (30.9)	9 (36.0)	0.529*
	Post-operative	42 (27.6)	4 (16.0)	
	Peripancreatic	35 (23.0)	7 (28.0)	
	Pelvic/deep	14 (9.2)	1 (4.0)	
Guidance method	Ultrasound	112 (73.7)	16 (64.0)	0.316*
	CT	40 (26.3)	9 (36.0)	
Wound infection	Yes	13 (8.6)	3 (12.0)	0.704**
	No	139 (91.4)	22 (88.0)	
Leak	Yes	7 (4.6)	0 (0.0)	0.595**
	No	145 (95.4)	25 (100.0)	

TABLE 3: ASSOCIATION OF DEMOGRAPHIC AND CLINICAL VARIABLES WITH SUCCESSFUL IMAGE-GUIDED DRAINAGE (N = 177)

*Chi square test **Fisher Exact Test

DISCUSSION:

The present study evaluated the outcome and determinants of success of image-guided percutaneous drainage for intra-abdominal fluid collections in 177 patients treated at a tertiary care center. Our results reveal a very high success rate

accounting for 85.9% and established that the technique is highly effective and minimally invasive. Most of the cases undergo ultrasonographic/CT guidance with reduced risk of complications highlighting the safety and clinical

reliability of the procedure in diverse population settings.

Our findings are also consistent with other previous studies documented that image-guided percutaneous drainage has widely replaced open surgical drainage in majority of the cases of abdominal collection because of its comparable efficacy and significant lower risk of morbidity. Meazher et al. (2017) in a previous study reported a successful drainage rate in 85.4% of cases, with no significant complications, concluding that it is a safe and effective alternative to surgical intervention.¹² The study also highlighted the role of radiologic assessment to determine the optimal catheter type and path, findings that are consistent with the procedural steps adopted in the present study, including the Seldinger technique and real-time imaging for needle and catheter placement.

Similarly, another study by Maradi et al. (2025) revealed a higher success rate i.e. 84.4%.¹³ The researchers concluded that most of the abscesses were hepatic in origin, which parallels the distribution, where liver abscesses constituted the largest subgroup (31.6%). Both trials reinforce that image-guided percutaneous drainage achieved a higher rate of cure with minimal procedural risk, even in resource-constrained environments.

Bua-ngam and others in (2017) also revealed comparable results by reporting 80% success rate for postoperative intra-abdominal collections managed with percutaneous drainage.¹⁴ They pointed out key predictive factors for failure of the procedure including biliary fistula, subhepatic collection location, small size of catheter (<12 F). Although these were not significant statistically in this study, however, a similar trend was noted—fecal contamination or collections with bile and complex postprocedure cavities had reduced success rates.

Ukweh et al in 2023 from Tanzania provided compelling comparative data between percutaneous and operative drainage.¹⁵ They reported 100% technical success for operative drainage for percutaneous drainage in addition to no complication rate whereas operative drainage had 64.5% success and 32.3% mortality. This significant difference emphasizes the superiority of

minimal invasive approaches and its safety. Our findings echoes these results by computing higher success rate reduced risk of complications i.e. wound infection in 9% and 4% leakage only.

Kuhelj and Langel in 2024 reported success rates exceeding 80% with minimal complications in the pediatric population.¹⁶ Their trial is in agreement that image-guided percutaneous abscess drainage is not only safe for the adult population but also in children, with the similar advantages of faster recovery and shorter hospital stay. This comparative efficacy among all age and population groups endorses that the success of this technique depends on more careful case selection and technique instead of demographics of the patients.

Our mean age of the patients was 44.47±11.12 years which is closely matched with the finding of Maradi et al i.e. 46 years¹³ and another study by Meazher et al showing 42 years.¹² This similarity reaffirms that the middle-aged adult population are the most affected population, possibly due to higher rate of postoperative complications, hepatobiliary infections and other metabolic comorbidities in this group of age. We also found slight male predominance i.e. 57.1% is also in agreement with the previous data where male to female ratio was between 2:1 and 3:1.^{13,14} The possible reason may be due to lifestyle factors including alcoholic use and smoking while occupational exposure which may predispose male population to gastrointestinal and hepatobiliary infections.

Regarding clinical presentation, abdominal pain, nausea, and fever were the predominant symptoms, mirroring the findings of Maradi et al¹³ and Bua-ngam et al.¹⁴ The presence of systemic inflammatory symptoms in the majority of cases reflects the infectious etiology of the collections. Surprisingly, diarrhea was documented as a statistically significant association with reduced procedural success rate i.e. ($p = 0.004$), however, it is not previously highlighted in the literature. It may be explained by the remarkable likelihood of diffuse peritoneal contamination or enteric fistulization in diarrhea cases that may complicate complete drainage and prolong cavity healing.

Other comorbid conditions including hypertension (31.1%) and diabetes mellitus (26.6%) were common in the study participants. In diabetic cases immune response is impaired and wound healing is delayed which affects good outcome. However, our study findings reveal insignificant association relating to these co-morbidities. The predominance of postoperative and liver abscesses in our trial mirrors international and regional epidemiologic patterns.¹²⁻¹⁴ Similar findings have been reported in Tanzanian and pediatric series,¹⁵ reinforcing that postoperative and hepatobiliary pathologies represent the leading etiologies of intra-abdominal collections globally.

The mean drain volume in this study was calculated as 321.6 ± 86.2 ml, is in agreement with earlier trials, however, due to differences in etiology variation exists in intervention timings and abscess size. The duration of catheterization was computed as 3.1 ± 1.4 days while the hospital stay as 3.0 ± 1.7 days capitalized the efficacy and efficiency of the procedure. Similarly, Maradi et al¹³ and Kuhelj & Langel¹⁶ recorded short catheter dwell times (3 to 5 days) and rapid recovery duration, pointing out that early mobilization and discharge is possible with adequate antimicrobial therapy and adequate drainage.

Our study showed a higher rate of complete resolution without the need of surgery i.e. 85.9% whereas 14.1% cases were in need of operative drainage. Except diarrhea, no clinical/demographic characteristics had a significant association with successful outcome. A previous study by Bua-ngam et al¹⁴ recognized size of catheter, subhepatic location, and presence of biliary fistula as predictors of failure; these findings provide a useful framework for clinical decision-making. Larger catheters size (> 12 F) are more effective for viscous or multiloculated collections, while smaller catheters may become obstructed, reducing drainage efficacy. In the current study, most procedures employed 12–16 F catheters, likely contributing to the high success rate observed.

Another important consideration is the selection of imaging modality. Both ultrasonography and computed tomography (CT) are used in previous literature. Using CT benefits superior visualization

for evaluation of deep/complex abscesses, however US provides cost-effectiveness, real-time guidance, and portability. Maradi et al¹³ and Kuhelj & Langel¹⁶ endorsed US as the first-line modality, with CT reserved for anatomically challenging sites. Adopting this hybrid approach may explain the absence of major complications.

In our study, complications rate was remarkably low i.e. 9% of the cases developed wound infection whereas 4% had leak formation which is close to the finding by Meazher and others¹² and Ukweli et al,¹⁵ both of the studies reported negligible/no procedure-related complications in their trials. It also reflects careful selection of patients, attributed to follow strict protocols, and proper radiologic guidance. By using local anesthesia and minimal invasive route further increases patients' comfort and safety and is also helpful in reducing prolonged hospitalization.

The generalized overview of our findings reveals that image-guided percutaneous drainage being the choice of treatment for intra-abdominal fluid collection/abscess particularly when the procedure is performed under experienced supervision and early. Another aspect of the advantage of this procedure is that it is suitable in poor surgical candidates not fit for general anesthesia in addition to cost-effectiveness. This is in support of various other studies,¹⁴⁻¹⁷ who advocate accelerated recovery, reduction of surgical trauma, and permits simultaneous diagnostic sampling for microbiologic and cytologic evaluation.

Though our study was comprehensive, certain limitations are acknowledged. Firstly, it was a single center study, which emphasizes that the results may not be generalized in all settings and need authentication through multicenter trials. Secondly, long-term follow-up data may further clarify for recurrence or late complications. Moreover, a detailed/in depth microbiologic profile was not analyzed which may provide insight optimization of antibiotics and pathogen-specific outcomes.

CONCLUSION:

The results of our study are evident that image-guided percutaneous drainage is an effective, safe

and minimally invasive technique while dealing with intra-abdominal fluid collection/abscesses. The reported higher success rate of 85.9%, reduced complications rate and shorter hospital stay is closely aligned with other international trials. The success of the technique is widely independent of clinical/demographic variables highlighting that proper imaging guidance, early intervention and appropriate selection of catheter are the potential determinant of advantageous outcomes. However, it must be considered as a first-line therapeutic approach for drainage of intra-abdominal fluid collections/abscesses in low resource health care settings.

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