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An Overview on Treatment of Appendicular Abscess

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Abstract:

An appendicular abscess is a localized collection of pus resulting from perforation or gangrene of the appendix, often due to delayed diagnosis or treatment of acute appendicitis. It represents a protective mechanism where the omentum and surrounding bowel loops wall off the infection, preventing generalized peritonitis. The incidence varies globally, with higher rates in regions with limited access to early surgical care. Management strategies have evolved from emergency appendectomy to more conservative approaches, including intravenous antibiotics and image-guided percutaneous drainage, followed by interval appendectomy when indicated. The choice of treatment depends on the patient's clinical status, size and location of the abscess, available resources, and surgeon's expertise.

Keywords: Appendicular abscess, Appendicitis, Interval appendectomy, Percutaneous drainage, Antibiotic therapy, Complicated appendicitis, Intra-abdominal abscess, Conservative management.

Introduction:

Appendicular abscess is a complication of acute appendicitis, occurring in approximately 2–6% of patients, typically as a result of delayed presentation or atypical clinical features that mask early diagnosis **(1).** In this condition, the inflamed appendix perforates, leading to localized pus collection contained by the omentum and adjacent bowel loops. The clinical presentation is often subacute, with persistent right lower quadrant pain, low-grade fever, anorexia, and localized tenderness, sometimes accompanied by a palpable mass.

Historically, immediate appendectomy was advocated; however, this approach is associated with higher morbidity due to dense adhesions, distorted anatomy, and increased risk of bowel injury **(2).** Current evidence supports an initial conservative approach—comprising broad-spectrum antibiotics, hydration, and, when indicated, percutaneous drainage—followed by interval appendectomy in selected patients **(3).** This strategy reduces postoperative complications and allows resolution of inflammation before definitive surgery.

Despite advances in imaging and minimally invasive drainage techniques, the optimal management of appendicular abscess remains debated, with variations in practice between institutions and regions. This article reviews the pathophysiology, clinical presentation, diagnostic modalities, and evolving treatment options for appendicular abscess, with a focus on evidence-based decision-making and individualized patient care.

Surgical drainage of appendicular abscess:

The surgical drainage can be done either laparoscopic or open. It is indicated When the patient present with life-threatening signs of peritonitis, large appendicular abscess and the patients with an extra luminal appendicolith **(4).**

Laparoscopic drainage:

Laparoscopic surgery is recently applied to the treatment of complicated appendicitis, including the drainage of peri-appendicular abscess. It offers the advantage of exploration of the peritoneal cavity and drainage

of abscess that are not amenable to a percutaneous approach. However, adhesion and combined phlegmonous change around the abscess make laparoscopic dissection a challenging, if not risky, procedure. **(5).**

Steps and approach:

Placement of trocars: Make a 2-cm supraumbilical incision directlyabove the umbilicus . Perform ,meticulous dissection through the subcutaneous tissue, beyond the Scarpa fascia, and down to the linea alba skeletonizing the fascia. Then gently introduce the trocar through this defect and initiate carbon dioxide insufflation.Meticulously visualize the entire abdominal cavity. ,For the placement of the next two 5-mm trocars place the patient into a steep Trendelenburg position. Place the first trocar to the left of the midline, 1 cm above the pubic ramus. Make a 1-cm horizontal incision. Place the second 5-mm port 2 cm above and medial to the left anterior superior iliac spine(ASIS).**(6).**

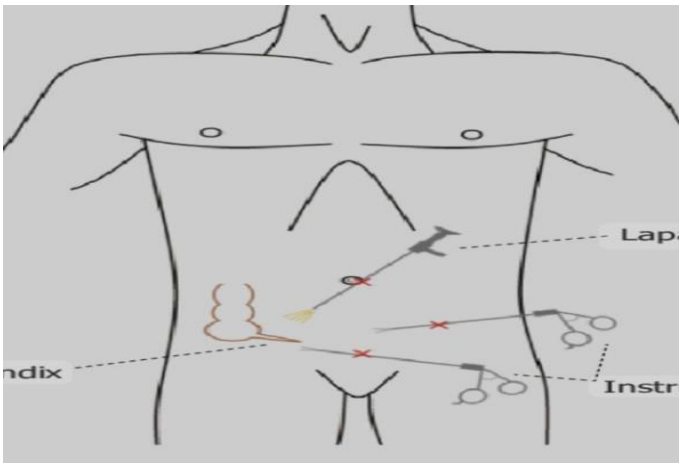


Fig 1: 3 ports are used to place instruments in the abdomen (7).

Once all of the trocars have been placed and in order to obtain the best visualization of the proposed target , rotate the patient so that the left side is down while maintaining the steep Trendelenburg position. This maneuver allows gravity to retract the small bowel away from the operating field. . **(6).**

Place two atraumatic graspers through the 5-mm trocars, assisting the gravitational pull; grasping both the the left upper quadrant toward omentum and small bowel, place them (LUQ) Locating the appendix .s hould always start with visualization of the right colon. Once the right colon has been identified, follow the taeniae coli down to the confluence at the base of the cecum; this leads directly to the appendix. Use the grasper to clutch the tip of the appendix through the suprapubic port, holding it up and out toward the LUQ. This should provide good visualization of the mesoappendix and the appendiceal base. **(6).**

In certain situations, for better visualization of the appendix, the right colon may have to be mobilized in .addition to the ileocolic junction. This can be done with either the hook electrocautery or the ultrasonic scalpel this mobilization along the white line of Toldt, grasp the colon through the ASIS port with accomplish Again, to the right hand, holding the colon up and out toward the LUQ. This clearly reveals the demarcation of the retroperitoneal attachments, allowing dissection through the suprapubic port. **(6).**

Removal of any adhesions with the surroundings by sharp and blunt dissection to gain access to appendicular abscess, drain all the pus by suction and irrigation with warm saline. **(6).**

After complete separation of the appendix from surrounding and complete drainage of pus and removal of all necrotic tissue, removal of the remnant appendix is performed as follow: With the tip of the appendix grasped and placed in the proper position, an ultrasonic device is used to divide the mesoappendix toward the base of the appendix. Once the entire mesoappendix has been coagulated and transected, the appendix should be well skeletonized . stapler is used for base of the appendix also endoscopic loops ,endoscopic clips and suturs are other options for ligation of the base.then appendix is removed from the umblical port . **(6).**

Irrigate and suction this area, as well as the pelvis. Irrigating and suctioning of the pelvis are best performed with the surgeon's body repositioned so that his or her back faces cephalad. With the right hand, place the suction irrigator through the suprapubic port into the pelvis. With the left hand, using an atraumatic grasper with its jaws spread apart, hold away the pelvic contents through the ASIS port. Once irrigation and suction are completed and Under direct visualization, remove all instruments from the abdominal cavity, helping to visualize any active hemorrhage. Cease abdominal insufflation, and turn off the light source to the camera/scope. All incisions are closed with interrupted 4-0 polyglactin or poliglecaprone sutures. Apply Dermabond to reinforce closure of the skin **(6).**

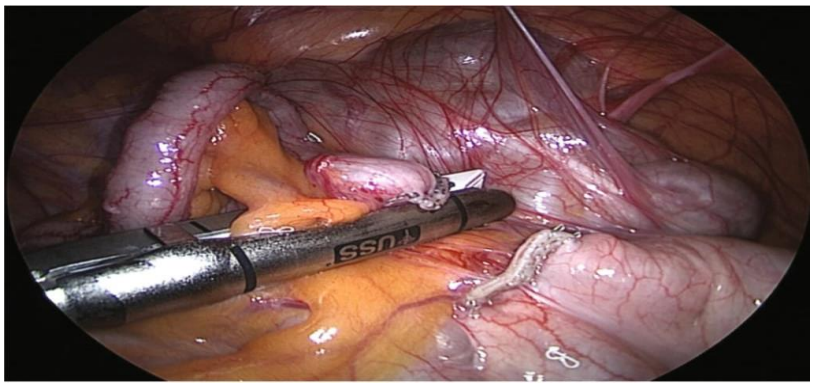
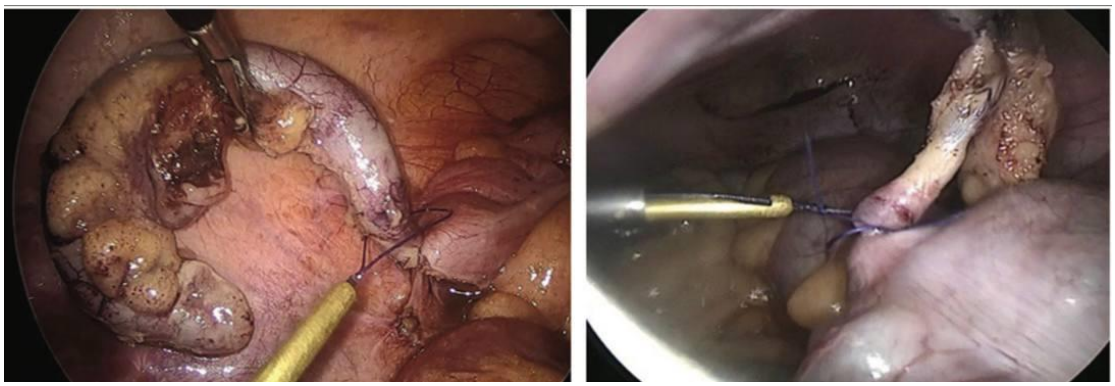
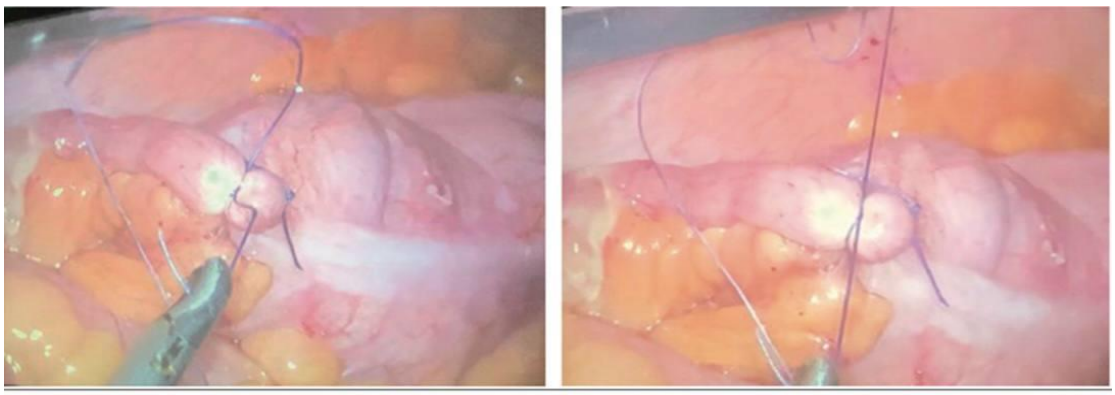


Fig 2: Resection of the base of the appendix with stapler (8).



Endoloop ligation base of appendix

Clips ligation base of appendix



Advantages of Laparoscopic surgery:

Better visualization: The laparoscope provides a magnified view, helping in precise identification of the appendix and extent of the abscess. Evaluation of the entire abdomen: Allows inspection of other intra-ab dominal organs, which is useful if the diagnosis is uncertain or if other pathology is suspected. Effective drainage and irrigation which reducing the risk of residual infection. Shorter hospital stay. Less postoperative pain. Lower risk of wound infection. Faster recovery and return to normal activity. Better cosmetic outcome. Less risk of incisional hernia. **(9).**

Disadvantages of Laparoscopic surgery:

Increased risk of intra-abdominal Contamination: During laparoscopy, manipulation of the abscess may lead to spillage of purulent material into the peritoneal cavity, potentially increasing the risk of generalized peritonitis or sepsis. Longer operative time: Laparoscopic surgery, especially in the presence of dense adhesions or inflamed tissues, may take longer than open procedures. Higher technical demand: Requires greater surgical expertise and experience, particularly when dealing with inflamed or friable tissues in difficult locations. Conversion to open surgery: In some cases, due to poor visualization, bleeding, or complications, conversion to open surgery may be necessary. Risk of injury to surrounding structures: Inflammation and distorted anatomy can increase the risk of iatrogenic injury to bowel, bladder, or vessels. Cost and Equipment: Laparoscopic surgery is generally more expensive. Limited Access in Complicated Cases **(10).**

Contraindications:

Absolute contraindications for laparoscopic are as follows:

1. Hemodynamic instability .
2. Lack of surgical expertise .
3. Cardiopulmonary diseases . **(11).**

Relative contraindications have included the following:

1. Severe abdominal distention that causes operative view obstruction or complicates abdominal entry and bowel manipulation
2. Generalized peritonitis
3. Multiple previous surgical procedures
4. Pregnancy
5. Extreme obesity **(11)**

Open surgery:

Steps and approach:

Under general or spinal anesthesia and at McBurney incision; the appendicular abscess can be surgically drained either extraperitoneal or intra-peritoneal depending on the size and the site of the abscess that is obtained by preoperative imaging **(12).**

1- **Extra-peritoneal**: skin, external oblique and internal oblique muscles are incised, peritoneum is reached; but instead of opening it as in appendectomy; finger is introduced laterally and posteriorly, abscess cavity is opened and drained. Retro-caecal and sub-caecal abscesses are drained through this route. In this way, general spread to peritoneum is avoided. **(13).**
2- **Intra-peritoneal**: pre and post ileal abscess cannot be drained extra-peritoneal. So, we have to open the peritoneum. **(13).**
3- **Rectal or vaginal:** if the abscess points to the rectum; it is better to drain it through this route. And the same in vagina. **(13).**

The extra peritoneal approach avoids intra-abdominal complications related to exploratory laparotomy, including dissemination of infection, bowel injuries and adhesion because the approach leaves the peritoneal cavity intact. With only minimal dissection, the inflammatory cascade related to laparotomy manipulation is not elicited. Therefore bowel function and patients' general condition are expected to recover sooner, along with a shorter hospital stay and less medical expenditure **(13).**

Intra-peritoneal abscess is a localized collection of pus within the abdominal cavity resulting from a ruptured or perforated appendix, contained by surrounding tissues. This condition is a serious complication of acute appendicitis .so unlike the extra peritoneal approsch , in intra peritoneal approach dissemination of infection ,bowel injuries and adhesion may occure . **(13).**

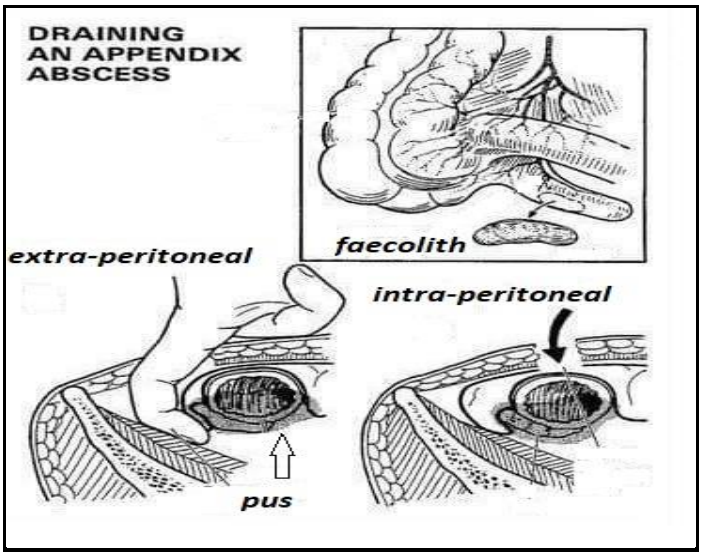


Fig 3: extra and intra peritoneal approach for drainage of appendicular abscess (4).

Advantages:

This procedure is relatively simple and straightforward and can be performed in any level of hospital, including private practitioners and in less well-developed areas and countries. With proper case selection; this approach is recommended as one of the alternatives in the treatment of late-presenting appendicular abscess with free fecolith **(5).**

It provides a definitive solution for the condition because the dilemma is further complicated by presence of free fecalith in a well-circumscribed abscess, which has been repeatedly demonstrated to be a major predicting factor of treatment failure of no operative treatment of acute appendicitis complicated with appendicular abscess. if left behind after drainage of the abscess, further operations for removal of retained fecalith or recurrence of abscess might be required **(14).**

Extra peritoneal drainage is an established method for treatment of intra-abdominal abscess. While it may appear to be unorthodox in this era of image-guided percutaneous drainage and laparoscopic surgery **(4).**

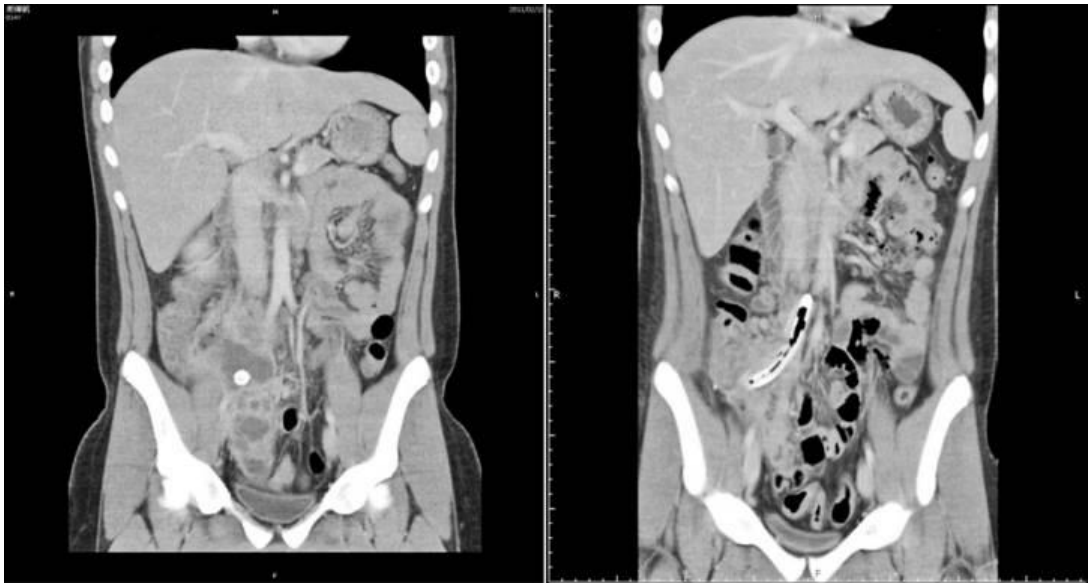


Fig 4: Preoperative CT scan (left) shows a fecalith in the abscess, and postoperative scan (right) exhibits proper placement of the drainage tube and complete resolution of the abscess (4).

Disadvantages and complications:

The risk of open drainage includes more extensive surgery, risk of bowl injury, longer hospital stays, wound infection, incisional hernia, complications of anesthesia and additional financial element **(15).**

For extra peritoneal approach Difficult to access deep or posteriorly located abscesses. Inadequate visualization of the appendix and surrounding structures. Less suitable for complex or multiloculated abscesses. Higher risk of residual pus or undrained collections, especially if abscess is large or multiloculated. The inflamed or perforated appendix is left in situ, which may necessitate interval appendectomy later. Risk of Fistula Formation: The extraperitoneal tract may predispose to formation of fecal or cutaneous fistulas in some cases. Requires precise anatomical knowledge and surgical experience. Technically challenging in obese patients or those with distorted anatomy. **(15).**

Image guided percutaneous drainage:

Preparation

No routine labs are obtained before the drainage procedure unless the patient has a history of abnormal bleeding or other medical problems. The procedure is discussed with the family, and the potential benefits and the risks are explained including sedation risks, bleeding and bowel or solid organ injury. Informed written consent is

obtained from the patient or the parents or the legal guardians. A proper history should be obtained if not completed previously. A standard sterile scrub is performed, hat, mask and gown are required for blood and body fluid precautions **(16).**

Sedation : L ocal anesthesia is the standard technique. However, patients may benefit from general anesthesia if the procedure is expected to be particularly painful and, in some patients, who have a history of failed local technique and in anxious people and generally in pediatrics .**(17).**

Fig 5: Ultrasound guided percutaneous drainage of an appendicular abscess (15).

Contraindication

Contraindications for percutaneous treatment are relatively few. The main ones are uncorrectable coagulopathy, lack of safe percutaneous access and inability of the patient to cooperate. **(16).**

For practical purposes, the absence of a safe percutaneous path is the only factor that prohibits percutaneous abscess drainage, since in most instances' coagulopathy can be corrected to allow drainage. The presence of bowel near the abscess may preclude percutaneous abscess drainage. Abscesses located near or between bowel loops are not amenable to percutaneous catheter drainage and may require surgery if the patient experiences symptoms of peritonitis. However, in the absence of acute peritonitis, needle aspiration of an inter-loop abscess can be performed to obtain material for culture. **(15).**

Catheter insertion techniques:

There are two methods for introducing a catheter into an abscess, both of which start with the insertion of a needle into the abscess cavity. Each method has its proponents, as well as its advantages and disadvantages. Operator preferences are usually a matter of personal experience **(18).**

Trocar Technique:

The trocar technique involves a catheter mounted on a sharp trocar and inserted into the abscess in tandem with a guiding needle. The accurate placement of the guiding needle is of the most importance to ensure the safety of this technique and the accurate positioning and deployment of the catheter. The needle length should be chosen so that several centimeters extend outside the skin while the needle is securely positioned within the abscess. The external portion of the needle serves as an accurate guide for catheter placement. When the guiding needle is in the correct position, a small incision is made in the skin alongside the needle, and blunt dissection is performed. The catheter, mounted on the trocar, is then advanced in perfect parallel with the guiding needle to a premeasured depth. Even if the shape of the abscess is affected by respiratory or other motion, the external portion of the guiding needle will indicate the appropriate path and angle of entry into the abscess. Advantages of this technique include the ability to rapidly deploy the catheter, which is essential if the temporal window for sedation is nearing its end. Disadvantages include the difficulty of repositioning a catheter that has been deployed sub optimally on the first pass **(19).**

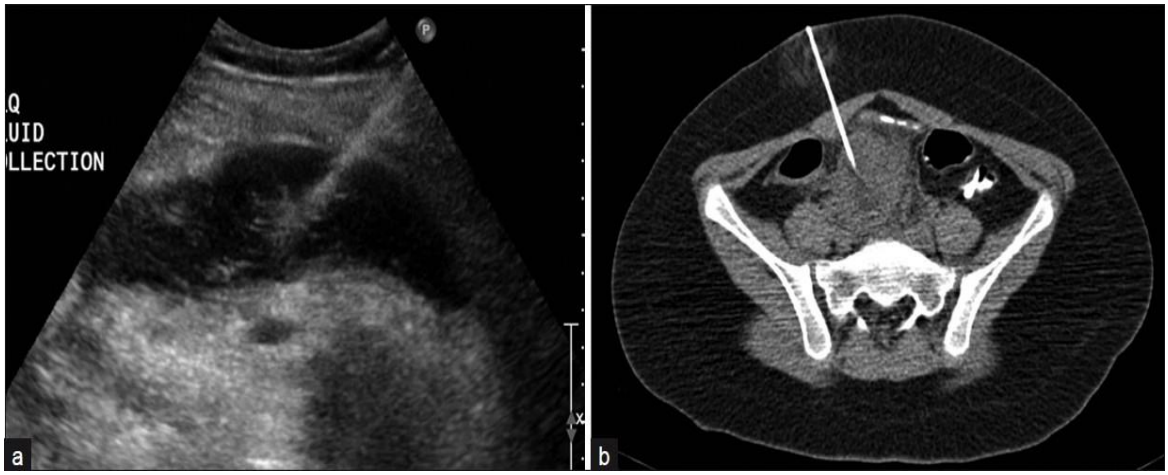


Fig.6: Ultrasound & C.T guided drainage of an appendicular abscess with use of the trocar technique (14).

Seldinger Technique

The Seldinger technique involves the insertion of a hollow needle into the abscess cavity and the placement of a guide wire through the needle to create a percutaneous path for a drainage catheter. After the guide wire is inserted, the needle is withdrawn and the catheter is placed over the wire and inserted into the abscess. **(20).**

Advantages of the Seldinger technique include the ability to direct the wire to the precise location desired for catheter deployment. Precise positioning is especially necessary in large abscesses, such as those that occur in the sub-phrenic region, and in locations in which access is tightly restricted. **(18).**

Disadvantages of the technique include the difficulty of working with wires in confined spaces, and the multiple steps involved in dilation. In addition, when dilators and wires are used with CT guidance, any buckling or kinking of the wire can be problematic. Leakage from small fluid collections around the wire during needle removal and dilations may substantially reduce operating space in the abscess and make catheter placement more difficult. Tissue elasticity is typically high in young children, and the insertion of the dilator or catheter into the abscess is difficult even in the best of circumstances; the implement may be deflected from the abscess wall and merely displace the fluid collection instead of penetrating it **(18).**

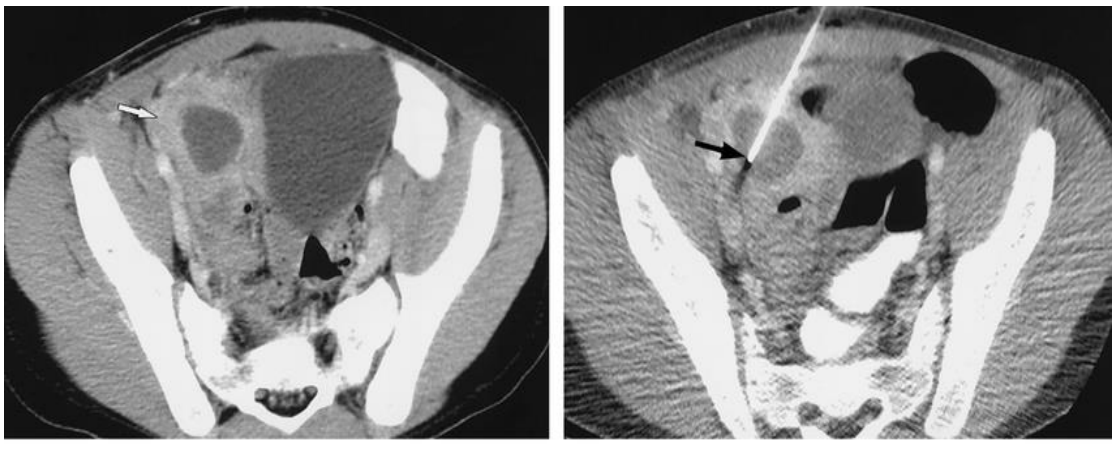


Fig 7: Imaging-guided drainage of an appendicular abscess with use of the Seldinger technique in an 11-year- old male patient. (a) Axial CT images obtained with oral and intravenous contrast material show a thick-walled abscess (arrow in a), a guiding needle placed in the abscess (arrow in b) (**21).**

Image modalities

The most straightforward imaging guidance modality for abscess drainage in children is ultrasonography (US). US allows real-time observation of the abscess and the catheter, without exposure of the patient to ionizing radiation. In large and readily accessible abscesses, deployment of the catheter by using the trocar technique with real-time US observation is the simplest and fastest way to achieve percutaneous drainage. However, if US depicts only part of an abscess or if more precise catheter positioning is required because of the proximity of adjacent structures, US must be supplemented with fluoroscopy for guidance of catheter deployment. Fluoroscopy is used to monitor wire manipulations in catheters placed with the Seldinger technique. Limitations of US include its inability to depict the entire extent of an abscess in a deep location such as the pelvis. In addition, an abscess that is partially obscured by bowel air can be difficult to localize, and an abscess that contains air may be difficult to see or impossible to differentiate from bowel at US. CT is free from these limitations. **(16).**

CT guidance can be performed either with standard incremental acquisition of a few contiguous axial images in the area of interest or with CT fluoroscopy **(16).**

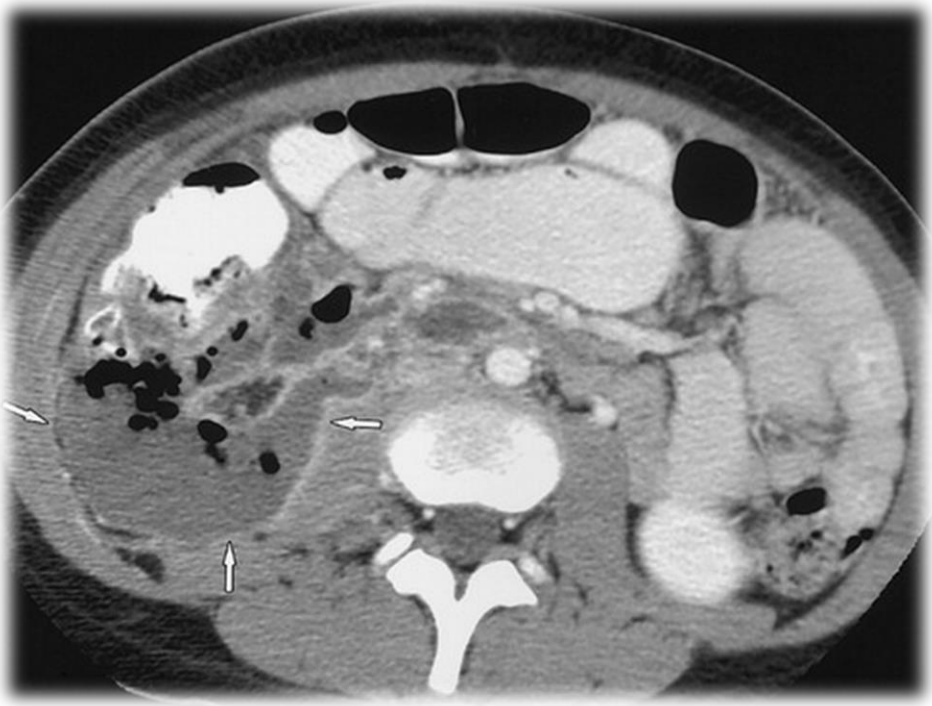


Fig.8: CT guided drainage of an abscess in a 13-year-old female patient after appendectomy. At US, the abscess could not be differentiated from the adjacent bowel. Axial CT image shows a large abscess (arrows) that has a thick enhancing wall and contains air. (21).

Catheter fixation and management

Most radiologists use two means of catheter retention: an internal retention mechanism and an external fixation device. For internal retention, most radiologists use locking pigtail catheters. A string that courses through the catheter is fixed in place near the hub of the catheter; this “pigtail” prevents inadvertent catheter withdrawal. Other specially designed external fixation devices have been developed to obviate the need to suture the catheter to the patient’s skin. This method avoids the skin irritation caused by sutures, as well as the need for suture removal. **(14).**

The abscess cavity is decompressed at the time of drainage with direct suction by using a syringe attached to the catheter. Some operators use a method analogous to surgical lavage and irrigate the abscess cavity with 10–15-mL aliquots of 0.9% saline to encourage further drainage of thick debris. Irrigation of the abscess, however,

must be performed with a lesser volume of fluid than that previously drained from the abscess, to avoid an increase in intra-cavitary pressure with resultant bacteremia and sepsis (**21).**

After the catheter is secured in place in the decompressed abscess, the catheter should be flushed every 8–12 hours with 5–10 mL of saline solution to clear the tube of any adherent plugs or encrustations that might cause blockage. Active management by the interventional radiologist can enhance the success of drainage and minimize catheter-related problems. The catheter position should be assessed to ensure that the catheter is not withdrawing from the abscess, and the access site and dressing should be carefully examined. If the abscess is incompletely drained, a clogged catheter will have to be exchanged for a new catheter. Changes in the character of the drained fluid may be the first indication of a fistula, and further imaging may then be indicated. If a fistula is suspected and no sepsis is present, an abscesso-gram may be obtained via catheter for signs of communication with structures such as the bowel, pancreatic and biliary ducts, or genitourinary system. In the presence of sepsis, this examination is deferred so as not to exacerbate sepsis. The interventional radiologist also is actively involved in deciding the time of catheter removal. **(14).**

Drainage in difficult locations

It may be difficult to access fluid collections deep in the pelvis, because of anterior bowel, bladder, uterus, lateral bones, blood vessels and posterior bones. In such abscesses, percutaneous access with routine anterior or lateral approaches is often impossible **(18).**

If an abscess is close to the rectum, a trans-rectal approach may be used. The trans-rectal approach has proved very successful for drainage of pelvic abscesses. **(22).**

Trans-rectal approach (Seldinger technique):

Dedicated endoluminal US transducers equipped with specialized hardware may be used with this approach to guide the needle or catheter into the appropriate position. In some pediatric patients, however, the rectal vault may be too small to allow insertion of the US transducer, or the patient may not tolerate it. In such patients, trans-rectal drainage can still be performed with US guidance by using an anterior approach, a routine surface transducer, and bladder distention to create an acoustic window. The operator positions the catheter while observing the real-time US images. Either the trocar or the Seldinger technique may be used. When considering use of the trans-rectal approach, which is not sterile, the interventionalist should assess the patient's overall clinical condition to determine whether infection is very likely present in the fluid collection; the goal is to avoid inducing infection in a sterile fluid collection. Trans-rectal catheters, though their presence may seem awkward at first, are well tolerated by most pediatric patients and permit them to ambulate and use the bathroom as they normally would **(23).**

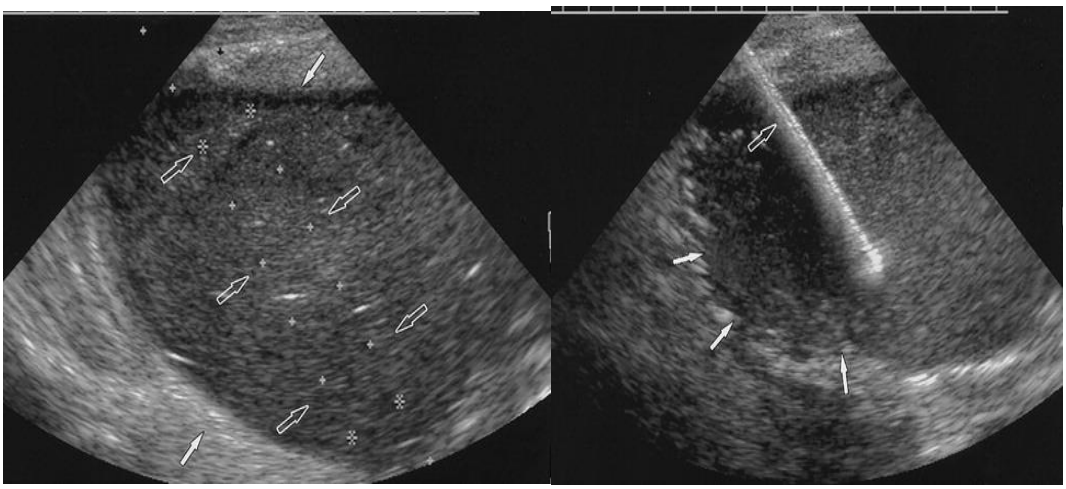


Fig.9: Sonar guided appendicular abscess drainage trans rectal approach (18).

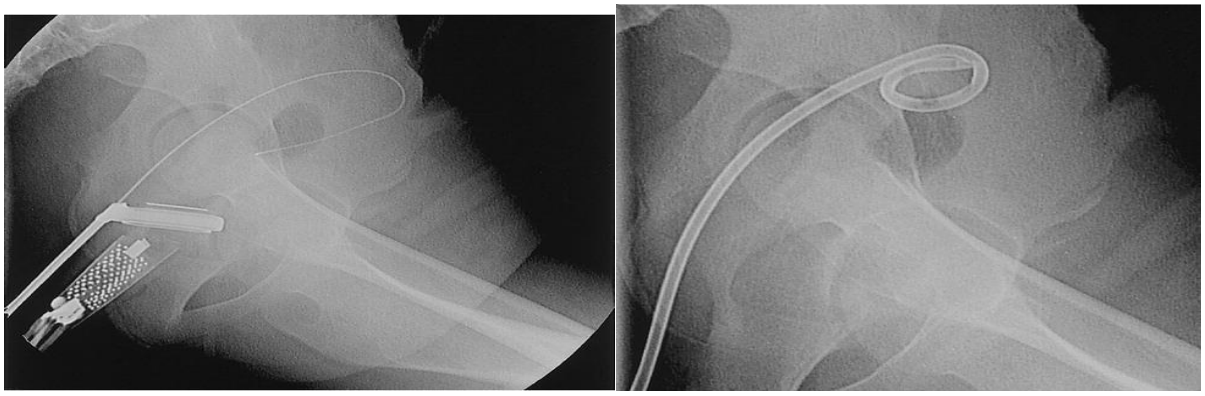


Fig.10: Imaging-guided drainage of an appendicular abscess with the Seldinger technique and a trans-rectal approach in a 12-year-old female patient. (14).

The trans-gluteal approach : through the greater sciatic foramen is an alternative approach to deep pelvic abscesses. Initially described by **Butch et al**. **(24)**, the trans-gluteal approach requires CT guidance and patient positioning in either the prone or the decubitus position. Butch et al cited a higher incidence of pain (approximately 20% of patients) with this approach, and some therefore recommend that the approach not be used in children. However, (**25)** have shown the trans-gluteal approach to be reasonably well tolerated by children. The choice of trans-rectal versus trans-gluteal access to a deep pelvic abscess is often determined by operator preference. The trans-gluteal approach has the advantage of allowing percutaneous access to abscesses located farther cephalad. In addition, use of the trans-gluteal approach is strongly favored in abscesses in which infection is uncertain, because this approach allows drainage while using strict sterile technique **(26)**.

Fig.11: Imaging-guided drainage of an appendicular abscess with use of the tandem trocar technique and a trans-gluteal approach in a 6-year-old male patient. (14).

Post-drainage Imaging: Challenges and Pitfalls

Many pediatric patients need no further imaging after percutaneous abscess drainage if the clinical course improves and catheter output declines to less than 10 to 20 mL daily. This is especially true in children with appendicular abscesses. However, persistent fever, pain, or leukocytosis after percutaneous abscess drainage suggests that further imaging may be needed. CT is most commonly used to monitor the adequacy of drainage, as well as the development of new abscesses. If CT images show that the abscess is completely drained, a decision to remove the catheter may be made, depending on the presence or absence of continued drainage. However, if CT images show in-complete resolution of the abscess in spite of optimal catheter positioning, then catheter patency should be reassessed with a 5- to 10-mL saline flush. If the catheter is patent and well positioned but the abscess persists, the catheter should be exchanged for a larger catheter. Locking pigtail catheters as large as 14 F are available. In general, the smallest catheter that should be placed initially is 8 or 10 F, since pus is viscous and will not drain effectively otherwise . **(27).**

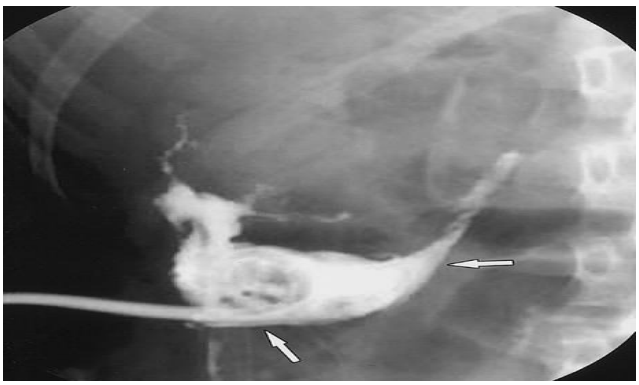


Fig.12: Imaging-guided drainage of persistent abscess in a 13-year-old female patient after appendectomy. Despite diminished catheter output and initial improvement in the patient's condition after initial percutaneous drainage, a low-grade fever persisted at 10 days. (23).

Advantages of image guided percutaneous drainage:

It is a less invasive technique, the patient should not be exposed to the risk of anesthesia and to the complication of open surgery in the form of surgical site infection, incisional hernia, spreading of infection to the entire peritoneum and fistula formation. In addition, it can be done in non-fit patient to the open surgery. And relatively it has low cost financially **(22).**

Disadvantages of image guided percutaneous drainage:

Many complications or disadvantages have recorded in many studies; Even the most talented and compulsive interventional radiologist will experience complications of abscess drainage, including complications of sedation, drug-related allergic reactions, cardiopulmonary complications, infection, bleeding, Nontarget Catheterization or Puncture and fistula formation. The most common minor complication is treatment failure resulting in repeat drainage or surgery and occurring in 16 to 18.5% of cases. **(27).**

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