Percutaneous drainage of abdominal abscess

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Abstract

The mortality in undrained abdominal abscesses is high with a mortality rate ranging between 45 and 100%. The outcome in abdominal abscesses, however, has improved due to advances in image guided percutaneous interventional techniques. The main indications for the catheter drainage include treatment or palliation of sepsis associated with an infected fluid collection, and alleviation of the symptoms that may be caused by fluid collections by virtue of their size, like pancreatic pseudocele or lymphocele. The single liver abscesses may be drained with ultrasound guidance only, whereas the multiple abscesses usually require computed tomography (CT) guidance and placement of multiple catheters. The pancreatic abscesses are generally drained routinely and urgently. Non-infected pancreatic pseudocysts may be simply observed unless they are symptomatic or cause problems such as pain or obstruction of the biliary or the gastrointestinal tract. Percutaneous routes that have been described to drain pelvic abscesses include transrectal or transvaginal approach with sonographic guidance, a transgluteal, paracoccygeal–infrafragluteal, or perineal approach through the greater sciatic foramen with CT guidance. Both the renal and the perirenal abscesses are amenable to percutaneous drainage. Percutaneous drainage provides an effective and safe alternative to more invasive surgical drainage in most patients with psoas abscesses as well. © 2002 Elsevier Science Ireland Ltd. All rights reserved.

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1. Introduction

Intraabdominal abscesses may be intraperitoneal, retroperitoneal or visceral. Although the clinical features vary depending on the location of an abscess, fever, leukocytosis, and increased erythrocyte sedimentation rate are frequently noted. The mortality in undrained abdominal abscesses is high with a mortality rate ranging between 45 and 100% [1,2]. The outcome in abdominal abscesses, however, has improved over the recent decades due to advancement in surgical techniques as well as development of image guided percutaneous interventional techniques which allow for an effective drainage with minimal trauma to the tissues. The role of percutaneous drainage in various abdominal abscesses has been reviewed in this paper.

2. Imaging

Radiological diagnosis of a clinically suspected abdominal abscess is essential to guide the treatment. The first-line diagnostic tools include plain abdominal films and ultrasonography (US). Although the plain films are of limited value, they can show the presence of intraperitoneal free air, and may detect extraluminal air-fluid levels. US is a fast, portable, and cheap diagnostic tool; furthermore it is free of ionizing radiation. US is a very useful tool for the detection and localization of fluid collection in the abdomen [3]. Although the sonographic appearances of sterile and infected collections may be similar, some criteria have been outlined in an attempt to differentiate these [4–6]. Typically, uninfected fluid collections such as cysts and lymphoceles have few internal echoes, well-defined walls, and excellent sonographic through transmission. In contrast, the typical sonographic appearance of an abscess is that of an anechoic mass with irregular margins and more or less internal echoes. Depending on the composition of the abscess, it may appear as a solid or a complex mass...
as the bloody or the cellular fluid tend to appear highly echogenic. Gas within the fluid collection is highly suggestive of infection. Gas appears as an area of increased echogenicity with or without acoustic shadowing depending on the amount that is present. US is particularly useful in evaluating the multiloculated collections [7]. US is difficult to use in patients who are obese, who have an ileus, or who have extensive surgical wounds [4].

Although US is useful, computed tomography (CT) is the preferred method in the diagnosis of an abdominal abscess. CT is more accurate than US for detection of intraabdominal abscesses and provides an excellent anatomic detail, and clearly demonstrates the relation of the fluid collection to the near-by structures [3,8]. Unfortunately, as with US, CT appearances of sterile and infected fluid collections are non-specific and overlapping. CT is not affected by the surgical wounds or dressings, ileus, or obesity. An abscess appears as a soft tissue mass with interior density measurements ranging between 0 and 25 Hounsfield units. The wall is represented by a high density irregular peripheral rim which enhances after contrast medium injection. There may be gas within the cavity. The adjacent fascial planes may be obliterated or thickened [8]. When performing CT scans for the purpose of detecting intraabdominal abscesses, it is essential to obtain thorough opacification of the bowel by using dilute barium or water-soluble contrast media. Otherwise fluid filled bowel loops may be mistaken for abscesses or conversely an abscess may be misinterpreted as a fluid filled bowel segment.

Radionuclide imaging with $^{67}\text{Ga}$- and $^{111}\text{In}$-labeled leukocytes provide useful information in the diagnosis of abdominal abscesses. These agents accumulate in the abscess and appear as hot spots in areas of inflammation or abscess and also in tumors [8]. The major disadvantage of scintigrapy studies is that they do not provide sufficient anatomic details to help plan and select the best access for percutaneous drainage.

### 3. Percutaneous drainage

The pre-procedural preparation includes identification of the indications for diagnostic needle aspiration and subsequent catheter drainage, excluding or treating coagulopathy, choosing the imaging modality for guidance during the procedure, and choosing the appropriate route of access. Before the procedure, informed consent should be taken following a thorough discussion with the patient. The basic indication for needle aspiration is to confirm the radiological diagnosis of an abscess because the radiological signs may not distinguish amongst various types of fluid collection including abscess, hematoma, urinoma, biloma, lymphocele, seroma, and loculated ascites. The main indications for the catheter drainage include treatment or palliation of sepsis associated with an infected fluid collection, and alleviation of the symptoms that may be caused by fluid collections by virtue of their size, like pancreatic pseudocoele or lymphocele.

Either US or CT may be used for guidance during the procedure. US provides real-time imaging and it is the method of choice with the relatively superficially located and unilocular abscesses, where there is little risk of transgressing a vascular structure, bowel, or pleural cavity. Combining fluoroscopy with the US and opacification of the cavity provide precise positioning of the catheter and increase both the safety and effectiveness of the procedure. US is a unique choice when transrectal or transvaginal imaging is to be used during the drainage procedure. CT is the method of choice when US guidance does not seem to be safe enough. In our experience, we prefer the combination of US and fluoroscopy in most of the cases.

Diagnostic aspiration is usually performed with a 22 G needle. Aspiration of pus is immediately followed by placement of a drainage catheter. Absence of bacteria on the Gram stain should not be surprising especially in the patients who have received antibiotics. Presence of bacteria without leukocytes may be seen in immune-compromised patients. If the sample does not look like pus, it will be useful to check for creatinine level to rule out a urinoma, presence of lymphocytes and fat globules for lymphocele, amylase for pancreatic pseudocysts, and bilirubin for bilomas. Diagnostic aspiration may be done as a separate procedure or it may serve as the initial step of a catheter drainage. Various methods may be employed to catheterize the cavity. These include Cope method, Hawkins method, tandem technique, two-needle non-tandem technique, single 18- or 20-G needle technique, and the Trocar technique [9]. The reader may refer to the Ref. [5] for a detailed description of these techniques. In our experience, we insert an 18-G needle under US guidance for diagnostic aspiration of the superficial abscesses. Later, we keep the needle in place and advance a 0.035 inch guide wire through the same needle for catheterization. For the deeply situated abscesses, we use a 22-G needle for the diagnostic aspiration. Then we exchange the needle for an 0.018 inch guide wire, followed by advancement of a 5-Fr dilator over the wire. A 0.035 inch guide wire placed through the dilator allows placement of drainage catheters of any size following serial dilatation. There is a wide range of drainage catheters including non-sump catheters ranging from 6 to 12 Fr in diameter, sump drains with double lumen available 12–18 Fr size, Malecot catheters of various size, and Trocar catheters which are designed for single step drainage [8,9]. Although the largest size that can be safely placed is recommended for an effective drainage, no difference was found in success rate, recurrence rate, incidence of
Abdominal abscesses categorized by their sites

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4.1. Liver abscess

Liver abscess formation occurs whenever the initial inflammatory response fails to clear an infectious insult from the liver [11]. Various diseases that may lead to pyogenic liver abscesses include prior abdominal surgery, trauma, neoplastic disease, biliary tract disease, or bacteremia in immune-compromised patients [12] (Fig. 1). Liver abscesses can be single or multiple. In a recent study, the authors found out that single liver abscesses are mostly cryptogenic in origin whereas most of the multiple abscesses had a biliary origin [13]. Klebsiella pneumonia was the main bacterium isolated in the single abscess group, while Escherichia coli was the leading microorganism in the multiple abscess group. Single pyogenic abscesses are frequently located in the right lobe of the liver where multiple abscesses occupy both lobes [14]. The percentage of multiple liver abscesses range from 45.5 to 71% [15,16].

Most of the pyogenic hepatic abscesses present as homogenous hypoechoic lesions on US. The cavity walls are thick and irregular. If there is air within the cavity it appears hyperechoic with or without acoustic shadowing. Demonstration of shifting fluid levels with changing position of the patient is very helpful in diagnosis. The posterior enhancement frequently seen in pyogenic abscesses is not seen in amebic abscesses [17]. The US findings suggesting an amebic abscess include a rounded or oval lesion that is hypochoic or homogenous in appearance with an absence of significant wall echoes; a lesion that is near or contiguous with the liver capsule, and enhanced through transmission of the sound deep to the lesion [18,19]. The CT findings of a pyogenic liver abscess include hypodense homogenous lesions with or without thick rims, fluid levels, or microbubbles.

Untreated pyogenic liver abscesses are almost uniformly fatal [11]. Early intervention in the form of surgical therapy or catheter drainage and parenteral antibiotics is the rule in pyogenic liver abscess. The single abscesses may be drained with US guidance only, whereas the multiple liver abscesses usually require CT guidance and placement of multiple catheters [20]. The abscesses located near the dome of the diaphragm may be technically difficult to drain. The safest access tract can be found with a combination of fluoroscopy and US. Drainage may also be done under CT guidance with an angled gantry. Over the past decade, percutaneous aspiration of pyogenic liver abscess without catheter drainage has gained increased attention. In combination with antibiotic therapy, success rates up to 98% have been reported with needle aspiration alone [21,22]. Future studies such as a randomized trial comparing needle aspiration with catheter drainage are needed to decide about the efficiency of the needle drainage alone (Fig. 2).

The management of amebic liver abscess differs radically from that of pyogenic liver abscess. Medical management with antibiotics such as metronidazole is the cornerstone of therapy in amebic liver abscess [23]. The amebic abscesses require drainage in cases of failure of medical treatment, a cavity larger than 6–8 cm in diameter, and increased risk of rupture [20]. The prognosis of amebic abscess is much better than that of pyogenic abscess and usually a quick response to therapy is seen in amebic abscesses [23].

It should be remembered that intrahepatic fluid collections from other causes may also be infected and turn into an abscess. Hematoma, tumors, simple cysts, and hydatid cysts may serve as sources for such secondary abscesses (Fig. 3). Excluding the tumors, all of the above mentioned secondary abscesses can be treated like the pyogenic abscesses. A tumoral abscess...
can also be drained if the tumor is not resectable. The treatment of the uninfected hydatid cysts, on the other hand, is not within the scope of this review, because the nature and treatment of these cysts are much different from the liver abscesses [24,25].

4.2. Pancreatic abscess

Pancreatic phlegmon is a solid mass of swollen inflamed pancreas often containing patchy areas of necrosis. Occasionally extensive areas of pancreatic

Fig. 1. Forty-one-year-old male patient was admitted to the hospital with right upper quadrant pain 2 years after liver hydatid cyst surgery. (a) PA chest radiogram reveals elevation of the right hemidiaphragm. (b) Abdominal US demonstrates 15 × 17 × 20 cm abscess in the right lobe of liver. (c) Abdominal CT demonstrates the huge liver abscess with calcification in the wall. (d) The abscess was catheterized under US guidance. Cavitogram obtained 1 day after the procedure shows decreased cavity size. (e) Control US demonstrates prominent decrease in the size. The catheter was withdrawn as the daily drainage was about 5 ml 1 month after the catheterization.
necrosis develop which require drainage. Pseudocysts of the pancreas are collections of tissue, fluid debris, pancreatic enzymes and blood, which develop over a period of 1–4 weeks after the onset of acute pancreatitis [26]. Pseudocysts may be seen as unencapsulated amorphous fluid collections early in acute pancreatitis and, if persistent, as a well-defined, encapsulated fluid space 4–6 weeks later. Immature pseudocysts are included in the descriptive term ‘acute pancreatic fluid collection’ which has the advantage of not implying clear margin or wall, as is suggested by the term 'pseudocyst'. Although progression of a pseudocyst to maturity is generally predictable on the basis of duration, with 6 weeks being the arbitrary time for maturation, this obviously is not true, and this concept has been questioned [27]. Occasionally, chronic pseudocysts are found to be immature at surgery. Evaluation of amylase isoenzymes has been proposed as a predictor of pseudocyst formation [28]. The phlegmons or pseudocysts may be secondarily infected, resulting in abscess formation. Abscess is suggested on clinical grounds. Contrast enhanced CT is useful in the diagnosis and differentiation of the above mentioned conditions associated with acute pancreatitis. Significant pancreatic fluid collection is found in approximately 40% of patients hospitalized for acute pancreatitis who are routinely examined with CT [27]. These fluid collections represent the so called acute pancreatic fluid collection and lack a wall on CT. Phlegmons present as pancreatic masses that enhance with intravenous contrast media throughout much of the mass [29]. Pancreatic necrosis and hemorrhagic necrosis occur within the first 1–2 weeks after the acute pancreatitis and manifest as lack of contrast enhancement of the pancreas [30]. Infected or non-infected pseudocysts appear as round collections with discrete walls.

The pancreatic abscesses are generally drained routinely and urgently [20,29,31,32] (Fig. 4). Non-infected pancreatic pseudocysts may be simply observed unless they are symptomatic or cause problems such as pain or obstruction of the biliary or the gastrointestinal tract [20]. The indications for drainage of pseudocysts include recurrent pain on attempts at feeding after resolution of acute pancreatitis, enlarging pseudocyst, secondary infection, intracystic hemorrhage, and mass effect causing biliary or bowel obstruction [27].

The most commonly preferred treatment for pseudocysts is direct catheter drainage that avoids intestinal loops [9]. The approach may be by transgastric, transperitoneal or retroperitoneal route depending on the anatomy of the surrounding viscera, and size, location, and the extent of the lesion. CT is recommended as the method of guidance because it clearly provides the most optimal depiction of abscesses, their response to intravenous contrast material, the presence or absence of gas, the potential for drainage, and the optimal position of adjacent structures [29]. Single step aspiration is not sufficient in most of the times with recurrence rates approaching 70% [33,34]. Catheter drainage is associated with much lower recurrence [34]. The output of externally draining catheters is followed and sinography is performed when output decreases to evaluate for completion of drainage, pancreatic duct communication, cysto-enteric fistula and retained debris [27]. The catheter is removed when the drainage is less than 10 ml/day. The reported success rates range between 70 and 100% [27,29,31–34]. Alternatively, a transgastric route has also been described in which the catheter is left in place 2 weeks or longer depending on whether communication with the pancreatic duct is present. If there is no communication the catheter can be removed 2–3 weeks after insertion. If communication is present the catheter is kept in place to ensure
development of a mature, fibrous tract between the pseudocyst and the stomach, preserving the ductal drainage and the decompression of the pseudocyst [9].

Percutaneous drainage of infected pseudocysts is similar to that of non-infected ones. Pancreatic necrosis can also be drained if it is liquefied. Large-bore catheters (20–30 F) are used for drainage [20].

5. Pelvic abscesses

The pelvis is a frequent site of abscess formation, particularly in postoperative patients because it is the most dependent portion of the abdominal cavity and the infected fluid can easily collect there and become walled off [3] (Fig. 5). Furthermore, appendicitis, diverticulitis, and pelvic inflammatory disease may lead to pelvic abscesses.

Percutaneous routes that have been described to drain pelvic abscesses include transrectal or transvaginal approach with sonographic guidance, a transgluteal, paracoccygeal–infragluteal, or perineal approach through the greater sciatic foramen with CT guidance [3,35–41]. In the transgluteal approach the needle is directed caudal to the sacrospinous ligament and it passes through the sciatic nerve. It is recommended that the catheter tract pass as close to the sacrum as possible while sparing the rectum (Fig. 6). Thus, transgression through the sciatic nerve and superior and inferior gluteal vessels is avoided [3,38]. The most commonly reported disadvantage of transgluteal approach is the associated pain or discomfort in as
Fig. 3. Fifty-eight-year-old male patient with fever and leukocytosis. (a) Abdominal US reveals hydatid cyst lesion with degenerated and separated endocyst. There is also internal echoes in the cyst. The cyst is very close to main bile duct, which is dilated (9 mm). (b) Cyst was catheterized under fluoroscopic and sonographic guidance. Purulent material was aspirated and 10 Fr catheter was introduced into the cavity. One hundred and twenty milliliter cystic fluid aspirated just after the procedure. Fever subsided the day after the procedure. Cavitogram demonstrates cysto-biliary fistula. Endoscopic papillotomy was performed to decrease the pressure in the biliary system to allow biliary decompression. (c) Patient was discharged from the hospital 1 month after the procedure but daily controls were made in the interventional radiology suite. Cavitogram which was obtained 2 months later showed nearly complete obliteration of the cavity. A few days later the catheter was withdrawn when daily drainage was about 5 ml. (d) Control CT examination was performed 1 month later and it demonstrated the absence of abscess. Note that there are the findings of chronic cholecystitis.

many as 20% of patients. However, advances in pain control and sedation, both for catheter placement and discomfort after the procedure have made transgluteal catheters acceptable to most patients including the pediatric age group [35]. A CT-guided paracoccygeal–infra-gluteal approach may also be used for presacral abscesses [39]. Another approach to drain the deep pelvic abscesses is the transvaginal US guided approach

[37,40]. Transvaginal approach provides the simplest, safest and most direct access for drainage of abscesses situated close to the apex of the vaginal vault. However, there are limitations to the use of this route for drainage of pelvic abscesses. In prepubescent or sexually inactive patients, the transvaginal route may not be appropriate. Collections situated in certain parts of the pelvis such as the presacral space and ischiorectal fossa are not accessible by the transvaginal route [37]. Furthermore, some technical difficulty may be encountered with this technique. Because the vagina is a muscular structure, puncture, dilatation and catheter placement

Fig. 4. Fifty-three-year-old female patient who was hospitalized for acute pancreatitis developed fever and abdominal mass. (a) Abscess just anterior the pancreas and posterior to stomach is identified on abdominal CT examination. (b) Abscess was catheterized under floroscopic and ultrasonographic guidance. Fourteen Fr catheter was introduced into the cavity and 450 ml of purulent material was aspirated just after catheterization. Control abdominal CT examination 1 month after the procedure demonstrates the catheter in the abscess cavity which is decreased in size. (c) Cavitogram demonstrates absence of fistulous communication and partial obliteration of the cavity. (d) Control abdominal CT 6 months after removal of the catheter revealed minimal residual collection but close follow-up was decided since the patient was asymptomatic. (e) Abdominal US demonstrated no change in the size of the lesion 1 year after the removal of the catheter.
may be difficult [36]. US-guided transrectal approach is another effective means of draining the deep pelvic abscesses [41]. In both standing and recumbent positions, the rectum is the most dependent portion of the pelvis. Abscess drainage using this approach, therefore, provides a pathway that allows drainage via the most dependent route [3]. In addition to US guidance, fluoroscopy or CT guidance may also be used for the transrectal approach. In our experience we use the US guidance in most of the times.

6. Enteric abscesses

The principle role of percutaneous drainage with diverticular, appendiceal, and other enteric abscesses such as Chron’s disease is usually temporizing. In the treatment of diverticular abscess, it can be used as an adjunct to relieve fever and other symptoms before surgery. Various presentations of diverticulitis have been outlined by Hinchey et al. [42]. These include small diverticular perforation localized to the mesentery, limited perforation still localized in the pelvis or mesentery, perforation into pelvis without fecal spillage, and perforation with fecal spillage. Percutaneous drainage seems to provide benefit in cases with limited perforation and pelvic perforation without fecal spillage [43]. After resolution of the symptoms, the patients can undergo resection of the affected colon segment.

Periappendiceal abscesses may arise as a complication of appendicitis or appendectomy. Abscess formation resulting from a gangrenous or perforated appendix is seen in 2–3% of appendicitis cases [8]. A periappendiceal abscess should be discriminated from phlegmonous thickening of omentum and small bowel loops, which presents as a mass of soft tissue density. A periappendiceal abscess, on the other hand, is a well-defined fluid collection. Periappendiceal abscesses may be drained preoperatively, in which case appendectomy can be done under elective conditions. Elective appendectomy may even be unnecessary after percutaneous abscess drainage of the periappendiceal abscess [44]. Patients with postappendectomy abscesses also respond favorably to percutaneous drainage. However, catheter drainage for several weeks is required in this group to allow the fistula that is already present to heal [45].

Abscesses may occur either spontaneously or postoperatively in Crohn’s disease. The abscess may be a result of the direct extension of the disease from the involved bowel segment, hematogenous seeding, and peritoneal contamination or anastomotic breakdown after surgery [46]. Abscesses in Crohn’s disease occur most frequently between the leaves of the mesentery (intramesenteric), between adjacent bowel loops (interloop), between the bowel loop and the adjacent viscera or the anterior abdominal wall (enteroparietal), and less frequently in the retroperitoneum and the pelvis. Crohn’s abscesses are associated with high morbidity rate. Selected cases can be drained percutaneously, without adding to the morbidity, and sometimes resulting in abscess resolution [47]. The drainage catheters should be kept in place long enough to make sure that the enteric communications close. However, because of the relapsing nature of the disease, the percutaneous drainage seems to have a temporizing role in the treatment prior to definite surgical intervention [48].
Postoperative abscesses can also be treated by percutaneous drainage. Because the mortality associated with postoperative intraabdominal sepsis may be as high as 30% [49], prompt recognition and treatment of these abscesses is important. Fluid collections resulting from intraoperative irrigation, edema, old blood, and inflammatory changes resulting from surgical manipulation in the immediate postoperative period can make the diagnosis difficult. The 8th postoperative day is generally the recommended time to perform CT imaging [50]. Once an abscess is detected, percutaneous drainage can be performed as a temporizing procedure before the surgical revision. In some cases the percutaneous treatment can be the definitive treatment [51]. The presence of anastomotic dehiscence, multiple loculations, high fluid viscosity may prevent successful percutaneous drainage. In cases of anastomotic abscesses the enteric communication can be demonstrated by a sinogram obtained after percutaneous decompression of the collection. The anastomotic leak may heal and seal by percutaneous drainage alone [20]. Surgery is needed in resistant cases.

In patients with abscesses related to enteric processes, drainage is best performed with CT guidance to adequately visualize the collections in relation to neighbouring bowel loops and thereby avoid traversing bowel with drainage catheter [3].

Fig. 5. Seventy-two-year-old female patient who underwent an operation for rectum adenocarcinoma had an abscess due to anastomosis leakage. (a) Abscess in the presacral space is identified with iv and rectal contrast enhanced abdominal CT. (b) Needle tip is demonstrated in the abscess under CT guidance. (c) Cavitogram of the presacral abscess with opacification of the bowel loops. (d) Abdominal CT 1 month after the procedure demonstrates the catheter in the empty abscess cavity before it is withdrawn.
Fig. 6. Twenty-year-old male patient with pericecal abscess after appendectomy. (a) Abdominal CT scan reveals pericecal abscess. (b) CT guided abscess drainage was performed and needle tip in the abscess cavity is seen. (c) Cavitogram 1 day after the procedure demonstrates the communication of the abscess with cecum. (d) Catheter was gradually withdrawn and finally replaced with a straight catheter. After disappeared communication with colon, decreased daily drainage, and subsided fever, the catheter was withdrawn.

7. Splenic abscess

Splenic abscess is a rare condition with an autopsy incidence of 0.14–0.70%. Predisposing causes include metastatic hematogenous infections as in endocarditis, contiguous site of infection, hemoglobinopathies as in sickle cell disease, immunodeficiency as in acquired immune deficiency syndrome, and trauma [52]. Annually reported cases of splenic abscess are fewer than 500, and the majority of reported cases are caused by hematogenous infections [53]. Clinically, the classic triad of fever, leukocytosis, and left upper quadrant abdominal pain is suggestive when present. Chest radiograms may be abnormal in 33–80% of the patients and the most common findings include a left pleural effusion, a left basilar pulmonary infiltrate, and an elevated left hemidiaphragm [52,54–56]. The abdominal radiograph may show a soft tissue mass, extraluminal gas shadow, or a non-gastric air-fluid level in the left upper quadrant. US has a sensitivity of 75–90% in the diagnosis splenic abscess [55,56]. Lesions are usually anechoic or hypoechoic with an irregular wall and occasionally mixed echogenic interior. CT is superior to US with a sensitivity of 96% [56]. Lesions are typically
low dense parenchymal areas with peripheral contrast enhancement after intravenous contrast material injection. Sometimes it may be difficult to distinguish a splenic abscess from a splenic infarct. Splenic abscesses have been treated successfully with percutaneous approach either by catheterization [53,57] or by needle aspirations [58]. Reported success rates ranged from 75 to 100% in the literature although several catheterizations have been needed to achieve cure [52,53,58]. In the above mentioned studies rescue splenectomies were performed for the failed percutaneous treatments. Multilocular abscesses, septations, tenacious contents, and abscess rupture with bleeding have been proposed as relative contraindications for percutaneous drainage [53,56]. Medical therapy alone has been recently successful in fungal abscess [55,59].

8. Renal and perirenal abscesses

There is a high incidence of underlying renal disease in patients with renal abscess [60]. Such predisposing conditions include nephrolithiasis, hydronephrosis, and sepsis [20,60]. Renal abscesses may rupture externally and may present as a perinephric abscess. Renal abscesses may also rupture into the collecting system or into the vascular structure. Both the renal and the perirenal abscesses are amenable to percutaneous drainage (Fig. 7). If urinary obstruction is associated with a renal or perirenal abscess, a percutaneous nephrostomy may be needed for access to stone removal or to relieve a malignant or a benign obstruction [20].

9. Iliopsoas abscess

The abscesses in the iliopsoas compartment may be secondary to previous surgery, penetrating trauma, hematogenous-contiguous spread from spinal osteomyelitis or tuberculosis, renal infection or inflammatory bowel disease [61–63]. Psoas abscesses can be drained under either US or CT guidance which is more sensitive to demonstrate the exact location, extent and relation to nearby structures of the abscess. Vertebral involvement in patients with pyogenic abscess is very rare than in patients with tuberculous abscess. Unilocular pyogenic abscesses can be easily treated by percutaneous drainage and antibiotics. Although surgery is generally performed in patients with iliopsoas tuberculous abscess, it is associated with 40% of failure or recurrence rate [64]. Therefore, percutaneous drainage under image guidance provides an effective and safe alternative to more invasive surgical drainage in most patients with tuberculous psoas abscesses as well as pyogenic abscesses [64,65] (Fig. 8).

Fig. 7. Fifty-nine-year-old female patient was admitted to the hospital with fever, leukocytosis and right costovertebral tenderness. (a) Abdominal CT reveals right perirenal abscess which displaces the right kidney anteriorly and medially. Abscess was catheterized under US and fluoroscopic guidance, 600 cc purulent material was aspirated just after catheterization. (b) CT examination performed 12 days after the catheterization demonstrates 14 Fr catheter in the cavity. Note decreased cavity size and normal position of the right kidney. Catheter was removed a few days later since daily drainage was under 5 ml and no collection was observed on US examination.
Fig. 8. Thirty-three-year-old male patient with bilateral psoas abscess. (a) Panoramic US image shows left psoas abscess. (b) Axial T2 weighted image of abdomen demonstrates bilateral psoas abscess. (c) Cavitogram of the left psoas abscess which was catheterized with 14 Fr catheter. (d) Cavitogram of the right psoas abscess which was catheterized with 12 Fr catheter. Acid resistant bacilli and gram (+) cocci were identified in the aspirated samples of both sides. Catheters were kept in place for about 1 month and withdrawn when there were no visible collections in the cavities on US.

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