The Egyptian Journal of Radiology and Nuclear Medicine (2013) **44**, 223–230

Egyptian Society of Radiology and Nuclear Medicine

The Egyptian Journal of Radiology and Nuclear Medicine

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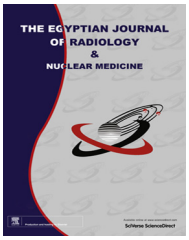

ORIGINAL ARTICLE

Percutaneous image-guided aspiration versus catheter drainage of abdominal and pelvic collections

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Received 14 January 2013; accepted 18 March 2013
Available online 13 April 2013

KEYWORDS

CT;
Ultrasound;
Aspiration;
Catheter;
Drainage;
Abdominal–pelvic fluid collections

Abstract *Purpose:* Intra abdominal and pelvic fluid collection is a serious problem that requires drainage. The goal of our study was to report our experience and evaluate the feasibility, safety and outcome of percutaneous image-guided aspiration versus catheter drainage of abdominal and pelvic collections.

Patients and methods: This is a retrospective study of 84 patients (45 males and 39 females of mean age 45.1 + 16.9 years) who have intra abdominal or pelvic collections and have a good coagulation profile. Small (< 5 cm) collections were treated by aspiration. Continuous catheter drainage was applied to failed aspirations or large collection.

Results: 112 Drainage procedures were carried out in 84 patients guided by either ultrasound or CT. Aspirations of 31 collections were carried out in 22 patients, and 81 catheters (8–10 French) were inserted in 66 patients. Four patients had both aspirations and catheters. The collections were either sterile or pus. Median diameter of aspirated collections was 4.2 cm (3–5 cm) compared to 7.2 cm (6–12 cm) of those treated by catheters $P < 0.05$. Technical success was 100% in both aspiration and catheter insertion using the Seldinger technique but it was 87% with the trocar technique. Clinical success rate for aspiration was 94% ($n = 29$) but increased to 100% after catheter insertion and that of catheter was 95%. No major complications were encountered.

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Peer review under responsibility of Egyptian Society of Radiology and Nuclear Medicine.

ELSEVIER Production and hosting by Elsevier

http://dx.doi.org/10.1016/j.ejrnm.2013.03.002

Conclusion: Image-guided drainage of abdominal and pelvic collections is safe and effective and can avoid surgery in selected patients. Aspiration should be tried before catheter insertion. Careful catheter selection for trochar technique is important.

1. Introduction

Percutaneous drainage is an effective treatment and considered the standard therapy for abdominal and pelvic fluid collection or abscesses in the absence of indications for immediate surgery with appropriate antibiotic therapy (1,2). It is curative in 80–90% of cases (3). Interventional radiologists can gain safe access to abdominal or pelvic fluid collections or abscesses guided by imaging (4,5). However there is still a debate about which is better, aspiration alone or continuous catheter drainage. Some authors believe that aspiration and lavage of abscess or collection is as effective as catheter drainage and it is less invasive and avoids the daily maintenance of catheter and has less complication and easily manipulated and repositioned especially in focal parenchymal organs (6). Other authors believe that continuous percutaneous catheter drainage (CD) is more efficient than intermittent percutaneous needle aspiration. Intermittent percutaneous needle aspiration is a valid alternative for abscesses 50 mm or less in longest diameter. CD is more efficient for multiloculated liver abscesses (7,8).

1.1. Objective

The purpose of this study is to report our experience with image-guided aspiration versus CD of abdominal and pelvic collections and to evaluate aspiration as an initial step in the management of abdominal and pelvic collection and role of continuous CD.

2. Patients and methods

This retrospective study included all patients with intra abdominal or pelvic fluid collections who underwent percutaneous aspiration or catheter drainage in our institution from July 2010 to May 2012. The institutional review board has approved the study. Preprocedure, written informed consents were obtained from all the patients. Prothrombin time, partial thromboplastin time and platelet count were checked and corrected promptly before the procedure.

The diagnosis of abscess or fluid collection was suspected by ultrasound or CT scan. The diagnosis was confirmed by aspiration of fluid that was sent for chemical and bacteriological tests and gram stain, culture and sensitivity and serological tests for amebiasis. Aspiration guided by either ultrasound or CT, without catheter placement was carried out if the collection is 5 cm or less in its longest diameter. An 18 gauge disposable trocar needle is used for aspiration till no further fluid could be aspirated. Ultrasound (US) exam was performed every 3 days. If there was no significant reduction in the abscess cavity or reaccumulation, aspiration was repeated. Repeated aspiration was attempted a maximum of four times for each patient. Lack of response to the fourth aspiration attempt was considered failure of treatment, and a catheter for continuous drainage was inserted. US was the imaging modality of choice when feasible using either 3–5 MHz convex transducer of Siemens SONOLINE or GE logic C5 premium Ultrasound system. Either the classical Seldinger technique or the Tandem trocar technique was used for catheter insertion. Prophylactic antibiotic was administered one hour before the procedure for patients who are not already receiving antibiotic. 1 g of Ampicillin and 80 mg of Gentamicin were administered IV. Consciously sedation was not used. The skin entry site was prepped and draped in the sterile surgical fashion. After having precisely located the abscess on ultrasound or CT, the staff attending radiologist determined the safest access pathway and local anesthesia was provided accordingly. All collections were accessed percutaneously. Extra-peritoneal approach was preferred whenever possible. The route was either anterior transabdominal or pelvic (Fig. 1) or posterior paraspinal or transgluteal (Fig. 2) for deep inaccessible pelvic collections.

2.1. Classic Seldinger technique

The collection was punctured by an 18-gauge needle under sonographic or CT guidance depending on the location of the abscess. A small quantity of fluid was aspirated and sent for lab as mentioned. A 0.035 inch guide wire was inserted guided by CT or US. 8 or 10 Fr. Pig tail catheter (Flexima hydrophilic coated multipurpose drainage catheter: Boston scientific, USA) or Polyurethane pig tail 8 or 10 Fr. (Genoflex: Genesis Medical, England) was advanced after track dilatation with gradual serial dilators. Once the catheter was in good position, it was sutured to the skin. Maximal aspiration of pus was initially performed in the intervention suite, and the abscess was then allowed to drain by gravity. Four irrigations per day with 10 ml of saline and monitoring of the drain were prescribed. Daily care of the catheter was provided by the interventional radiology team as regards the output and flushing and decision of withdrawal. Follow-up imaging was performed depending on the clinical circumstances. Catheter withdrawal was decided when fever subsided and daily catheter output was reduced to less than 10 ml, provided that the catheter was not clogged and CT scan confirmed the absence of significant residual collection.

2.2. Tandem-trocar technique

An initial diagnostic scan was obtained with the skin marker in place. The distance and angle of trajectory of the abscess from the skin was measured by using a safe approach. A 20-gauge needle was inserted into the collection under CT guidance. Small amount of collection was aspirated and sent for lab studies. Care was taken not to decompress the abscess cavity before catheter insertion. The accurate depth of the abscess cavity was determined. The catheter brand and sizes were identical to that used with the Seldinger technique. Drainage catheter was assembled. The depth of the abscess cavity was marked on

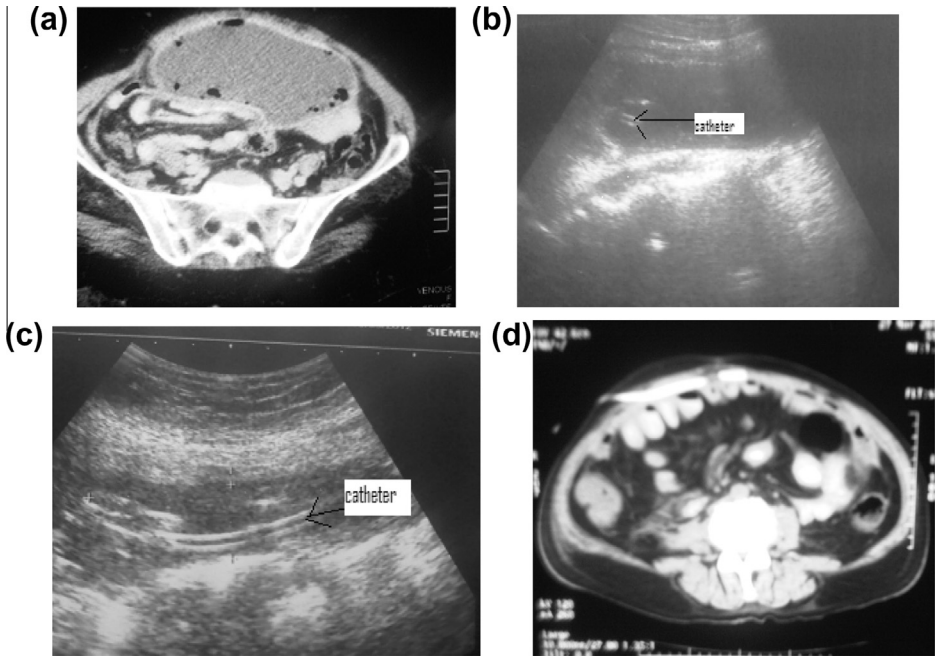

Fig. 1 65 Year old woman presented with high fever and pain and tenderness at the lower abdomen with diarrhea. (a) Contrast enhanced CT scan for the pelvis showed pericolic encysted collection with enhanced capsule and few air bubbles. Ultrasound guided access and placement of 8 Fr. Polyurethane catheter arrow. (b) Gradual reduction of catheter output to less than 10 ml/24 h and clinical improvement in terms of pain and fever and normal leukocytic count, ultrasound exam. (c) Showed resolution of the collection and confirmed by CT scan (d).

the catheter. The catheter was placed through a skin incision close to the needle and was advanced perfectly parallel and tandem to the needle when CT was used. With the tandem technique, the catheter tip was guided to the abscess cavity by the needle. Once the catheter has reached the desired depth, the inner stylet was removed and the catheter was fed off of the metal cannula into the abscess cavity. Final CT scans confirmed the final position of the catheter within the cavity. Complete evacuation of the cavity was carried out. When the collection is accessible by US, a 20 gauge Chiba needle was removed and free hand insertion of the assembled catheter within the collection was carried out in a single step. Catheter care and withdrawal decisions were identical to that with the Seldinger technique. After discharge from the hospital, patients underwent follow-up evaluation in the outpatient clinic at least once a week and biweekly until 6 months. Primary technical success was considered when the catheter successfully inserted within the collection at the first attempt. Secondary technical success was considered when a second trial with a different technique or different type of catheter was achieved. Clinical

Fig. 2 38 Year old woman presented with diffuse pelvic pain dysurea with fever of 37.5 °C and Leukocytosis ultrasound (not shown) depicted localized pelvic collection confirmed by CT, No safe window to access the collection because of bowl loops and urinary bladder anteriorly and iliac bone and sacrum posteriorly, CT guided transgluteal approach with the single step tandem trocar technique for placement of 8 Fr Flexima catheter. (b) After complete aspiration of the collection. Catheter was left in place for 7 days and catheter output reduced to less than 10 ml/day then removed.

success was considered when clinical improvement of fever and reduction of Leukocytosis and resolution of the collection were achieved and eventually the withdrawal of the catheter without the need of surgical intervention. Complications were classified as major or minor according to the Society of Interventional Radiology Criteria (9).

Data were collected and tabulated. Descriptive and analytic statistics were used. Quantitative variables were compared by the two-sample Student's t test for independent samples with adjustment carried out for unequal variances when needed using Excel 2007 software. The result considered statistically significant when P value was less than or equal to 0.05.

3. Results

The study population was 84 patients. 45 males and 39 females, mean age + SD were 45.1 + 16.9 year for males and 45.5 + 13.9 years for females. 112 drainage procedures were carried out in 84 patients. Aspiration without placement of catheter was carried out for 31 collections in 22 patients. 81 catheter drainage procedures were carried out in 66 patients. Four patients had multiple liver abscesses amebic ($n = 2$) and pyogenic ($n = 2$) managed by both aspiration and catheter drainage (Table 1).

3.1. Biloma

Aspiration without placement of catheter was carried out in two bilomas; one was a 3×3 cm cystic lesion at the gall bladder bed after laparoscopic cholecystectomy. Ultrasound (US)-guided aspiration was performed till complete resolution without recurrence. The other biloma was seen in a 21 year old man with hepatic contusion that was surgically repaired after a motor car accident. The lesion was 4×4 cm cyst seen at segment 7 of the liver, 7 days postoperative. Complete resolution of the biloma was obtained after second aspiration.

3.2. Seroma

Seroma of the anterior abdominal wall after C-section ($n = 2$) and at the gall bladder bed after laparoscopic cholecystectomy ($n = 1$) were seen. All were resolved after the first aspiration guided by ultrasound.

3.3. Urinoma

Drainage of two Urinomas in two patients was carried out. A large sized free intraperitoneal Urinoma after C-section was drained by an 8 Fr. Polyurethane catheter. The second was a small perirenal Urinoma in the patient with advanced hydronephrosis aspirated with a needle without recurrence.

3.4. Liver abscesses

17 amebic liver abscesses were seen in six patients who failed to respond to Metronidazole. The mean diameter + SD was 7.3 + 1.7 cm. Five abscesses in three patients were aspirated. The mean diameter ± SD was 5.3 ± 0.9 cm, the mean aspirated volume ± SD was 54.6 + 15.2 ml. 12 abscesses were in the right lobe and five in the left lobe. Aspiration alone was successful after the first attempt in 40% of abscesses and success has increased to 60% at the second and 80% after the third attempt ($n = 4$) and one abscess did not respond to aspiration. The abscess content was too thick to be aspirated through an 18 gauge needle. But it was successfully drained by an 8 Fr. catheter. Large Amebic abscess (> 5 cm) was managed by catheter placement (Fig. 3). 12 abscesses were drained by 12 catheters. The US-guided trocar technique is used in 10 abscesses and the CT guided tandem trocar technique in two abscesses. CT was used because air bubbles within the abscesses prevented a safe access to the lesion. Two patients were subjected to both aspiration for one abscess and CD for the other one. The abscesses/collections that were treated by CD were significantly bigger than those treated by aspiration P value < 0.0001 (Table 2). Catheter output volume (mean + DS) was 274 + 99 ml and it was higher than the aspirated volume, P value $= 0.0007$ (Table 2).

3.5. Pyogenic abscesses

Table 1 showed the details of abdominal and pelvic collections managed either by aspiration or drainage. 19 abdominal and

Table 1 Abdominal and pelvic collections both sterile and pyogenic that were treated either by aspiration or catheter drainage.

Collections		No abscesses	No pts	Diameter (cm)	No aspirated abscess	Diameter (cm)	No pt	No CD abscesses	Diameter (cm)	No pt
Pyogenic	Ilio psoas abscess	10	10	10 (8–12)	0			10	11(8–12)	10
	Infected pseudo pancreatic cyst	9	9	11(7–13)	0			9	11(7–13)	9
	Subphrenic abscess	7	7	6(5–87)	0			7	8(5–8)	7
	Para colic abscess	11	11	12(12–15)	0			11	12(7–17)	11
	Pelvic abscess	10	6	7(4–8)	3	4.3(4–5)	2	7	6(7–9)	4
	Appendicular abscess	9	9	4(3–10)	5	4(3–5)	5	4	6.7(6–8)	4
	Liver abscess	29	17	6(3–12)	10	4(3–6)	5	19	10(8–12)	14
	Perinephric abscess	2	2	6 (5–8)	1	5	1	1	8	1
Sterile	Amoebic	17	6	7(4–10)	5	5(4–6)	3	12	9(7–11)	5
	Biloma	3	2	3(3–5)	3	3(3–5)	2	0		
	Seroma	3	3	5.3(4–6)	3	5.3(4–6)	3	0		
	Urinoma	2	2	8.5 (5–12)	1		1	1	12	1
	Total	112	84		31		22	81		66

Numbers between parentheses are range, CD: catheter drainage, No pt: number of patients.

pelvic abscesses were aspirated alone without catheter in 13 patients, at the rate of 1.5 abscesses per patient. 31 catheters were inserted to drain 31 abscesses in 25 patients at the rate of 1.2 abscesses per patient. The mean size and the volume of aspirated content were significantly smaller than the lesion managed by catheter drainage (Table 2). CD was applied to large abscess as pericolic (Fig. 1), subphrenic and ilio-psoas, hepatic, appendicular, pelvic, infected pseudo pancreatic cysts, and perinephric. Two patients with multiloclular liver abscesses were treated by both aspiration sessions and CD. Technical success was achieved in all cases with the Seldinger technique; however it was 87% with the trocar technique. First attempt to insert catheter with the trocar technique was unsuccessful in 5 out of 40 procedures. All primary unsuccessful procedures were related to Polyurethane catheters (Table 3). Aspiration of simple collection like urinoma, biloma, and seroma was clinically successful in 100% of cases. Clinical success was achieved after two aspiration sessions for appendicular abscesses (Fig. 4) and three sessions for pelvic abscess and two sessions for perinepheric abscess but the success rate for aspiration of liver abscess was 80% after four sessions and increased to 100% by insertion of an 8 Fr catheter. Overall success rate for aspiration was 94% ($n = 29$) but increased to 100% after catheter insertion. The number of aspiration attempts ranged from 1 to 4. Clinical success rate for CD was 95%. CD was unsuccessful in four collections in four patients, two patients with pseudopancreatic cysts that became infected and required laparotomy for necrosectomy. The other two were paracolic abscess secondary to Crohn's disease and diverticulitis both were managed surgically. The average treatment duration + SD was 5 + 3 days for sterile collection (range 1–10 days) and that for abscess was 15 + 5 days (range 7–26 days). The average duration for abscess and collection drainage by aspiration was 6 + 3 days (range 1–11 days) and that with CD was 12 + 5 days (range 7–26 days) (See Table 4).

Complications: No major complications were encountered at aspiration or CD. Neither fatal, bleeding nor organ injury was encountered. Minor complications were bacteremia (fever and chills without hypotension) in five patients within 2 h after abscess drainage of liver ($n = 2$), ilio-psoas abscess ($n = 1$) and difficult paracolic ($n = 2$). All were lengthy and difficult procedures associated with manipulations of guide wires and catheters in the Seldinger technique ($n = 3$) and the trocar technique ($n = 2$) that failed in the first attempt followed by a successful placement of Flexima catheter in thick walled complex abscess. All patients recovered uneventfully. Catheter kink was seen in 5% of catheters ($n = 4$), 8 Fr. polyurethane ($n = 2$) and 8 Fr.Flexima ($n = 2$). They were managed by catheter exchange. Three catheters were partially dislodged but could be replaced by new catheters. Catheter insertion site infection was observed in two patients and were controlled by local antibiotic cream twice daily and resolved after catheter withdrawal.

After patients are discharged, 10 patients lost to follow up. Recurrence rate was 7% ($n = 5$). Recurrence was observed in two diabetic patients with pyogenic liver abscesses treated by aspiration alone after two and three months respectively. Both presented with small single abscess. They were treated by single aspiration and antibiotic and strict control of blood sugar without further recurrence. Three patients of the CD group showed recurrence after two, three and four months. Two cases were with paracolic abscess and the third had deep pelvic abscess.

4. Discussion

Management of abdominal and pelvic abscesses has been moving strongly toward nonsurgical methods but in many institutions, surgical intervention is still preferred by surgeons. Percutaneous catheter drainage and antibiotics are considered by many authors as the treatment of choice for most abdominal and pelvic abscesses in the absence of immediate surgical indication, primarily because this treatment avoids the risks of general anesthesia and surgery (1–4). The two basic surgical principles of abscess treatment are evacuation and prolonged drainage. Many authors investigated either aspiration or continuous drainage for liver abscess but for abdominal and pelvic collections the most commonly used technique is CD. Wroblicka and Kuligowska concluded that percutaneous needle aspiration and lavage of abdominal/pelvic abscess can be a safe, effective alternative to the more conventional treatment of prolonged catheter drainage. In selected patients, including pa-

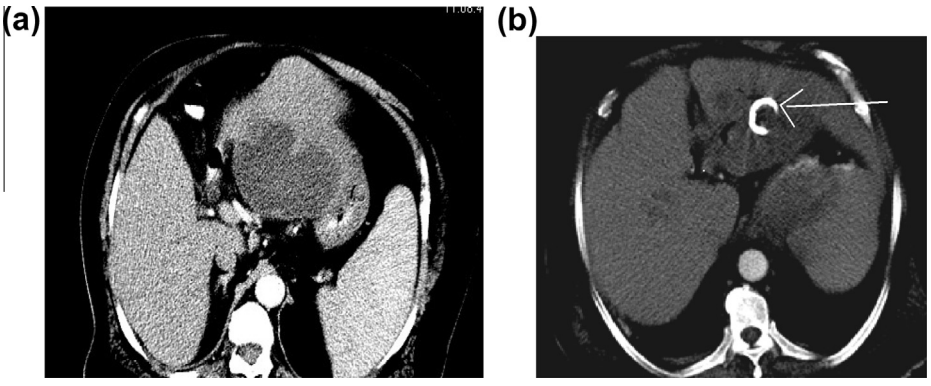

Fig. 3 75 Year old man presented with fever and pain and tenderness at the epigastric region. The patient had diabetes mellitus, hypertension and ischemic heart disease. Contrast enhanced CT showed a large left lobe liver abscess. Chocolate-colored pus was aspirated. No growth with ordinary culture media was obtained (a). Ultrasound-guided access and placement of 10 Fr. Flexima pig tail drainage catheter (b) (white arrow). Patient received Metronidazole 500 mg three times daily for 10 days with significant reduction is abscess size and minimal residual fluid collection just before discharge after clinical and laboratory improvement.

Table 2 Abscesses treated by aspiration compared to that treated by catheter drainage.

	Aspiration				Catheter drainage				
	No pt	No abscess	Diameter (cm)	Volume (ml)	No pt	No abscess	Diameter (cm)	Volume (ml)	*P* value
Pelvic abscess	2	3	4.6 (4–5) *	35 (23–40)**	4	7	6.7(5.5–8)*	57(40–70)**	0.009* 0.02**
Appendicular	5	5	3.9(3–5)	22(20–30)	4	4	6.5(6–7)	62(40–80)	0.0004 0.001
Liver	5	10	4(3–5)	32(20–50)	16	19	7.8(6–12)[a]	138(80–200)[b]	NS[a] NS[b]
Perinephric	1	1	5	30	1	1	8	90	
Total	13	19			25	31			

NS: Non significant.
* Pelvic abscess diameter.
** Pelvic abscess output volume.
[a] Liver abscess diameter.
[b] Liver abscess output volume.

Table 3 Comparison of the Seldinger and trocar techniques for catheter placement.

	Age	Gender		US	CT	No	Fle	Pol	Size Fle		Size Pol		1ry Tech success	2ry Success
		M	F						8 Fr	10 Fr	8 Fr	10 Fr		
Seldinger	23	16	10	16	10	26	14	12	11	3	8	4	26/26 100%	
Trochar	27	29	11	20	20	40	28	12	18	10	8	4	35/40 87%	40/40 100
		45	21	36	30	66	42	24	29	13	16	8	61/66 92%	66/66 100%

M: male, F: female, 1ry: primary, 2ry: secondary, Fle: Flexima, Fr: French, Pol: polyurethane base catheter, tech: technique, No: number.

tients with multiloculated abscesses, needle aspiration and lavage should be considered as the initial method of treatment of abdominal and pelvic abscesses (6). The main advantages of needle aspiration over CD include the following: Needle aspiration is less invasive and less expensive; it avoids problems related to follow-up catheter care, so less medical or nursing care is required; and multiple cavities can be aspirated in the same session (10,11). Abscesses that are smaller than 3–4 cm often cannot accommodate a catheter, and needle aspiration alone can be therapeutic (12). The more the manipulation of instruments in abscess cavity, the more the risk of septicemia is expected. Aspiration and lavage get rid of the bacteria but they have the risk of septicemia during the infusion of normal saline after complete evacuation of the abscess cavity. Although septicemia that required admission to intensive care unit was encountered in a single patient with perirenal abscess out of 72 patients who were treated by aspiration and lavage in the study of Wroblicka (6). In the other study seven (26%) of 27 patients who had abscess drainage with catheters became septic post procedure despite being on antibiotics. The authors speculated that sepsis in this setting is likely secondary to overwhelming bacteremia due to intravasation of bacteria directly into the bloodstream (13). In the other study there was 4.6% mortality after percutaneous drainage of 335 abdominal and pelvic abscesses in the follow up period attributed to septicemia (14). Many authors showed that aspiration alone or intermittent aspiration is effective and does not carry the risk of septicemia (15). In our study, single or multiple intermittent aspirations without lavage were the first line of treatment for

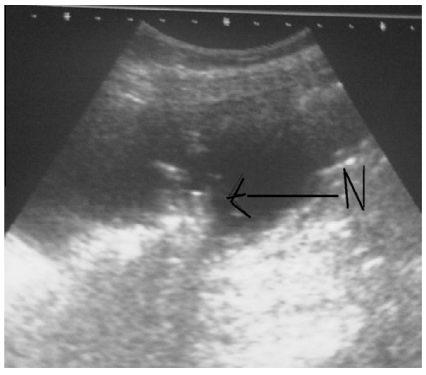

Fig. 4 25 Year old woman presented with pain and tenderness at the right iliac fossa with temperature of 38 °C and leukocytic count of 15 K, ultrasound- guide aspiration of frank pus till complete resolution of the abscess. Aspiration was repeated 3 days later. 18 gauge needle was used (arrow).

all simple collections either sterile or non sterile that were 5 cm or less in maximum diameter (Fig. 4). Aspiration alone was successful in 100% for simple sterile fluid collection such as seroma, urinoma and biloma and 80% of amebic liver abscesses after the third attempt. The unsuccessful 20% by aspiration were cured by catheter drainage. 100% success rate is achieved for aspirated small appendicular, pelvic, liver and perinepheric abscesses after a maximum of four aspiration sessions. These results are close to the results of Rae et al. who

Table 4 Primary catheter access failure using the trocar technique.

Gender	Age	Approach	Size of the catheter	Guidance	Site of collection
Male	23	Paraspinal	10 Fr	US	Ilio-psoas
Male	18	Paraspinal	10	US	Pseudo pancreatic
Male	33	Paraspinal	8	US	Pseudo pancreatic
Female	37	Transgluteal	8	CT	Pelvic abscess
Male	60	Anterior transabdominal	10	US	Liver abscess

performed percutaneous aspiration alone on 25 patients with hepatic abscesses smaller than 5 cm and had a 100% cure rate (16). Zerem and Hadzic had 100% success rate for ultrasound guided aspiration of small liver abscesses (17). Giorgio et al. reported 98% cure rate of 115 patients who suffered from liver abscess and were treated by ultrasound guided needle aspiration. The abscesses ranged from 3 to 16 cm in diameter with mean of 6.8 cm (11). Lorenzen et al. had a favorable clinical outcome of 33 patients who had deep pelvic abscesses, 14 of them had median abscess diameter of 4 cm. The abscesses were treated by aspirations (18). Zerem and Hadzic concluded that continuous catheter drainage was more efficient than intermittent aspiration for liver abscess bigger than 50 mm (17). Lorentzen et al. treated 18 of 19 patients who had large sized abscesses (median of 6 cm) by US-guided CD. The authors had a favorable clinical outcome (11,17,18). Catheter can be inserted guided by US, CT or both and fluoroscopy. The choice of the most secure and efficient access is crucial. CT is particularly useful in complex or multiloculated collections or in collections that are deeply located (19). US and fluoroscopy are used for superficial or obviously accessible collections (Fig. 1). In complex cases, more than one drain may be needed for optimal drainage, eventually with different access pathways. Catheter can be inserted using either the Seldinger or single step trocar technique. Each technique has its advantage and disadvantage. Advantages of the trocar technique include the ability to rapidly deploy the catheter; Disadvantages include the difficulty of repositioning a catheter that has been deployed suboptimally on the first pass. Advantages of the Seldinger technique include the ability to direct the wire to the precise location desired for catheter deployment. Disadvantages of the technique include the difficulty of working with wires in confined spaces, and the multiple steps involved in dilation. In addition, when dilators and wires are used with CT guidance, any buckling or kinking of the wire can be problematic. Leakage from small fluid collections around the wire during needle removal and dilations may substantially reduce the operating space in the abscess and make catheter placement more difficult (20). In our study we used both techniques. The technical success of catheter drainage with the Seldinger technique was 100% but it was 87% with the trochar technique. Catheter insertion using the single step trochar technique was unsuccessful in 5 out of 40 procedures. Posterior paraspinal approaches through the paraspinal muscle were the routes in three male patients guided by US to access iliopsoas abscess ($n = 1$) and Pseudo pancreatic cyst ($n = 2$) their ages were 23, 18, and 33 years. All were muscular. The anterior approach was used to drain liver abscess guided by ultrasound in a 60 year old muscular male patient. CT–guided access to deep pelvic collection via posterior transgluteal approach was attempted in a 37 year old woman. Polyurethane catheters, 8 and 10 Fr. were used in the failed procedures using the single step trocar technique. Those procedures were eventually successful using matching size of Flexima catheter guided by US or CT. The unsuccessful access to the abscess using the trocar technique can be explained by the lack of dilatation of tract and softness and elasticity of the catheter material with buckling of the catheter over the metal stiffener and trocar. Those two factors make it challenging to advance the catheter through tough tissues and muscle. Contrary to few failures with the trocar technique, the polyurethane based catheters were 100% technically successful in all attempted cases with the Seldinger technique. In our study, skin incision and blunt dissection and dilation through the subcutaneous tissue were not sufficient to advance the polyurethane catheter. Percutaneous abscess drainage route was feasible in all our cases guided by either US or CT. The approach was either anterior abdominal or posterior paraspinal, transgluteal. The posterior transgluteal approach (Fig. 2) was used to drain pelvic collections when a safe transabdominal route was not feasible because of bowel loops and urinary bladder or uterus and iliac bones. When using the transgluteal approach, it is necessary to avoid the sciatic nerve, which is located slightly posterior to the acetabulum. Inserting the catheters adjacent to the sacrum or coccyx will usually spare the sciatic nerve (12). Worthen and Cunning reported the clinical success rate for drainage of pelvic abscess was 94% for needle aspiration and 77% for CD (21). In our study, the clinical success rate for CD was 95%. It was unsuccessful in four collections in four patients; two patients with pseudo pancreatic cyst that became infected and required laparotomy for necrosectomy and phlegmon could not be differentiated from pus in CT scan. Third failed case was a 55 year old woman with left paracolic abscess one week after the second step of resection and anastomsis of the left colon that showed persistent high output drainage with poly microbial invasion and appropriate antibiotic was administrated. Laparotomy showed a leakage at the anastomosis site that was revised. The fourth case was a 72 year old man with pelvic abscess secondary to diverticulitis of the left colon that failed to respond to catheter drainage and proper antibiotic eventually managed surgically. Our results are comparable with that of other studies that showed clinical success rate ranged from 64% to 96% for abdominal and pelvic abscesses that were treated by CD (14,1). It was reported that the success rate was 91% for appendicular abscess drainage (22), and 96% for pelvic abscess drainage with the transgluteal approach (23). The average treatment duration was shorter in sterile than in pyogenic collections and that was drained by aspiration compared to those drained by catheter. This can be explained as sterile collection is not expected to reaccumulate after the first aspiration except for amebic liver abscess where inflammatory process is still going on and reaccumulation ensues. The duration for CD was longer than that for aspiration because CD was applied to bigger abscesses and collections.

Complications: Reported major complications include severe hemorrhage; post procedural sepsis severing of a mesen-

teric vessel, transgression into the bowel; and fistula formation. Minor complications include self-limiting hemorrhage, wound sepsis, malpositioned tubes; and accidental tube removal and undue pain; the latter is most commonly encountered with the posterior transgluteal approach (1,12). In our study neither procedure-related mortality nor major complications were encountered. According to the (SIR) definition of complications, minor complications such as bacteremia were seen in 5% of patients ($n = 5$) this is lower than other studies who encountered septicemia in 26% after liver abscess drainage (24). This may be because almost all of our patients were already under the umbrella of a broad spectrum antibiotic by referring physicians. Access site sepsis was encountered in 8% of cases ($n = 8$), all resolved by local antibiotic cream. US allows the real time visualization of the needle or catheter. The CT-guided tandem trocar technique allows precise catheter insertion. Both strategies minimized the complications. Patients' coagulation profiles were checked thoroughly and coagulopathy was corrected promptly. Although many authors suggested that transgluteal access is associated with pain and a low risk of sciatica, in our study, none of our patients suffered from sciatica post procedure. Only pain was encountered but it was controlled by oral analgesic. Our entire procedures required neither general anesthesia nor sedation. Only local infiltration anesthesia was used. The age population of our study was old enough to be cooperative precludes the need of sedation and general anesthesia. In our study recurrence rate was 7% and this is similar to the result of Van Sonnenberg who had 20 cases of recurrence out of 250 cases (1). Three patients of the catheter group showed recurrence after two, three and four months. One patient had recurrent paracolic abscess that was managed by CD but failed to respond and end up with resection and anastomosis and diagnosed as Crohn's disease. The second patient had recurrent ilio-psoas abscess treated successfully with CD and anti tuberculous therapy without any further recurrence. The third recurrence was deep pelvic abscess in a woman, 3 months after catheter withdrawal. The patient was managed by CD followed by laparoscopic excision of deep endometriosis without further recurrence. In our study the recurrent cases were managed by CD and only surgical intervention was required in two out of five recurrences. In both cases surgical intervention was mandatory and CD improved patient's general condition.

In **conclusion** image-guided aspiration for small sized collection is safe and effective and should be the initial step to drain collection. Catheter drainage should be reserved for large collections or after aspiration failure. Both aspiration and CD are safe, effective and minimally invasive techniques to drain abdominal and pelvic fluid collections in the absence of indication for surgical intervention. Further studies are needed to address the effect of catheter type and technical success rate for abscess drainage. Careful catheter selection for the trochar technique is important.

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