Original Research Article

Study of technique, advantages and effectiveness of percutaneous drainage of intra-abdominal abscesses

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International Archives of Integrated Medicine, Vol. 4, Issue 3, March, 2017.

Available online at http://iaimjournal.com/
ISSN: 2394-0026 (P) **ISSN: 2394-0034 (O)**
Received on: 25-02-2017 **Accepted on:** 02-03-2017
Source of support: Nil **Conflict of interest:** None declared.
How to cite this article: Anita S, Senthil Anbumani. Study of technique, advantages and effectiveness of percutaneous drainage of intra-abdominal abscesses. IAIM, 2017; 4(3): 30-36.

Abstract

Background: Intra-abdominal abscess remains a significant cause of morbidity and mortality in the patient population. Despite therapeutic advances, it is a perplexing diagnostic and management challenges and remains a dreaded complication of surgery.

Materials and methods: Forty eight patients underwent fifty one percutaneous drainage procedures in the Barnard Institute of Radiology at the General Hospital, Chennai. There were 44 men and 7 women. The youngest of the patients was 13 years old and the oldest 56 years old.

Results: Of the 51 drainage, 35 were done under CT guidance and 16 under US guidance. Successful drainage of the collection with avoidance of operation was achieved in 43 of the 48 abscesses (89.5%). If the total number of drainages were considered, the success rate was 84.3% (43 out of 51).

Conclusion: Percutaneous catheter drainage is an important treatment option for management of intra-abdominal abscesses. It is especially valuable in patients at high risk for general anesthesia. It is also an effective alternative to operative drainage in other healthier patients. Computed tomography is the imaging modality of choice for percutaneous abscess drainage.

Key words

Intra-abdominal abscess, Percutaneous drainage, Technique, Advantage, Effectiveness.

Introduction

Intra-abdominal abscess remains a significant cause of morbidity and mortality in the patient population. Despite therapeutic advances, it is a perplexing diagnostic and management challenges and remains a dreaded complication

of surgery [1]. Nearly all intra-abdominal abscesses require some form of drainage. Surgical drainage has long been established as proper therapy for patients with infected fluid collections. Antimicrobial drugs, while important, primarily serve in an adjuvant role [2]. Over the past years, percutaneous drainage methods have evolved as an important therapeutic tool in the management of this problem [3]. With improvements in cross sectional imaging and advances in catheter technology and drainage techniques, the scope of percutaneous abscess drainage is expanding such that the majority of infected intra-abdominal fluid collections are now amenable to image guided percutaneous treatment. In 1953, solitary pyogenic abscesses of the liver that were successfully treated by percutaneous aspiration and antibiotics. Since then percutaneous abscess drainage has been refined and applied to abscesses in many locations [4]. Following the initial report by Gronvall, et al. of four cases drained under ultrasound guidance, Gerzof, et al. formalized the technique for percutaneous abscess drainage using combined ultrasound and computed tomographic guidance for successful abdominal abscess drainage in twenty nine cases. Subsequently Haaga and Weinstein confirmed the safety and effectiveness of percutaneous abscess drainage using primarily CT guidance in thirty three patients [5].

Materials and methods

Forty eight patients underwent fifty one percutaneous drainage procedure in the Barnard Institute of Radiology at the General Hospital, Chennai. There were 44 men and 7 women. The youngest of the patients was 13 years old and the oldest 56 years old.

Inclusion criteria

- Percutaneous catheter drainage is most apt to succeed when the abscess is well defined, unilocular, has a discrete wall and no internal septation. A bilocular cavity can also be drained by a single catheter, providing free communication and sufficient side holes can be placed in both lobules.
- A safe access route is mandatory. The problems that must be avoided include traversing interning loops of bowel, damaging viscera or vessels and traversing sterile cavities.
- Patients in the post-operative period or otherwise critically ill patients whose risk for general anesthesia is deemed excessive are also good candidates for percutaneous abscess drainage [6, 7].

Exclusion criteria

- Poorly defined phlegmonous collections were not considered suitable for catheter drainage. A phlegmon consists largely of inflammatory granulation tissue and is not amenable to drainage by catheter. Any manipulation of the phlegmon may be attended by exacerbation of the symptoms.
- Abscesses for which safe access routes could not be identified were not included in the study.
- Multiple loculations as well as multiple abscesses are relative contraindications. When this is the case, more than one catheter may be necessary.
- A few lesions are better treated surgically.
- Echinococcal cysts should not be punctured since there is a possibility of a violent anaphylactic reaction to spillage of contents into the peritoneal cavity.
- Inter loop abscesses if overlying bowel loops do not permit a safe passage.
- Pelvic abscess are better drained surgically through either the vagina or the rectum.
- Abnormal clotting mechanism is a relative contraindication to percutaneous catheter drainage [8, 9].

Technique

Precise localization of the abscess is mandatory. Both CT and ultrasound were used for this

purpose. CT scan was favored, although some abscess cavities were demonstrated satisfactorily on ultrasound scans. CT was preferred because of its inherent advantage over ultrasound in presence of gas, bone and bowel loops overlying the abscess. Reconstructions in the sagittal, coronal and oblique planes were deployed whenever needed to demonstrate the relationship of the abscess to adjacent organs, fascial planes and to each other if they were multiple. Contrast enhanced CT scans was obtained to assess areas of phlegmon in parenchymal organs. Following injection of IV bolus of (60 - 100 ml) contrast medium, CT sections were obtained through an area of interest identified on previous non enhanced CT scans. Phlegmonous areas are characterized by heterogenous enhancement during the phase of capillary transit of the contrast medium while liquefied components of the abscess lack enhancement [11].

Diagnostic aspiration

Demonstration of the abscess by any imaging technique is followed by diagnostic needle aspiration, the initial step in percutaneous abscess drainage. The diagnostic puncture was often under CT guidance, which usually provides optimal demonstration of the abscess and is most effective in planning a safe route of approach. Some abscesses, especially large superficial ones, may be approached with sonographic guidance and the aspiration can be guided by real time scanning [12].

Technique of aspiration

A 20-gauge needle was routinely used for this purpose. The safest and most appropriate access route was determined. The depth of needle insertion (usually to the center of the collection) was calculated from CT/US images and the distance marked on the shaft. After sterile local preparation and administration of local anesthesia, the skin was punctured. The needle was advanced in the predetermined route till the mark and negative suction applied. If gross pus is recovered, only 5 ml was aspirated. If the fluid was not grossly purulent, 20 ml was aspirated and sent for gram stain, culture and sensitivity and biochemical evaluation. If the pus was too thick to be aspirated with a 20 G needle, a 18 G needle was inserted via a new puncture. Because particulate cellular and proteinaceous debris in an abscess may settle into dependent sediment, the needle/sheath had to be advanced or withdrawn and appropriately manipulated to obtain a fresh specimen in some cases. If the patient was not on antibiotics previously, IV broad spectrum antibiotics were started after the pus had been aspirated but before actual guide wire and catheter manipulation to protect against possible bacteremia and sepsis when the abscess wall is traversed [13, 14].

Route Planning

Selection of a safe and appropriate route is perhaps the most crucial aspect of the entire procedure. Generally, drainage routes followed established surgical approaches to that particular location. Route planning includes meticulous consideration of the skin entry site, angle and depth of entry. The optimal drainage route should be direct and as short as possible, but must be absolutely free of any intervening organs or vital anatomic structures. The point of entry should be the most dependent past of the abscess as possible. CT is the method of choice for detailed anatomic delineation of the catheter access route [15].

Technique of Catheter Insertion

The “Seldinger technique” used for angiographic catheter insertion was modified for use in this procedure. Catheter insertion was done using either CT or US guidance. Fluoroscopy was used as an adjunct whenever needed as during catheter manipulation or repositioning. A floppy tip J guide wire was advanced through the aspiration needle, coiled along the back wall of the cavity and the sheath removed. An effort was made to direct the guide wire such that it will lie in the most dependent portion. A curved angiographic catheter can be used to manipulate the guide wire into the desired position. At this stage, a series of angiographic vessel dilators (8-12 F) were passed over the guide wire to dilate the tract. This facilitated subsequent catheter insertion across

the tissues of the body wall, intervening solid organ parenchyma, and surrounding reactive and fibrous tissue. The drainage catheter (9-1 2 F pigtail) was then advanced and coiled within the abscess cavity so that all the side holes are placed within the cavity lumen for optimal drainage. This can be made sure of by injecting contrast medium through the catheter. This also demonstrates any loculation and provides a comparison study for later contrast injection. The "trochar technique" is best suited for superficial collections where the window of access is large and unimpeded. The drainage catheter is back-loaded onto the trochar and the assembled unit advanced into the collection in one step. Once positioning is confirmed, the drainage catheter is slid off the trochar and the pigtail allowed to form within the cavity. This technique has the advantage of being very quick however, since initial access is with a large diameter device, repeated punctures to get the optimal tube tract are not feasible as with fine needle puncture. The trocar technique was not used in this study and all procedures were done using Seldinger technique. The abscess should not be evacuated significantly until the catheter is optimally positioned. Allowing the cavity to collapse precipitously may make subsequent catheter positioning more difficult. However, once the catheter is seated, all pus should be aspirated. With copious irrigation of normal saline, till the returns are clear, the majority of pus can be initially removed. Injection of contrast material can be done for imaging but must be gentle. The catheter was then firmly secured to the skin using sutures and placed in a sealed drainage bag [16, 17, 18].

Drainage Catheters

Two types of catheters can be used for percutaneous drainage. i) Pigtail catheters: These multiple side-hole catheters are available in various sizes. In this study 9-12 F pigtail catheters were used, the larger ones being used for the more viscous collections. ii) Sump catheters: These are multiple side-hole large bore (14 F) catheters inserted over a long metal introducer. The fitted introducer stylet provides support for the catheter and avoids the frequent problem of tissue resistance from body wall or fibrous tissue; it often obviates the need for dilators. These catheters are introduced using the trocar technique.

Catheter after Care

Close monitoring of the catheter drainage is essential for good results. The daily volume and the nature of drainage were charted to aid in the Assessment of progress [19, 20].

Results

Site of abscess, number of abscess and drainage was as per **Table – 1**. Of the 51 drainage, 35 were done under CT guidance and 16 under US guidance. Successful drainage of the collection with avoidance of operation was achieved in 43 of the 48 abscesses (89.5%). If the total number of drainages were considered, the success rate was 84.3% (43 out of 51) as per **Table - 2**.

Table – 1: Site, number of abscess.

Site of the abscesses	No. of abscesses	No. of drainages
Liver	16	16
Psoas	10	12
Spleen	1	1
Subphrenic	12	13
Paracolic gutter	3	3
Subhepatic	4	4
Total	**48**	**51**

Table – 2: Success rate of drainage.

Site	No. of drainage	Successful drainage	Success rate
Liver	16	16	93.7%
Psoas	12	8	66.6%
Spleen	1	1	100%
Pyonephrosis	2	2	100%
Subphrenic	13	11	84.6%
Paracolic	3	2	66.6%
Sub hepatic	4	4	100%

Five of the 48 abscesses were not cured by percutaneous catheter drainage (11.5%). Of the 51 drainage, 8 were failure resulting in a failure rate of (15.7%) as per **Table - 3**. Out of the 57 drainages performed, there were 4 recurrences (**Table – 4**). The recurrence rate in this series was 7.8%. About 6 patients developed complications, which gave a complication rate of (11.8%).

Table – 3: Causes of failure of drainage.

Site	No. of cases	Cause of Failure
Liver	1	Viscous contents with phlegmonous areas
Psoas	2	Indeterminate recurred twice.
Subphrenic	1	Viscosity ofcontents. Multiple loculations
Paracolic	1	Enteric communication

Table – 4: Recurrence of abscess.

Site	Cases	Cause	Management
Psoas	2	Indeterminate	Both redrained; one successful, one failed
Subphrenic	1	Premature catheter withdrawal	Redrained successfully
Paracolic	1	Enteric communication	Surgery

Discussion

The technical feasibility and clinical efficacy of PAD have been well established. An average success rate about 78% has been demonstrated in the following series. In this study, the success rate was 84.3%. Sixteen out of the seventeen liver abscess, ten out of the twelve psoas abscesses, both pyonephroses, twelve out of the thirteen subphrenic abscess, one splenic abscess, two out of the three paracolic gutter abscess and all four subhepatic abscesses were drained successfully [21].

There were five failures in this study. One liver abscess had very viscous contents with phlegmonousareas. It could not be drained with a 10 F Catheter. A 12 F Catheter was exchanged, but even then only partial cavity closure was attainable. The patient was taken up for surgery. Of the two failed psoas abscesses, one could not be drained because of the thick nature of the contents. The other recurred about 1 month after apparently satisfactory drainage. A catheter was reinserted but the abscess again recurred after catheter withdrawal and hence was considered a failure. Multiple loculations precluded successful drainage in a subphrenic abscess. Surgery was undertaken for this case. Enteric communication was demonstrated in a paracolic gutter collection, which had recurred after apparent cavity closure. The referring surgeons decided to operate upon the case, The failure rate in one series was 15.7% which compares favorably with the failure rates ranging from 12-27% in the other series [22, 23].

Premature catheter withdrawal was the cause for recurrence in a subphrenic abscess (ruptured liver abscess) after about 7 days after catheter withdrawal. Percutaneous catheter drainage was repeated for this patient and it was successful. Two psoas abscesses recurred, reason indeterminate. Both were redrained, of which one was successful and the other a failure which had been described above. The last case with recurrence was the paracolic gutter with enteric communication described above [24].

Many patients in our series were in the postoperative period or were critically ill to be considered suitable candidates for general anesthesia. There were also healthier patients fit for G.A. who were referred for PAD by the surgeons. There are several advantages of percutaneous abscess drainage over operative drainage [25].

Complication rate in various series was as per **Table – 5** and site of complications was as per **Table – 6**.

Table – 5: Complication rate in various series.

Series	No. of abscesses	Success	Complications	Morality
Hagga	32	88%	0%	0%
Gerzof	71	86%	15%	11%
Martin	22	73%	8%	0%
Van Sonnenberg	58	85%	5%	0%
This series	51	84.3	11.8	0%

Table – 6: Site of complications.

Nature of complication	No. of cases	Site
Bacteremia	3	• Sub hepatic • Liver • Pyonephrosis
Pneumothorax	1	Right lobe liver abscess
Pleural effusion	1	Subphrenic abscess
Cutaneous sinus tract	1	Spleen

Conclusion

Percutaneous catheter drainage is an important treatment option for management of intra-abdominal abscesses. It is especially valuable in patients at high risk for general anesthesia. It is also an effective alternative to operative drainage in other healthier patients. Computed tomography is the imaging modality of choice for percutaneous abscess drainage.

References

1. Altemeier, et al. Intraabdominal abscess. Am J Surg., 1973; 125: 70-79.
2. Mel, et al. Classification, diagnosis and treatment of subphrenic abscess. Rev Surg., 1971; 28: 1-21.
3. Bydder, et al. Computed tomography in diagnosis of abdominal abscess. CT, 1980; 4: 132-145.
4. Casola, et al. Abscesses in Crohn disease: percutaneous drainage. Radiology, 1987; 163:19-22.
5. Connel, et al. Upper abdominal abscess: a continuing and deadly problem.
   AJR, 1980; 134: 759-765.
6. Crass, et al. Bedside drainage of abscesses with sonographic guidance in the desperately ill. AIR, 1982; 139: 183-185.
7. Deveney, et al. Improved treatment of intra-abdominal abscess: a result of improved localization, drainage and patient care, not technique. Arch Surg., 1988; 123: 1126-1 129.
8. Dixon GD. Combined CT and fluoroscopic guidance for liver abscess drainage. AJR, 1980; 135: 397-99.
9. Doust, et al. Ultrasonic distinction of abscesses from other intra-abdominal fluid collections. Radiology, 1977; 125: 213-218.
10. Fry, et al. Reoperation for intra-abdominal abscesses. Surg Clin North Am.,
    1991; 71: 159-174.
11. Gazelle, et al. Pelvic abscesses: CT guided transrectal drainage. Radiology, 1991; 181: 4951.
12. Gerzof, et al. Percutaneous catheter of abdominal abscess guided by ultrasound and computed tomography. AIR, 1979; 133: 18.

13. Gerzof, et al. Percutaneous abscess drainage. Semin Roentgenol., 1981; 16: 62-71.
14. Gerzoff, et al. Percutaneous catheter drainage of abdominal abscesses: a five year experience. NEJM, 1981; 305: 653-657.
15. Gronvall, et al. Ultrasound-guided drainage of fluid-containing masses using angiographic catheterization techniques. AJR, 1977; 129: 9974-002.
16. Haaga, et al. CT-guided percutaneous aspiration and drainage of abscess. AJR, 1980; 135: 1187-1194.
17. Halasz, et al. Drainage of intra-abdominal abscesses: tactics and choices. Am J Surg., 1983; 146: 112-114.
18. Hemming A, Davis NL, Robbins RE. Surgical versus percutaneous drainage of intra-abdominal abscesses. Am J Surg., 1991; 161: 593-595.
19. Jaques, et al. CT features of intra-abdominal abscesses:prediction of successful percutaneous drainage AJR, 1986; 146: 1041-1045.
20. Jeffrey, et al. Percutaneous drainage of periappendiceal abscesses: review of 20 patients. MR, 1987; 149: 59-62.
21. Johnson, et al. Treatment of abdominal abscesses. Ann Surg., 1981; 194: 510-519.
22. Knochel, et al. Diagnosis of abdominal abscess with computed tomography, ultrasound and 111 in leucocyte scans. Radio1ogy, 1980; 137: 425-432.
23. Lamêris, et al. Ultrasound-guided percutaneous drainage of intra-abdominal abscesses. Br J Surg., 1987; 74: 620-623.
24. Malangoni, et al. Factors influencing the treatment of intra-abdominal abscesses. Am J Surg., 1990; 159: 167-171.
25. Martin, et al. Percutaneous drainage of postoperative intra-abdominal abscess. AJR, 1982; 138: 13-15.