Percutaneous Catheter Drainage of Abdominal Abscesses Guided by Ultrasound and Computed Tomography

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Ultrasonography and computed tomography were used to diagnose, localize, and guide the percutaneous drainage of 24 intraabdominal and retroperitoneal abscesses in 23 surgical and medical inpatients 16 of whom had abscess formation as a postoperative complication. On the basis of anatomic detail from sectional imaging, safe percutaneous drainage routes similar to surgical approaches were defined. After confirmation by needle aspiration, one of two methods of percutaneous catheter introduction were used: (1) a modified Seldinger technique for placement of an 8 French pigtail catheter and (2) a trocar catheter technique for placement of a 12 or 16 French catheter. Once in position, the catheters were managed as a surgically placed drain. In 22 of 24 cases, percutaneous catheter drainage was curative with no surgery required. There were no deaths or recurrences with an average follow-up period of 12 months ranging from 1 week to 3 years. Percutaneous aspiration and drainage should be considered as an alternative to surgery in the treatment of intraabdominal or retroperitoneal abscess.

Traditionally the management of abdominal abscess has been based on incision and drainage. The surgical approaches to the common sites of abscess formation have been well defined [1–7]. In this tradition, percutaneous needling of abscesses has been viewed with considerable disfavor [1, 8, 9]. However, the advent of computed tomography (CT) and ultrasonography which allow precise localization of abscesses has made possible guided percutaneous placement of catheters large enough to effect adequate and definitive drainage [10–12]. This paper presents the results of our efforts using this methodology as an alternative to surgery.

Subjects and Methods

Percutaneous aspiration and drainage was performed on 24 abscesses in 23 patients (18 male and five female). Age range was 19–77 years (average, 53). All were medical or surgical inpatients clinically suspected of having an intraabdominal or retroperitoneal abscess. Initially, high surgical risk was a pertinent factor in patient referral. However, more elective cases were referred as success was documented. Initially too, all cases were from the Boston Veterans Administration Medical Center. Later, however, eight abscesses in seven patients were drained by one of us (S.G.G.) at five local institutions. 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 [13, 14].

Sonograms were performed with a variety of commercially-available gray scale ultrasound scanners. Longitudinal and transverse scans were performed generally at 1 cm intervals in the area of interest.

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CT was performed using either the Ohio Nuclear Delta 50 Scanner (2½ min scan time, 13 mm slice thickness) or an Ohio Nuclear 2010 Scanner (2 sec scan time, 1 cm slice thickness). Scans were performed at 1 cm intervals in the area of interest and at 2 cm intervals elsewhere. CT examinations were generally performed first without and then with contrast enhancement [15]. For the 2½ min scanner, 300 ml of 30% methylglucamine diatrizoate (Reno-M-Dip, Squibb) was infused over 20 min with the enhanced scans performed during the last half of the infusion. For the 2 sec scanner, enhanced scans were performed immediately after a bolus injection of 50 ml of methylglucamine diatrizoate 60% (Renografin 60, Squibb). CT was used whenever sonographic findings were equivocal or whenever finer anatomic detail was necessary for choice of a safe drainage route.

While both CT and ultrasonography were used diagnostically and for planning the drainage route, CT alone would have provided all necessary diagnostic information in those cases where it was used. Indeed, it should be stressed that drainage procedures would likely *not* have been attempted without CT-derived information in about half of the cases. Because it provides closer monitoring by multiplanar scanning and simultaneous imaging, ultrasonography was generally used for final guidance of needle placement (20 of 24 cases). CT was used for needle guidance when ultrasonography was limited (4 of 24 cases).

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.

Intravenous antibiotics were generally being given for a presumed abscess prior to aspiration. Gram stain and culture of the aspirate was used to corroborate or correct the choice of antibiotic therapy [16].

The exact cutaneous entry site and proposed catheter route were meticulously planned prior to needling and were based on the size, location, and anatomic relation of the abscess to surrounding structures as shown by CT and/or ultrasound scan. The depth for needle aspiration was the shortest distance from the entry site to the near wall of the abscess to avoid perforation of the far wall, dissemination of sepsis, or viscus perforation.

Abdominal abscesses are typically ellipsoid, displacing surrounding viscera to provide a safe "window" for percutaneous access [17]. Not surprising therefore, the larger the abscess, the more displacement of surrounding viscera and the safer the percutaneous approach. Only one abscess referred for percutaneous drainage was refused for lack of a safe drainage route.

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 [18, 19]. The cutaneous entry sites were prepared and draped in aseptic fashion. Under local anesthesia and discretionary premedication, a 4 mm incision was made and then widened by blunt dissection. Using a rubbershod Kelley clamp as a needle stop, the aspiration needle was inserted in a single motion to the chosen depth and angle. The needle was withdrawn leaving the sheath in place and no more than 5 ml was aspirated for immediate smear and culture.

Only a small diagnostic sample was aspirated initially since evacuation of the abscess would permit displaced viscera to return to normal position, close the percutaneous window, and preclude any re-entry. Percutaneous drainage then proceeded immediately without moving the patient, lest any change in patient position alter the anatomic relationships and invalidate the preselected drainage route.

Drainage catheters were inserted by one of the following methods.

Modified Seldinger technique as used in angiography. After confirmatory aspiration with a sheathed needle, an 0.089 cm floppy-tip angiographic guide wire was inserted through the sheath which was then removed. A single angiographic dilator was passed over the wire to enlarge the track slightly. After removal of the dilator, an 8 French multiple-side-hole pigtail catheter was passed over the guide wire into the abscess and the wire removed [20]. The abscess was completely evacuated and the catheter sutured securely in place. The catheter tip immediately assumes its coiled pigtail shape within the abscess cavity and protects against perforation of the far wall or accidental dislodgement. In one patient only, a graduated set of dilator catheters (Biliary Stone Dilator Set, Cook, Inc., Bloomington, Ind.) up to 20 French was sequentially passed over a guide wire into a subphrenic abscess. This cumbersome technique was abandoned in favor of the simpler trocar catheter method below.

Trocar catheter technique. After confirmatory aspiration, the sheath was removed and a 12 or 16 French Argyle Ingram trocar catheter (Sherwood Medical Industries, St. Louis, Mo.) with multiple side holes, 5 ml retention balloon, suture cuff, and self-contained central stainless-steel trocar was inserted at the same site, angle, and depth as the immediately preceding aspiration needle [21–24]. The trocar was removed, the abscess aspirated, and the catheter sutured in place. Because of a tendency of the catheter to slide out through the suture cuff, the latter was removed and the suture tied around the catheter itself. In only one patient, a cholecystostomy trocar was introduced into a retroperitoneal abscess and through it a drainage tube inserted. The Argyle trocar device is clearly superior because of its smaller outer diameter.

Extraperitoneal routes were selected rather than transperitoneal routes whenever possible in accordance with general surgical principles. The routes were selected to be as dependent as possible to promote gravitational drainage.

Choice of drainage catheter technique depended on size, depth, ease of access, and location of the abscess. The smaller, less traumatic, 8 French pigtail catheter was used for small, deep abscesses with narrow percutaneous windows, for those in intimate relation to the bowel, and for parenchymal abscesses (intrarenal or intrahepatic). For larger, more superficial, nonparenchymal abscesses, the 12 or 16 French trocar catheter was used. The use of trocar catheters in vascular parenchymal organs was avoided because of the danger of laceration and hemorrhage. These decisions were based on our early experience and reports of successful nonsurgical drainage of hepatic and renal abscesses using needles or catheters of comparable size [20, 25–27].

After insertion, catheters were very gently advanced until resistance was met. Then the abscess was evacuated and the catheter very securely sutured in place. Routine isolation techniques were used whenever drainage procedures were performed.

Complete evacuation of the abscess was documented by repeat imaging studies. Position of the radiopaque catheters was documented by anteroposterior and lateral radiographs. Once in position, these catheters were managed like any surgically placed drain. They were removed when absence of drainage, clinical improvement, and repeat scan or sinogram indicated complete resolution.

Representative Case Reports

Case 1: Retrocecal Appendiceal Abscess

A 64-year-old male alcoholic with a history of cirrhosis, major variceal hemorrhages, and severe emphysema was admitted with a right lower quadrant mass, fever of 38.9°C, and white blood cell count of 14,700. Sonography showed an oval mass in the right flank consistent with an abscess in contact with the posterolateral

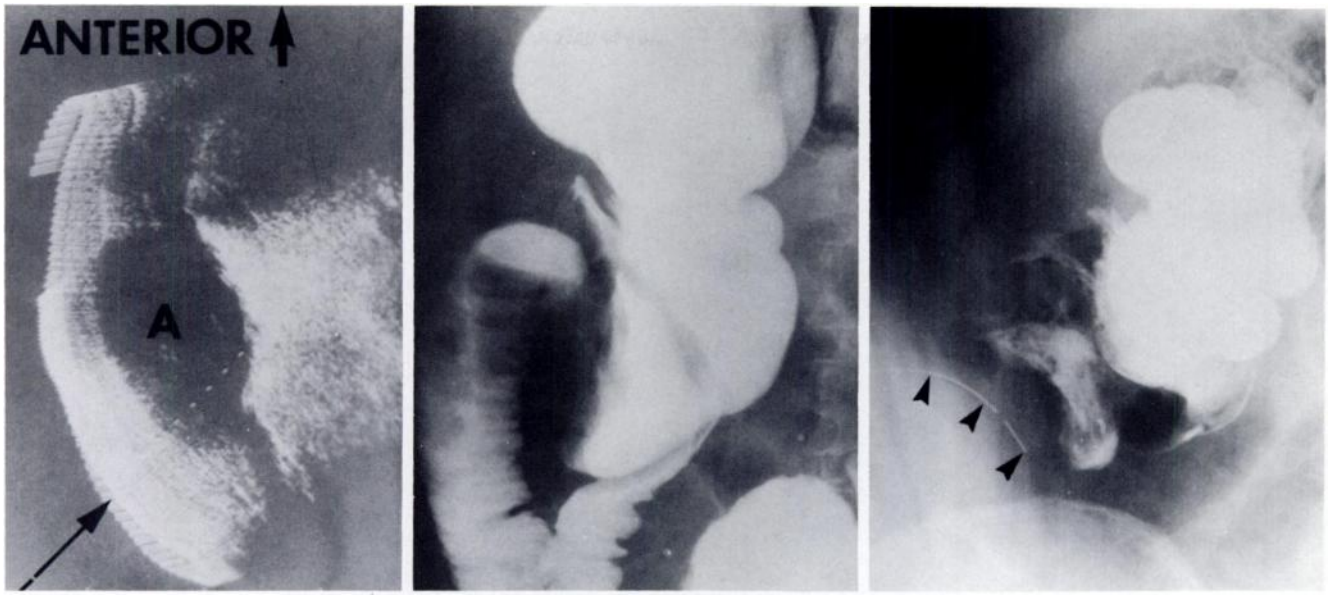


Fig. 1.—Case 1. **A,** Sonogram of right flank in transverse plane 2 cm above iliac crest. Oval 5 × 10 cm relatively anechoic abscess (A) 4 cm deep to skin posterolaterally in right lower quadrant. Good through-transmission of ultrasound by homogeneous mass with many low-level internal echoes. Long *arrow* and sonographic marker demonstrate site and angle of planned drainage route via preferable retroperitoneal pathway. Sonographic markers at 1 cm intervals indicate depth of abscess. **B,** Barium enema examination. Lateral compression and anteromedial displacement of cecum by extrinsic mass. Appendix not visualized. **C,** Radiograph immediately after percutaneous drainage. Trocar catheter (*arrowheads*) in abscess. After initial drainage of 750 ml, there is decreased mass effect on cecum which has returned to normal position.

abdominal wall (fig. 1A). Barium enema study was performed to determine the position of the cecum relative to the abscess and to exclude a perforated cecal carcinoma (fig. 1B). A diagnosis of retrocecal appendiceal abscess was made. Because the patient was a poor operative risk, percutaneous drainage was elected.

A posterolateral retroperitoneal approach was planned to take advantage of the anteromedial displacement of the cecum. After confirmatory needle aspiration, a 16 French trocar catheter was placed and 750 ml grossly purulent material was drained (fig. 1C). The patient recovered without surgery and was discharged.

Case 2: Right Subphrenic Abscess

A 19-year-old high jumper sustained a fractured liver due to blunt trauma in a track meet. Emergency right hepatic lobectomy was required to control hemorrhage. Six weeks after surgery he developed fever of 38.9°C, anorexia, and right shoulder pain. White blood cell count was 21,200. Gallium scanning and sonography (fig. 2A) showed a right subphrenic abscess and percutaneous drainage was elected.

Sonographic demonstration of the right kidney, liver, abscess, and diaphragm in the prone oblique position permitted a subcostal drainage route with 70° cephalad angulation at a depth of 9 cm. After confirmatory needle aspiration with a 20 gauge Teflon-sheathed needle, a 16 French trocar catheter was placed over the same route (fig. 2B). Moderately thick purulent material (300 ml) was aspirated and grew *Staphylococcus aureus.* The patient defeversced immediately and remained afebrile. White blood cell count returned to normal within 6 days. Daily drainage of 50–100 ml ceased on day 12 and the patient was discharged after tube removal on day 14. He remains well at follow-up 1 year later.

Case 3: Interloop Abscess

A 77-year-old immune-suppressed debilitated woman had four episodes of septic shock after a total colectomy for ulcerative colitis which required high dose maintenance steroid therapy. CT scanning (fig. 3A) showed a dumbbell-shaped interloop abscess and provided the fine anatomic detail necessary to avoid loops of bowel. An 8 French pigtail catheter was used because of the proximity of the abscess to the bowel. Moderately thick purulent material (105 ml) was aspirated and grew *Proteus mirabilis* and *E. coli.* No further epidoses of sepsis occurred. Repeat scanning (fig. 3B) showed no residual collection, but removal of the catheter disclosed a chronic cutaneous sinus tract. Shortly thereafter she died of hemorrhage from steroid-induced gastric ulcers.

Case 4: Septic Pancreatic Phlegmon

A 57-year-old man with massive hemorrhagic pancreatitis developed signs of sepsis. CT scanning showed involvement of the anterior pararenal (pancreatic) space by a phlegmon extending from the diaphragm to the pelvis (fig. 4A). Needle aspiration confirmed a high amylase and grew *Pseudomonas.* Because the patient was desperately ill and a poor operative risk, percutaneous drainage was performed as a planned temporizing measure. Three 16 French trocar catheters were placed via a retroperitoneal flank approach to drain the high, middle (fig. 4B), and pelvic retroperitoneum. Because this was a phlegmon and not yet centrally liquefied, there was relatively small but continuous drainage.

After 2 weeks, there was a seven unit hemorrhage from one of the drains, presumably from erosion of a lumbar vein. It ceased on removal of the tube. One week later, after marked nutritional improvement, the patient had surgical drainage and debridement of

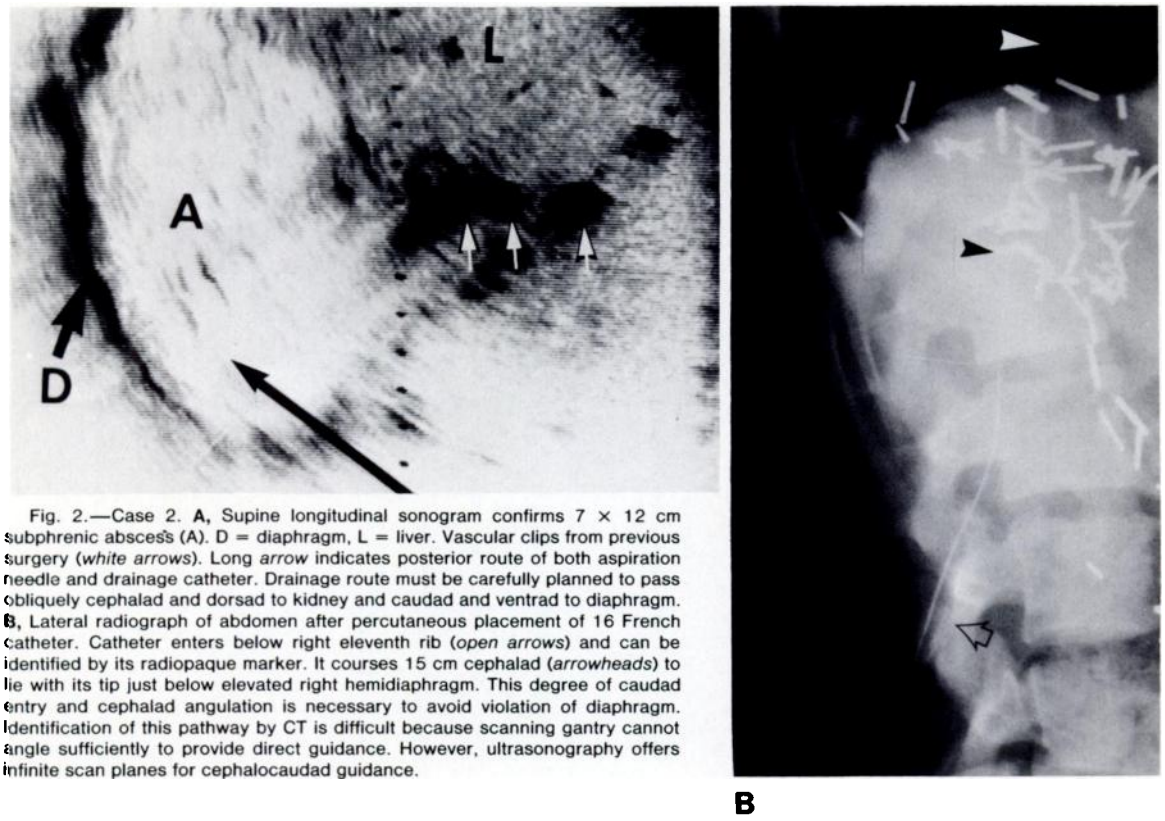


Fig. 2.—Case 2. **A,** Supine longitudinal sonogram confirms 7 × 12 cm subphrenic abscess (A). D = diaphragm, L = liver. Vascular clips from previous surgery (*white arrows*). Long *arrow* indicates posterior route of both aspiration needle and drainage catheter. Drainage route must be carefully planned to pass obliquely cephalad and dorsad to kidney and caudad and ventrad to diaphragm. **B,** Lateral radiograph of abdomen after percutaneous placement of 16 French catheter. Catheter enters below right eleventh rib (*open arrows*) and can be identified by its radiopaque marker. It courses 15 cm cephalad (*arrowheads*) to lie with its tip just below elevated right hemidiaphragm. This degree of caudad entry and cephalad angulation is necessary to avoid violation of diaphragm. Identification of this pathway by CT is difficult because scanning gantry cannot angle sufficiently to provide direct guidance. However, ultrasonography offers infinite scan planes for cephalocaudad guidance.

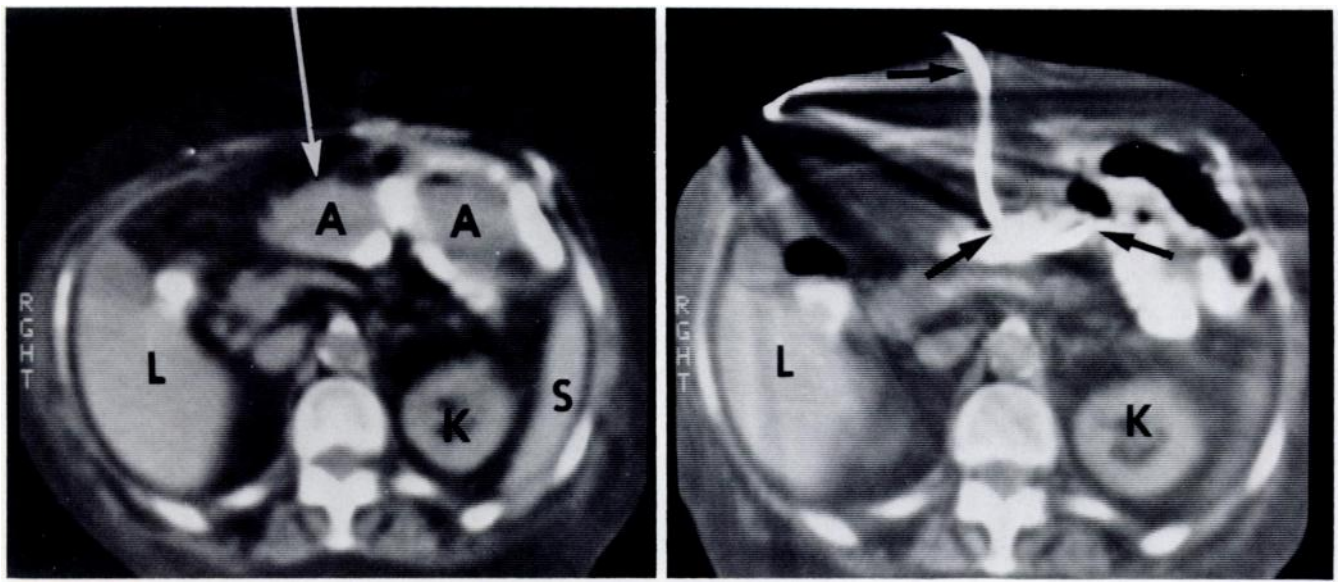
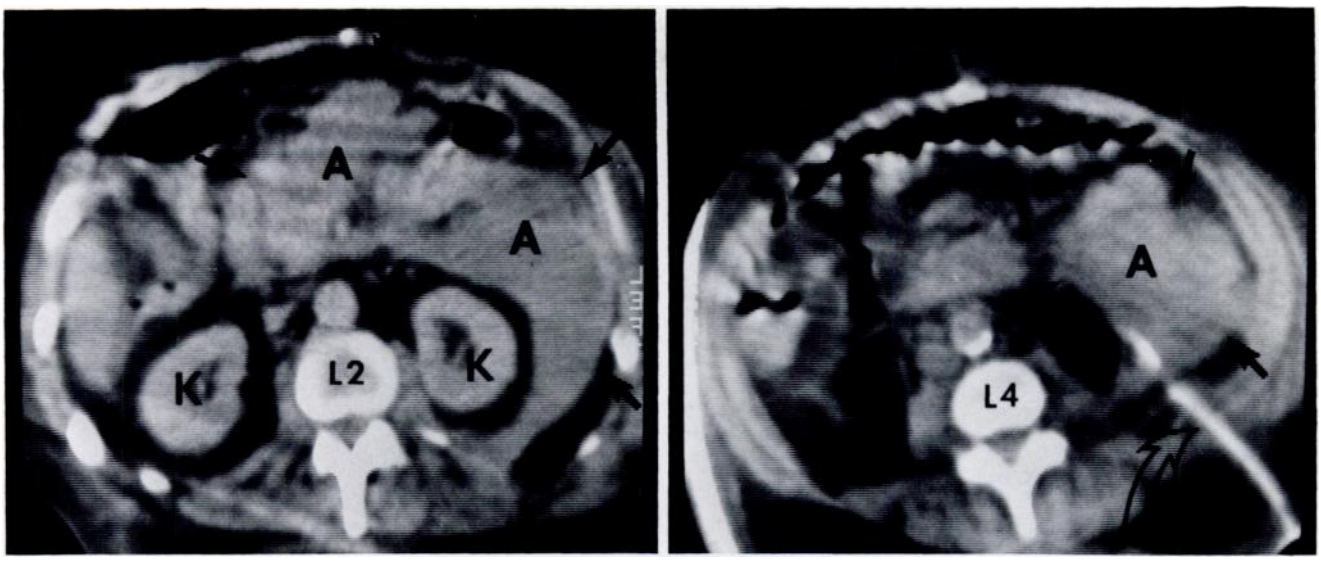


Fig. 3.—Case 3. **A,** Midabdominal CT scan. Biloculate abscess (A) surrounded by contrast-filled loops of bowel. Effect of chronic steroid therapy is apparent: decreased muscle mass and increased adipose tissue. Although ultrasonography demonstrated abscess, it did not indicate intimate relation to bowel. *Arrow* indicates needle and catheter route. L = liver, K = kidney, S = spleen. **B,** Postdrainage scan at same level. No. 8 French pigtail drain in place (*arrows*) with no evidence of residual collection.



A B

Fig. 4.—Case 4. **A**, CT scan of upper abdomen. Large septic phlegmon (A) involves anterior pararenal space (*arrows*) and extends posterolateral to left kidney. K = kidney, L2 = second lumbar vertebral body. **B**, CT scan of midabdomen. One of three 16 French trocar catheters (*open arrow*) draining lateral caudad extent of anterior pararenal space (*arrows*). L4 = fourth lumbar vertebral body.

necrotic pancreatic tissue using one of the drainage tubes as an intraoperative guide for a retroperitoneal approach. He recovered uneventfully.

Results

Table 1 summarizes the drainage procedures performed on 24 abscesses in the following locations: four subphrenic (all postoperative; three left, one right), four pancreatic (two postoperative), five intrarenal (none postoperative), three retroperitoneal (two postoperative), two intrahepatic (both postoperative), one subhepatic (postoperative), two midabdominal (both postoperative), two perirenal transplant (both postoperative), and one interloop (postoperative). Of the 24, 16 (67%) were postoperative complications. All were confirmed by smear and/or bacteriologic culture. There were 18 extraperitoneal and six transperitoneal drainage routes. All patients received a course of intravenous antibiotics while drainage catheters were in place.

There were two major complications: one empyema and one hemorrhage. There were three minor complications: one shaking chill and one fever of 40.6°C, 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).

All patients tolerated the percutaneous drainage procedure well, experiencing little or no discomfort. They generally became afebrile within 24–48 hr 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).

Three abscesses were irrigated at the discretion of the referring physician. An elongate septic pancreatic pseudocyst treated with two catheters was lavaged with normal saline injected through an 8 French pigtail catheter and aspirated from a 16 French trocar catheter. An appendiceal abscess was irrigated with half-strength Betadine. In one liver abscess, extremely viscid contents were successfully thinned and aspirated by means of vigorous saline lavages with six 25 ml volumes four times a day via an 8 French pigtail catheter. Most catheters were flushed intermittently with minimal amounts of sterile irrigant to maintain patency. Blockage of catheters did not occur.

Discussion

Percutaneous nonoperative catheter drainage is a significant departure from universally accepted but heretofore unchallenged surgical methods of operative incision and drainage for therapy of abdominal abscess. Established long before the advent of cross-sectional imaging, these surgical principles remain valid and, in fact, are generally followed in this new technique. Indeed, most of our percutaneous drainage routes closely parallel recommended operative approaches to abscesses in similar locations. Instead of direct but limited view through surgical incision, a broader field of view is obtained with cross-sectional imaging. Instead of removing purulent material at surgery by sponging, irrigation, and suction, it is aspirated via catheter. Instead of maintaining drainage with operatively placed Pen-

TABLE 1

Summary of Pertinent Data

Abscess	Size Range (ml)	Catheter Technique Used		Drainage Route		Primary Method Necessary for Route Planning	Catheter Removed (days, range)	Complications	Follow-up (range)	Successfully Treated (no surgery)	Total Treated
		Trocar	Pigtail	Extraperitoneal	Transperitoneal						
Subphrenic	590–2850	2	1	4	—	1 CT, 3 US	5–17	1 empyema	15 days to 9 mos.	4	4
Subhepatic	480	—	1	1	—	1 US	12	None	2 yrs.	1	1
Intrahepatic	65–100	—	2	1	1	2 CT	12–14	None	3–4 mos.	2	2
Intrarenal	35–80	1	4	5	—	5 US	9–12	1 shaking chill	4 mos. to 3 yrs.	4	5
Septic pancreatic phlegmon	60–3000	2	—	2	—	2 CT	21–27	1 bleed	2–6 mos.	1	2
Infected pancreatic pseudocyst	210–2000	2	1	1	1	2 CT	5–19	1 fever	2 wks. to 6 mos.	2	2
Retroperitoneal	125–480	2	1	2	1	1 CT, 2 US	6–28	None	7 mos. to 1.5 yr.	3	3
Interloop	105	—	1	—	1	1 CT	40	1 cutaneous sinus tract	6 wks.	1	1
Midabdominal intraperitoneal	425–600	2	—	—	2	1 CT, 1 US	7–9	None	1 wk. to 3 mos.	2	2
Perirenal transplant	200–250	2	—	2	—	2 US	13–27	None	4–13 mos.	2	2
Total	35–3000	13	11	18	6	10 CT, 14 US	5–40 (avg. 14)	2 major 3 minor	2 wks. to 3 yrs.	22	24

Note.—Data on 24 cases.

rose and sump drains, the percutaneously placed catheters are retained, and provide adequate drainage.

Prevalent surgical opinions suggest that 8–16 French catheters are too small to effectively aspirate and maintain drainage of abscesses because of viscosity and debris. However, to our knowledge this objection has never been studied. In our series this occurred only once when sepsis developed in a preexisting pancreatic phlegmon where necrotic debris from pancreatic digestion prevented complete resolution by percutaneous means alone (case 4).

It should be stressed that whenever percutaneous drainage is deemed inadequate, surgical drainage may then be elected at any time. Indeed, percutaneous abscess drainage may be planned as a temporizing measure in any patient who is a poor operative risk, but where some form of decompression or drainage is desirable (case 4).

Ultrasonography and CT have advantages and disadvantages that make them complementary rather than competitive in the diagnosis and management of abscesses [10, 28]. The fact that ultrasonography alone can frequently provide information to allow appropriate management decisions has been recently highlighted [28]. In our series ultrasonography alone did suffice in many cases. However, CT was crucial for the identification of many abscesses as well as the precise demonstration of their relation to the variable position of the bowel (case 3).

In this regard virtually all necessary diagnostic information was available from CT and not available from one-half the ultrasound examinations performed. Given equal availability of the instrumentation, this would strongly favor using CT as the initial diagnostic method when percutaneous aspiration and drainage of an intraperitoneal abscess is anticipated from the outset. Ultrasonography remains a valuable screening procedure and is the method of choice for most retroperitoneal, especially intrarenal, abscesses, and where guidance for cephalocaudad angulation is required (case 2). From our experience in this series, which includes representatives of all common sites of abscess formation, it seems that at least 80–90% of all abdominal abscesses are technically approachable percutaneously when using ultrasonography and/or CT for guidance.

The CT and sonographic characteristics of abscesses have been well described but are not specific, and several other entities must be considered in the differential diagnosis [10, 11, 29–32]. They include pancreatic pseudocysts, all the normal fluid-filled hollow viscera of the gastrointestinal and genitourinary tracts, hematomas, seromas, urinomas, lymphoceles, collections of bile, cysts of any origin, and, on rare occasion, primary and secondary neoplasms.

It cannot be overemphasized that correlation with clinical data and all other pertinent radiographic studies is essential prior to needling. Only then is needle aspiration performed for conformation and precedes any attempt at drainage. Unnecessary surgical exploration may be avoided by a negative diagnostic needle aspirate, if one of the above nonseptic abnormalities is found [18]. However, when aspiration is positive, a trial of percutaneous drainage is warranted.

Analysis of our experience (table 1) suggests some generalizations about percutaneous drainage procedures:

1. Renal abscesses are well drained by 8 French pigtail catheters through a retroperitoneal approach [33]. Ultrasonography usually suffices both for diagnosis and guidance.

2. It seems that supervening sepsis in a preexistent pancreatic pseudocyst is quite different from the infected pancreatic phlegmon in its response to percutaneous drainage. In the former, complete aspiration of fluid is easy, resolution is rapid, and there is no recurrence of pseudocyst. In the latter, percutaneous catheters are temporizing measures that provide decompression. They may not suffice for definitive drainage due to necrotic debris from pancreatic tissue digestion.

3. Transperitoneal drainage routes can be used when CT provides the anatomic detail necessary to avoid bowel (case 3). When CT is not available, standard radiographic contrast studies of both small bowel and colon may demonstrate bowel displacement around intraperitoneal abscesses to allow safe percutaneous access when combined with sonographic imaging and guidance (case 1).

4. The combination of CT for anatomic detail and ultrasonography for simultaneous triplanar guidance provides the easiest safest method for catheter insertion.

5. This series includes abscesses in all common locations. There was only one abscess whose small size (3 cm) and subdiaphragmatic retrogastric location were so shielded by surrounding vital structures that percutaneous needling was deemed unsafe. Therefore, it seems that most abdominal abscesses have safe percutaneous drainage routes.

6. The percutaneous accessibility of an abscess is determined by its size and location. The larger and more superficial the abscess, the easier the percutaneous access.

It is unfortunately impossible for us to directly assess the impact on length of hospitalization by this method of abscess drainage, because many patients were treated as part of a more complex clinical setting. The actual drainage time in those successfully managed averaged 14 days. However, these catheters were generally left in place 2–3 days longer than was felt necessary, to avoid potential recurrence due to premature removal. This length of treatment time still compares quite favorably with patients treated by incision and drainage in the past [2]. In addition, our success rate compares favorably with recent series that report mortality rates of 7.5%–43% and recurrence rates of up to 49% [34]. The absence of recurrence in this series may be related, in part, to two aspects of CT and sonographic imaging of abscesses: (1) earlier diagnosis and therapy, and (2) serial examinations to follow resolution and determine proper timing for drainage tube withdrawal. It was somewhat surprising that in those few cases where inadvertent premature catheter withdrawal occurred, results were no less successful than in those where catheters remained in place. We are therefore currently assessing the effect of earlier catheter removal on abscess resolution. It seems that percutaneous drainage time may be significantly shorter than that used in this study.

Conclusions

Although this series is small, the results indicate that nonsurgical drainage by percutaneously placed catheters of relatively small size in combination with appropriate antibiotics may suffice for definitive therapy in many intraabdominal and retroperitoneal abscesses. This procedure is potentially widely applicable since many institutions have CT and/or ultrasonography, materials are easily obtainable, the technique is simple, and most abdominal abscesses are amenable to this mode of therapy.

When CT or ultrasonography demonstrates a unilocular abscess with safe percutaneous access, a trial of percutaneous drainage should be considered as a method of definitive treatment. It cannot be emphasized strongly enough that this procedure need no longer be blind, as CT and ultrasonography are extremely precise for localization and guidance of the aspiration needles and drains. Although the procedure is technically simple, it is best performed by those trained in guided needle biopsy and cyst aspiration procedures, and experienced in cross-sectional imaging.

Finally it should be pointed out that guided percutaneous aspiration and drainage of abscesses fulfills the classic surgical criterial suggested 40 years ago by Ochsner and DeBakey [9]. They stated "the ideal type of drainage procedure" is, "one characterized by directness, simplicity, and above all, avoidance of unnecessary contamination of uninvolved areas"!

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