Peroxide-enhanced Anal Endosonography: Technique, Image Interpretation, and Clinical Applications[1]

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Because current techniques for examination and imaging of perianal fistulas tend to underestimate the extent, location, and course of perianal fistulas—information essential for decisions about surgical management—the use of hydrogen peroxide was investigated as an image-enhancing contrast agent for confirmation of the presence of and improvement in the depiction of fistulas during endoanal ultrasonography (US). After conventional endoanal US was performed with a side-fire 7.5- or 10.0-MHz rotating endoprobe, external perianal openings were cannulated and approximately 1 mL of peroxide was administered. After reinsertion of the endoprobe, the entire course of the echogenic fistula, including its relation to the internal and external sphincters and the levator ani muscle, was depicted in real time in three dimensions. This depiction of fistulas permits accurate classification, which facilitates surgical planning. In experience with more than 60 patients, peroxide-enhanced endoanal US was found to be a useful technique for documentation of the presence, number, and internal course of perianal fistulas and for characterization of abnormalities seen at endosonography performed without use of contrast enhancement. In addition, the technique permitted surgeons to stratify patients into treatment groups and has been especially useful for planning surgical treatments.

Index terms: Anus, US, 157.12988 • Fistula, gastrointestinal tract, 757.245

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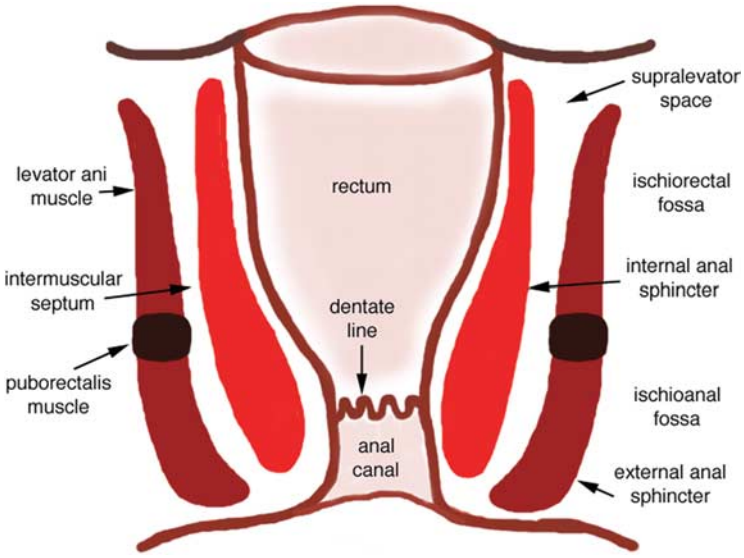


Figure 1. Surgical anatomy of the anal canal. Line diagram shows the normal coronal-view anatomic characteristics of the anal canal and perianal region, depicting all structures and spaces relevant to classification of perianal fistulas.

Introduction

Anal fistulas are a chronic manifestation of acute perianal abscesses. Treatment of fistulas typically involves surgical management, which is associated with postoperative incontinence and recurrence (1). To minimize these complications, accurate preoperative definition of the anatomy of the tract is essential for surgical planning. Of the current options available for preoperative evaluation of perianal fistulas, physical examination and endoanal ultrasonography (US) are most commonly used (1). The use of hydrogen peroxide–enhanced endosonography in patients with perianal fistulas has recently been reported (1–3). We describe, on the basis of our recent experience, the technique and imaging findings in more than 60 patients who underwent peroxide-enhanced endoanal US for preoperative evaluation of perianal fistulas.

Surgical and US Anatomy of the Anal Canal

Surgical Anatomy

The anal canal is an approximately 3-cm-long tubular structure surrounded by a supportive complex of smooth and striated muscle sphincters (Fig 1). The involuntary internal sphincter, which is responsible for approximately 85% of resting anal tone, is composed of smooth muscle and is continuous with the circular smooth muscle of the rectum (4). Surgical division of this muscle is seldom associated with incontinence. The voluntary external sphincter, composed of striated muscle, is continuous superiorly with the puborectal and levator ani muscles. Division of this muscle, which is responsible for only approximately 15% of resting anal tone, is associated with incontinence (4). Therefore, for surgical planning, it is essential to define the relationship of fistulas to both the internal and external anal sphincters.

Anatomy at US

The appearance of the anal canal at US is dependent on the height of the axial level being imaged. The internal sphincter is a longitudinally oriented muscle and appears as a well-defined, circular, hypoechoic band that varies in thickness and lies immediately subjacent to the echogenic submucosal layer (Fig 2). The external anal sphincter, which lies immediately outside the internal sphincter, is echogenic, less well defined, and broader than the internal sphincter (5). The echogenicity arises from obliquely oriented decussate muscle fibers interspersed with fat. The lower end of the anal canal is identified by the loss of the circumferential hypoechoic ring of the internal anal sphincter as the transducer exits the anus (Fig 2). The upper end of the canal is identified by the hyperechoic horseshoe sling of the levator ani muscle posteriorly (6), loss of the external sphincter in the midline anteriorly (Fig 2), and loss of acoustic contact as the rectal lumen becomes too wide for the hard anal transducer cap.

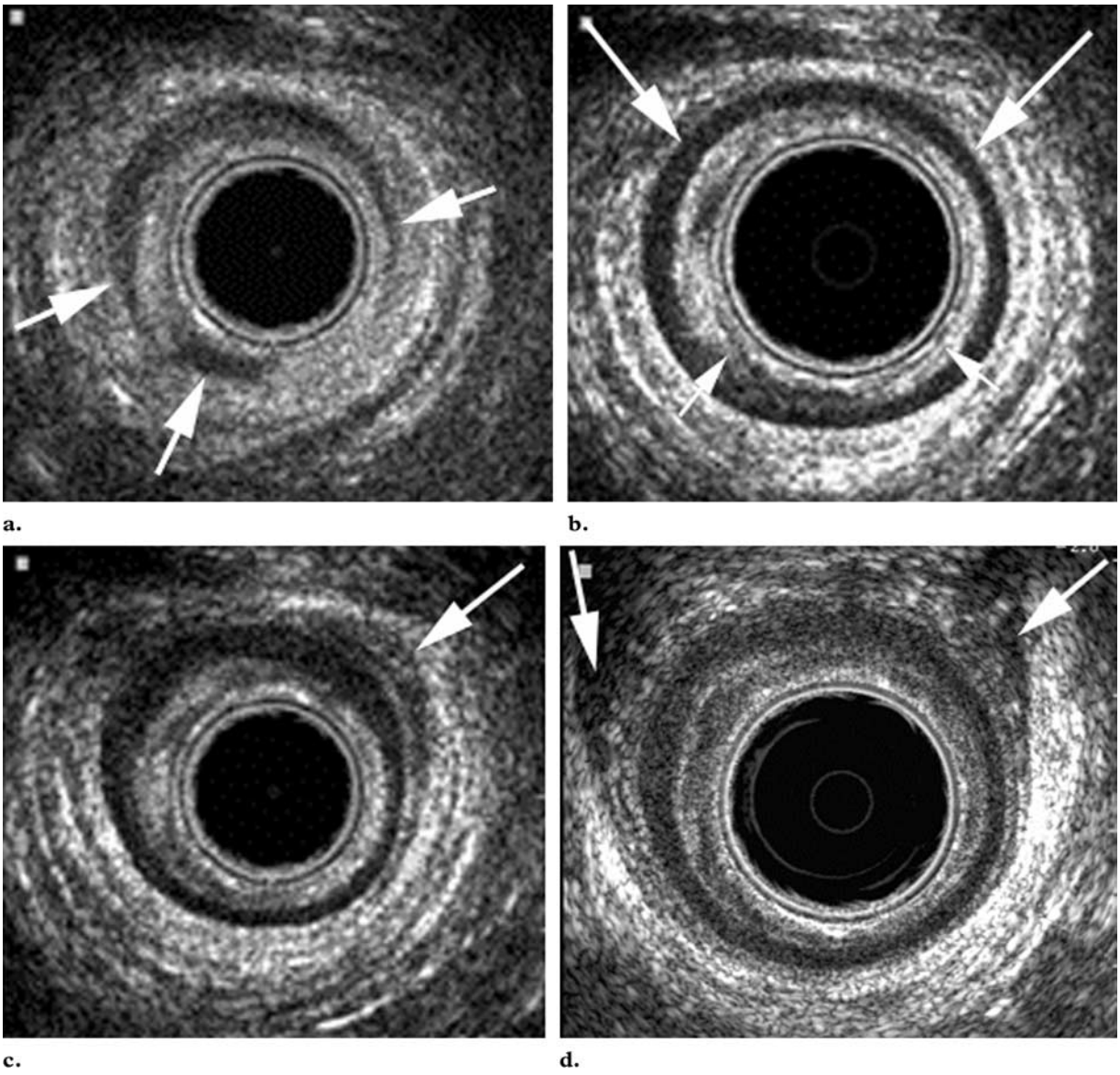


Figure 2. Normal appearance of the anal canal at US. Axial images of the anal canal show the normal anatomy from the most caudal aspect of the anal verge **(a)** extending up to the level of the levator ani muscle **(d)**. **(a)** At the anal verge, the internal anal sphincter is typically seen as an incomplete ring (arrows) that partially encircles the canal. **(b)** Once the transducer is in the anal canal, the internal sphincter is seen as a continuous hypoechoic ring (large arrows) that surrounds the submucosal space (small arrows). The external anal sphincter appears as a less well-defined hyperechoic band immediately outside the internal sphincter. **(c, d)** At the cranial end of the anal canal, the external sphincter muscle becomes more hypoechoic (arrow in **c**) and gives rise to the levator ani sling above this level (arrows in **d**).

Pathogenesis, Clinical Presentation, and Work-up of Perianal Fistulas

Pathogenesis

Perianal abscesses and fistulas represent a spectrum of abnormalities that occur in the interstitium, muscle, or loose connective tissue that surrounds the anal canal. Infection is thought to originate in the anal glands that lie in the intersphincteric space between the internal and external anal sphincters of the anal canal (6). The anal glands lie at the level of the dentate line in the middle of the anal canal and can penetrate the internal sphincter to lie in the intersphincteric space. The majority of fistulas occur as simple intersphincteric tracts and can be treated successfully without the need for imaging. However, accurate delineation of more complex fistulas is required prior to surgery. For example, the infection may spread from the site of origin downward

to form a perianal abscess and intersphincteric fistula, upward into the pelvis to form a pelvic abscess and suprasphincteric fistula, or outward through the external anal sphincter to form an ischiorectal abscess and transsphincteric fistula (6).

Fistulas arise from anal tears or fissures, foreign bodies, episiotomy incisions and related obstetric trauma, infected hemorrhoids, superficial skin lesions, or the anal crypts that line the anal canal. Fistulas that arise in anal glands at the anorectal junction (cryptoglandular fistulas) are the most common variety and are typically single and located posteriorly. In 10% of cases, no internal opening can be identified. Conditions coexistent or associated with fistulas include Crohn disease, infections (tuberculosis and lymphogranuloma venereum), anal canal tumors, trauma, radiation exposure, and previous surgery, including complicated episiotomy repairs or internal hemorrhoid repair.

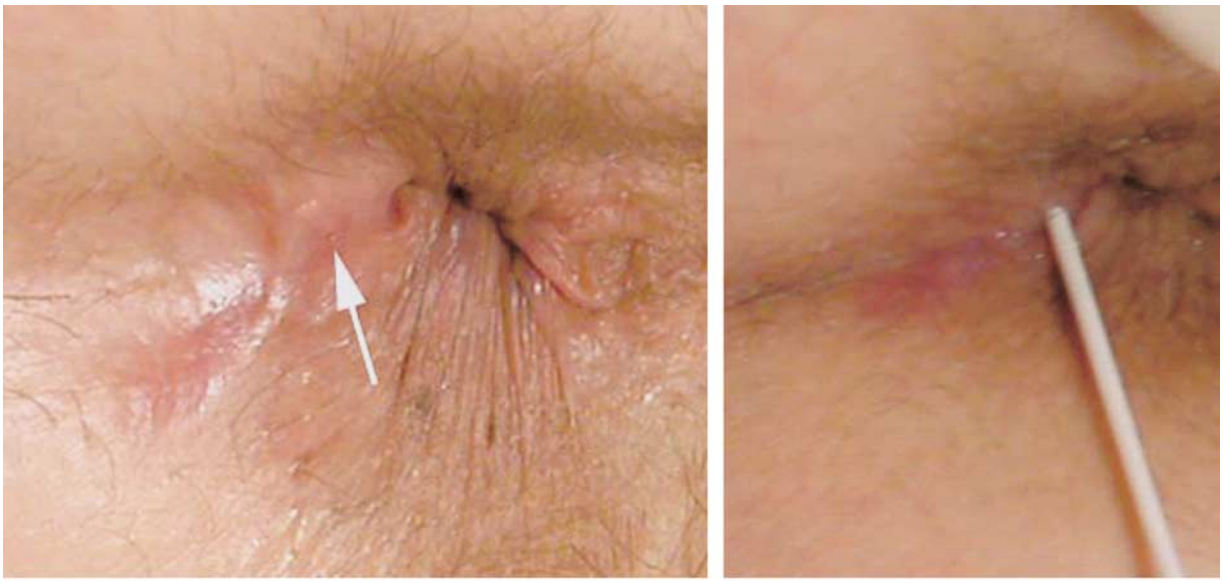
Clinical Presentation and Work-up

The spectrum of symptoms produced by perianal fistulas includes rectal pain, perianal purulent or bloody discharge, recurrent perianal swelling, or erythema. Anal canal tumors should always be excluded. During examination of the patient with perianal sepsis, an abscess or fistula must be distinguished from an acute anal tear or fissure, and the number and location of any external openings should be documented. Traditionally, inspection, palpation, and probing have been used to identify the openings of fistulas. Because of the pain and associated spasm of the anal sphincter muscles, patients are frequently unable to tolerate a thorough digital rectal examination and may need general anesthesia to be examined. Digital examination remains a reasonably accurate method of fistula assessment, especially when performed by an experienced colorectal surgeon (7). When possible, proctoscopy is performed to identify the presence and location of internal openings.

Several adjunctive procedures may be used for fistula assessment: These include fistulography (8,9), computed tomography (CT)(10,11), magnetic resonance (MR) imaging (4,12–15), and US (16–19). Contrast fistulography may be inaccurate and unreliable (9). Because the sphincter complex is not directly visualized, its position and that of the levator ani sling must be inferred (4). CT does not allow distinction of fistulous tracks from fibrotic scars unless air, fluid, or contrast medium has entered the track (4,10,11). While symptoms attributed to fistulas usually preclude insertion of endorectal coils for MR imaging, MR imaging with surface coils has already been shown to have an impact on the preoperative assessment of perianal fistulas (4). In our own experience, MR imaging becomes less sensitive when fistulas are close to the anal verge, and it often does not allow prediction of the patency of fistulous tracks. While US remains the modality of choice for imaging anal disease, it fails to reliably allow distinction of fistulas from scarring and inflammation and is limited in its ability to accurately delineate the anatomic spaces outside the external anal sphincter. Numerous reports have described the accuracy of endoanal US in the depiction of the anatomy of perianal fistulas (19–21). Although results have been dependent in part on transducer frequency, US has a reported 57%–95% accuracy in the detection of the primary fistula. While US has several obvious advantages over other imaging modalities, difficulties may arise with stenosis of the anal canal or where perianal pain precludes easy insertion of the transducer. When severe pain is present and surgery is required, it may be necessary to perform the entire examination with the patient under anesthesia. Peroxide-enhanced endoanal US takes advantage of the exquisite anatomic detail afforded by endoanal US, and additional information is provided by the injection of contrast-enhancing peroxide into the fistula.

Surgical Management

Minimally invasive surgical management may limit or prevent postoperative incontinence or recurrence. Successful treatment is dependent on identification of all tracks and characterization with relation to the anal sphincters (22,23). The majority of fistulas are simply managed with drainage of fluid or pus and the laying open of superficial fistulas. When fistulas are more complex, additional surgical options exist that are based in part on the number and internal course of the tracks. Fistulotomy involves simple unroofing of the fistula with no excision of the sphincter and is reserved for intersphincteric and low transsphincteric fistulas. Fistulectomy is more complex and involves unroofing and coring out of the entire fistula, with excision of the sphincter muscle below the internal opening. A less invasive alternative is the use of setons, made of elastic or suture material, which are inserted through fistulas to form a continuous loop extending through both the cutaneous and internal anal openings. Setons may serve either cutting or draining roles. Cutting setons are regularly tightened to slowly cut through the sphincter, allowing the track to



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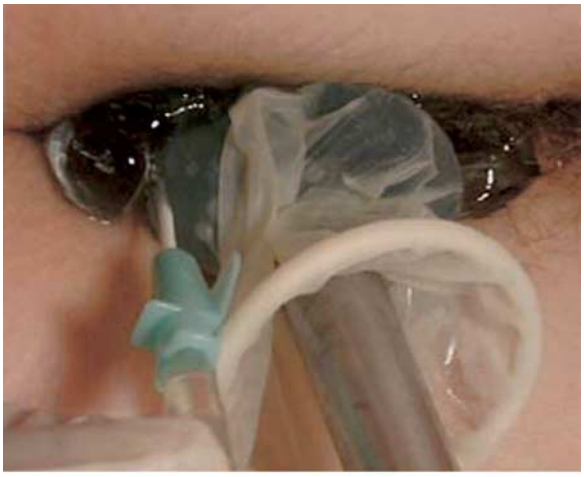


c.

Figure 3. Technique of peroxide-enhanced endoanal US. **(a)** With the patient in the left lateral position, a careful search for any cutaneous openings (arrow) is performed. A conventional endoanal US examination is performed to document any abnormalities in the anal wall. The transducer is then removed, and an 18-gauge plastic catheter is gently inserted into the opening of the fistula **(b)**. **(c)** The transducer is then carefully reinserted into the anal canal, and images are obtained throughout the length of the anal canal during slow injection of peroxide via the catheter inserted into the fistula.

become progressively more superficial as the deeper portions granulate and heal with scarring. Drainage setons are left loosely in place and, through maintenance of track patency, permit residual pus to drain out (22,23). Setons are useful when fistulas involve significant amounts of the external sphincter in patients with preexistent poor sphincter control or who have undergone previous sphincter surgery, when patients have multiple fistulas, or when patients have inflammatory bowel disease. Other surgical options include laying open of the track and creation of advancement flaps. More recently, fibrin sealants have been used to treat fistulas (24). These agents allow the patient to avoid the risk of fecal incontinence and the discomfort of prolonged wound healing that may be associated with fistulotomy.

Technique of Peroxide-enhanced Endoanal US

The procedure is performed in four steps (Fig 3). After careful examination of the perianal skin to identify external openings, a conventional endoanal US examination is performed. The transducer is then removed, and any external openings are cannulated. The transducer is then reinserted, and the US study is performed during gentle injection of peroxide through the cannula.

Endoanal US

After external inspection, all patients underwent endoanal US (type 1846; Bruel & Kjaer, Naerum, Denmark) in the left lateral decubitus position by means of a 10-MHz rotating endoprobe (focal depth, 2–10 cm) with a lubricated hard anechoic plastic cone (diameter, 17 mm) on the tip. End-fire probes are not recommended, since they do not allow depiction of the relevant circumferential anatomy of the perianal region. Prior preparation

or rectal cleansing is not necessary. The cone is filled with degassed water and covered with a condom sheath with gel applied to both surfaces. The transducer is placed into the anal canal with direct vision. Sequential axial 360° images are recorded along the entire length of the canal once orientation is established and the relevant landmarks of the anal canal are identified. Attention should be focused on documentation of the integrity of the internal and external anal sphincters, since tears or defects may arise from or be associated with focal infections, previous injury, or surgery. Any abnormal soft tissue must be noted, since fistulas usually appear as hypoechoic bands or focal soft-tissue abnormalities in any location within the anal wall. Abscesses seldom contain air, and fistulas are usually narrow and have an irregular path, so fluid or even air within the track is unlikely to be easily recognized. It is therefore difficult to distinguish between abscesses and scarring or to confirm the path or patency of a track without the use of a contrast-enhancing agent. The transducer is then removed.

Cannulation of the Fistula

With the patient still in the left lateral decubitus position, perianal openings are identified and cleansed with iodine topical solution. The openings are gently cannulated with an 18-gauge plastic cannula, which is fixed to the skin surface with tape. When no obvious external opening is present, a focal elevated erythematous region immediately adjacent to the anal opening is frequently identified. The soft catheter tip should be firmly pressed onto or probed into the center of this region, where the skin is easily broken and the external opening located.

Peroxide-enhanced Study

The endoanal transducer is then carefully reinserted, without dislodgment of the cannula, and images are recorded along the entire length of the anal canal during slow injection of 1.0–2.0 mL of 3% hydrogen peroxide. Since injection pressure is low, passage of peroxide along the fistula track may be slow, and images should be obtained during slow insertion and removal of the transducer from the entire length of the anal canal.

Classification of Perianal Fistulas

Fistulas are classified according to their primary path of extension relative to the external anal sphincter and the puborectal muscle (4,25) (Fig 4). Superficial fistulas typically arise from anal fissures that communicate with an adjacent anal crypt, with or without extension through the internal anal sphincter. Spread of fistulas may be vertical or horizontal in the submucosal, intersphincteric, or even extrasphincteric spaces. The classification used most commonly was described by Parks et al (25) and correlates the coronal course and relationship of perianal fistulas to the sphincter mechanism. This classification is useful for stratification of patients into groups for surgical management. Morris et al (4) have recently described a practical and elegant classification system of perianal fistulas at MR imaging. We use a modification of the above systems for US classification of perianal fistulas and classify fistulas relative to the internal and external anal sphincter muscles.

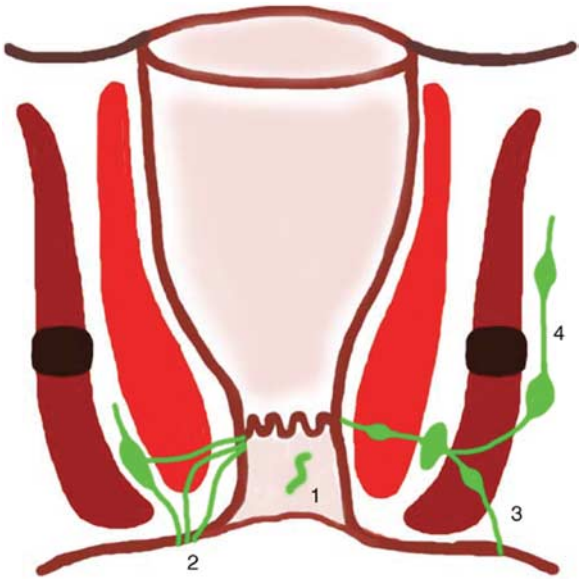
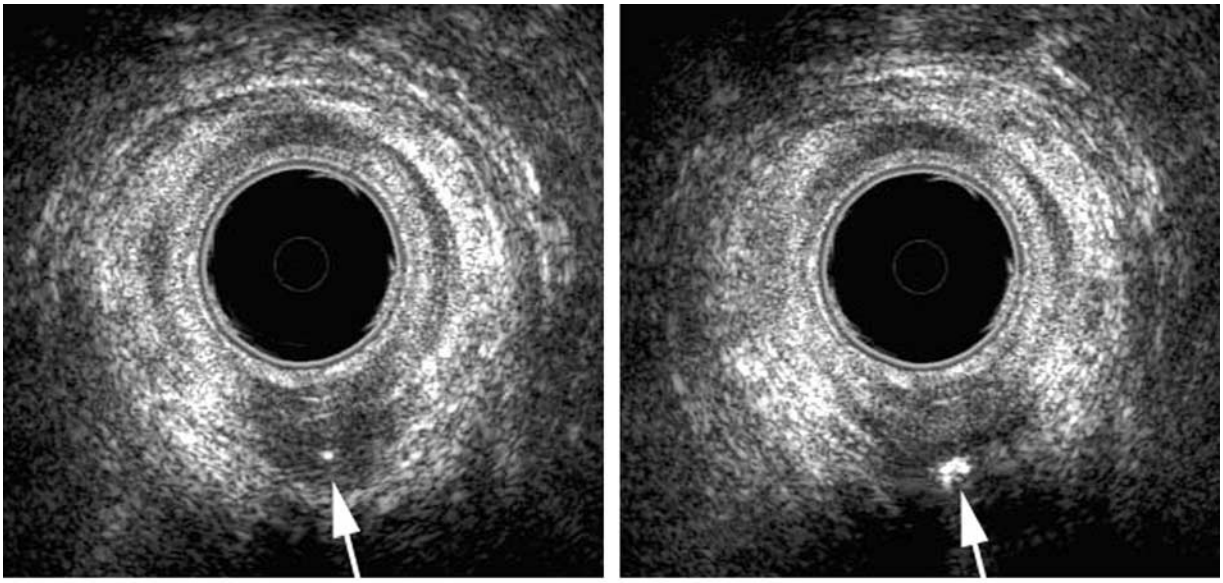


Figure 4. Classification of anal fistulas. Coronal line diagram depicts the spectrum of fistulas that can occur in the anal wall and perianal spaces. Perianal fistulas may appear as erosions of the anal wall *(1)* or superficial fistulas that do not traverse any sphincter muscle. According to Parks et al (25), fistulas are intersphincteric when they traverse the intersphincteric space or internal anal sphincter *(2)* or transsphincteric *(3)* when they extend through the external anal sphincter into the ischioanal space *(3)*. Spread beyond the external sphincter results in extrasphincteric or suprasphincteric fistulas *(4)*.

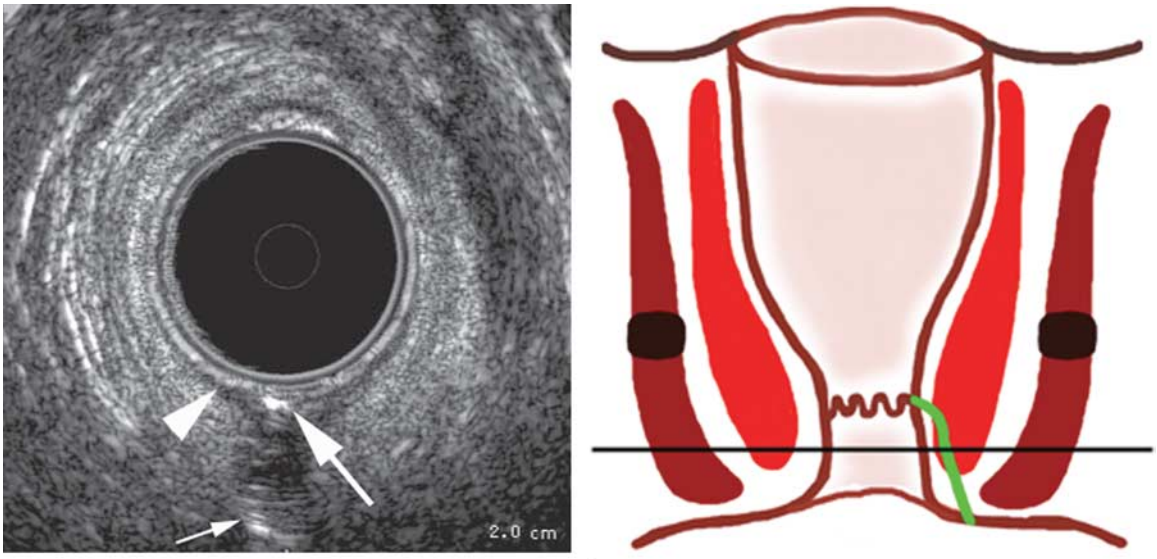
US Classification

Simple linear intersphincteric fistulas extend directly from the perianal skin into the anal canal, sparing both the ischiorectal and ischioanal spaces (Fig 5). These fistulas do not traverse the external anal sphincter but may traverse the distalmost portion of the internal sphincter below the level of the dentate line (Fig 6).



a. b.

Figure 5. Posterior intersphincteric abscess. **(a)** Endoanal US scan obtained before administration of peroxide reveals marked deficiencies of numerous areas of the internal anal sphincter, with a hypoechoic soft-tissue mass containing air immediately posterior to the anal canal in the intersphincteric zone (arrow). **(b)** Scan obtained after peroxide injection shows prompt communication with this intersphincteric abscess (arrow).



a. b.

Figure 6. Simple transsphincteric fistula. **(a)** After administration of peroxide, endoanal US scan shows a direct communication that extends from the skin immediately adjacent to the anal canal (small arrow) through the distal aspect of the posterior internal anal sphincter (arrowhead) to the anal canal (large arrow). Echogenic air is trapped in the anal mucosa anteriorly, which may falsely suggest communication at this location. After demonstration of this single superficial posterior fistula, the patient underwent an unroofing procedure only, with no loss of continence. **(b)** Drawing in the coronal plane, with a horizontal line corresponding to the level of the US image, shows extent of the fistula depicted in **a**.

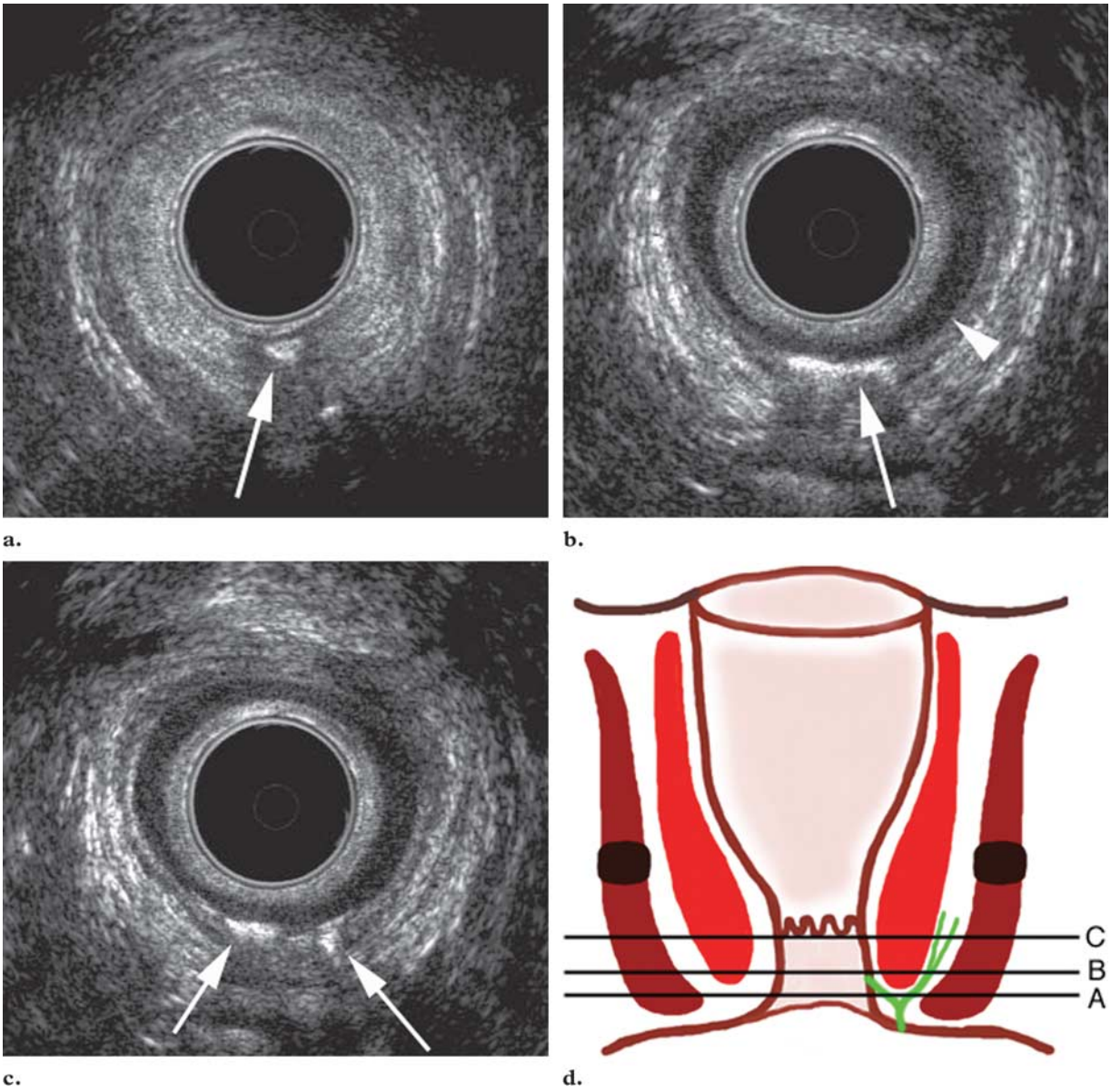
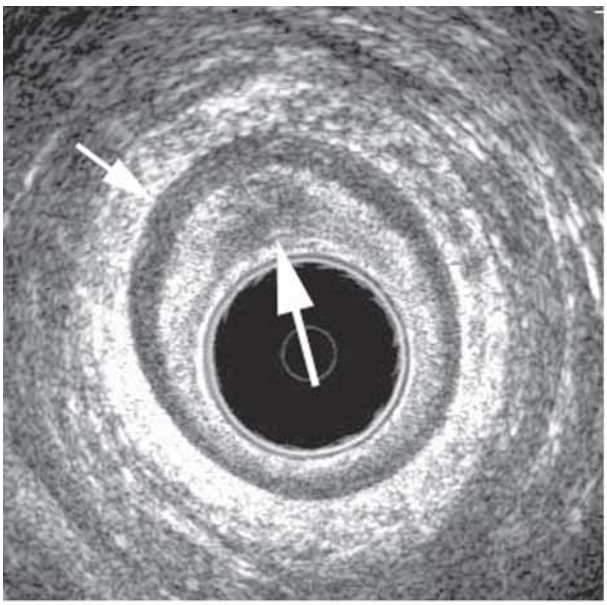


Figure 7. Intersphincteric fistula. **(a)** After administration of peroxide, endoanal US scan shows immediate extension to the anal lumen, below the level of the internal anal sphincter (arrow). **(b, c)** The fistula also tracks upward below the internal sphincter (arrowhead in **b**), tracks posteriorly into the intersphincteric plane (arrow in **b**), and forms a second track in this intersphincteric region (arrows in **c**). **(d)** Drawing in the coronal plane, with horizontal lines corresponding to the levels of the US images, shows extent of the intersphincteric fistula depicted in **a–c**.

Complex intersphincteric fistulas are associated with abscesses or secondary tracks and are limited by the external anal sphincter (Fig 7). One or more abscesses may be identified in the submucosal space (Fig 8), in the substance of the internal sphincter, or in the intersphincteric space (Fig 9). The secondary tracks may be single or multiple (Fig 7) and may be of the horseshoe type, even crossing the midline.

Figures 8, 9. **(8)** Transsphincteric fistula extending through the internal anal sphincter. **(a)** Prior to injection of peroxide, endoanal US scan shows a hypoechoic soft-tissue abnormality (large arrow) superficial to the anterior part of the internal anal sphincter (small arrow). **(b)** After cannulation of the fistula and injection of peroxide, prompt visualization of the peroxide was noted in this fistula, which extends through the internal anal sphincter into a small superficial submucosal abscess cavity (arrow). **(c)** Drawing in the coronal plane, with a horizontal line corresponding to the level of **b**, shows the extent of the transsphincteric fistula and abscess. **(9)** Transsphincteric fistula extending through the external anal sphincter and communicating with an intersphincteric abscess. **(a)** Peroxide-enhanced endoanal US scan reveals a transsphincteric fistula communicating with a small yet high posterior intersphincteric abscess cavity (arrow). No peroxide traverses the internal sphincter, and no communication with the anal lumen was identified. **(b)** Drawing in the coronal plane, with a horizontal line corresponding to the level of **a**, shows the extent of the fistula and abscess.



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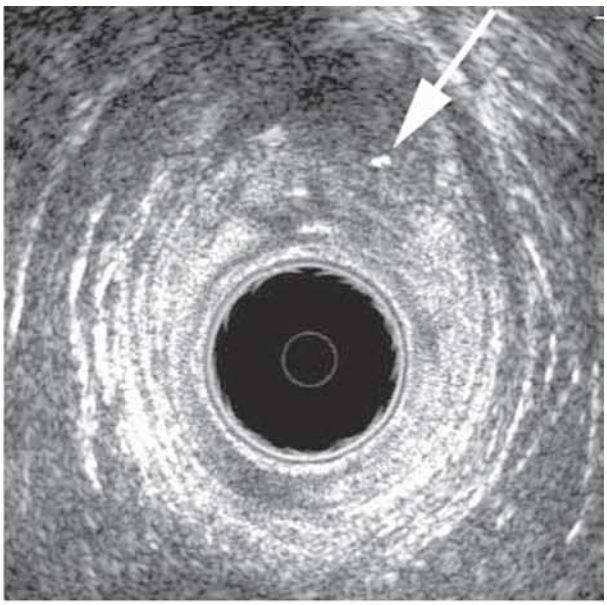

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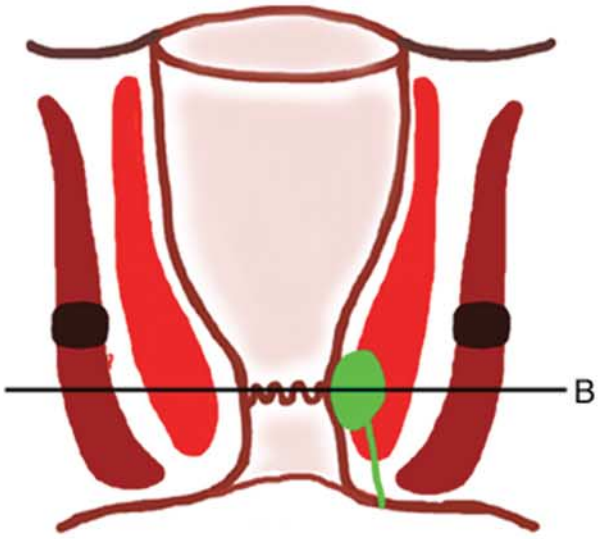

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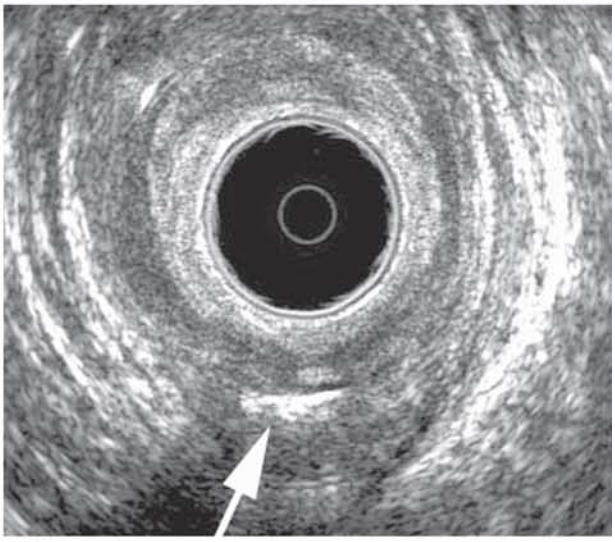
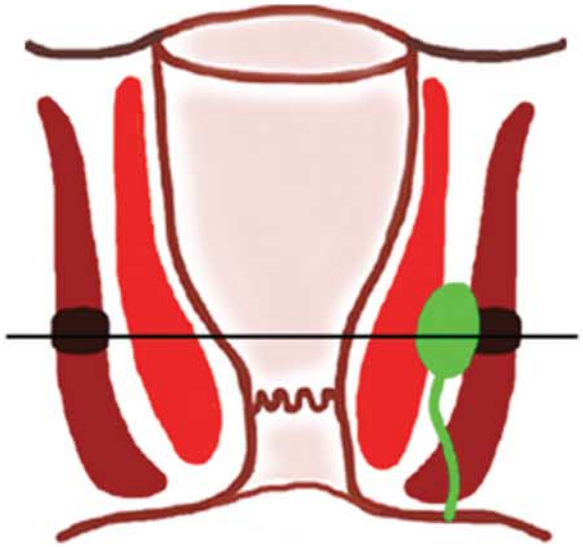


9a.



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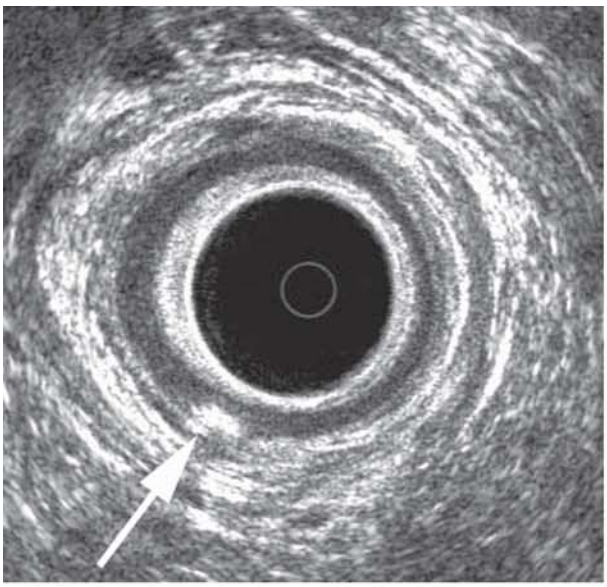

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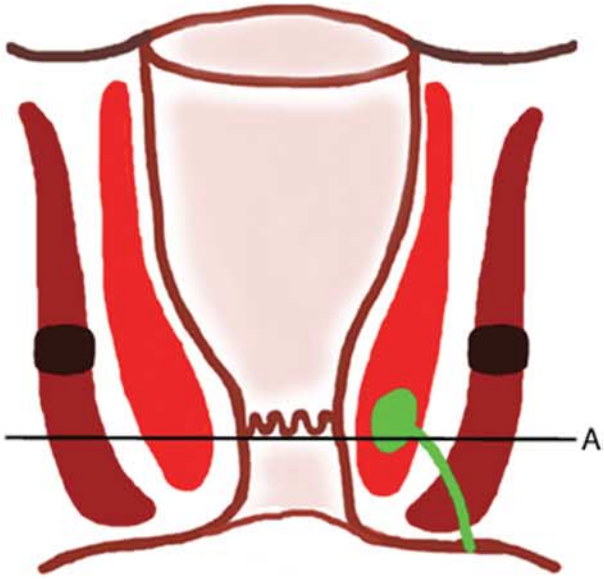

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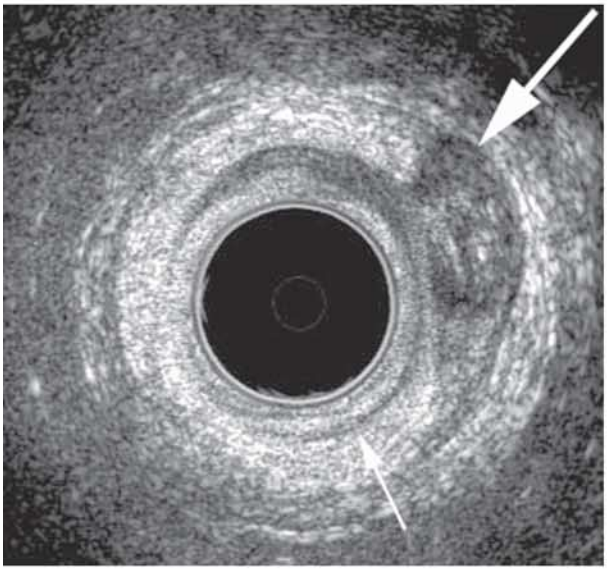

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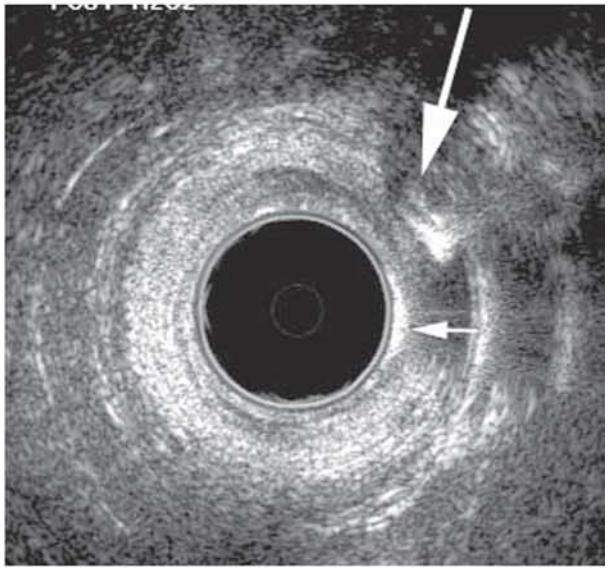
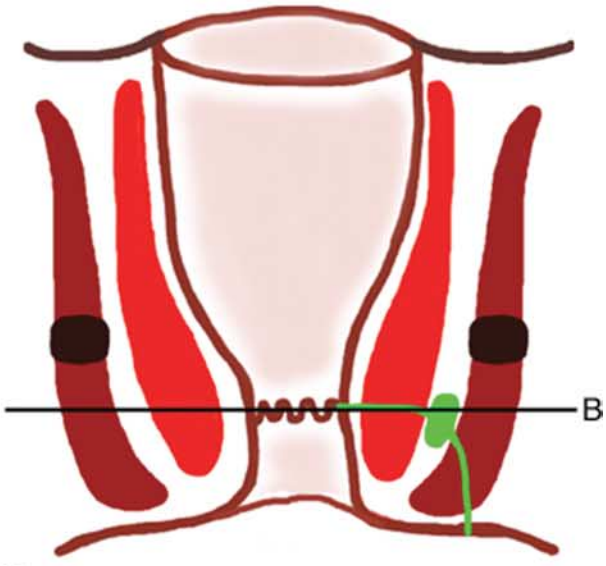


11b.

Figures 10, 11. **(10)** Transsphincteric fistula extending through the internal and external anal sphincters. **(a)** Peroxide-enhanced endoanal US scan shows extension of the fistula through the external anal sphincter into a small abscess within the posterior aspect of the internal anal sphincter (arrow). No communication with the anal canal was identified at subsequent surgery. **(b)** Drawing in the coronal plane, with a horizontal line corresponding to the level of **a**, shows extent of the fistula and abscess. **(11)** Transsphincteric fistula. **(a)** Preliminary US scan reveals a hypoechoic soft-tissue mass in the left lateral intersphincteric plane (large arrow) with marked deficiency of the internal sphincter posteriorly (small arrow). **(b)** After peroxide injection, the US scan shows immediate communication with this abscess (large arrow), with the fistula extending through the thickened and irregular internal anal sphincter anterolaterally into the anal canal (small arrow). **(c)** Drawing in the coronal plane, with a horizontal line corresponding to the level of **b**, shows extent of the fistula and abscess.



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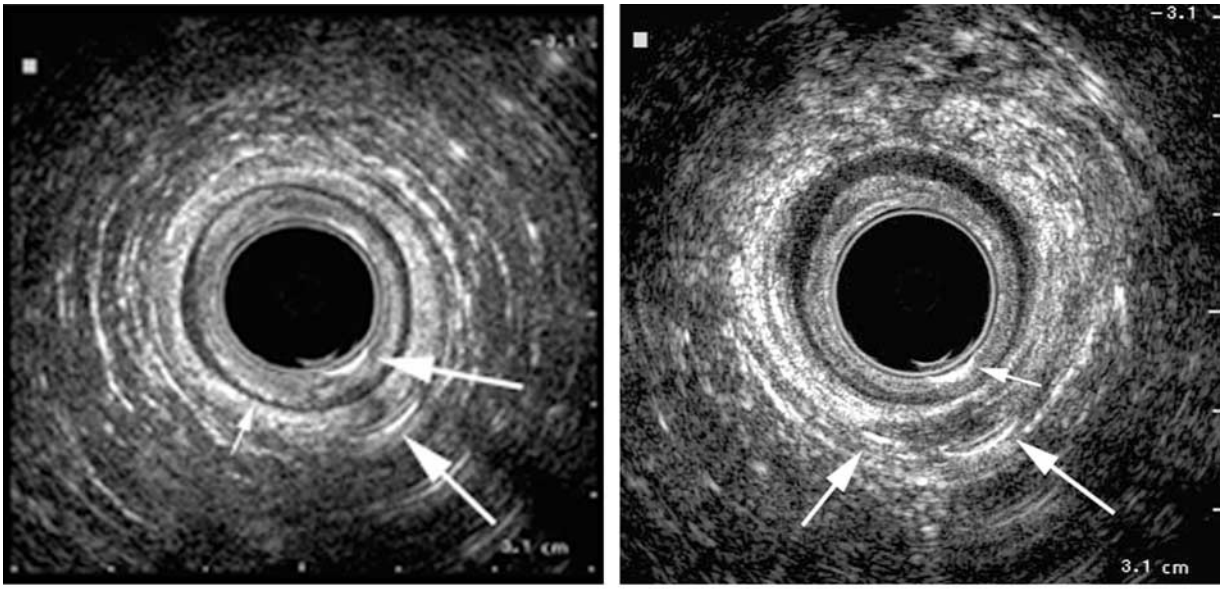

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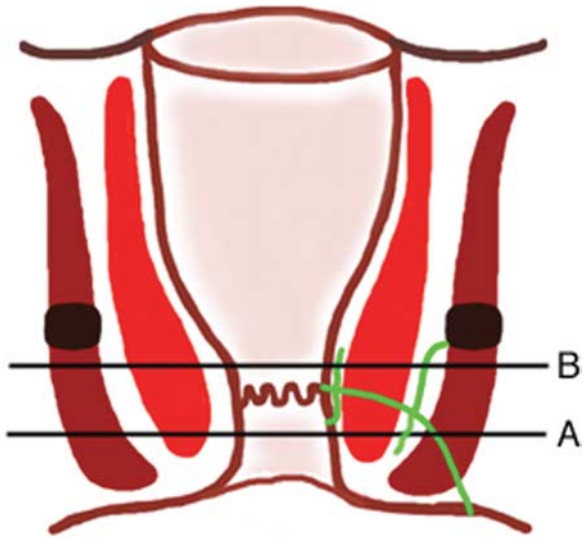


c.

Figure 12. Vertical submucosal and intersphincteric extensions. **(a)** Despite an unremarkable initial endoanal US examination, US scan obtained after peroxide injection into a superficial posterior opening shows a fistula extending through both the markedly thinned internal (shortest arrow) and external anal sphincters, communicating with the anal lumen, and tracking in both the submucosal and intersphincteric spaces (long arrows). **(b)** US scan shows that, in the middle of the anal canal, approximately 2 cm more cranial than image in **a**, additional tracks extend vertically in the submucosal (shortest arrow) and intersphincteric spaces (long arrows). **(c)** Drawing in the coronal plane, with horizontal lines corresponding to the levels of the US images, shows extent of the fistula and additional tracks.

Transsphincteric fistulas extend through the external anal sphincter and reach the skin by traversing the ischiorectal or ischioanal fossa (Figs 10–13). Transsphincteric extension occurs through the external sphincter or puborectal muscle, involves a variable circumference of the anal wall, and may extend in a horseshoe manner for a variable distance around the anal wall. These fistulas are more complex, and surgical management is likely to disrupt the external sphincter and alter continence. When imaging transsphincteric fistulas, one or more abscesses may be identified in any location within the anal wall (Figs 10, 11). One or more secondary tracks may occur and be identified at different levels of the anal canal (Figs 12, 13).

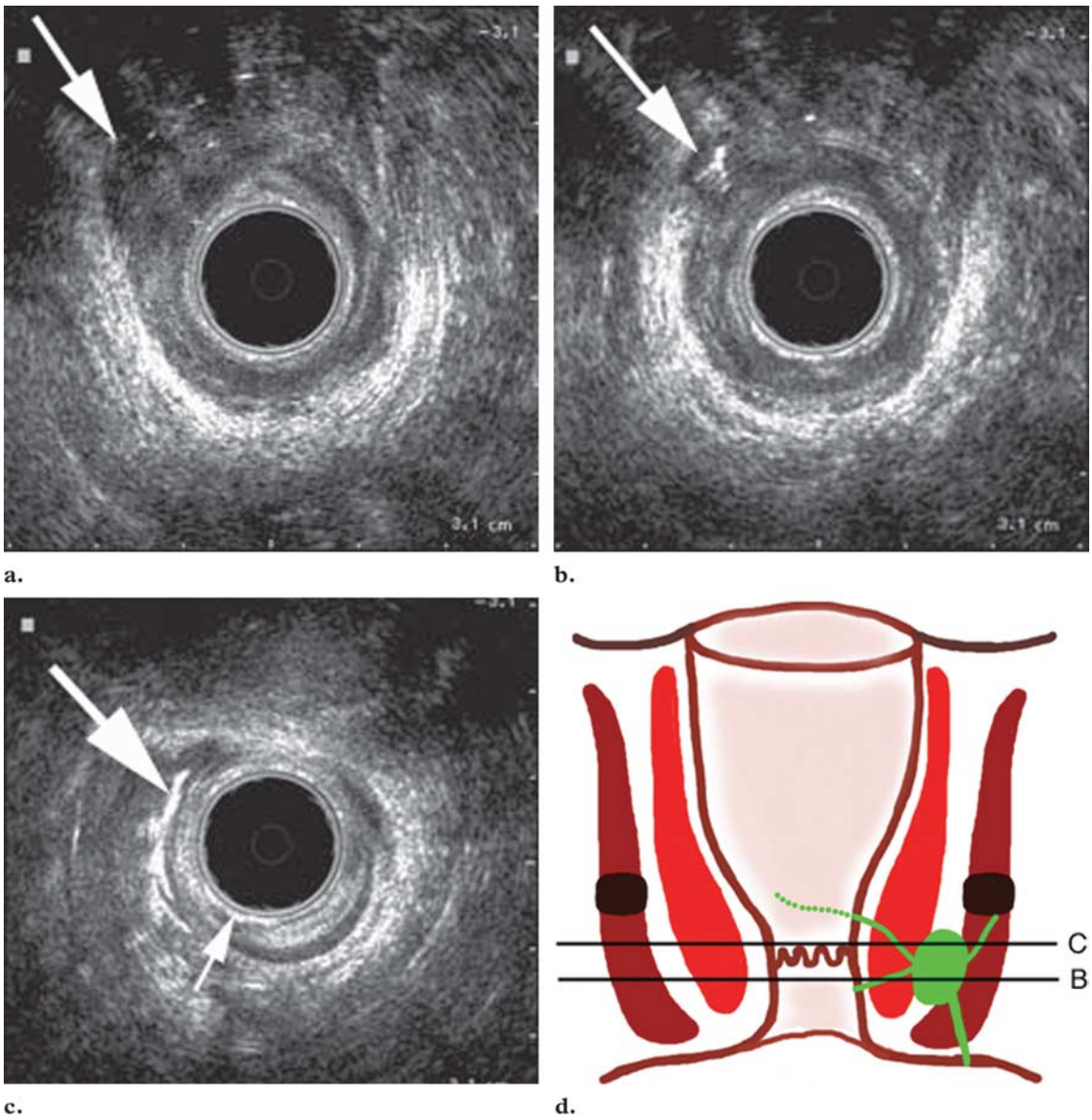


Figure 13. Horseshoe fistulas. **(a)** Preliminary endoanal US scan reveals irregular thickening with a soft-tissue mass (arrow) at the 11-o'clock position in the internal anal sphincter and the intersphincteric plane. **(b, c)** After peroxide injection, the US scans show immediate communication (arrow in **b**), with fistulas extending posteriorly in the external anal sphincter (large arrow in **c**) and through the internal anal sphincter into the anal lumen (small arrow in **c**). **(d)** Drawing in the coronal plane, with horizontal lines corresponding to the levels of **b** and **c**, shows extent of the fistulas and abscess.

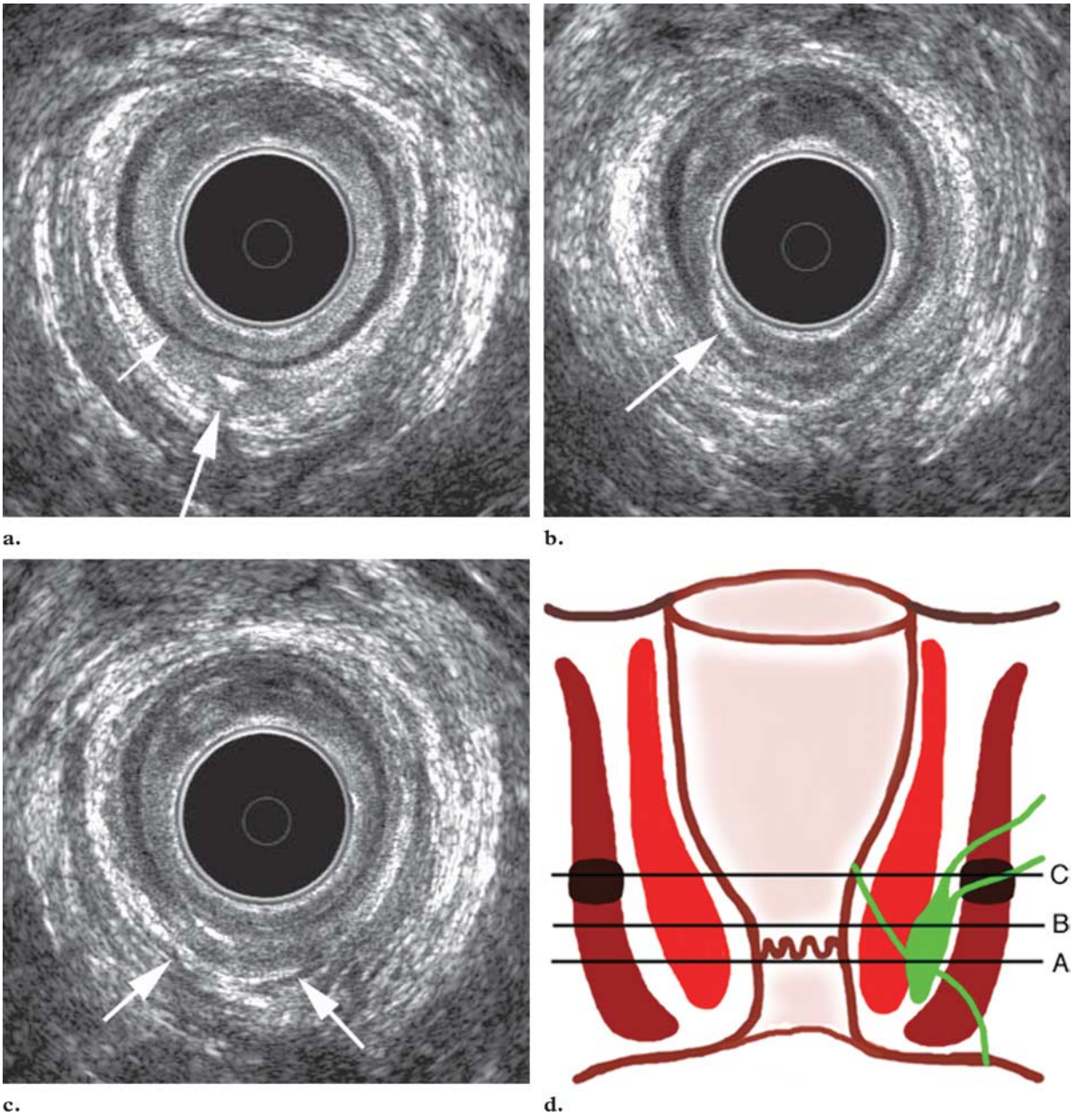


Figure 14. Suprasphincteric fistula. **(a)** After injection of peroxide, a US scan shows an intersphincteric abscess posteriorly (large arrow) immediately external to the internal anal sphincter (small arrow). **(b, c)** Subsequent scans show secondary fistulas extending from this abscess through the right side of the internal anal sphincter into the anal lumen at the level of the puborectal muscle (arrow in **b**) and through the levator ani muscle superiorly (arrows in **c**). **(d)** Drawing in the coronal plane, with horizontal lines corresponding to the levels of the US images, shows extent of the abscess and fistulas.

Extrasphincteric and suprasphincteric fistulas are the most difficult to delineate with US. These complex fistulas are usually associated with abscesses and secondary tracks (Fig 14), all of which should be documented prior to surgery. With careful attention to depth of field and gain settings, these fistulas can be identified within the substance of and outside the external anal sphincter (Figs 14, 15). Their position should be documented relative to the puborectal muscle and easily recognized organs such as the prostate gland (Fig 15).

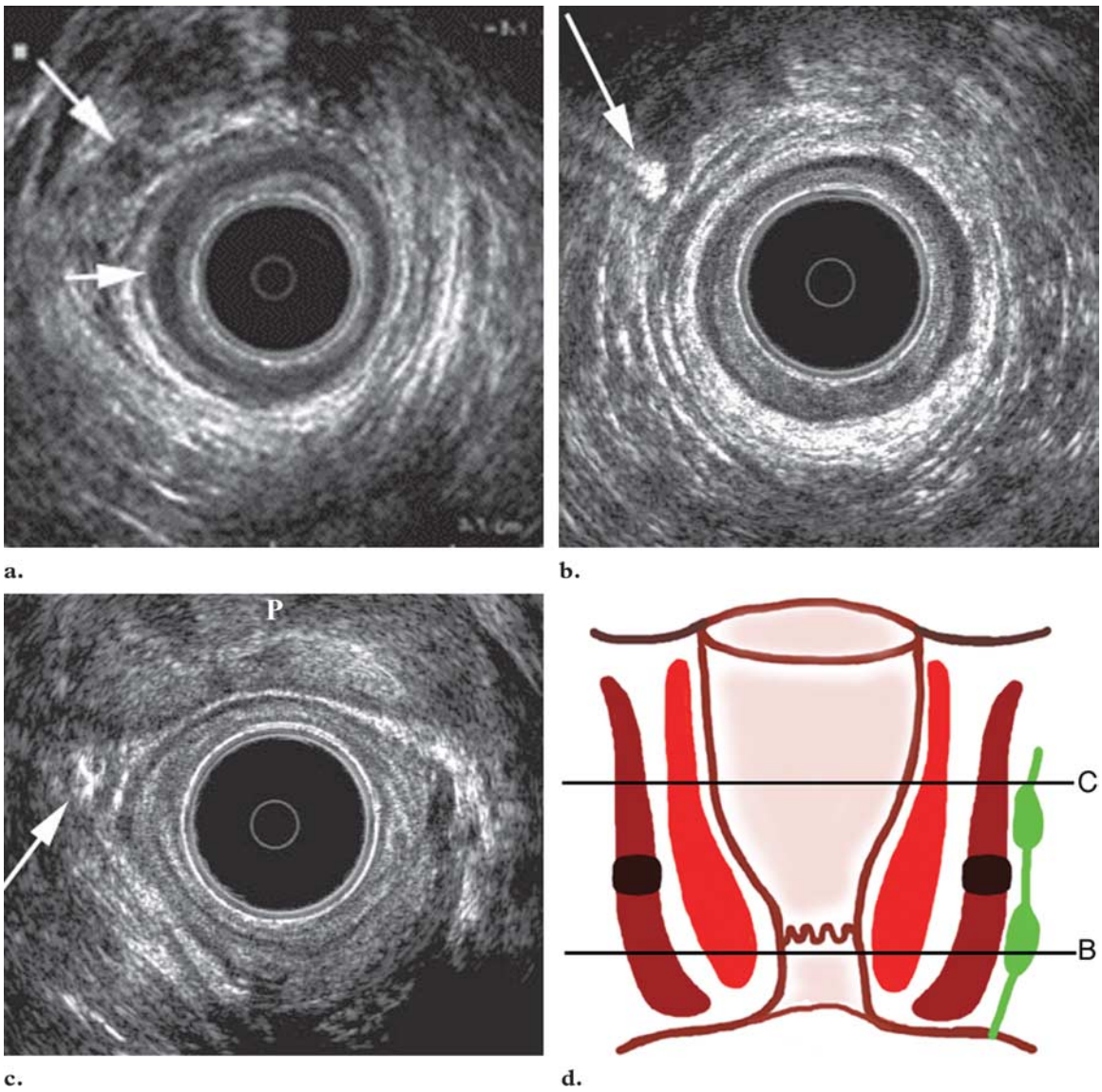


Figure 15. Extrasphincteric fistula. **(a)** Endoanal US scan shows a single hypoechoic mass (large arrow) outside the internal (small arrow) and external anal sphincters prior to peroxide injection. **(b, c)** US scans obtained after injection show immediate communication with this small abscess cavity (arrow in **b**), with a fistula (arrow in **c**) tracking up the anterolateral rectal wall to the base of the prostate gland (*P* in **c**). **(d)** Drawing in the coronal plane, with horizontal lines corresponding to the levels of **b** and **c**, shows extent of the fistula and abscesses.

Clinical Experience with Peroxide-enhanced Endoanal US

To our knowledge, only three reports have described the use and results of peroxide enhancement during endoanal US (1–3). Our series of 60 patients may be the largest reported to date. Ratto et al (1) found that peroxide-enhanced US was reliable in defining the anatomy of fistulas and their relationship to anal sphincters and therefore useful in surgical planning. They also showed that the use of peroxide improved identification of secondary extensions, especially when horseshoe

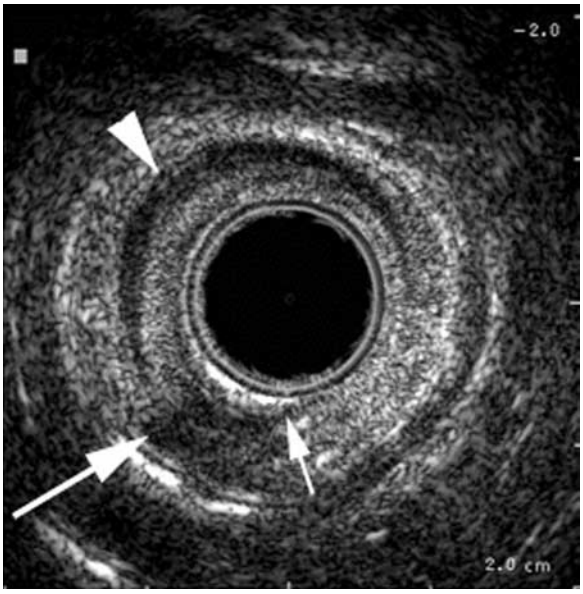


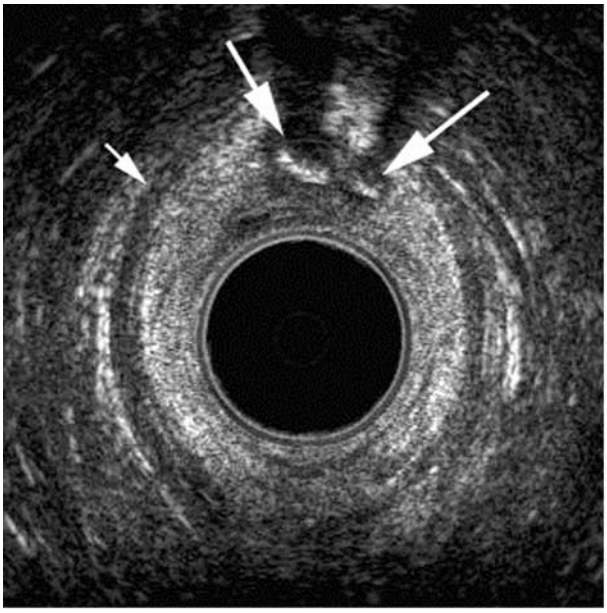
Figure 16. Trapped air simulating an anal fistula. US scan of the lowermost segment of the anal wall shows submucosal hemorrhoids (large arrow) with echogenic air trapped in the anal mucosa (small arrow). The left posterior part of the internal sphincter is absent, a normal finding at this low location, whereas the sphincter is intact in the right anterior position (arrowhead). This constellation of findings may falsely suggest a posterior abscess communicating with the anal lumen.

tracks had developed. Cheong et al (3) showed that peroxide enhancement of the fistula track is a simple, effective, and safe method of improving the accuracy of endoanal US assessment of recurrent anal fistula. In a prospective study that compared conventional US with hydrogen peroxide–enhanced US before surgery in 21 patients, Poen et al (2) showed that hydrogen peroxide–enhanced US was superior to physical examination and standard US in delineating the anatomic course of perianal fistulas.

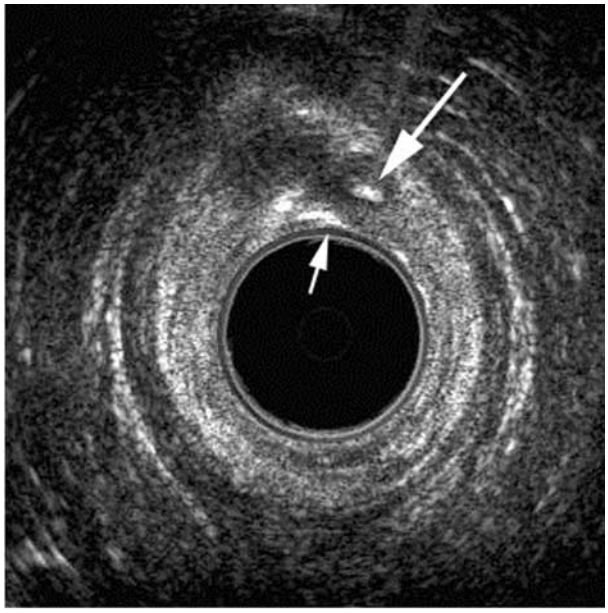
To date, we have performed 60 examinations. Despite the results of 12 endoanal US studies initially being normal, eight showed transsphincteric fistulas and eight superficial sinus tracks after hydrogen peroxide injection. Of 39 endoanal US examinations with abnormal findings, hydrogen peroxide–enhanced US helped confirm 30 fistulas and nine sinus tracks. Peroxide injection permitted fistulas to be distinguished from scarring in 20 of 30 patients. Data from hydrogen peroxide–enhanced US examinations resulted in sphincter-sparing surgery only in 13 patients and facilitated decisions about the site of seton insertion and fistulotomy incision in 29.

Potential Pitfalls of Imaging

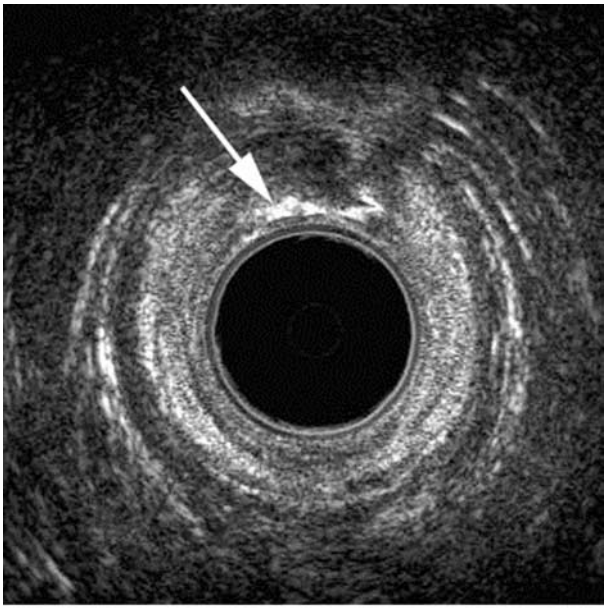
The operator should be aware of several common pitfalls that may result in overestimation of the extent of fistula formation. When external openings are immediately adjacent to the anal opening, peroxide may leak from the external opening across the skin and reflux into the anal canal. Air trapped in the anal canal has an appearance similar to that of peroxide (Fig 16). This phenomenon will result in brightly echogenic shadowing



a.



b.



c.

Figure 17. Hemorrhoidal band in the anal wall. **(a)** Endoanal US scan was obtained of a patient with a hemorrhoidal band in the high anal wall (large arrows) in whom a perianal fistula was suspected. The relative position of the internal anal sphincter (small arrow) is shown. Shadowing from the surgical band occurs prior to peroxide administration. **(b, c)** After peroxide injection into a small cutaneous opening, prompt passage of the contrast agent shows communication with the bands (large arrow in **b**) and with the anal lumen (small arrow in **b**, arrow in **c**).

that seems to arise from the lumen of the anal canal, suggesting a patent track communicating with the anal lumen. Clips, setons, surgical drains, and hemorrhoidal bands in the anal wall are echogenic and may simulate a small intramural abscess (Fig 17). It is therefore important to identify and document any abnormalities in the anal wall on the scans obtained before peroxide is administered. The course of the fistula must be carefully documented during injection into these patients, since this hardware is frequently associated with the fistula track.

Conclusions

Peroxide enhancement improves the accuracy of endoanal US and provides a dynamic depiction of perianal fistulas. Accurate preoperative depiction

of anal fistulas is fundamental to successful surgical management (6). The technique may be especially useful for patients with recurrent perianal fistulas in whom scarring should be distinguished from recurrent fistulas. Hydrogen peroxide–enhanced US allows delineation of the anatomic course of fistulas, permits accurate preoperative assessment, and facilitates choice and performance of surgery. We strongly recommend this technique for preoperative evaluation in patients with recurrent perianal fistulas.

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