OTHERS (TECHNICAL NOTE)

Percutaneous drainage of psoas and iliopsoas muscle abscesses with a one-step technique under real-time computed tomography fluoroscopic guidance

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Abstract : PURPOSE : To evaluate the utility and safety of drainage catheter installation for psoas/iliopsoas muscle abscesses using a one-step technique under the guidance of real-time computed tomography (CT) fluoroscopy. MATERIALS and METHODS : Ten psoas or iliopsoas muscle abscesses in 7 patients that were treated with percutaneous drainage were included in this study. All drainage procedures were carried out using a one-step technique under real-time CT fluoroscopic guidance. RESULTS : The drainage catheter insertion was performed successfully with the one-step technique in all lesions. Improvements in the patients' symptoms and blood test results were seen after the drainage procedure in all cases. In addition, postoperative CT scans demonstrated that the abscesses had reduced in size or disappeared in all but one patient, who was transferred to another institution while the drainage catheter was still in place. No major complications were seen in any case. CONCLUSION : The one-step procedure is simple to perform. The percutaneous drainage of psoas or iliopsoas muscle abscesses with the one-step technique under real-time CT fluoroscopic guidance is accurate and safe. Moreover, compared with the two-step technique the one-step procedure results in a shorter drainage procedure and exposes the patient and operator to lower amounts of radiation. J. Med. Invest. 63 : 323-327, August, 2016

Keywords **:** *psoas or iliopsoas muscle abscess, drainage, computed tomography fluoroscopy*

INTRODUCTION

Psoas and iliopsoas muscle abscesses were thought to be rare (1). However, the development of imaging modalities, such as computed tomography (CT) and magnetic resonance imaging (MRI), have made the diagnosis of such abscesses easier (2, 3). In addition, the incidence of methicillin-resistant Staphylococcus aureus (MRSA) abscesses has increased (4). At present, psoas and iliopsoas muscle abscesses are frequently treated with less invasive methods such as percutaneous drainage and antibiotic drugs, and percutaneous drainage using CT fluoroscopic guidance has become the standard of care (2, 5-7). However, in previous studies the percutaneous drainage of such abscesses was performed using a two-step technique (2, 3, 8), and there have not been any reports about drainage procedures involving a one-step technique.

The purpose of this study was to evaluate the utility and safety of real-time CT fluoroscopy-guided drainage catheter installation using a one-step technique for psoas and iliopsoas muscle abscesses.

MATERIALS AND METHODS

Patients

Between January 2010 and March 2014, 10 psoas or iliopsoas muscle abscesses in 7 patients were treated with percutaneous drainage and antibiotics at our hospital. All patients were informed about the benefits and potential risks of the procedure, and written informed consent was obtained from each of them. Institutional review board approval was not obtained because it is not required by our institution for this type of study. There were 6 men and 1 woman, and their ages ranged from 41 to 77 years (mean : 62.8 years). The patients' profiles are summarized in Table 1. All 7 patients had psoas muscle abscesses. Among the 7 patients, one patient had both psoas and iliopsoas muscle abscesses, and four lesions were drained in this patient (Table 1, lesion No. 4-7).

The diagnostic criteria for psoas and iliopsoas muscle abscesses were as follows : the detection of fluid collection in the relevant muscle on CT and/or MRI and an increased white blood cell (WBC) count and elevated C-reactive protein (CRP) levels in blood tests. The maximum abscess diameter was defined as the greatest diameter of the cross section of the abscess on CT or MRI.

Drainage Procedure

All drainage procedures were performed using a one-step technique under real-time CT fluoroscopic guidance. Each procedure was carried out using a 7-or 8-French Bioteq drainage catheter (Bioteque, Taipei, People's Republic of China) (Figure 1) by one of two interventional radiologists that were experienced in CT-guided interventional radiology.

The CT fluoroscopic imaging was performed with a 64-section CT scanner (Somatom Sensation Cardiac 64 ; Siemens Medical Solutions, Forchheim, Germany). The scanning parameters used for the fluoroscopic examinations were as follows : tube voltage, 120 kVp ; collimation, 12 detector rows with a slice thickness of 1.2 mm ; tube current-time product per reconstructed image, 30

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Table 1. Summary of the patients' profiles

Lesion No.	Patient's position	Location	Properties	Maximum diameter on CT (mm)	Depth of lesion (mm)	Procedure time (min)	Time until the withdrawal of the drainage catheter (days)
1	prone	psoas	bloody fluid	22	60	35	10
2	prone	psoas	abscess	15	70	27	7
3	prone	psoas	abscess	18	67	20	– (transferred)
4	lateral	psoas	serous fluid	64	95	22	20
5	lateral	iliopsoas	serous fluid	46	33	23	20
6	lateral	iliopsoas	abscess	58	35	25	9
7	lateral	iliopsoas	serous fluid	74	33	17	22
8	prone	psoas	abscess	55	42	15	7
9	prone	psoas	abscess	107	18	15	8
10	supine	psoas	serous fluid	47	92	22	7

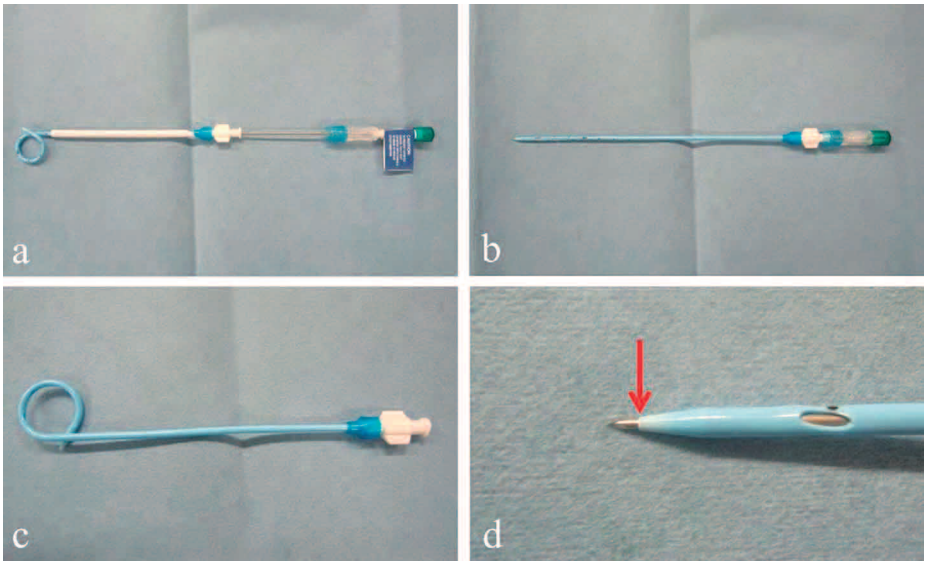


Figure 1.
The Bioteq drainage catheter (Bioteque, Taipei, People's Republic of China)
(a) Photograph of the one-step drainage catheter system
(b) Photograph showing the one-step drainage catheter system after the needle and stylet had been inserted
(c) Photograph showing the one-step drainage catheter after the needle and stylet had been withdrawn
(d) Photograph showing the tip of the catheter system after the needle and stylet had been inserted
Note the gap between the end of the drainage catheter and the tip of the trocar needle (arrow).

mAs ; rotation time, 0.5 seconds. All scans were obtained with angular beam modulation (ABM). When ABM (HandCARE ; Siemens Medical Solutions, Forchheim, Germany) was enabled, the X-ray tube was turned off between the 10 and 12 o'clock positions.

At the beginning of the procedure, CT images were obtained while the patient was in a predetermined position (a positioning marker was placed on the patient's body surface) (Figure 2b, 3a, 4a). The level of the catheter entry site and the orientation of the drainage catheter were decided after referring to the CT images in order to ensure that major blood vessels and other important organs were avoided. Second, an operator and an assistant (both of which were wearing protective lead aprons) entered the CT room, and the CT couch was moved to an appropriate position based on the positions of the entry site and abscess cavity on CT fluoroscopy. After these preparatory steps had been performed, the operator subcutaneously injected a local anesthetic at the puncture point. Then, a drainage catheter containing a trocar needle and a trocar stylet (Figure 1b) was advanced into the target lesion under real-time CT fluoroscopic guidance (Figure 3b, 4b). Since the tip of the needle was in a more advanced position than the end of the catheter (Figure 1d), when the tip of the stylet reached the middle of the fluid cavity, the catheter was pushed in while withdrawing the needle and stylet. After confirming that the fluid had been manually aspirated via the drainage catheter, CT images were obtained at the level of the catheter to check that there was no kink in the drainage catheter and that it had been accurately inserted into the abscess cavity (Figure 2c, 3c, 4c). The drainage procedure was finished after it had been confirmed on CT that no complications had occurred.

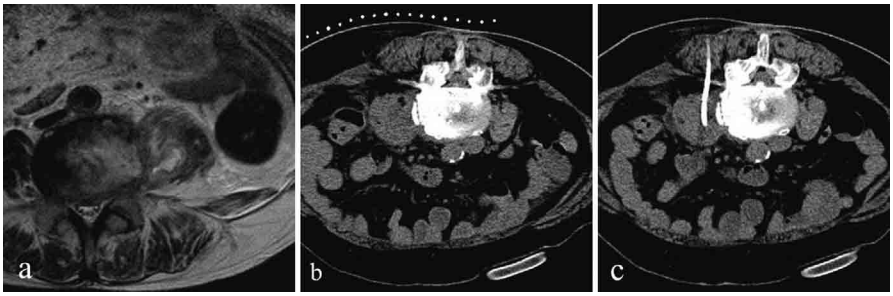


Figure 2.
A left psoas muscle abscess in a 68-year-old woman (lesion No. 2 in Table 1)
(a) MRI T2-weighted image showing a small abscess in the left psoas muscle
(b) CT image obtained in the prone position (a positioning marker was placed on the subject's body surface)
(c) A 7-French drainage catheter was accurately inserted into the left psoas muscle abscess

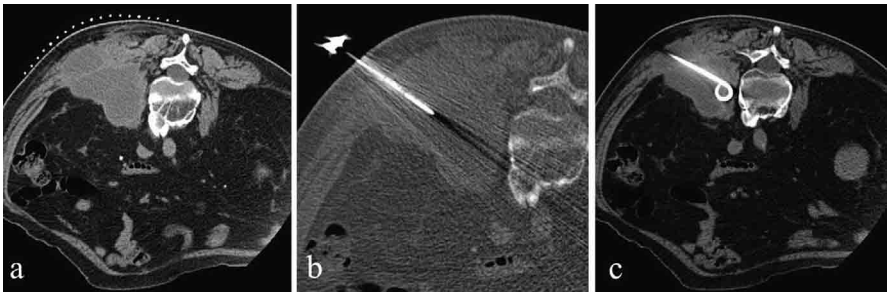


Figure 3.
A right psoas muscle abscess in a 69-year-old-man (lesion No. 9 in Table 1)
(a) CT scan obtained in the prone position (a positioning marker was placed on the patient's body surface)
The image shows a large psoas muscle abscess that extended to the subcutaneous region.
(b) CT fluoroscopic image showing the tip and root of the one-step drainage catheter
(c) An 8-French drainage catheter was accurately inserted into the right psoas muscle abscess

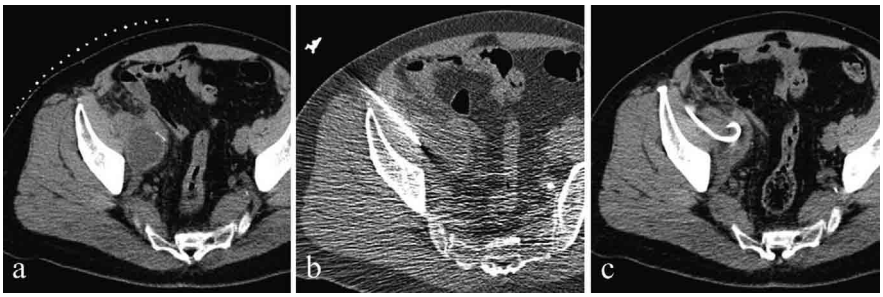


Figure 4.
A right psoas muscle abscess in a 60-year-old man (lesion No. 10 in Table 1)
(a) CT scan obtained in the supine position (a positioning marker was placed on the patient's body surface)
(b) CT fluoroscopic image showing the tip and root of the one-step drainage catheter
(c) A 7-French drainage catheter was accurately inserted into the right psoas muscle abscess

RESULTS

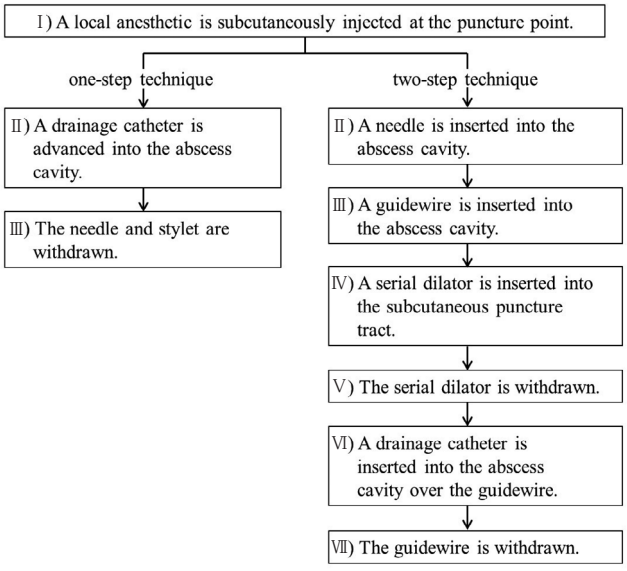
Drainage catheter insertion was successfully performed with our one-step technique in all lesions. The maximum abscess diameter ranged from 15 to 107 mm (mean : 50.6 mm). The depth of the lesions (measured from the body surface to the shallowest part of the lesion) varied from 18 to 95 mm (mean : 54.5 mm). The procedure time (defined as the time from the injection of the local anesthetic to the final checks) ranged from 15 to 35 minutes (mean : 22.1 minutes). Detailed data about each lesion are shown in Table 1. Improvements in the patients' symptoms and blood test results were seen in all cases after the drainage procedure. In all cases, postoperative CT demonstrated that the abscesses had reduced in size or disappeared. Usually the drainage catheter is removed when the inflammatory findings (e.g. : blood test abnormalities, high fever) are improved and fluid has not been aspirated any more. In this study, the drainage catheters were removed in all but one patient, who was transferred to another institution while the drainage catheter was still in place. The period until the withdrawal of the drainage catheter ranged from 7 to 22 days (mean : 12.2 days). There were no major complications related to the drainage procedure.

DISCUSSION

Psoas and iliopsoas muscle abscesses are usually treated with antibiotics and surgical drainage via an extraperitoneal approach (1, 9-17). In addition, the development of imaging modalities and drainage devices has led to imaging-guided percutaneous drainage being widely used as a new treatment for the condition (2, 3, 6, 18-22). CT fluoroscopic guidance is particularly suitable for treating such lesions because CT fluoroscopy is capable of showing the whole abscess, the puncture site and route, major blood vessels, and other organs that should be avoided in real-time (18-22). The utility of CT fluoroscopic guidance for aiding the treatment of abdominal and pelvic abscesses has been widely reported. Daly *et al.* (18) reported that 95% (56/59) of CT fluoroscopy-guided drainage procedures for abdominal and pelvic fluid collections were successful. Similarly, Kato *et al.* (20) and Yamagami *et al.* (8) reported that 97% (35/36) and 100% (28/28) of drainage procedures were successful. Therefore, CT fluoroscopy is useful for facilitating the accurate and safe drainage of abdominal and pelvic abscesses (21, 22).

However, the drainage procedures described in previous reports involved a two-step technique. Such drainage procedures usually require the following stages (Table 2) (22) : 1) a needle is inserted into the abscess cavity using forceps to reduce the amount of radiation that the operator's hands are exposed to under the guidance of real-time CT fluoroscopy, and the abscess is aspirated manually ; 2) a guidewire is inserted into the abscess cavity under X-ray fluoroscopy ; 3) a serial dilator is inserted into the subcutaneous puncture tract ; 4) the serial dilator is withdrawn ; 5) a drainage catheter is inserted into the abscess cavity through the guidewire ; and 6) the guidewire is withdrawn. On the other hand, our one-step technique does not require a guidewire or serial dilator because the drainage catheter contains the puncture needle (Figure 1). Thus, the use of the one-step technique simplifies the drainage procedure and can result in shorter procedure time. In this study, the procedure time ranged from 15 to 35 minutes (mean : 22.1 minutes). Yamagami *et al.* (22) reported that the mean time required to drain a psoas muscle abscess with the two-step technique was 35.6 minutes. In the latter study, the mean procedure time was longer than the mean procedure time obtained in the present study. Shortening the procedure time not only lightens the burden on the patient but also reduces the amounts of radiation that the patient and operator are exposed to.

Table 2. Drainage procedures employed with the one-step and two-step techniques



The abscesses in the present study were located in deep regions. The depth of the lesions (measured from the body surface to the shallowest part of the lesion) ranged from 18 to 95 mm (mean : 54.5 mm). Despite this, all of the drainage procedures were successful, partly because the tip of the drainage catheter could be easily visualized on CT fluoroscopy (Figure 3b, 4b).

Nevertheless, there are some disadvantages to our one-step drainage procedure. One is that the needle insertion force of the Bioteq drainage catheter is inferior to that of the needle used in the two-step technique because there is a gap between the end of the drainage catheter and the tip of the trocar needle (Figure 1d). The second is that when the Bioteq drainage catheter is inserted, it is grasped with forceps in order to reduce the amount of radiation that the operator's hands are exposed to, and the tips of the forceps are covered with rubber to prevent the drainage catheter from being damaged. Forceps with rubber tips can easily slip, which makes puncture procedures involving such forceps a little difficult. However, in the present study, drainage catheter insertion with the one-step technique was performed successfully in all cases. Third, there is a possibility that the tip of the catheter will penetrate into the tissue beyond the abscess in cases involving small abscesses, even when the location of the tip is confirmed on CT images during the puncture procedure, because the catheter tip becomes curled after the withdrawal of the needle.

The present study had several limitations. First, the present study was a retrospective, single-center study. Second, this was a feasibility study involving a small sample size. Third, smaller abscesses can be treated with antibiotics alone. Weal N *et al.* (5) reported that psoas abscesses that are smaller than 3 cm in greatest diameter can be managed successfully with antibiotics alone. In the present study, there were three abscesses that were smaller than 3 cm in greatest diameter. Therefore, it is possible that these three lesions could have been treated with antibiotics alone. However, antibiotics had been given to the three patients with small abscesses for 1 week prior to the drainage procedure, but they were not effective. Thus, percutaneous drainage was effective in these patients.

In conclusion, the percutaneous drainage of psoas and iliopsoas muscle abscesses with the one-step technique under real-time computed tomography fluoroscopic guidance is accurate and safe. The one-step technique is simple and easy. Moreover, compared with the two-step technique it results in a shorter drainage procedure and exposes the patient and operator to lower amounts of radiation.

REFERENCES

1. Ricci MA, Rose FB, Meyer KK : Pyogenic psoas abscess : worldwide variations in etiology. World J Surg 10 : 834-843, 1986
2. Cantasdemir M, Kara B, Cebi D, Selcuk ND, Numan F : Computed tomography-guided percutaneous catheter drainage of primary and secondary iliopsoas abscess. Clin Radiol 58 : 811-815, 2003
3. Mueller PR, Ferrucci JT Jr, Wittenberg J, Simeone JF, Butch RJ : Iliopsoas abscess : treatment by CT-guided percutaneous catheter drainage. AJR Am J Roentgenol 142 : 359-362, 1984
4. Alonso CD, Barclay S, Tao X, Auwaerter PG : Increasing incidence of iliopsoas abscesses with MRSA as a predominant pathogen. Journal of infection 63 : 1-7, 2011
5. Yacoub WN, Sohn HJ, Chan S, Petrosyan M, Vermaire HM, Kelso RL, Towfigh S, Mason RJ : Psoas abscess rarely requires surgical intervention. The American Journal of Surgery 196 :

223-227, 2008
6. Vatandaslar F, Alemdaroglu A : CT-guided percutaneous drainage of psoas abscess. Urology 29 : 450-453, 1987
7. Gaener JP, Meiring PD, Ravi K, Gupta R : Psoas abscess—not as rare as we think. Colorectal Dis 9 : 269-274, 2007
8. Yamagami T, Terayama K, Yoshimatsu R, Matsumoto T, Miura H, Nishimura T : Percutaneous drainage of psoas abscess under real-time computed tomography fluoroscopic guidance. Skeletal Radiol 38 : 275-280, 2009
9. Gruenwald I, Abrahamson J, Cohen O : Psoas abscess : case report and review of the literature. J Urol 147 : 1624-1626, 1992
10. Leu SY, Leonard MB, Beart RW Jr, Dozois RR : Psoas abscess : changing patterns of diagnosis and etiology. Dis Colon Rectum 29 : 694-698, 1986
11. Procaccino JA, Lavery IC, Fazio VW, Oakley JR : Psoas abscess : difficulties encountered. Dis Colon Rectum 34 : 784-789, 1991
12. Walsh TR, Reilly JR, Hanley E, Webster M, Peitzman A, Steed DL : Changing etiology of iliopsoas abscess. Am J Surg 163 : 413-416, 1992
13. Desandre AR, Cottone FJ : Iliopsoas abscess : etiology, diagnosis, and treatment. Am Surg 61 : 1087-1091, 1995
14. Lee YT, Lee CM, Su SC, Liu CP, Wang TE : Psoas abscess : a 10 year review. J Microbiol Immunol Infect 32 : 40-46, 1999
15. Santaella RO, Fishman EK, Lipsett PA : Primary vs. secondary iliopsoas abscess. Arch Surg 130 : 1309-1313, 1995
16. Kao PF, Tsui KH, Leu HS, Tsai MF, Tzen KY : Diagnosis and treatment of pyogenic psoas abscess in diabetic patients : usefulness of computed tomography and gallium-67 scanning. Urology 57 : 246-251, 2001
17. Afaq A, Jain BK, Dargan P, Bhattacharya SK, Rauniyar RK, Kukreti R : Surgical drainage of primary iliopsoas abscess—safe and cost-effective treatment. Trop Doct 32 : 133-135, 2002
18. Daly B, Templeton PA : Real-time CT fluoroscopy : evolution of an interventional tool. Radiology 211 : 309-315, 1999
19. Carlson SK, Bender CE, Classic KL, Zink FE, Quam JP, Ward EM, Oberg AL : Benefits and safety of CT fluoroscopy in interventional radiologic procedures. Radiology 219 : 515-520, 2001
20. Kato T, Yamagami T, Iida S, Tanaka O, Hirota T, Nishimura T : Percutaneous drainage under real-time computed tomography-fluoroscopy guidance. Hepato-Gastroenterology 52 : 1048-1052, 2005
21. Matsumoto T, Yamagami T, Morishita H, Iida S, Asai S, Masui K, Yamazoe S, Sato O, Nishimura T : CT-guided percutaneous drainage within intervertebral space for pyogenic spondylodiscitis with psoas abscess. Acta Radiologica 53 : 76-80, 2012
22. Yamagami T, Tanaka O, Yoshimatsu R, Miura H, Ochiai T, Otsuji E, Sawada M, Soh J, Nishimura T : Percutaneous drainage with a one-step technique under real-time computed tomography fluoroscopic guidance. Hepato-Gastroenterology 59 : 701-704, 2012