ADDIS ABABA UNIVERSITY
COLLEGE OF HEALTH SCIENCES
SCHOOL OF GRADUATE STUDIES
DEPARTMENT OF RADIOLOGY

PATTERN OF IMAGE GUIDED PERCUTANEOUS ABSCESS AND FLUID COLLECTION DRAINAGE/ASPIRATION AT TASH

A THESIS SUBMITTED TO THE RADIOLOGY DEPARTMENT, COLLEGE OF HEALTH SCIENCE, ADDIS ABABA UNIVERSITY IN PREPARATION FOR PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE POST GRADUATE STUDY IN RADIOLOGY.

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Project submission form

Name of the principal investigator	Dr. Zeleke Mogne Mulu, MD, final year radiology resident
Full title of the research	Cross sectional study of pattern of image guided percutaneous abscess and fluid collections aspiration and drainage and determinant of successful drainage at Tikur Anbessa specialized hospital, Addis Ababa university, Addis Ababa, Ethiopia from Hamle 2007ec - Meskerem 2013 Ec.
Duration of the project	One year(September 2019-augist 2020)
Study area	Black lion hospital
Total cost of the project	25 thousand birr
Name of the advisor	Dr. Tesfaye Kebede , MD ,senior consultant radiologist ,SSBI, Associate professor of radiology

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Contents

Lists of abbreviations

AJR: American Journal of Roentgenology

CT: computed tomography

E.C: Ethiopian calendar

GC: Gregorian calendar

JAMA: The Journal of the American Medical Association

MRI: Magnetic resonance imagining

PCD: percutaneous abscess drainage

SPSS: Statistical Package for the Social Sciences

TASH: Tikur Anbesa Specialized Hospital

US: Ultrasound

Std: standard deviation

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Operational definitions

Abscess: is a localized collection of purulent fluid that can have a significant impact on the care and clinical outcome of a patient.

Image guided abscess drainage: The placement of a catheter with the use of image guidance to provide continuous drainage of a fluid collection using access pathways that may either be transcutaneous or trans-orificial.

Image-guided percutaneous aspiration: evacuation or diagnostic sampling of a fluid collection with the use of a catheter or a needle during a single imaging session, with removal of the catheter or needle immediately after the aspiration.

Successful drainage: defined as 1 or more PCD procedures that resulted in the complete resolution of both symptoms and fluid collections identified on imaging studies without the need for open operative drainage to resolve the acute septic process.

Failed drainage: defined as the need to convert to operative treatment or open drainage prior to complete resolution of the intra-abdominal infection.

Seldinger technique: The catheter is inserted over a stiff guidewire into the collection.

Trocar technique: the collection is initially accessed using a small gauge needle and contents are aspirated to verify needle placement. Then, parallel to this needle, a coaxial combination of a catheter, stiffening cannula, and sharp stylet is advanced directly into the collection

Loculation of abscess and fluid cavity: The presence of septations in the collection of fluid and abscess.

Recurrence: initial evacuation of the cavity and clinical improvement, but eventual re-accumulation of fluid contents (either before or after the original catheter had been removed.

Abstract

Introduction: Image guided percutaneous abscess and other fluid collection aspiration drainage (PCD) is safe and cost effective means of draining an abscess. PCD is noninvasive, has decreased procedure associated morbidly and mortality, reduced cost of treatment and reduces length of hospital stay as compared to open surgical drainage. The imaging modalities that can be used for drainage can either ultrasound or CT or both of the modalities. The technique of drainage can be done by one of either trocar or Seldinger technique based on the size of the abscess, depth from the skin surface and absence or presence of intervening structures.

Objective: In this study assessment of pattern of image guided percutaneous fluid and abscess aspiration and drainage and determinant of success of the procedure were done.

Methods: Cross sectional prospective and retrospective study was employed from September 2019 to September 2020GC. Cases of abscess collections were identified from the US and CT log books as well as the computerized data bases of i-care from Hamle 2007 to Meskerem 2020. The medical records of all patients with abscess or fluid collection, who had undergone PCD in the study period, were studied. Data was analyzed by using SPSS version 25.0 computer software. Then summarization and comparison of data was done. Binary logistic regression analysis was used to identify predictors of successful outcome following PCD.

Results: 59 patients were included in this study .The mean age of patients who undergo PCD in this study is 43.58 with STD±15.6. Most of patients who undergo PCD were male accounting 67.8 %(40 patients) and came from urban areas accounting 58.3%. The most common site of abscess in this study was liver accounting 45%. In 37.3% of patients Seldinger technique and 32.2% trocar techniques were used for catheter drainage of abscesses and fluid drainage. The mean amount of abscess drained is 281 ml±47 Std initially in the procedure room. The majority of abscesses drained had intermediate consistency 37.3% (22 abscesses drained).Microscopic examination was done only on 22 patients (37.3 %) of the samples of abscesses aspirated and drained. The most common microscopic finding that was confirmed was pyogenic from different sites. The mean time taken to fully drain an abscess collection or fluid collection was 5.714±6 Std days. The aspiration and drainage was successful in 55 patient accounting 93.2 %. The procedure had failed in four patients accounting 6.8%. Seven (11.9%) had major complications. Six developed recurrence and one had pneumothorax. The only negative predictors of successful outcome was having concomitant chronic illness (odds ratio [OR] = 0.006; 95% confidence interval [CI], -5.008-1.31; *P* = .001).

Conclusions: The modality used to guide for abscess and fluid collection drainage is usually depends on the site, loculation and radiologist preference. Successful PCD can be done in almost every organs and spaces, with exception of intra-cranial collection, which are even multiloculated and have thick echo debris on pre-procedure ultrasound. The presence of chronic concomitant illness is one of the negative predictor of successful drainage. Mere aspiration in small and multiple collections is as successful as catheter drainage. PCD is proved to be safe and effective and has less morbidity and mortality, avoid general anesthesia and complications related to laparotomy, less numbers of days in the hospital and less cost compared to the surgical method of drainage.

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Key words: ultrasound, CT, aspiration, catheter drainage, abscess and fluid collections

Chapter One

1.1. Introduction

1.2. Background

An abscess is localized purulent fluid collection which has significant impact on the clinical care and outcome of the patients. Usually abscess can lead to life threating complication when it results in sepsis which is the 10th leading cause of death in USA. Abscess drainage can be done either surgically using general anesthesia or percutaneously with the help of different imaging modalities. Percutaneous abscess and other non-infected fluid collection aspiration and drainage (PCD) is done using imaging guidance to place a needle or catheter through the skin into the abscess to drain the infected and non-fluid (1).

Evolution of precise imaging modalities with improved contrast and temporal resolution, improved techniques of percutaneous drainage, and improved antibiotic regimens rendered image guided percutaneous abscess aspiration and drainage the primary procedure for draining abscesses in most body locations, especially pelvic and abdomen. As compared to surgical drainage, PCD is minimally invasive, has decreased procedure associated morbidly and mortality, reduced cost of treatment and reduces length of hospital stay. In older times the mortality risk of open surgical abscess drainage reached up to 50% in some series. In addition, PCD can be used in critically ill patient who may not able to cop the stress of surgery and general anesthesia and can be done in outpatient basis (2, 5, and 9).

The imaging modality used to localize the abscess collection and do PCD mostly depends on the site of collection, size of abscess and operator preference. Computed tomography (CT) is the most appropriate modality for the detection and localization of intra-abdominal collections because of its wider field of view that can help planning access route. With multiloculated empyemas, mediastinal abscesses, and lung abscesses, CT is necessary for full delineation of the abscess cavity. Sonography can also be usually used in detecting upper abdominal collections such as subdiaphragmatic collections, paracolic collections, or collections in solid viscera such as the liver and spleen. Septation and loculation are much more easily identified by sonography. For pleural space collections, plain films and sonography are often sufficient to demonstrate the entire fluid collection. Fluoroscopy is used in conjunction with either of CT or US to do serial dilatation and catheter placement following successful needle access. A combination of initial US or CT guidance for the placement of the access needle and guidewire followed by fluoroscopic guidance for the wire and catheter manipulations and completion of the procedure can be useful for difficult drainages such as small or relatively deep cavities.

Gram stain and culture must be obtained to make determination of the etiologic agent which results in an abscess because imagining is not able tell for sure whether the collection is infected or not (2, 3).

There are two basic methods of draining an abscess or fluid collection: the Seldinger technique and the trocar technique based on the size and location of the abscess. With the trocar technique, the collection is initially accessed using a small gauge needle and contents are aspirated to verify needle placement. Then, parallel to this needle, a coaxial combination of a catheter, stiffening cannula, and sharp stylet is advanced directly into the collection. In the Seldinger technique, an 18-gauge long-dwell sheath is placed in the cavity and a 0.038-inch guidewire is coiled within the cavity. Alternatively, a one-stick system using a 22-gauge needle and 0.018-inch guidewire can be used (Neff set, Cook, Bloomington, Ind.). The track is dilated with fascial dilators to two French sizes larger than the catheter to be placed. The catheter is then inserted over a stiff guidewire into the collection. It is important to coil the catheter within the collection so that all of the side holes are within the collection (1, 2, 3, and 4).

Initial criteria for PCD specified that the abscess cavity be unilocular and have a clear access route, and that no communications, fistulas, or complicating factors exist; surgical backup was considered essential. Currently, PCD is performed for multiple or multilocular abscesses, for abscesses associated with communications, for abscesses shielded by overlying structures, and for abscesses in critically ill patients. PCD currently is used to treat many infected and non-infected collections including pancreatic collections (abscesses and pseudocysts), abscesses with internal communications, hematomas, lymphoceles, empyemas, lung and mediastinal abscesses, enteric-related abscesses, necrotic tumors, benign cysts, amebic and echinococcal abscesses, and splenic and tubo-ovarian abscesses(4).

The Society of Interventional Radiology (SIR) standards of practice guidelines for adult recommend antibiotic prophylaxis1 hr. prior to the procedure considering PCD is a dirty procedure. Organisms encountered include skin flora (gram-positive organisms) and intracavitary pathogens (typically gram negative bacteria). Two reasonable drug regimens include a second- or third-generation cephalosporin or ampicillin/sulbactam (vancomycin or clindamycin in case of penicillin allergy) for gram-positive coverage, plus an aminoglycoside for gram negative coverage.

1.3. STATEMENT OF THE PROBLEM AND SIGNIFICANCE OF STUDY

There are no ample studies done in this country in general and in this hospital in particular regarding the pattern of image guided percutaneous abscess and other fluid collections aspiration and drainage. This study showed the pattern and success rate of percutaneous abscess drainage at Tikur Anbesa specialized hospital. The study may also serve as an input in the future development of local guidelines in the procedures to do image guided percutaneous abscess aspiration and drainage and replace surgical drainage which is practiced in most of health institutions in the country. The experience of Tikur Anbesa hospital depicted here in this study will be shared to other hospitals and teaching institutes.

Chapter Two

2.1. Literature review

In one study done to compare operative drainage versus percutaneous catheter drainage guided by computed tomography or ultrasound showed that complications (4%), inadequate drainage (11%), and duration of drainage (17 days) were less than in the operative group (16%, 21% and 29 days respectively). These results indicate that image guided percutaneous aspiration and drainage is at least as efficacious as operative drainage and avoids the risks of a major operative procedure. This study also showed that PCD is 89 %(86%in the postop abscess and spontaneous abscess 92%) successful as compared to the 70%(62% in the postop and 82% spontaneous abscess) success in the operative group .Treatment of an abscess was considered successful if the abscess resolved quickly, was no longer a septic focus, did not recur, and the drainage modality was not contributory to death (5).

In the research published at JAMA surgery which studied determinants for successful percutaneous image-guided drainage of intra-abdominal abscess including 96 patients showed that drainage of intra-abdominal infections was effective with a single treatment in 70% of patients and increased to 82% with a second attempt. A successful outcome is most likely with abscesses that are postoperative, not pancreatic, and not infected with yeast .In this study CT guidance was used for drainage in 80% of patients, and US was used in 20%. The duration of abscess drainage was less than 14 days in 64%. Complete resolution of the infection with a single treatment of PCD was achieved in 67 patients (70%) and with a second attempt in 12 (12%). Thirty-three patients (34%) had PCD for the resolution of intra-abdominal sepsis prior to an elective, definitive procedure. Open drainage as a result of PCD failure was required in 15 (16%) and was more likely in patients with yeast (P<.001) or a pancreatic process (P = .02). Postoperative abscess (P = .04) was an independent predictor of successful outcome (6).

One paper done in Iran on safety and efficacy of percutaneous CT-guided drainage in the management of abdominopelvic abscess showed that the common signs and symptoms manifested in patients with abdominal abscess were pain (83%) and fever (80.5%). The most prevalent abdominal abscess etiology was previous surgery in 31 cases (75.5%). Abscess diameter ranged between 5 and 12 cm (mean 7.8 cm). The average hospital stay was 8 days (4-15). Thirty five cases (86%) were successfully treated. Only one case (2.5%) developed complication (peritonitis) after the procedure (7).

A survey done in Duke University medical center radiology department about the practice patterns in percutaneous image-guided intra-abdominal abscess drainage in the 193 academic and 300 private radiology departments in the United States -Among 95 academic respondents and 52 private practice respondents, respectively, 56 (59%) and 33 (63%) do not perform drainage if an abscess has a diameter of less than 3 cm; 30 (32%) and nine (17%), if the white blood cell count is normal; and 16 (17%) and six (12%), if the patient is afebrile. Most (90 [95%] of 95 academic, 45 [87%] of 52 private practice) respondents use conscious sedation. A transabdominal approach and 8 –12-F catheters are most frequently used by both groups. Academic respondents more frequently use transvaginal and transrectal approaches (54 [57%] and 51 [54%] of 95, vs 16 [31%]and 15 [29%] of 52 private practice respondents ;P<.003) and 14-F catheters (69[73%] of 95 vs 18 [35%] of 52;P<.001).This survey concludes percutaneous drainage is usually performed by fellowship-trained radiologists in abscesses of more than 3 cm in diameter, for appropriate clinical indications (multiple parameters above the established threshold), by using conscious sedation and 8 –12-F catheters(8).

In study done in Nepales on 39 patients who develop intra-abdominal abscess from colorectal pathologies and PCD done, the result showed PCD was successful in 89.7% and no mortality and low morbidity. PCD failed in four patients (10.25%) which was elderly neoplastic with chronic illness following colorectal anastomotic dehiscence. The abscess measured above 10cm in two patients and below 10cm in the other two patients. All the four patients were drained surgically after 10 days PCD trial. This study also showed that the no major complication encountered. Regarding minor complications, catheter displaced in two patients (5%). Sepsis resolution in 35 healed patients was achieved in 5.1 ±2.9 days. The drainage was removed after 13.1±6.9 days in patients with anastomotic fistula and in 7 .8±4.9 days in the other patients. This study concluded that the use small diameter catheter used at the beginning of the procedure resulted in unable to drain large collection of thick pus or necrotic material or become obstructed (9).

In a paper published on the AJR on 23 patients with 24 abscess & aspiration and drainage done percutaneously with CT and ultrasound guidance summarized that of the 24, 16 (67%) were postoperative complications. All patients underwent diagnostic studies with either ultrasonography or CT, or both. Ultrasonography was usually the initial procedure with CT performed subsequently to provide the more detailed anatomic and diagnostic information felt prerequisite for percutaneous drainage in many cases. Information from both CT and ultrasonography was used to plan the drainage routes. Criteria for consideration of percutaneous drainage included a well-defined abscess cavity, a safe percutaneous route, concurring surgical consultation, and immediate operative capability in case of failure or complication. Abscesses with extensive internal

septae which might preclude free drainage were excluded. Diagnostic needle aspiration with a 25-30 cm 20 gauge needle with external Teflon sleeve was always performed prior to drainage to confirm both the diagnosis and the proposed drainage route. Choice of drainage catheter technique depended on size, depth, ease of access, and location of the abscess. The smaller, less traumatic, 8 French pigtail catheters was used for small, deep abscesses with narrow percutaneous windows, for those in intimate relation to the bowel, and for parenchymal abscesses (intra-renal or intrahepatic). For larger, more superficial, nonparenchymal abscesses, the 1 2 or 1 6 French trocar catheters was used. There were 18 extra-peritoneal and 6 trans-peritoneal drainage routes. There were two major complications: one empyema and one hemorrhage. There were three minor complications: one shaking chill and one fever of 40 degree centigrade, both immediately after instrumentation, and one cutaneous sinus tract. There were no deaths or recurrences observed. The follow-up period averaged 12 months (range, 1 week to 3 years). They generally became afebrile within 24-48 hrs. after drainage. In most cases there was a marked tendency toward decreasing daily drainage volumes. In the 22 patients treated without surgery, catheters remained in place for an average of 14 days (range, 5-40) .This study concluded that percutaneous aspiration and drainage should be considered as an alternative to surgery in the treatment of intra-abdominal or retroperitoneal abscess (10).

A paper on CT guided percutaneous aspiration and drainage of abscesses classified 103 patients into two groups: Non-operative candidate (33 patients)and operative candidates(70 patients).The operative candidate who had fluid collections aspirated only for diagnostic specimens and aspiration was successful in obtaining specimens in 63 cases. In these 70 patients, 34 aspirations proved to be sterile and 36 proved to be abscesses. In the group of 36 abscesses, specimens were found in 33 of the procedures. In the group of 34 specimens which proved to be sterile, specimens were found in 30 cases. These 30 specimens included nine hematomas, seven pseudocysts of the pancreas, four lymphoceles, three liver cysts, three loculated ascites, one positive sterile abscess, one urinoma, and two renal cysts. The group in which drainage of abscesses were attempted included 28 patients with 33 suspected abscesses. There were five abscesses that were not successfully drained. This study again classified patient in the drainage group into those who were operative candidates and those who were not. There were nine patients who were not operative candidates. Seven patients were successful drained. There were two patients in this non-operative group who were not successfully drained and who died; these patients had abscesses which were anatomically too extensive for percutaneous drainage procedure. The remainder of the group in which percutaneous drainage was attempted included operative candidates. In this group, PCD were successful in 22 of 24 abscesses (11).

The significance of peri-procedural antibiotics were not significant in a study done on 296 procedures performed with CT guidance. Forty of 296 patients received no antibiotics (presumed to be non-infected fluid collections), and 256 patients received peri- or pre-procedure antibiotic doses. Eight of 256 received antibiotics between 0-1 hours prior to the procedure, while the remaining 248 patients received antibiotics greater than one hour prior to the procedure. None of the doses were ordered by the interventional radiologist. No patients had post-procedural complications of fever, bacteremia, sepsis, or hemorrhage .This study concluded that CT-guided abdominal or pelvic abscess drainage can be performed safely without peri-procedural antibiotic administration (12).

At the Massachusetts General Hospital, Boston and the University of California, San Diego 212 patients underwent 250 PCD. The majority of collections were pyogenic abscesses (139 cases). There were also sterile abscesses (abundant poly-morphonuclear white cells without bacterial growth) (51 cases), amebic abscesses (12 cases), and secondarily infected tumors (5 cases). There were ten non-infected hematomas, nine pancreatic pseudocysts, nine bile collections, seven urinomas, four lymphoceles, and four seromas Successful drainage of the collection with avoidance of operation was achieved in 209/250 (83.6%) cases. There were 21 failures and 20 recurrences of previously drained collections; partial success occurred in 18 of these 41 cases. Partial success was defined as adequate drainage of the abscess, but surgery was undertaken for another reason (i.e. -repair of anastomosis, fistula, other complication) or temporizing drainage with clinical improvement prior to surgery. Overall, complete and partial successes totaled 227/250 (90.8%). Non-infected collections were successfully drained (cured) in 31 of 43cases. Twenty six complications occurred (10.4%); seven were major .This study concluded that phlegmonous, multi-loculated, poorly-defined collections are generally not entirely curable by PCD, but they are also often difficult to drain thoroughly at laparotomy. Thus, in critically ill, poor operative risk patients with complicated ted abscesses, PAD is useful as a temporizing maneuver preoperatively. Eventual surgery may be electively scheduled and more limited in scope after the abscess is partially drained and the patient’s condition improved (13).

CHAPTER THREE

3.1. OBJECTIVES

- To assess the value of image guided percutaneous aspiration / drainage of abscess and other fluid collections at TASH
- Specific objectives:
    - To determine the site of abscess collections which were drained by image guided PCD.
    - To determine the nature of abscesses assessing size, depth from the skin, the presence of loculation, debris and air.
    - To determine the imaging modality used as guidance and techniques used.
    - To assess the determinant of successful aspiration and drainage.
    - To determine the microscopic and pathologic findings from samples taken through aspiration and drainage.
    - To assess standard procedures and techniques used to undergo image guided PCD of abscess and other fluid collections.

CHAPTER FOUR

4.1. PATIENTS AND METHODS

This study was conducted prospectively and retrospectively at TASH, radiology department on 59 patients who underwent image guided aspiration and PCD from Hamle 2007 to Meskerem 2013 E.C. Patients included retrospectively were identified from the electronic log book and were included if they had complete procedure note in the radiology department and chart recordings in the admission wards. Prospective study was conducted from September 2019GC to September 2020GC on patient who came to the radiology department for image guided percutaneous abscess drainage. Important variables including Sociodemographic data, imaging characteristics and other variables were systematically collected by structured questionnaire. Patients were treated with image guided percutaneous aspiration and drainage by single experienced staff radiologist.

Data analysis was performed by SPSS software for Windows version 25. Variables entered into the analysis included Sociodemographic data (age, sex, address), causes of abscess (idiopathic, post op, etc.), clinical presentation, presence of concomitant illness imaging characteristics (location, loculation, depth from the skin and maximum size of abscess in cm). The technique, the type, size and number of catheter used, amount and consistency of abscess drained, number of days it took to drain the abscess were also entered as variables into SPSS. The data are presented as mean ± SD (minimum and maximum) for quantitative variables, and the number of observations, frequencies and percentage for qualitative variables in tables, bar graphs and pie charts. Binary logistic regression analysis was done after checking the absence of collinearity between the dependent and the independent variables and among the independent variable to identify predictors of successful outcome following PCD. CT images of patients who had successful image guided PCD were included to temporally depict the success of the procedure.

4.2. Procedures and techniques

Abscess and fluid collections were identified on computed tomography (CT) and ultrasound (US) and were characterized by the largest diameter in centimeter (cm), location of the collection, loculation, extent of debris, and maximum distance from the surface of the skin.

All the PCD in this study were ultrasound guided and the all patients had standard pre-procedure preparations. The patient would be positioned on the procedure couch according to the site of abscess collection and the radiologist preference. All aseptic

techniques were practiced. The performing radiologist would wear surgical glove and the skin would be cleaned with iodine and drape applied on the site were procedure would be done. The ultrasound probes used for guidance would also be covered with surgical glove and K-Y jelly applied on the foot print. Patients were either put on broad spectrum antibiotics for days in the admitting ward or were given 30 minutes to 1hr prior to the procedure in accordance to the Society of Interventional Radiology (SIR) standards of practice guidelines for adult. The local anesthesia used was lidocaine with or without adrenaline which was infiltrated in the route of aspiration and drainage. Initial diagnostic aspiration was done for confirmation and laboratory sample for every patient who underwent image guided aspiration and drainage. Aspirations were the only procedure done for some patients who had as small and multiple collections.

Either of the Seldinger or trocar technique was used under ultrasound guidance for definitive catheter drainage of the abscess and fluid collections. The catheter sized used were selected by the performing radiologist ranging from 8 Fr to 12 Fr gauge. The amount of fluid or abscess drained and its consistency was documented. The available laboratory and culture result of drainage was collected. The catheters were removed when there was no more output from the catheter and the patient clinically stabilized.

Improvement was assessed based on absence of sepsis due to collection, loss of fever, loss of collection size or shrinkage of the abscess wall by follow-up ultrasonography or CT scan (figure 1). The data regarding the successfulness of the procedure, the number of days on draining catheter and the presence of complications were collected.

Successful PCD was defined as 1 or more PCD procedures that resulted in the complete resolution of both symptoms and fluid collections identified on imaging studies without the need for open operative drainage to resolve the acute septic process. Failure of PCD was defined as the need to convert to operative treatment or open drainage prior to complete resolution of the intra-abdominal infection. Patients had monthly follow-up up to six months in the respective ward where they were referred from to the radiology department.

Figure 1: 45 years old male patient who had right sub-phrenic collection which was found to be pyogenic on microscopic examination and trocar method of catheter drainage was done.

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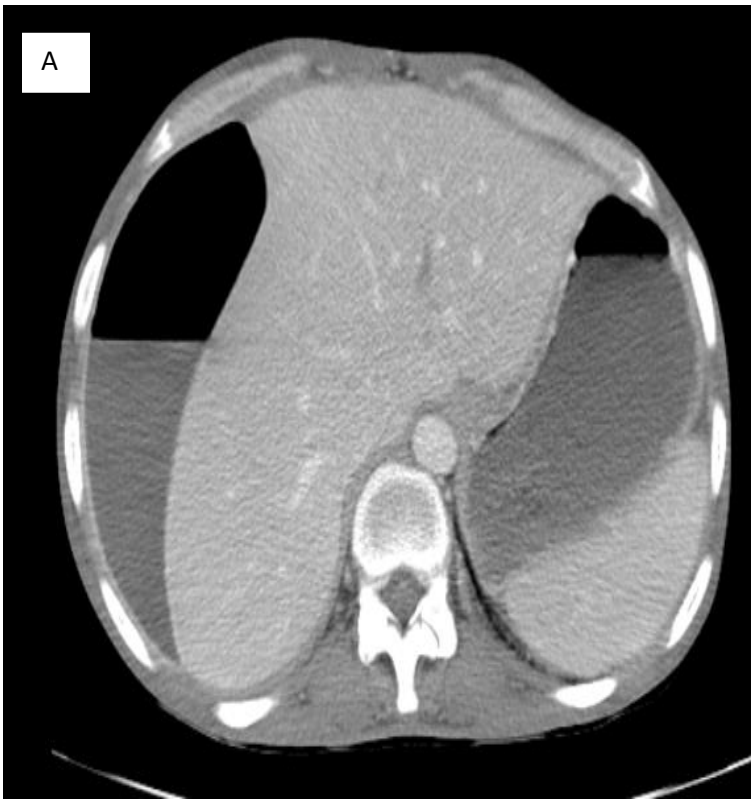
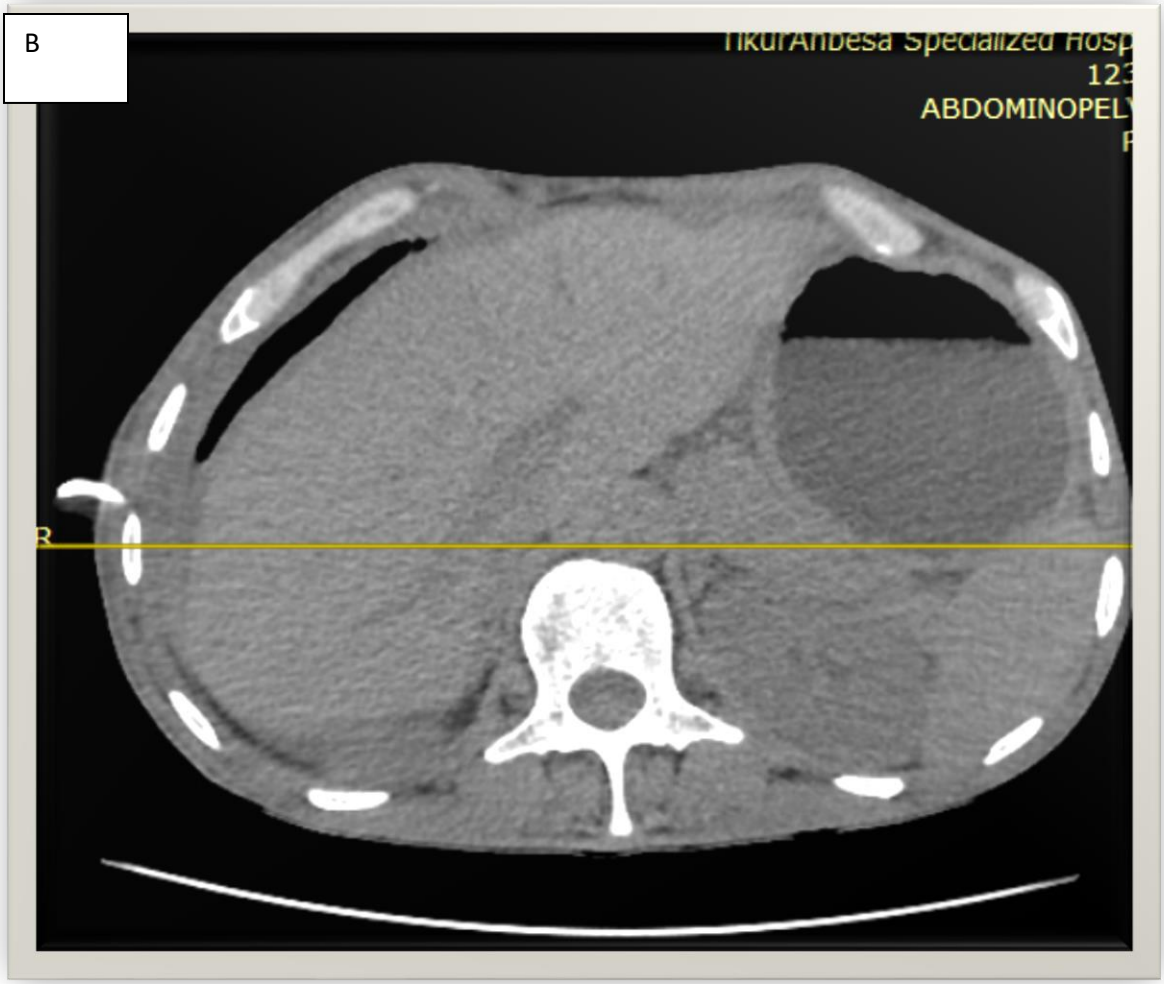
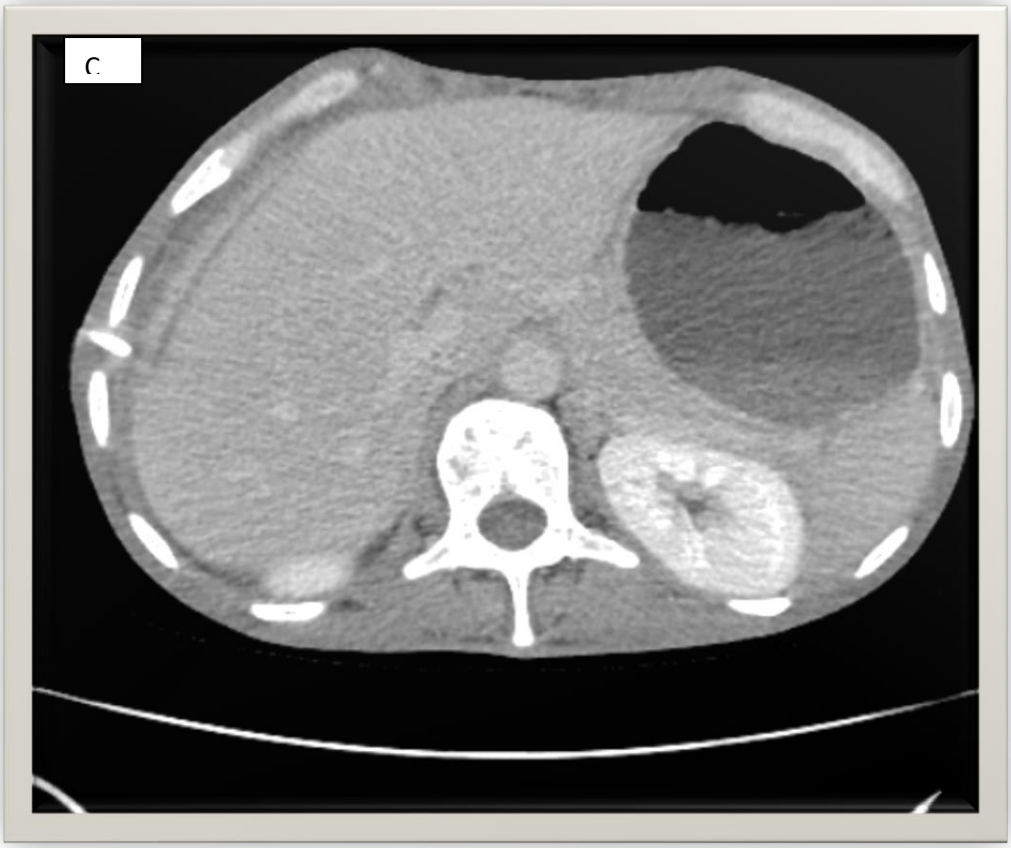


A: Post contrast abdominopelvic axial CT showed large right sub-hepatic collection which has air fluid level measuring 10cm in its largest diameter



B: Same patient on 6th day after the trocar catheter drainage done revealing that the collection has significantly decreased and the pigtail catheter coiled inside the abscess cavity.



C: same patient one day before (11th post procedure day) the catheter was removed showing the pig catheter is still inside the abscess cavity and the abscess cavity is totally collapsed showing successful drainage.

CHAPTER FIVE

5.1. Results

5.2. Patient demographics

There were 59 patients included in this study who had aspiration and PCD done during the six year period from Hamle 2007E.C to September 2013E.C.The mean age of patients who underwent PCD in this study is 43.58 with STD±15.6.The maximum and minimum age is 80 yrs. and 10 yrs., respectively. Most of the patients were in reproductive age group from 15-45 yrs. old accounting 61 %. Only one patient (1.7%) was in the pediatric age group (below age of 15yrs). Six (10.2%) patients were above the age of 60yrs.

Most of patients were male accounting 67.8 %(40 patients) and came from rural areas accounting 58.3% (28 patients out of 48 whose address clearly documented on either the charts of the patients and I- care electronic data).

Table 1: Sociodemographic data of patient who undergo PCD abscess drainage

Age	Frequency	Percentage	Valid percentage
Under 15	1	1.7	1.7
16-45	36	61.0	61.0
45-60	16	27.1	27.1
Above 60	6	10.2	10.2
Sex			
Male	40	67.8	67.8
Female	19	32.2	32.2
Address			
Urban	20	33.9	41.7
Rural	28	47.5	58.3

5.3. Clinical presentation and indication of abscess drainage

The common clinical presentations of the patients were pain at the site of abscess or fluid collection accounting 44.1 % followed by more than one clinical presentation including fever and Pain(table 2).

The most common indication of PCD was suspected or confirmed infected fluid or abscess accounting 37.3%(22 patients out of 48 patient and the next most common indication was the need for fluid characterization accounting 23.7%(14 patients)(table 2).

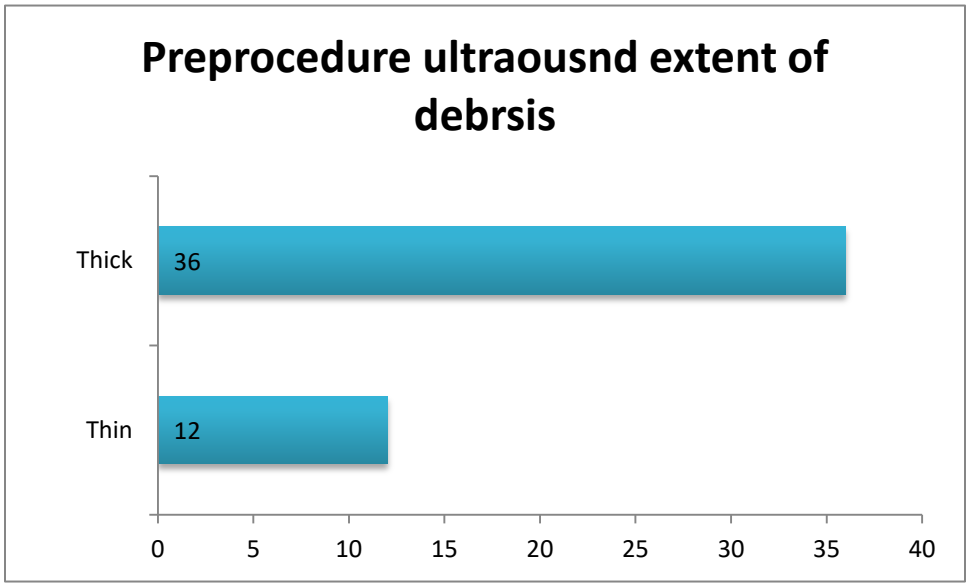
Table 2: frequency of clinical presentations and indications for PCD

Clinical presentation	Frequency	Percent	Valid Percent
Pain	26	44.1	54.2
Chest manifestations	2	3.4	4.2
More than one clinical presentations	20	33.9	41.7
Indication for PCD			
Suspected /Confirmed infected fluid	22	37.3	45.8
Need for fluid characterization	14	23.7	29.2
Collection suspected to produce symptoms that warrant drainage	12	20.3	25.0

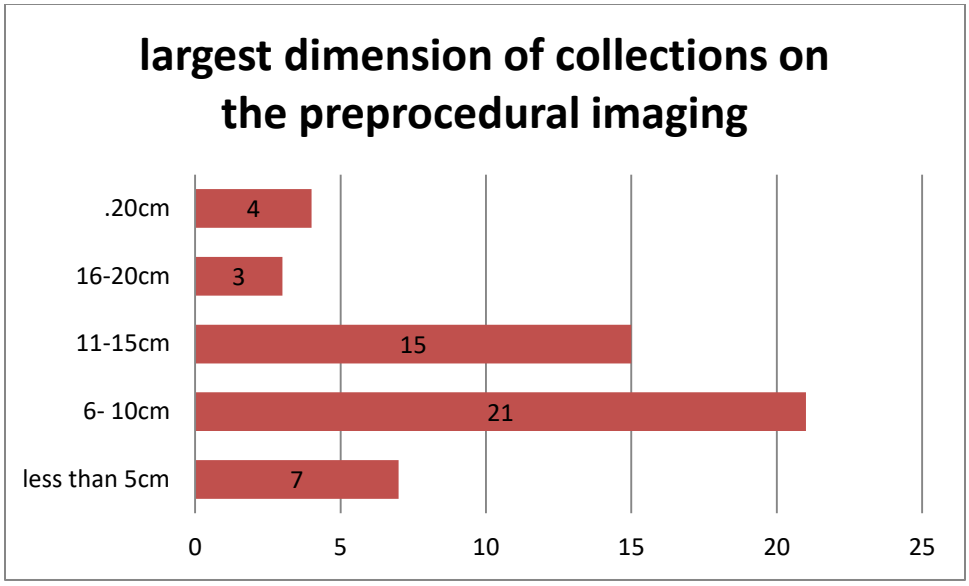
5.4. Imaging findings of fluid collections and abscesses

The pre-procedure ultrasound imaging finding of the fluid and abscess collections was that 36 patients have thick echo-debris (61%) and 12 patients have thin echo debris (20.3%) as documented on the chart among a total of 48 patients who had complete documentation (bar chart 1). Most of the fluid collections and abscesses were multiloculated accounting 59.3% (35 out of 49 patients) (pie chart 1). The mean diameter of the collections on the preprocedural imaging was 10.4cm ±5.3 cm Std with maximum diameter 24.4cm and minimum diameter 2.8cm (bar chart 2).

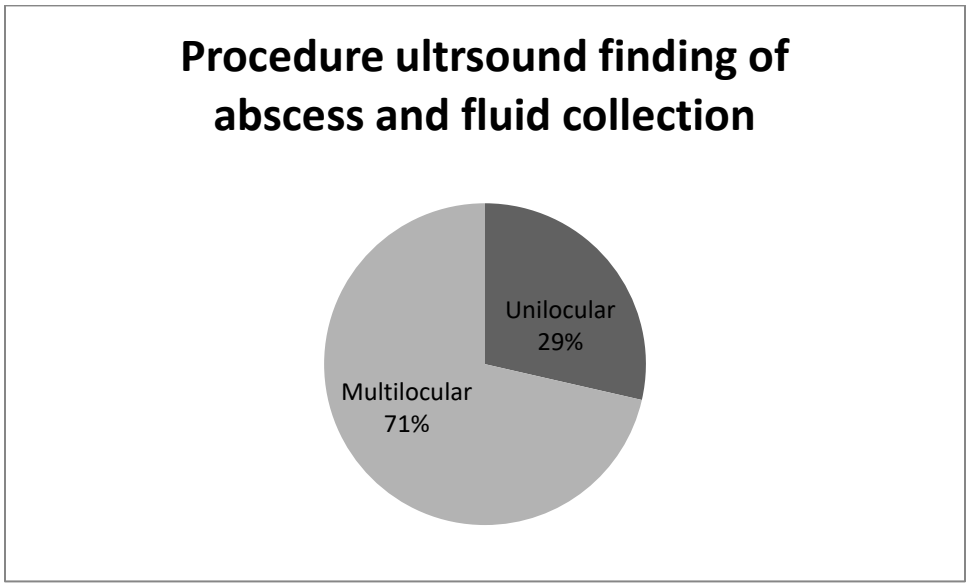
Bar char 1: frequency distribution of extent of debris on the pre-procedure ultrasound



Bar chart 2: showing the frequency of largest dimension of abscesses collections.

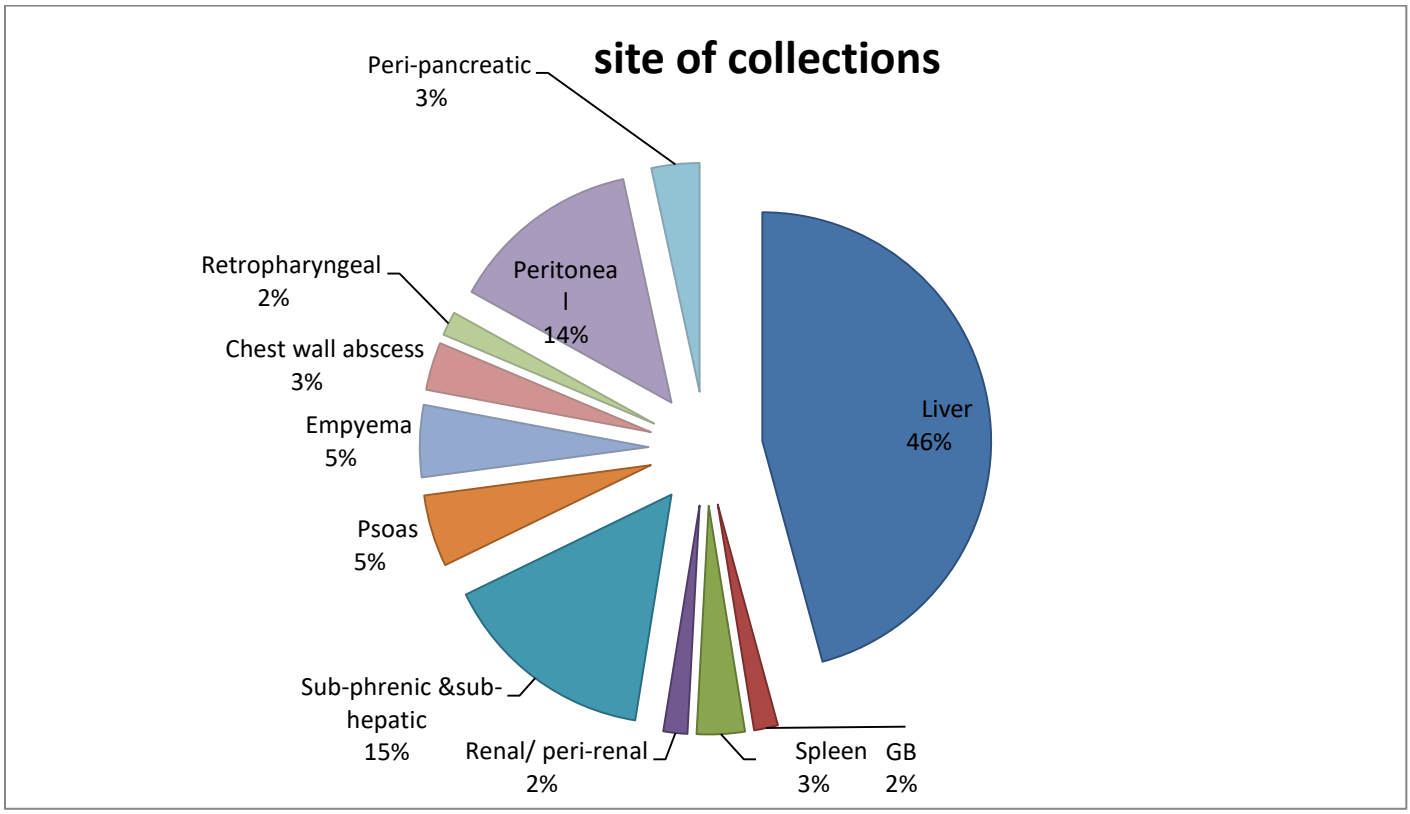


Pie chart 1: Frequency distribution showing the type of loculation of abscesses and fluid collections on the pre-procedural imaging.



Regarding the location of the abscesses and fluid collections liver was the most common site (45. 8 %) followed by sub-hepatic and sub-phrenic space (15.3%) and the rest of peritoneal cavity (13.6%)(pie chart 2).

Pie chart 2: frequency of abscesses and fluid collection based on the site of collection



5.5. Procedure techniques and post procedure findings

In 37.3 %(22) of patients Seldinger technique and 32.2% (19) patients trocar techniques were used for catheter drainage of abscesses and fluid drainage. In the rest of the cases only aspiration was done which accounted 30.5% (18 patients) (table 3).

Table 3: technique used, type, size and number of catheter used

		Frequency	Percent
Technique used	Trocar	19	32.2
	Seldinger	22	37.3
	Mere aspiration	18	30.5
Type of catheter	Sump		
Size of catheter	8-12 Fr		

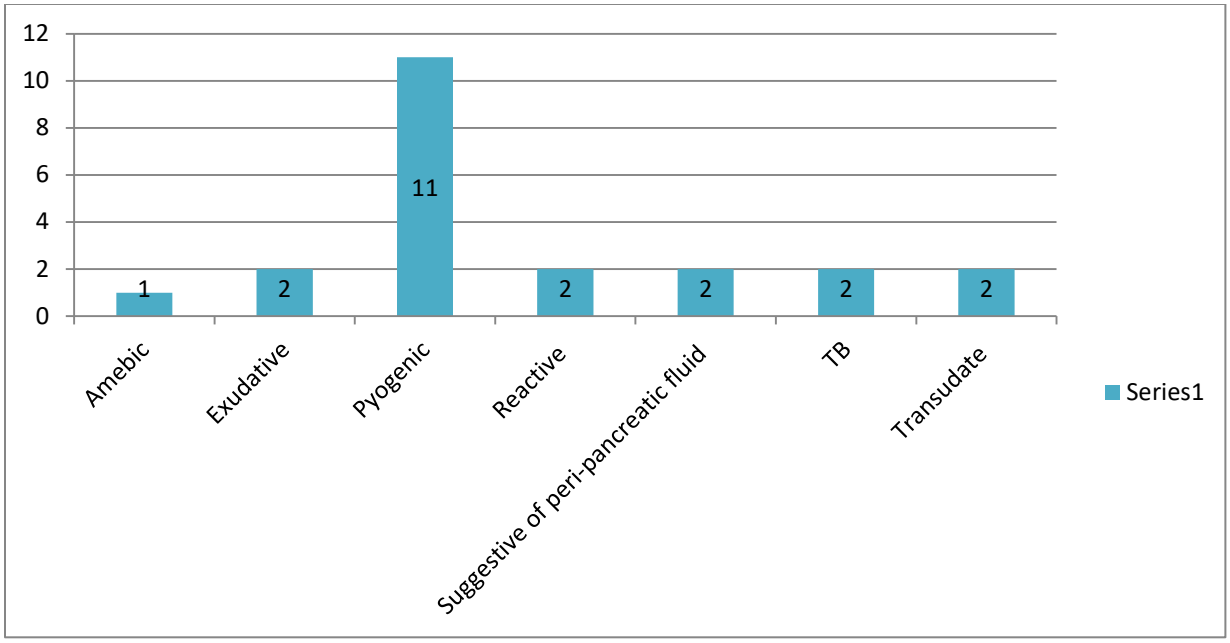
The catheter used for drainage in both trocar and Seldinger technique was sump type No 8 -12 French gauge. The number catheter used per procedure was one in all cases with the exception of two cases in which two catheter were used per procedure (table 3).
The mean amount of abscess drained initially with in the procedure room is 281 ml±47 Std in volume with minimum amount of abscess drained is 0 ml in one case which was bloody during trial aspiration and maximum amount of drained abscess 1140 ml. The majority of abscesses drained had intermediate consistency 37.3% (22 abscesses drained), 30.5% had thin consistency and the rest 10.2% had thick consistency (table 4).

Table 4: Consistency of abscess drained, frequency of laboratory done

		Frequency	Percent	Valid Percent
Consistency	Thin	18	30.5	39.1
	Thick	6	10.2	13.0
	Intermediate	22	37.3	47.8
Laboratory examination	Done	22	37.3	52.4
	Not done	20	33.9	47.6
	Data missing	17	28.8	

Microscopic and pathologic examination was done on the samples of 22 patients (37.3 %) of abscesses aspirated and drained (table 4). The most common microscopic finding that was confirmed was pyogenic from different sites. Two cases were confirmed to be TB aspirated from the liver. In these cases no drainage was done only aspiration (bar chart 3).

Bar chart 3: laboratory and culture finding



The mean time taken to fully drain an abscesses or fluid collections was 5.714±6 std days.

The aspiration and drainage was successful in 55 patient accounting 93.2 % with complete resolution of clinical signs and symptoms and collapse and resolution of abscess cavity on follow up ultrasound and CT scan. The procedure had failed in four patients accounting 6.8%.Two of patient had peri-pancreatic collection which recurred after 5 and 7 days of drainage by trocar technique. Both of these patients end with open surgical drainage. The other two patients despite having PCD, the clinical symptoms and imaging evidence of collections did not resolve. One of the patients was known diabetic and spear positive pulmonary TB patient with empyema who finally succumb after a month. The other patient is also known diabetic and hypertensive patient died after two weeks of PCD. Six patients developed recurrence and had repeat successful drainage done with complete clinical and radiologic resolution. One patient developed significant pneumothorax after drainage of empyema and chest tube was inserted. There was one minor complication in one patient who had intractable pain due to the drainage tube and it was re-inserted and pain resolved (table 5).

Table 5: time taken to drain the abscess, success rate, major and minor complications

		Frequency	Percent
Time taken to drain the abscess(days)	under 5 days	16	27.1
	5 to 10 days	13	22.0
	10 to 15 days	6	10.2
	15 to 20 days	4	6.8
	above 20 days	2	3.4
Successful	Successful	55	93.2
	Failed	4	6.8
Major Complication	Recurrence	6	10.2
	Pneumothorax	1	1.7
Minor complications	Intractable pain	1	1.7

5.6. Predictors of success

To determine predictors of success with PCD, binary logistic regression analysis was performed. Variables included age, sex, address, clinical presentation, causes of abscess, depth from the skin, estimated size of abscess, loculation, location of abscess, technique used, abscess size on an initial CT scan and presence or abscess of concomitant chronic illness including DM, HTN, and chronic renal, liver and lung disease. There is no positive or negative correlation found between the age, sex, address, clinical presentation, causes of abscess, depth from the skin, estimated size of the abscess, loculation, location of abscess, techniques used and abscess size. Negative predictors of successful outcome was presence of concomitant illnesses and the only independent predictor of failure rate (odds ratio [OR] = 0.006; 95% confidence interval [CI], -5.008-1.31; *P* = .001).

Table 6: Predictors of success

Predictor of success	p-value of significance
Age	.999
Sex	.999
Address	.999
Clinical presentation	.999
cause of the abscess	.999
amount of debris	.997
location of the abscess	1.000
technique used for PCD	1.000
Indication for PCD	.999

time taken to complete the drainage in days	.999
estimated size of abscess in area[cm2}	.998
depth from the skin to outer surface of the abscess in cm	.996

CHAPTER SIX

6.1. Discussion

PCD or aspiration could be performed potentially in every organ. This study revealed that successful treatment was achieved in 93% of the cases. It is in concordance with most of the previous reports. The complication rate was 10.6%. In older reports, a complication rate of 4-29% has been reported for PCD, which is reduced in recent studies.This finding could be attributed to interventional technique improvement during the last two decades.

6.2. Role of imaging in diagnosis, guiding and follow-up of abscess and fluid collections

The development of modern sophisticated cross sectional imaging modalities with improved spatial and contrast resolution rendered early diagnosis, localization and description of extent of abscesses and fluid collections an easy job for the radiologists. CT has greater than 95% accuracy and is the best diagnostic imaging method for abscess because of its wider field of view that can help planning access route. The presence of ileus, dressings, drains, or stomas does not interfere with reliability of the CT which makes ultrasound imaging difficult. The previous studies showed that the imaging modality used to guide percutaneous drainage mostly depends on the site of collection, size of abscess and the radiologist preference. In this study both CT and ultrasound were used to characterize the abscesses and collections and all the aspirations and drainage were guided by ultrasound. With multiloculated empyemas, mediastinal abscesses, and lung abscesses, CT is necessary for full delineation of the abscess cavity. Sonography can also be usually used in detecting upper abdominal

collections such as subdiaphragmatic collections, paracolic collections, or collections in solid viscera such as the liver and spleen. Ultrasound has an advantage over CT during placement because the position of the needle/catheter can be monitored in real-time. This is compared to CT where a stop and shoot technique is used, as the needle is advanced, repeat CT images are performed to check that the catheter is in the correct place. Septation and loculation are much more easily identified by sonography (2, 3, 15 and 16).

Though clinical follow up of signs and symptoms and drainage catheter output is critical for patient who has image guided aspiration and PCD, follow up imaging is also equally important to see the resolution of abscess cavity and development of complication including fistula and sinus formation and recurrence. For good anatomic resolution, use oral and intravenous (IV) contrast. Oral contrast may help to differentiate a fluid-filled extra-luminal structure from a normal intestine. Extravasation of oral contrast indicates a fistula or an anastomotic leak. IV contrast may enhance the abscess by concentrating the contrast material within the abscess wall (15).In this study follow up imaging was done either by ultrasound or CT or both based on the clinician request and performing radiologist suggestion. Most of the patient has imaging done before removal of the drainage catheter.

6.3. Nature of abscess and success of PCD

This study revealed that successful treatment was achieved in 93.2% of the cases and there were 6.8% failure rate. This finding is in concordance with most of the previous reports (5-14). There is no clear association noted between the success rate and the location of the abscess, presence of loculation and amount of debris. The presence of concomitant illness is associated with higher failure rate the procedure. The postoperative origin of abscess than the idiopathic one were more successful and pancreatic origin of the abscess and the presence of yeast were more associated with failure rate in the research published JAMA surgery(6).

6.4. Techniques used and mere aspiration VS catheter drainage

The two renowned Seldinger and trocar techniques of catheter drainage were used. The techniques used were based on the choice of the operator, the size and depth from the skin of the abscess. In addition only aspirations were done successfully on 18 patients who had multiple small abscesses and less than 5cm in the largest diameter. Similar result was found in the study done in Egypt comparing image guided aspiration and catheter drainage. The site majority of aspirations done were on liver accounting 50 %(9 patients. Other collections which were treated by aspiration were four empyemas, three peritonea collections and two peri-pancreatic collections which weres all successful. Compared to the study in Egypt which showed clinical success rate of 94% which increased to 100% after catheter insertion and this of catheter was 95%, all the abscesses and fluid collections were successfully aspirated (14).

6.5. PCD vs surgical drainage

Both abscesses and non-purulent fluid collection can be treated surgically or aspirated and drained percutaneous using the imaging modality as a guiding instruments (1-5). Even if the main objective of both surgical and PCD be removing the focus of sepsis, PCD is less invasive, can be done with only local anesthesia which is infiltrated only on the site of tube insertion. In addition, the length of hospital stay and rate of complications associated with the procedure and general anesthesia are higher for surgical drainages. Avoidance of general anesthesia, laparotomy, and prolonged postoperative hospitalization temporizing and reverse potentially fatal situations in gravely ill patients are advantage of PCD. Cure rates, morbidity and mortality, failures, and recurrences compare favorably with traditional surgery. Cost-saving is another abscess probable benefit (5).

This study showed that abscesses can safely be treated with semi-invasive methods. Open surgical drainage, which was the routine before the recent introduction of interventional radiology in the country, could be avoided. The site of collection and its consistency, uni/multilocularity and volume of collection were neither positive nor negative predictors of successful drainage. Intra-abdominal or intrathoracic abscess collections, whatever the cause of the collection, should be drained either as a therapeutic means or to postpone emergency surgery. Not doing this in a timely manner may lead to the development of sepsis and later death.

In older studies there were strict criteria were set for percutaneous abscess and other fluid aspiration and drainage .These included unilocular collection, clear access route, no fistula and no complicating factors. Surgical backs were also must. In this study collections which are multilocular, have no clear pathways and patients which have complicating factors are successfully aspirated and drained (4).

This study showed collection in every body parts with exception of intracranial collection could be drained successfully and safely including peritoneal and pleural cavity, liver, spleen, renal and perineal, pancreatic and peri-pancreatic collections, Gall bladder, intramuscular collection in the psoas and other musculatures. This is in compliance with the study done by Eric Vansonneberg et al. In addition two tuberclous liver collections were successful aspirated then anti TB continued and no recurrence documented on follow up (6, 10).

As recommended by American society of interventional radiology(SIR) standardized pre-procedure care were practiced in this study which include all aseptic techniques ,IV injection of broad spectrum antibiotics 30 min to 1 hr ahead, and infiltration of local anesthesia along the course of the aspirating needle and draining catheter(1,4-14).

The complication rate was 10.1% (6 patients with recurrent collections after drainage). In older reports, a complication rate of 4-29% has been reported for PCD (7, 11, 12),

which is reduced in recent studies. This finding could be attributed to interventional technique improvement recently and increased experience of the radiologist on the procedure.

6.6. Limitation

One of the limitations data on pediatric patient is lacking; only one patient was below the age of 15yrs and so conclusions made by this study may not be representative for pediatric age groups.

In addition information on the type and size of catheter used for drainage in this study was not complete. So conclusion cannot be made on the effect of catheter size and type on success rate, duration of drainage and hospital stay.

The internal characteristic of the abscess depth from the skin, internal septa or gas formation were not mentioned in the medical records in most of the cases and therefore, could not be utilized, since recent studies have suggested that gas formation within the abscess might be an important predictor for PCD failure.

Conclusion

Recent accurate diagnosis of the abscesses and fluid collection is an easy task for the radiologists because of technological advancement and improvement of ultrasound and CT imaging modality. The modality used to guide for abscess and fluid collection drainage is usually depends on the site, loculation and radiologist preference. Follow-up imaging which better delineate extent of the collection and development of complication like fistula and sinus formation than clinical follow-up after the procedure.

Successful PCD can be done to drain collections almost every organs and spaces with exception of intra-cranial collection which is even multiloculated and have thick echo debris on pre-procedure ultrasound. The presence of chronic concomitant illness is one of the negative of predictor of successful drainage. Mere aspiration in small and multiple collections is as successful as catheter drainage.

Though abscess and fluid collection can be drained either surgically or percutaneously to remove the septic focus, PCD is proved to be safe and effective and has less morbidity and mortality, avoid general anesthesia and complications related to laparotomy, less numbers of days in the hospital and less cost compared to the surgical method of drainage.

REFERENCE

1. Hearns W. Charles. Abscess Drainage,seminars on the interventional radiology.2012
2. Vascular and Interventional Radiology, The Requisites, Second Edition.2014
3. High yield imaging,interventional,2010
4. Sonnennberg, et al .Percutaneous Abscess Drainage: Current Concepts, ,1991
5. Willard c. Johnson, S G Gerzof ,et.al .Treatment of Abdominal Abscesses-Comparative Evaluation of Operative drainage versus Percutaneous Catheter Drainage Guided by Computed Tomography or Ultrasound. Annals of surgery 1981 Oct; 194(4): 510–520.
6. Marianne E. Cinat, Samuel E. Wilson,et.al. Determinants for Successful Percutaneous Image-Guided Drainage of Intra-abdominal Abscess. JAMA network 2002
7. Makhtoom Shahnazi , Alireza Khatami,et.al. Safety and efficacy of percutaneous ct-guided drainage in the management of abdomino-pelvic abscess. Iranial journal of radiology 2014: 11(3):e20876
8. Tracy A. Jaffe, Rendon C. Nelson,et.al. Practice Patterns in Percutaneous Image-guided Intra-abdominal Abscess Drainage: Survey of Academicand Private Practice center. Radiology 2004;233:750 –756
9. Brusciano L, Maffettone V, Napolitano V. Management of colorectal emergencies: percutaneous abscess drainage. Ann Ital Chir. 2004 Sep-Oct;75(5):593-7
10. Stephen G. Gerzof,Alan H. Robbins,Desmond H. Birkett,et.al. Percutaneous Catheter Drainage of Abdominal Abscesses Guided by Ultrasound and Computed Tomography. AJR Am J Roentgenol. 1979 Jul;133(1):1-8
11. Haaga, JR and AJ Weinstein. CT-guided percutaneous aspiration and drainage of abscesses. American Journal of Roentgenology. 1980;135: 1187-1194
12. A. Fadl, A. Baadh, S. Onderi,et.al. Image-guided percutaneous abscess drain placement can be performed safely without routine administration of periprocedural antibiotics. Journal of vascular and interventional radiology.2015 Feb;539-540
13. Eric vanSonnenberg, Peter R. Mueller, Joseph T. Ferrucci. Percutaneous drainage of 250 abdominal abscesses and fluid collections. Part I: Results, failures, and complications. Radiology. 1984 May; 151(2):337-41.
14. Mohammad Alaa Abusedera , Magdy Khalil , Ayman M.A. Ali ,Asem Elsani M.A. Hassan, Percutaneous image-guided aspiration versus catheter drainage of abdominal and pelvic collections, The Egyptian Journal of Radiology and Nuclear Medicine. 2013 April :223-230
15. Alan A Saber, Raymond D LaRaja. What is the role of CT scanning in the diagnosis of abdominal abscess?, Medscape.

16. Damien O'Neill and Hamed Asadi. Image Guided Drainage of Fluid Collections. June 2017 Interventional Radiology for Medical Students pp 111-117

Questionnaire (Data Collection Format)

1. Sociodemographic data
   - 1.1. Sex:
     - 1.1.1. M
     - 1.1.2. F
   - 1.2. Age:-
   - 1.3. Address:
     - 1.3.1. Rural
     - 1.3.2. urban
   - 1.4. Ethnicity ……..specify……..
2. Clinical symptoms and signs presented
   - 2.1. Abdominal pain
   - 2.2. Fever
   - 2.3. Chills and perspiration
   - 2.4. Nausea and vomiting
   - 2.5. Weight loss
   - 2.6. Loss of appetite
   - 2.7. Chest manifestations
   - 2.8. Jaundice
   - 2.9. Diarrhea
   - 2.10. Any other……..any……
   - 2.11. More than manifestations
3. Indication for drainage
   - 3.1. Mere Presence of fluid collection
   - 3.2. suspected infected fluid
   - 3.3. the need for fluid characterization
   - 3.4. collection suspected to produce symptoms that warrant drainage
   - 3.5. patient critically ill to cop surgical drainage
   - 3.6. other
4. Imaging technique used to guide percutaneous abscess drainage
   - 4.1. ultrasound
   - 4.2. CT
   - 4.3. fluoroscopy
5. pre procedure preparation
   - 5.1. local anesthesia

5.2. prophylactic antibiotics
5.3. fluid aspirated
5.4. Any other…….specify…….

6. Causes of abscess
   6.1. Idiopathic
   6.2. Post operation
   6.3. Pancreatitis
   6.4. Crohn's disease
   6.5. Trauma
   6.6. Pott's disease(TB)
   6.7. Any other causes……specify……
7. Imaging pattern of the abscess before the procedure done. Imaging findings
   7.1. Amount of debris
      7.1.1. Small
      7.1.2. Large
   7.2. Depth from the surface of the skin to outermost border of the abscess
   7.3. Estimated size of the abscess in ml
   7.4. Loculation
      7.4.1. Unilocular
      7.4.2. Two
      7.4.3. More than two
   7.5. Sites of abscess
      7.5.1. Abdomen
         7.5.1.1. Liver
         7.5.1.2. GB abscess
         7.5.1.3. Spleen
         7.5.1.4. Renal/perirenal
         7.5.1.5. Pancreas
         7.5.1.6. Subdiaphragmatic/subhepatic
         7.5.1.7. Peri-appendiceal
         7.5.1.8. Psoas
         7.5.1.9. Abdominal wall
         7.5.1.10. More than one organ
         7.5.1.11. Other……specify……..
         7.5.1.12. Retroperitoneal/paravertebral
      7.5.2. Chest
         7.5.2.1. Lung parenchymal abscess

7.5.2.2. Empyema
7.5.2.3. Chest wall abscess
7.5.2.4. Empyema necessistansi
7.5.2.5. Other…….specify……
……..

7.5.3. MSK
7.5.3.1. Upper limb
7.5.3.2. Lower limb

7.5.4. Other sites……specify……
…….

8. Technique of the procedure
   8.1. seldinger
   8.2. trocar
   8.3. aspiration
9. type of catheter used
   9.1. sump (double lumen)
   9.2. Non sump(single lumen)
10. Catheter gauge size used for drainage
   10.1. 7-9 F
   10.2. 12-14 F
   10.3. 16-20 F
11. Findings after the procedure done
   11.1. Amount of abscess drained_____
   11.2. Consistency of the pus
      11.2.1. Thick
      11.2.2. Thin
      11.2.3. Intermediate
   11.3. Number of catheter used
      11.3.1. One
      11.3.2. Two
      11.3.3. More than two
12. Microscopic examination
   12.1. Done…….specify finding……
   12.2. Not done
13. Time taken to complete drainage
   13.1. Hours
   13.2. Days

13.3. Weeks

14. Numbers of attempts
    14.1. Once
    14.2. Twice
    14.3. More than twice
15. Complications of the procedure
    15.1. Major complications
        15.1.1. Colonic perforations
        15.1.2. Neurovascular injury
        15.1.3. Hematoma
        15.1.4. Peritonitis
        15.1.5. Fistula
        15.1.6. Empyema
        15.1.7. none
    15.2. Minor complications
        15.2.1. Displacement of drainage
        15.2.2. Incomplete drainage
        15.2.3. Catheter obstruction
    15.3. Any other……..specify……
    …….
    15.4. none