Ultrasound Guided Percutaneous Drainage of Intra-Abdominal Abscesses and Fluid Collections

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ABSTRACT:

BACKGROUND :

Percutaneous image-guided drainage is the first-line treatment for infected or symptomatic fluid collections in the abdomen and pelvis, in the absence of indications for immediate surgery and considered potentially a life saving therapeutic surgical procedure in high risk patients .

OBJECTIVE:

To evaluate the efficacy of US-guided percutaneous drainage in treating intra-abdominal abscesses and fluid collections

PATIENTS & METHOD :

Patients with intra-abdominal collections underwent percutaneous drainage under ultrasound (US) guide were studied prospectively in the Gastro-enterology and hepatology hospital in baghdad from April 2008-Sept 2009. The procedure done under local anesthesia & aseptic technique, needle access obtained before placing the catheter .Peritoneal Dialyses catheter was used in our study.

RESULTS :

There were 43 patients (29 females and 14 males), Age ranging 8-67 years. The collections diagnosed basically on US in 33 patients (76.7%) & US and CT-scanning needed in 10 (23.3%). These collections were post-operative in 36 patients (83.7%) and primary (spontaneous) in 7 (16.3%)The post-operative cases were as follow:18 patients (50 %) operated on for gall bladder diseases, 6 (16.7 %) for abdominal trauma ,4 (11%) for acute abdomen , 4 (11%)for Hydatid cyst, 2 (5.6 %) colonic surgery and one patient (2.8 %) operated on for acute appendicitis and one (2.8%) after ERCP. Twenty three (53.5 %) of the collections were single & 20 (46.5%) were multiple. The single collections were located as: Right Hypochondrial(Right subphrenic,Subhepatic and Hepatic) in 15 patients (65.2 %), Epigastric in 4(17.4 %),2 of them were pancreatic, Pelvic in 3 (13 %) , and paracolic in one patient (4.4 %). Six patients(14 %) have hepatic collections, 4 of which were following Hydatid Cyst Surgery, the remainder were Pyogenic hepatic abscesses. Material drained was Bile in 24 patients (56 %),Pus in 17(39.5 %) & blood and urine in one patient (2.25 %) for both, Fourteen patients (32.6%) underwent more than single drainage procedure, nine of them (64.3 %) twice , three (21.4 %) three times& two (14.3%)more than 3 re-interventions.

The operations has been avoided in 26 patients (60.5 %) but was not avoidable in 17 (39.5%), because of the ultimate need of the condition for operation in 15 patients (88 %)and failure of drainage in 2 patients (4.7 %)

CONCLUSION:

US guided drainage is an efficacious therapy for intra-abdominal collections and have become the treatment of choice for a wide variety of collections. It helps to obviate or delay a major surgery.

KEY WORDS :percutaneous drainage,abdominal collections, ultrasound

INTRODUCTION:

Diseases of the abdominal organs and their surgical therapy are not infrequently complicated by intra-abdominal and pelvic abscesses and fluid collections[1,2]

Surgery is the most common aetiology of intra-abdominal abscesses [3,4,5,6]. Patients undergoing major operative procedures will presumably have nonsuppurative fluid collections from old blood,serum and irrigant[5,7] Treatment of these abscesses and collections , traditionally required clinical diagnosis and surgical intervention,and this has been revolutionized by high-resolution radiologic techniques such as computed tomographic scanning and/or ultrasonography[1,6].These studies permit precise anatomic localization of the abscesses and fluid collections and nonsurgical drainage using

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percutaneous techniques[1,7,8]. The radiologist have been playing an important role in the diagnosis and treatment of the abscesses with the recent development of these widely used imaging modalities and interventional radiology techniques [9]. A delay in the diagnosis and treatment of an abdominal abscesses may result in sepsis and multiple organ system failure,therefore early detection followed by adequate treatment is crucial and can significantly reduces mortality [10,11]. The introduction of percutaneous ultrasound-guided drainage (PUD) for the treatment of abdominal collections has completely modified the approach to this kind of complication that frequently occurs during the postoperative period following digestive surgery, PUD is an interventistic and mini-invasive procedure[11,12]. It is actually recognized as an acceptable alternative to surgical intervention [13]. Percutaneous drainage can be considered as a temporizing treatment when surgical risk is considered to be excessive ,as in critically ill patient [14]. Moreover, many reports in recent years have described successful treatment for complicated collections, like multiloculated, fistulized, or postoperative ones.[13] This procedure has become the treatment of choice for a wide variety of fluid collections[15]. It is designed to obviate or delay a major surgery [16]. The use of ultrasound scans was preferred because it is easy to perform, repeatable, and, furthermore, it provides live images of the abdominal anatomic structures during the procedure[17]. US also has the advantage of portability, which allows bedside procedure to be performed in critically ill patients who are difficult to transport[14]

Definitions

Percutaneous drainage is defined as the placement of a catheter using imaging guidance to provide continuous drainage of a fluid collection. This includes localization of the collection, and placement and maintenance of the drainage catheter(s). [4,15]

Percutaneous aspiration is defined as evacuation of a fluid collection using either a catheter or needle, with removal of the catheter or needle immediately after the aspiration.[4,15]

Indications:

The prerequisite for percutaneous drainage is an abnormal fluid collection and one of the following: suspicion that the fluid is infected, need for fluid characterization, or suspicion that the collection is producing symptoms sufficient to warrant drainage[15]

Contraindications :

Common contraindications include uncorrectable coagulopathy and the absence of a safe percutaneous path access the collection [14,15,19]

Catheter insertion technique

There are 2 methods both of which start with the insertion of a needle into the cavity

Trocar Technique ;

The trocar technique involves a catheter mounted on a sharp trocar and inserted into the abscess or collection in tandem with a guiding needle.[18,19,20]

Seldinger Technique ;

The seldinger technique involves the insertion of a hollow needle into the abscess cavity or the collection and the placement of a guide wire through the needle to create a percutaneous path for a drainage catheter. After the guide wire is inserted, the needle is withdrawn and the catheter is placed over (ie, around) the wire and inserted into the cavity[18,19,20]

PATIENTS AND METHOD:

Patients with intra-abdominal abscesses and fluid collections underwent percutaneous drainage under US guide were studied prospectively in Gastro-enterology and Hepatology Hospital in Baghdad from April 2008 to Sept 2009. The collections were detected and localized by US or US and CT-scanning and confirmed by guided percutaneous needle aspiration and a safe drainage route planned that avoided vital anatomic structure.

The procedure done under local anesthesia and aseptic technique. When the guiding needle is in the correct position, a small incision is made in the skin alongside the needle, and blunt dissection is performed. The catheter, mounted on the trocar, is then advanced in perfect parallel with the guiding needle to a premeasured depth. Even if the shape of the collection is affected by respiratory or other motion, the external portion of the guiding needle will indicate the appropriate path and angle of entry into the cavity.Correct placement within the collection is confirmed by repeating US or by free flow of fluid. The catheter is attached to a draining bag and secured to the skin by stitches, closed drainage system was used to contain the drainage and to prevent contamination. Multihole peritoneal dialyses catheter was used, the catheter flushed regularly with variable amount of saline to prevent it from clogging.Usually the catheter is removed when the drained fluid becomes scanty and clinical condition improves. Repeated imaging is required to monitor progress.

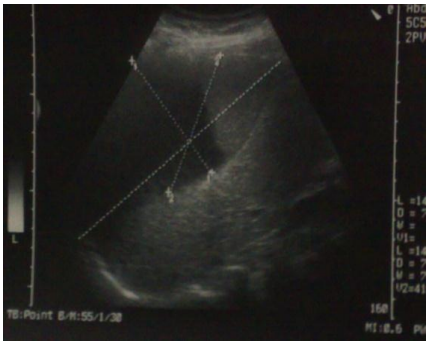

Fig 1:Collection as seen by Us

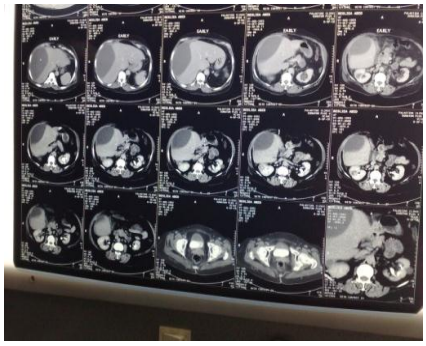

Fig 2: Collection as seen by CT scanning

Fig 3:PD catheter Set used for drainage

Fig 4:Catheter fixed to skin

Fig 5:Collecting bag

Fig 6: US after drainage

RESULTS :

Forty three patients with intra-abdominal abscesses and fluid collections underwent 65 percutaneous drainage procedure under ultrasonic guide, there were 29 females(67.4 %)and 14 males(32.6%) ,the age of the entire group ranging from 8- 67 years with a mean age of 41+16 There were 43 patients (29 females and 14 males), Age ranging 8-67 years. The collections diagnosed basically on US in 33 patients (76.7%) & US and CT-scanning needed in 10 (23.3%). These collections were post-operative in 36 patients (83.7%) and primary (spontaneous) in 7 (16.3%)The post-operative cases were as follow:18 patients (50%) operated on for gall bladder diseases, 6 (16.7 %) for abdominal\l trauma ,4(11%) for acute abdomen , 4 (11%)for Hydatid cyst, 2 (5.6 %) colonic surgery and one patient (2.8 %) operated on for acute appendicitis and one (2.8%) after ERCP.

Table 1: Distribution of the post-operative cases according to the primary operation or procedure

Operation	No,	%	% of Total
Cholecystectomy	18	50 %	42 %
Laparotomy for Abdominal trauma	6	16.7 %	14 %
Laparotomy for acute abdomen	4	11 %	9,3 %
Hydatid Cyst surgery	4	11 %	9.3 %
Colonic surgery	2	5.6 %	4.6 %
Appendicectomy	1	2.8 %	2.25 %
ERCP	1	2.8 %	2.25 %
Total	36	100%	83.7 %

Twenty three (53.5 %) of the collections were single & 20 (46.5%) were multiple.
The single collections were located as: Right Hypochondrial(Right subphrenic,Subhepatic and Hepatic) in 15 patients (65.2 %), Epigastric in 4(17.4 %),2 of them were pancreatic, Pelvic in 3 (13 %) , and paracolic in one patient (4.4 %)

Table 2: Locations of single collections (R.H.C.Subphrenic, Subhepatic &Hepatic)

Location	No	%	% of Total
R.H.C.	15	65.2 %	35 %
Epigastric*	4	17.4 %	9.2 %
Pelvic	3	13 %	7 %
Paracolic	1	4.4 %	2.3 %
Total	23	100%	53.5 %

- including pancreatic collections

Six patients(14 %) have hepatic collections, 4 of which were following Hydatid Cyst Surgery, the remainder were Pyogenic hepatic abscesses. Material drained was Bile in 24 patients (56 %),Pus in 17(39.5 %) & blood and urine in one patient (2.25 %) for both,

Fourteen patients (32.6%) underwent more than single drainage procedure, nine of them (64.3 %) twice , three (21.4 %) three times& two (14.3%)more than 3 re-interventions

Table 3: Cases underwent repeated drainage and their causes

Case No.	No.of procedures	Causes
1	2	Recollection at an another site
2	2	Recollection at an another site
3	2	Recollection at an another site
4	2	Recollection at an another site
5	2	Recollection at the same site
6	2	Recollection at the same site
7	2	Recollection at the same site
8	2	Catheter blockage
9	2	Early removal
10	3	Recollection at another site not drained primarily
11	3	Recollection at another site not drained primarily
12	3	All of the above
13	4	All of the above
14	5	All of the above
Total	36	

The operations has been avoided in 26 patients (60.5 %) but was not avoidable in 17 (39.5%), because of the ultimate need of the condition for operation in 15 patients (88 %)and failure of drainage in 2 patients (4.7 %)

DISCUSSION:

The development and refinement of percutaneous radiologic techniques have provided an effective alternative to operative drainage[21]. Compared with conventional treatment, ultrasonically guided puncture or catheter drainage is an easy, gentle, and relatively atraumatic procedure with few complications[22]. General anesthesia is unnecessary[22,23], the patients are mobile immediately, and the risk of pulmonary infections and thromboembolism is minimized[22]. In our study, detection of the collections by US only was in 33 patients(76.7%) , while CT scanning was needed in addition to US in 10 (23.3 %)of the patients, Ultrasound accuracy has also been quite favorably reported by numerous authors for fluid collection detection. Knochel et al [26] reported a sensitivity of 82% and a specificity of 94.5% and, , Carroll et al [27]reported an overall accuracy of 84%. CT scanning represents the ideal in anatomical definition of abscesses and fluid collections and in the planning of access route, but Ultrasound alone will usually provide sufficient information to establish diagnosis and guide therapy ultrasound has the advantage of flexibility during the actual insertion of the catheter and in providing rapid information on the progress of the procedure[6,28]. The most common cause of intra-abdominal collections is surgery. There were 20 multiple collections(46.5%) underwent drainage by PD under US guide, While percutaneous drainage of abdominal collections was formerly restricted to simple or single collections, experience has shown that percutaneous drainage is also successful in a high percentage of multiple or complex collections[21]. Bile was drained in 24 (56 %) of the cases. Interventional radiological procedures are effective in the emergency management of surgical bile duct injury since they are minimally invasive and have a high success rate and a low incidence of complications compared to the more complex and dangerous surgical or laparoscopic options and can be considered as life saving procedure[29]. Pus was drained in 17 (39.5 %) of our patients. Several large clinical series have documented the safety and efficacy of percutaneous drainage for treatment of intra-abdominal abscesses[14]. In some cases, laboratory analysis of a specimen may reveal the cause of the abscess; for example, a high creatinine level helps confirm a diagnosis of urinoma, and a high bilirubin content helps confirm a diagnosis of biloma or bile leak[20],amylase characterizes pseudocyst [34]. Percutaneous abscess drainage (PAD) can help stabilize critically ill patients by reducing the "toxic load" and, perhaps, improving the outcome of necessary surgical procedures. Second, PAD can improve patient management by changing a 2-step surgical procedure into a 1-step procedure[21]. Percutaneous collection drainage is now a commonly used staging method for the resolution of intra-abdominal sepsis prior to corrective operation [35],So that the successful treatment of abscesses with percutaneous drainage either obviated surgery altogether or facilitated surgery by providing a clean operative field[12]. Inspite of the 100% technical sccess in the procedure , which is exactly the same as in Marianne E et al study [35], failure of drainage in our study occurred in 2 patients(4.7 %), compared to Kumar et al[36] study , in which 3% failed to improve and underwent operative intervention, van Sonnenberg et al [10] 3.7%, and to Lagana et al [37] 8.4 %.Others reporting include Gerzof et al [38] with 26.4%, Lang et al [17] with 23%, Jaques et al [39]with 34% (15% failure and 18% partial success), Mueller et al [40] with 15%, Lameris et al[41] with 26% and Haage et al [21] with 14% . There are specific characteristics of the collection that make it unsuitable for drainage such as difficult location and thickened collection contents (hematoma, pus) [36]. Our analyses found that 29 of the patients (67.4%) with intra-abdominal abscesses and fluid collections selected for ultrasound-guided percutaneous drainage treated by a single percutaneous drainage procedure and so repeated interventions done in 14 (32.6 %) of our patients ,9/14 (64.3 %) of them (21%of total cases) needed two attempts so our results are nearly similar to that of Marianne E et al[35] study in which they concluded that percutaneous drainage is successful on the first attempt in 70 % of patients who are judged by the surgeon and radiologist to be suitable candidate. A second attempt at percutaneous drainage extended the resolution of the collection to 82 % .The results in Jeffrey et al [42] study were 57 % single drainage and 43% repeated intervention. The operation was avoided in 26 (60,5 %) of the patients ,and this is nearly similar to Karen et al study[44],in which 58.3% required no surgical management.

CONCLUSION:

US guided drainage is an efficacious therapy for intra-abdominal collections and have become the treatment of choice of wide variety of collections.It is helpful to obviate or delay a major surgery

REFERENCES:

1. Andrea Bernini,Michael P.Spender, W.Douglas Wong et al :Computed Tomography-Guided Percutaneous Abscess Drainage in Intestinal Disease:Diseases of the Colon & Rectum 1997;40: 1009-13.
2. Joerg Theisen,Holger Bartels,Wolfgang Weiss et al :Current Concepts of Percutaneous Abscess Drainage in Postoperative Retention;Journal of Gastrointestinal Surgery2005;9:280-83.
3. Jared L.Antevil, John C.Egan ,Robert O. Woodbury et al :Abdominal Computed Tomography for post operative Abscess;Is It useful during the first week?Journal of Gastrointestinal Surgery, 2006; 10:901-5.
4. R.Golfieri.A.Cappelli :Computed tomography-guided percutaneous abscess drainage in coloproctology;Tech Coloproctol 2007;11:197-208 (abstract).
5. Norwood SH,Civetta JM. Abdominal CT scanning in critically ill patients. Ann Surg 1985 ;202:166-75.
6. D P MacErlean ,R G Gibney: Radiological management of abdominal abscesses;Journal of the Royal Society of Medicine 1983;76 :256-61.
7. Junji Machi , Bernard Sigel ,Julio C.Beitler et al :Ultrasonic Examination During Surgery for Abdominal Abscess: World Journal of surgery 1983;7:409-15.
8. Amy R.Evenson ,Gautam Shrikhande,Josef E.Fischer ,Abdominal Abscess and Enteric Fistula In:Maingot's Abdominal Operations, 11th ed,McGraw Hill,2007;179-99.
9. Dervim Akinci , Okan Akhan , Mustafa N. Ozmen;Percutaneous drainage of 300 intraperitoneal abscesses with long term follow up;Cardiovasc Intervent Radiol 2005;28:744-50. (abstract)
10. Van Sonnenberg,E:Percuatneous drainage of abscess & fluid Collections:Technique,results and applications,Radiology 1982;142:1.
11. Jaffe T.Nelson R.Delong D.Paulson E : practice Patterns in percutaneous image-guided intraabdominal abscess drainage:survey of academic and private practice centres,Radiology 2004;233:750-76.
12. Guido Cerullo.Daniele Marrelli . Franco Roviello et al:Treatment of the intraabdominal abscesses through percutaneous ultrasound-guided drainage; Surg Endosc 2008;22:1200-5.
13. Giuseppe Civardi,Fabio Fornari, Luigi,Cavanna et al : Ultrasonically Guided Percutaneous Drainage of Abdominal Fluid Collections; Gastrointestinal Radiol 1990;15:245-50.
14. Jennifer L.lynch,Daniel L. Overdeck et al: Percutaneous Abdominal & Pelvic Abscess Drainage Technique , : Seminars in Interventional Radiology; 2003;20:185-93.
15. Curtis W.Bakal, David Sacks , Dana R.Burker et al :Quality improvement guidelines for adult percutaneous abscess and fluid drainage: J Vasc Interventional Radiol 2003;14:223- 25.
16. Gazelle GS,Mueller Abdominal Abscess, Imaging and Intervention,Radiol Clin North Am 1994; 32:913-32.
17. Lang , E.K, Springer, J. F. Bulch,R.J et al:Abdominal abscess drainage under radiologic guidence:Causes of failure,Radiology 1986;159:329.
18. Peter R.Mueller ;The Evolution of Image-Guided Percutaneous Abscess Drainage: Seminars in Interventional Radiology 2003; 20.
19. Duszak RL, Jr, Levy JM, Akins EW, et al. Percutaneous catheter drainage of infected intra-abdominal fluid collections. American College of Radiology. ACR Appropriateness Criteria (abstr). Radiology 2000;215:1067-75.
20. A,Gervais ,Stephen D et al ;Percutaneous Image-guided Abdominal and pelvic Abscess Drainage,RadioGraphic 2004;24:737-54.
21. John R.Haaga :Imaging Intra-abdominal Abscesses and Nonoperative Drainage Procedures; World Journal of Surgery: 1990;14:204-9.
22. Per Bagi, Svend Dueholm , Steen Karstrup : Percutaneous drainage of Appendicular Abscess ,Disease of the Colon & Rectum July 1987 ;30:532-35.
23. K.P.Wong et al : Percutaneous drainage of Pyogenic Liver Abscess;World Journal of Surgery 1990;14:492-97.
24. Elyaderani MK.Skolnick ML, Weinstein BJ.Ultrasound detection and aspiration confirmation of Intra-abdominal fluid collection;Surg Gynecology Obstetric 1979;149:529-33.
25. Gronval S. Gammelgaard J Haubek A.Holm HH.: Drainage of abdominal abscess guided by Sonography Am J R 1982;138:527-29.

26. Knochel,J.O.,Koehler,P.R.,Lee,T.G.:Diagnosis of Abdominal Abscess with Computerised Tomography & U/S : Radiology 1980;137:427.

27. Carroll,B,Silverman,P.M.,Goodwin,D.A, et al :Ultrasonograghy for detection of Intra-abdominal Abscess:Radiology 1981;140:155.

28. Hemmiy A,Davis NL, Robins RE :Surgical versus Percutaneous drainage of intra-abdominal abscess: Am J Surg 1991;161:593-95.

29. Gianpaolo Carrafiello , Domenico Lagana , Massimilliano Dizonno et al ;Emergency percutaneous treatment in surgical bile duct injury :Emergency Radiology 2008;15:335-41.

30. Windsor JA : minimal invasive pancreatic necrosectomy , Br J Surg 2007;94:132-33.

31. Benjamin P.T.L.Loveday.Anubbav Mittal. Et al : Minimally invasive management of pancreatic abscess, pseudocyst And necrosis:World J Surg 2008;32:2338-49.

32. Isaji S. Takada T. Kawarda Y et al:guidelines for the management of acute pancreatits,Surgical management. J . Hepatobiliary pancreatic surgery 2006;13:48-55.

33. Tushar R. Patel , Kepal N. Patel ,Andrew H .Boyarsky:Staphylocaccal liver abscess and acute cholecystitis in a patient with Crohn s disease receiving Infliximab:Journal of Gastriintestinal surgery, 2006;10 :105-10.

34. Van Sonnenbey , Gerhard R ,Wittich et al ;Percutaneous abscess drainage;World journal of surgery , Vol 25 ,No 3, March 2001:362-72.

35. Marianne E,Cinat,Samuel E.Wison,Adnan M.Din :Determinants for successful percutaneous image-guided drainage of intraabdominal abscesses;Arch Surg, Vol 137,July 2002:845-49.

36. Ravin R,Kumar .Justin T.Kim,Jansa.S et al: Factors Affecting the Successful Management of Intra-abdomonal Abscesses with Antibiotics and the need for Percutaneous Drainage ;Disease of the Colon &Rectum, 2006:183-89.

37. D Lagana , G. Garrafiello ,M . Mangini et al ; Image-guided percutaneous treatment of abdominal-pelvic abscesses: a 5-year experience: Radiol med 2008;113 :999-1007-abstract.

38. Gerzof , S.C.Johnson,W.c.,Robbins.A.H. et al: Expanded criteria for Percutaneous abscess drainage ,Arch. Surg 1985;120:227.

39. Jaques,P. ,Mauro ,M. ,Safrit ,H. et al features of intraabdominal abscess .Am J.Roentgenol 1986;146:1041.

40. Mueller,P.R., Simeone , J.F. ,Butch,R.J. et al :Percutaneous drainage of subphrenic abscess: Am J Roentgenol 1986;147:1237.

41. Lameris ,J.S.,Bruining,H.A.,Jeekel,J:Ultrasound-guided percutaneous drainage of intraabdominal abscess , Br.J.Surg. 1987;74:620.

42. Jeffrey W.McCann,Sanjay Maroo,Paul Wales et al ,Image-guided drainage of multiple intraabdominal abscesses in children with perforated appendicitis:an alternative to laparotomy,Pediatr Radiol 2008 ;38:661-68 (abstract)

43. Brain C,lucey,Debra H, Gervais, Peter R. Mueller; Seminars in Interventional Radiology: Catheter Management, 2003; 20 :195-202.

44. Karen B. Karlson,Eric C.Martin,Elliott I. et al ; Non-Surgical Drainage of intra-abdominal & mediastinal Abscesses ; Cardiovascular & Interventional Radiology 1981;4 :170-76.