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# Image-Guided Percutaneous Drainage of Intra Abdominal Fluid Collections and Abscesses: A Hospital Based Prospective Study

*Wani RA[1]*, Digra NC[1] and Gupta K[2]*

[1]Department of General Surgery, Government Medical College Jammu, India

[2]Department of Radiodiagnosis, Government Medical College Jammu, India

## Abstract

**Aim:** To study demographic and clinical profile of patients presenting with intra-abdominal collections/abscesses and feasibility of image-guided percutaneous drainage as temporarizing measure or definitive treatment.

**Material and Methods:** This is a prospective study of all the patients of intra abdominal collections or abscesses presenting to a surgical unit in a tertiary care hospital of a developing country. Image-guided Percutaneous Drainage (PCD) was offered as initial treatment modality and results were analyzed.

**Results:** Around 90% of intra-abdominal collections in our study comprised of liver abscesses, postoperative collections and peripancreatic collections following acute pancreatitis. Majority of postoperative collections resulted from surgeries performed in emergency settings. Overall success rate of 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.

**Conclusion:** Image-guided percutaneous drainage is the least invasive drainage procedure for intra abdominal collections/abscesses with fairly good success rate. PCD coupled with directed antibiotic therapy can replace conventional open or laparoscopic modalities in majority of such cases. Moreover PCD can act as a temporarizing measure in critically ill patients with comorbidities, often deemed unfit for general anesthesia.

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***Correspondence:***

*Reyaz Ahmad Wani, Department of General Surgery, Government Medical College Jammu, India, E-mail: wani.riaz@gmail.com*

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## Introduction

Abnormal fluid collections represent a wide range of pathologies including abscesses, cysts, pseudocysts, lymphoceles, seromas, biliomas, hematomas and urinomas. Intra-abdominal collections can be broadly classified as visceral and non-visceral; intraperitoneal and extra peritoneal; spontaneous and post-operative. Visceral abscesses are caused by hematogenous or lymphatic dissemination of bacteria to a parenchymatous viscus [1]. Non-visceral abscesses arise following resolution of diffuse peritonitis in which a loculated area of infection is effectively localized by peritoneal defenses [2]. Intraabdominal abscesses and fluid collections are highly variable in clinical presentation that ranges from asymptomatic to features of septicemia and shock. Abdominal pain, fever with or without rigors and chills, anorexia, jaundice, weight loss and gastrointestinal dysfunction in the form of diarrhea, constipation and abdominal dysfunction are the common symptoms. Collections in certain locations give rise to discrete symptoms like shoulder pain, hiccups, respiratory distress and cough in subphrenic collections; frequent urination or dysuria and tenesmus in pelvic abscesses; hip deformity in psoas abscesses. Postoperative fever, disproportionate abdominal pain and distension are early indicators of postoperative collections. Tachycardia, tachypnoea, abdominal tenderness or abdominal lumps are the usual signs. Ultrasonography and CT scan help in quantification and localization of collection. Treatment options include conservative with antibiotics and supportive measures or surgical drainage by percutaneous or open method. Appropriate management depends on clinical presentation, location and size of collection, type of collection, response to medical management and the presence of complicating factors like fistulae, septations and viscosity.

Image-guided Percutaneous Drainage (PCD) of abdominal collections and abscesses has become the treatment of choice for majority of cases regardless of etiology. The procedure is technically

easy, reproducible and cost-effective, with the advantage of being performed under local anesthesia. PCD is thus feasible for critically ill patients who are unfit for general anesthesia. PCD has replaced the traditional method of drainage of abdominal collections in most of the patients and has also been used as a temporarizing measure in critically ill patients. The later subsets of patients undergo definitive procedure after initial stabilization.

## Material and Methods

The prospective study was conducted on patients admitted from 1st November 2013 till 31st October 2014 in the Department of General Surgery, Government Medical College, Jammu, India in collaboration with the Department of Radiodiagnosis, Government Medical College Jammu India. The patients with clinical suspicion of intra-abdominal collection/abscess were subjected to baseline investigations in the form of complete blood count, renal function tests, urine microscopy, liver function tests, coagulogram, HIV and hepatitis B and C serology. This was followed by radiological investigations like chest X-ray, ultrasonography of abdomen and if required CT scan of the abdomen. The patients with ultrasound or CT documented collections/abscesses were assessed for image-guided percutaneous intervention as per the following inclusion and exclusion criteria:

### Inclusion criteria

Abnormal fluid collection and one of the following:

Suspicion that the fluid is infected.

Suspicion that the collection is producing symptoms sufficient enough to warrant drainage.

Refractory to medical treatment.

Temporizing maneuver to stabilize the patient's condition before definitive surgery.

### Exclusion criteria

Significant coagulopathy that cannot be adequately corrected.

Lack of safe pathway to the abscess or fluid collection.

Inability of the patient to cooperate with, or to be positioned for the procedure.

Refusal of the patient for the procedure.

Abscess was precisely delineated and a safe route from skin to abscess cavity was identified by ultrasound. The optimum access route was determined by the following:

Shortest safe pathway.

Easiest angulation or localization.

Avoidance of intervening or adjacent structures like bowel, major blood vessels or pleural cavity.

Most convenient catheter location for the patient.

For a solid organ abscess like liver, access path should traverse a small amount of normal organ to reduce the risk of spillage and bleeding.

The procedure was carried out under all aseptic precautions, under local lidocaine anesthesia with or without sedation and under imaging (USG/CT) guidance. Diagnostic aspiration using 18 or 20 gauge needle was the first step done once the needle has been inserted up to the centre of the collection under image-guidance. Only about 5 ml of collection/abscess was drained to avoid collapsing cavity walls prematurely. This was followed by introduction of a flexible 'introducer guidewire' (0.035 inch). The tract was dilated over the guidewire by serial 6 F to 14 F dilators depending on the size of the catheter. At this stage, the introducer guidewire was removed and exchanged for a catheter, a pig-tail or a malecot (12 F to 16 F), using seldinger technique. Once in position, the catheter was secured and attached to a drainage bag. Aspirated sample of collection was sent for Gram staining, culture sensitivity, and/or biochemical and cytological evaluation. Injectable broad-spectrum antibiotics were started and modified as per culture sensitivity results.

Drainage was recorded daily and the response to treatment assessed by clinical and laboratory parameters and also by serial ultrasound. Normal saline was used for irrigation, whenever required. The patients were discharged with clinical improvement; in ambulatory state, tolerating proper diet and oral antibiotics. Patients were assessed for catheter removal using the following criteria:

### Clinical criteria

Defervescence.

Decreased counts.

Improved appetite and overall condition.

### Radiological criteria

Significant decrease in size on follow up imaging.

No evidence of loculation or multiple collections.

### Catheter criteria

Decreased drainage.

Clearing of contents.

The procedure was considered successful if the patient was cured without the need for surgical drainage. Patients wherein open drainage was needed were labeled as failures. In a subset of patients, PCD acted as a temporarizing measure before safe definitive procedure could be done at a later stage. Such patients were called partial success. After catheter removal, patients were followed up for three months.

## Observation and Results

A total of ninety patients (75 male and 15 female) in age group ranging from 22 years to 94 years, were subjected to PCD. Major chunk of patients comprised of liver abscesses (64%), followed by post-operative collections (17%), Pancreatic pseudocyst/collections (8%), Gall bladder perforation with localized collections (3%), Appendicular abscess (3%) and others (5%). Majority of liver abscesses were confined to right lobe (38 out of 58). Out of the 15 postoperative collections, 5 followed LSCS, 4 occurred after emergency surgery for duodenal ulcer perforation, 2 each after laparoscopic cholecystectomy and open appendectomy, 1 each after emergency splenectomy and hepatorrhaphy for hemoperitoneum (post blunt trauma abdomen). Abdominal pain and fever were the most common symptoms and tenderness was the most important sign.

16 patients were critically ill with or without underlying comorbidities (Table 2). These included 6 patients of severe acute pancreatitis, 5 patients of liver abscess, 3 patients of post-operative collection and 2 patients of gall bladder perforation. PCD dramatically

**Table 1:** Clinical profile of patients.

| Nature of collection | N | % (N=90) | Clinical features | Other characteristics | Average volume drained (ml) | Average hospital stay (days) | Average catheter duration (days) |
|---|---|---|---|---|---|---|---|
| Liver Abscess | 58 | 64.4 | Abdominal Pain=53, Fever=50, Right hypochondric tenderness=52, Hepatomegaly=45 | Lobar distribution: Right=38, Left=7, Bilateral=13<br>Number of abscesses: Single=44, Multiple=14 | 685 | 7.5 | 15.5 |
| Post-operative collection | 15 | 16.6 | Abdominal pain=15, Fever=12, Abdominal distension=9, Constipation=5, Loose stools= 8, Tenderness=14, Pallor= 9 | Antecedent surgery: LSCS=5, Laparotomy for DU perforation=4, Laparoscopic cholecystectomy=2, Open appendectomy=2, Splenectomy and hepatorrhaphy for BTA= 1 each | 450 | 8.5 | 20 |
| Peripancreatic collections | 7 | 7.7 | Abdominal pain=7, Vomiting=6, Abdominal distension=5, Fever=2, Respiratory distress=2, Tenderness=7 | All had severe acute pancreatitis | 1015 | 12 | 26 |
| GB perforation with localized collection | 3 | 3.3 | Abdominal pain=3, Fever=3, Vomiting=2, Localized tenderness=3 | - | 167 | 9 | 19 |
| Appendicular abscess | 3 | 3.3 | Abdominal pain=3, Vomiting=3, Fever=3, Tenderness=3, Loose stools=2 | - | 165 | 6 | 14 |
| Others | 4 | 4.4 | Abdominal pain=4, Fever=3, Vomiting=3, Local tenderness=4 | - | - | - | - |

**Table 2:** Comorbidities/complicating factors in critically ill patients (n=16) and outcome with PCD.

| Nature of collection | Case No. | Comorbidities/Complicating factors | Outcome of PCD |
|---|---|---|---|
| Peripancreatic collection | 1 | Septicemia | 1,2,3,4,5 and 6 improved |
| | 2 | Gastric outlet obstruction with severe anemia | |
| | 3 | Severe acute pancreatitis with shock | |
| | 4 | Severe acute pancreatitis | |
| | 5 | Severe acute pancreatitis | |
| | 6 | Severe acute pancreatitis | |
| Liver abscess | 1 | T2DM with shock | 1 died; 2,3,4 and 5 improved |
| | 2 | Hypertension with COPD | |
| | 3 | Hypertension with T2DM | |
| | 4 | Severe anemia | |
| | 5 | ARF | |
| Post operative collection | 1 | Septicemia | 1,2 and 3 improved |
| | 2 | Septicemia | |
| | 3 | Severe anemia | |
| GB perforation with localized collectionm | 1 | Hypertension with CCF | 1 and 2 improved |
| | 2 | T2DM | |

changed the course of illness in 15 of them while one patient died due to decompensated septic shock.

70 patients had hemoglobin of less than 10 g/dl while 56 had total leukocyte count of 10,000 or more. Pus culture grew organisms in only 18 patients, majority of them being liver abscesses (15). Most common organism isolated was *E. coli* (8), followed by *Klebsiella* (5), *Pseudomonas* (2), *Acinetobater* (1) and Candida (1).

Average volume drained was 685 ml in liver abscess, 450 ml in post-operative collections, 1,015 ml in pancreatic pseudocyst/ collection, 167 ml in gall bladder perforation and 165 ml in appendicular abscesses. Average hospital stay after catheter insertion was 7.5, 8.5, 12, 9 and 6 days for liver abscess, post-operative collection, pseudocyst pancreas, Gb perforation and appendicular abscess, respectively. Overall mean hospital stay was 7.9 days ± 3 days. Mean catheter days were almost double the average hospital stay (Table 2).

Out of 90 patients who underwent PCD, one patient died. Besides this, there were 6 complications which include three residual collections, one catheter blockage, and one bowel injury during catheter insertion and one persistent drainage. Two of the residual collections were drained percutaneously while one needed open drainage. Besides this, the procedure failed to drain two liver abscesses and one post-operative collection that were treated by open drainage. The complications of catheter blockage and gut injury were treated by open method. In one patient, spontaneous bilioma was drained but due to persistent drainage of bile, was subjected to Endoscopic Retrograde Cholangiopancreatography (ERCP). One patient of pancreatic pseudocyst was discharged on request after catheter insertion and was lost to follow up.

55 liver abscesses were successfully drained and needed no

**Table 3:** Final outcome of PCD.

| Nature of collection | N | Success | Partial success | Failure | Death | Lost to follow up |
|---|---|---|---|---|---|---|
| Liver abscess | 58 | 55 | 0 | 2 | 1 | 0 |
| Post operative collection | 15 | 13 | 0 | 2 | 0 | 0 |
| Peripancreatic collection | 7 | 5 | 0 | 1 | 0 | 1 |
| GB perforation with localized collection | 3 | 0 | 3 | 0 | 0 | 0 |
| Appendicular abscess | 3 | 0 | 3 | 0 | 0 | 0 |
| Spontaneous bilioma | 1 | 0 | 1 | 0 | 0 | 0 |
| Splenic abscess | 1 | 1 | 0 | 0 | 0 | 0 |
| Others | 2 | 2 | 0 | 0 | 0 | 0 |
| Total | 90 | 76 | 7 | 5 | 1 | 1 |
| Percentage | 100 | 84 | 8 | 6 | 1 | 1 |

further intervention; while the procedure failed in 2, who were later on subjected to open drainage. Both of them were complex liver abscesses. Amongst the 15 post-operative collections, 13 were successfully drained. Five pancreatic fluid collections were successfully treated. Procedure failed in one and yet another was lost to follow up. In 6 patients, PCD stabilized the patients for elective (definitive) surgery which included 3 gall bladder perforations and 3 appendicular abscesses (Table 3).

## Discussion

The mainstay of treatment of intra-abdominal abscesses and collections is drainage. The traditional method of open drainage has been superseded by image-guided percutaneous method and the indications of PCD are still expanding due the development and refinement of techniques. Thus compared to initial 40%, up to 90% abdominal abscesses can now be subjected to PCD [3]. In fact the initial success in simple abscesses has encouraged its use in complex abscesses/fluid collections like multiple and multilocular abscesses, infected pseudocysts and acute fluid collections, splenic abscesses and abscesses with fistulae.

Compared to conventional treatment, ultrasound-guided drainage is an easy, gentle and relatively atraumatic procedure with few complications. General anesthesia is unnecessary, the patients are mobile immediately and the risk of pulmonary infections and thromboembolism is minimized. The other advantages are easier nursing care, less morbidity with shortened hospital stay and less cost. Further in moribund patients, PCD would be the only method available.

In the present study, a total of 90 patients were subjected to image-guided PCD. Imaging modality used was ultrasonography in 89 patients. Only in 1 patient, where ultrasound had difficulty delineating the safe route of access, CT was used for guidance. Ultrasound allows a rapid searching of intra-abdominal collections even in extremely ill patients. Haaga and Weinstein preferred CT over ultrasound [4]. Gerzof et al. [5] consider CT and USG complementary rather than competitive, the former better for localization of abscess and route planning (as bowel gas or bone does not hamper it) and the later for catheter placement (as imaging and sector plane flexibility are achieved simultaneously). Civardi et al. [6] preferred USG-guided PCD of abdominal abscesses over other imaging techniques due to its high clinical efficacy and safety and low cost.

Liver abscess, being a major tropical disease of the gastrointestinal system, comprised roughly 64% of cases in our study. The liver abscess is mainly classified as amoebic and pyogenic. Liver abscess is 3 to 10 times more common in men. In our study, 52 were male and 6 were female making a male to female ratio of 8.6:1. Isolated right lobe was involved in 38 cases (65.5%) and left lobe in 7 cases (12%). Bilobar abscesses were present in 13 cases (22.5%). These findings are similar to Huang and associates (1996). We encountered multiple liver abscesses in 14 cases (24%), similar to 20% to 25% incidence reported by Sharma et al.

The most common symptoms in liver abscess patients were abdominal pain (91.4%), followed by fever (86%), rigours/chills (29%) and nausea/vomiting (20%). The main signs were tenderness in right hypochondrium (89.6%) and hepatomegaly (77.6%). These results are similar to those of Chiu et al. [7], Barnes et al. [8] and Singh et al. [9].

In our study the final outcome of PCD was designated as success, partial success or failure. The definition of each is in accordance with quality improvement guidelines for percutaneous drainage/aspiration of abscesses and fluid collections by Wallace et al. [10]. Seventy six (84.4%) patients were successfully drained by percutaneous method in our study. Partial success was achieved in 7(7.7%) patients and the procedure failed in 5 (5.5%) patients, which subsequently needed open drainage. The results are similar to those of Larneris et al. [11], and Wallace et al. [10]. Similar failure rates were reported by others like Kumar et al. [12] (3%), (3.7%) and Lagana et al. [13] (8.4%).

The success rate of individual abscesses/collections is liver abscess 94.8% (55 out of 58), Post-operative collections 86.6% (13 out of 15) and pancreatic pseudocyst/acute fluid collections 71.4% (5 out of 7). Various published studies have favored our results have reported success rate of more than 95% in liver abscess. The successful result of PCD of infected pancreatic fluid collections has ranged from 65% to 96% in the literature had reported a success rate of 95.7% in post-operative collections. However, observed a success rate of 67% to 86% in PCD of post-operative abscesses.

Overall mortality of 0% to 3% after PCD in literature is consistent with the mortality of 1.1% in our study.

There were 6 procedure related complications in the present study, comprising a complication rate of 6.6%. The complications include residual collections (3), gut injury (1), persistent drainage (1) and catheter blockage (1). Most large series report complications varying from 0% to 15%, which is consistent with our study.

## Conclusion

Image-guided percutaneous technique is simple, cost-effective

and less traumatic method of draining intra-abdominal abscesses and fluid collections. Lesser complications and shorter hospital stay are other advantages. It avoids the risks of general anesthesia, thus the only method available for critically ill and moribund patients. PCD coupled with proper antibiotic therapy cures majority of liver abscesses. In post-operative abdominal collection, it is highly undesirable to subject the patients to yet another surgery to get him/her rid of the collection resulting from index surgery. PCD has emerged as the method of choice for draining such collections. The role of PCD is also getting established in symptomatic huge pancreatic pseudocysts and acute fluid collections in critically-ill patients of acute pancreatitis, where it can help stabilize the patient. Same is true for perforated gall bladder with localized collection and appendicular abscess. Definitive treatment can be offered at a later date in such circumstances. Most of the times procedure can be performed under ultrasound guidance, which is readily available, cost-effective and without radiation hazard. These advantages also make ultrasonography very useful tool for follow up after drainage. Patients can be discharged soon after the procedure along with the draining catheter to minimize the risk of hospital acquired infections and further decrease the cost of treatment.

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