

Role of transperineal ultrasound in infective and inflammatory disorders

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Abstract

Aims: To evaluate the role of transperineal ultrasound as screening tool in infective and inflammatory diseases of perianal region. **Materials and Methods:** Initially, clinical examination of the perineal region of patients (pts) for perianal external opening of tracts, swelling and tenderness is done. The perineal USG was performed using 2 -5 MHz sector probe and 7 -13 MHz linear probe on GE logiq P 5 ultrasound machine. Internal opening of any fistulous tract were described with clockwise position and tracts were traced upto their external opening and perifocal area were screened for any ramification. The Park *et al.* classification was used for classifying the tracts. **Results:** Out of 492 pts, 60 pts were normal, 257 pts had fistula, 114 pts had sinuses, 44 pts had only abscess without fistula or sinus and 17 pts had other pathologies with 95% sensitivity (Sn), 100% specificity (Sp) and Positive Predictive Value (PPV) and 95% Negative Predictive Value (NPV) for fistula and 94% Sn, 97% Sp, 89% PPV and 98% NPV for active sinuses and 98% Sp, 96% ppv and 100% NPV and Sn for abscesses. **Conclusions:** Transperineal Ultrasound should be performed as first line imaging modality for suspicion of low perianal fistula with high sensitivity, specificity, and negative predictive value at much lower cost and less time as compared to perineal MRI.

Key words: Anal fistula; anal sinus; fistula in ano; horse-shoe fistula; perianal abscess; pilonidal sinus; transphincteric fistula; transperineal; usg

Introduction

Perianal inflammatory disorders include perianal abscess, pilonidal sinus, fistula in ano, recto-vaginal fistula, and recto-urethral fistula, sinus and these generally present with severe perineal pain, pus discharge, and discomfort while sitting. They have the propensity for chronicity, recurrence, and resistance to treatment, which needs frequent follow-up imaging and multiple surgeries. Thereby, increasing the morbidity of patients and cost of healthcare. Magnetic resonance imaging (MRI) with its scarcity and cost and computed tomography with

poor capability in soft tissue differentiation of perianal region, perineal ultrasound seem to be a simpler, less expensive, easily available, and repeatable methods that can adequately evaluate perianal fistulas and abscesses. Transrectal ultrasound has its own problem of limited field of view and discomfort. Before going into details of perianal pathologies, review of perianal anatomy is important.

Relevant anatomy

The anal canal extends from the anorectal ring (the circular upper border of the puborectalis muscle) to the perineal

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Cite this article as: Puranik CI, Wadhvani VJ, Vora DM. Role of transperineal ultrasound in infective and inflammatory disorders. Indian J Radiol Imaging 2017;27:482-7.

Access this article online

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DOI:
10.4103/ijri.IJRI_417_16

skin. The total length of anal canal is 3.8–4 cm. The anal sphincter comprised three layers [Figure 1]:

- Internal sphincter (IS) is a continuance of the circular smooth muscle of the rectum, involuntary, contracted during rest, and relaxes at defecation
- Intersphincteric space containing loose fat containing areolar tissue
- External sphincter (ES) is a voluntary striated muscle divided into three layers (submucosal, superficial, and deep) and functioning as one unit. These three layers are continuous cranially with puborectalis muscle and levator ani.^[1]

The mucosal surface of the proximal anal canal is lined by a series of longitudinal mucosal columns, known as the columns of Morgagni.^[2] The spaces between the columns are known as the anal sinuses (or crypts of Morgagni), which receive drainage from the anal glands. Distally, the columns are connected to each other circumferentially by small anal valves, which collectively form the dentate line.

Pathophysiology

Primary (cryptoglandular theory)

The cryptoglandular theory of Eisenhammer and Parks is now widely accepted, although there have been very few subsequent studies to confirm or refute it.^[3] According to the “cryptoglandular theory,” up to 90% of perianal fistulas are believed to arise secondary to infection of obstructed anal glands. Anal gland gets infected and because of subsequent infective obstruction of its connecting duct is unable to drain spontaneously into the anal canal. Infection and anal gland drainage obstruction may lead to an acute perianal abscess.^[4] Some abscesses may resolve

spontaneously via internal drainage into the anal canal or with treatment (antibiotics). However, other abscesses, those inadequately or incompletely drained or resistant to medical treatment, will persist and may ultimately seek additional drainage pathways through the intersphincteric space or across the sphincter complex and, in the process, create fistulous tracts.

According to Parks’ classification^[5] [Figure 1], fistula is divided into:

- Intersphincteric fistulas (70%)
- Transsphincteric fistulas (24%)
- Suprasphincteric fistulas (5%)
- Extrasphincteric fistulas (1%)

The remaining 10% of cases result from other causes, such as Crohn’s disease, tuberculosis, diverticulitis, pelvic infection, trauma, anorectal cancer, iatrogenic (hemorrhoidal surgery), or radiation therapy.

Materials and Methods

A total of 492 patients (pts) from March 2010 to December 2014 with clinical suspicion of perianal infective/inflammatory disease were studied prospectively at our hospital. The examination was initiated with inspection and palpation of the perineal region in left lateral position and in supine lithotomy position for perianal external opening of tracts, swelling, and tenderness. The perineal ultrasound (sonography) was performed using 2–5 MHz sector probe and 7–13 MHz linear probe on GE Logiq P5 ultrasound machine. Patients were given lithotomy position for perineal sonography. In obese pts or who are unable to maintain lithotomy position for perineal sonography, sonography is done in lateral or rarely in prone position according to comfort of patient and radiologist. Initial screening was done to get the orientation of the anatomy by the sector probe in sagittal and parasagittal planes. Then the high-resolution linear probes were used directly over the skin with aseptic latex shielding. The transducer was placed over anal canal and every external opening of tract in all patients and transverse, sagittal, parasagittal, oblique images were taken as necessary. The openings of any fistulous tract in the anal canal/rectum/vagina were described with clockwise position [Figure 2]. All tracts were traced up to their external and/or internal opening and perifocal area were screened for any ramification. The parks’s classification was used for classifying the tracts. The patients were asked to bear down (strain) to see the movement of the air foci in the fistulous tract (active tract) and at internal anal opening.

Findings were confirmed by surgeon on clinical examination, digital rectal examination (DRE) as well as proctoscopy, and surgery wherever it was required for treatment. MRI was done in few cases with complex and high types of fistula.

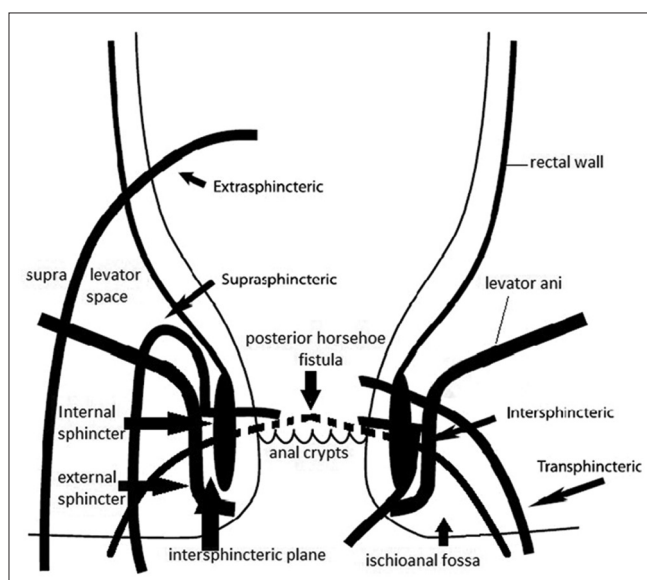


Figure 1: Diagrammatic representation of ano-rectal junction and fistula in ano according to park's classification and posterior horse shoe fistula

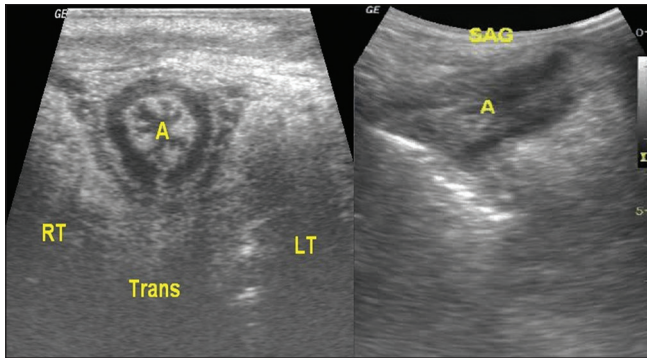


Figure 2: Transeverse (trans) and sagittal (sag) images of normal anal canal (A). The internal sphincter is hypoechoic band completely surrounding the more echogenic anal canal mucosa. The external sphincter is slightly thicker, mixed echogenic

Results

There were 492 pts from 17 to 89 years age groups, of which maximum 263 (53%) were in the 31–51 years of age group with 432 (88%) males and 60 (12%) females. Out of which, 60 (12%) pts were normal with no surgically significant abnormality detected on perineal sonography and confirmed on clinical examination, DRE, and proctoscopy with sensitivity and negative predictive value (NPV) of 100%. Also, 432 (88%) pts were having some abnormality detected on sonography and were found on clinical examination, DRE, proctoscopy, and surgery. Out of 432 pts, 257 pts had fistula, 114 pts had sinuses, 44 pts had only abscess without fistula or sinus, and 17 pts had other pathologies.

Out of 257 pts with fistula, 184 pts (72%) had single fistula and 73 (28%) pts had multiple fistulas. Three pts had both active and inactive fistula confirmed by surgery; 21 pts had inactive fistula (i.e., granulated/fibrosed tract) and 233 pts had active fistula with 100% specificity and sensitivity. Out of 236 pts with active fistulas, 149 pts (63%) had simple fistulas and 87 pts (37%) had complex fistulas with ramifications. According to Parks' classification, we had 200 pts (84.7%) with transsphincteric, 25 pts (10.5%) with intersphincteric, and 9 pts (3.8%) with high extrasphincteric/suprasphincteric fistulas. One case each of cutaneo-cutaneous and vagino-cutaneous fistula are not classifiable according to Parks' classification. Seventy-two pts had active fistulas associated with abscess of which 33 pts (46%) had intrasphincteric abscess and 39 pts (54%) had extrasphincteric abscess. Forty-eight pts had active horseshoe transsphincteric fistulas. Out of 236 pts with active fistula, 163 pts (69%) had single external opening and 73 pts (31%) had multiple external openings. Posterior anal opening was seen in 144 pts (61%) and 90 pts (39%) had anterior anal opening.

One hundred and nine pts had active sinuses and five pts had inactive sinuses, confirmed on clinical examination and

surgery. Out of 109 pts with active sinuses, 33 pts (30%) had simple active sinus and 76 pts (70%) had active sinus with abscess, of which 43 pts (57%) had intrasphincteric and 33 pts (43%) had extrasphincteric abscesses. Sixty-five pts (60%) had posterior sinus and 44 pts (40%) had anterior sinus.

Out of 44 pts with only abscesses without any associate tract, 24 pts (55%) had intrasphincteric and 20 pts (45%) had extrasphincteric abscess. Totally, 192 pts had abscesses, of which 76 pts (40%) were associated with sinuses, 72 pts (37%) were associated with fistula, and 44 pts (23%) had only abscesses. Of total abscesses, 100 pts (52%) had intrasphincteric and 92 pts (48%) had extrasphincteric abscesses.

On clinical and surgical follow-up, out of 492 pts, 236 pts with active fistulas, 109 pts with active sinus, and 192 pts with abscesses detected on perineal sonography, 12 pts with active sinus were surgically proved to be active fistulas with internal opening which was not visualized by perineal sonography with 95% sensitivity (Sn), 100% specificity (Sp), 100% positive predictive value (PPV), and 95% NPV for fistula. Six pts with abscess were clinically and proctoscopically diagnosed as active sinuses with internal anal opening which were missed on perineal sonography with 94% Sn, 97% Sp, 89% PPV, and 98% NPV for active sinuses and 98% Sp, 96% PPV, and 100% NPV and Sn for abscesses.

Among other pathologies, nine patients were diagnosed as masses of anal canal/rectum, which turned out to be malignant, three pts with pilonidal sinus, three pts with perianal inflammation – pruritis ani, one with anal wart, and one with lipofibromatosis.

Discussion

Most of the patients with long-sitting hours, such as long distance drivers, desktop jobs, hairy perineal region, poor personal hygiene, constipation, fistula in ano are common afflictions. Overall, perineal sonography has high sensitivity with 100% NPV to differentiate between normal [Figure 2] and abnormal pt. A fistula is an abnormal communication between any two epithelial lined surfaces. Fistula in ano is defined as a tract with an internal opening in the anal canal and external opening on the perineum with fluid or air within. On perianal sonography fistula in ano appears as hypo to anechoic tract with mobile internal echoes with perifocal increased echogenicity of fat due to induration. In all cases with active fistula on straining, we were able to demonstrate “mobile particulate/air echoes” moving within the tract or entering into anal canal, confirming the active fistula even in those patients who were not having continuous discharge from external opening with 100% accuracy on clinical examination or surgical follow-up.

Patients with inactive or granulated (healed) tract showed hypoechoic tract with no evidence of mobile internal echoes and external or internal discharge with 100% accuracy on clinical examination and proctoscopy [Figure 3]. Initially, most of complex fistulas [Figure 4] were considered simple on clinical examination; however, due to either secondary extensions or abscesses found on sonography, they were labeled as complex tracts and more extensive surgery was required. So this helps in explaining the prognosis to pts and overview road map of various tracts for surgeons because if secondary extensions or abscesses were not treated during surgery there are high chances of recurrence.

Communication with surgeon was based on the Parks' classification and anatomical description as in lithotomy position, which is the position of pt during surgery [Figure 3]. The internal opening decides description of tract according to, at what clock hour, the tract that has opened into anal canal and lying anterior or posterior to a plane passing transversely through anal canal. According to Goodsall's rule,^[6] fistulas with an external opening anterior to a plane passing transversely through the center of the anus in lithotomy position will follow a straight radial course to the dentate line. Fistulas with their openings posterior to this line will follow a curved course to the posterior midline. Exceptions to this rule are external openings greater than 3 cm away from the anal verge. All naïve pts who had no history of any previous perianal surgery followed Goodsall's rule with its exception in our study. However, pts with past history of any perianal surgery did not follow this rule in our study.

In our study, the most common fistula was low active transsphincteric fistula [Figure 5] and then intersphincteric fistula [Figure 6]. However, according to Parks' classification, intersphincteric fistulas are more common than transsphincteric fistula. Marks *et al.*^[7] mentioned in their study that there are limitations to Parks' classification. Superficial fistulas are not classified because of the emphasis

on the intersphincteric plane. These are common and makeup around 16% of one series. A review article by Matthew *et al.*^[3] described that the lowermost fibers of the ES curve under the distal edge of the IS and on endoscopic ultrasound the lower third of the anal canal has no IS. Even very low fistulas cross some of these lowest fibers of the ES and are, hence, transsphincteric.

On perineal sonography, it was difficult to differentiate high extrasphincteric or suprasphincteric active fistula and pts were advised perineal MRI due to poor resolution of deeper tissues with convex probe and poor penetration by linear probe. However, out of nine pts with high fistulas, five tracts were seen near vicinity of urethra and suggested possibility of urethral communication of which two were confirmed on perineal MRI.

Sinus is any tract having a blind end and either internal anal opening or external cutaneous opening. Active and inactive sinuses were diagnosed just like fistula with 100% accuracy.

In 12 pts with fistula and six pts with sinus, internal opening was not seen and were wrongly diagnosed as sinus and abscesses, as per definition, respectively. Most of these pts were too obese or having incompatible anatomical area for placing linear or convex probe for perineal sonography. Maximum of about 48% pts had internal opening at 6 o'clock and 17% pts had opening at 12 o'clock, may be due to maximum pressure generated in anal canal and posteriorly glands getting obstructed and infected, which is in accord with cryptoglandular theory of Eisenhammer and Parks.

All patients with inactive granulated/fibrosed (healed) fistula or sinuses and all normal pts on sonography were

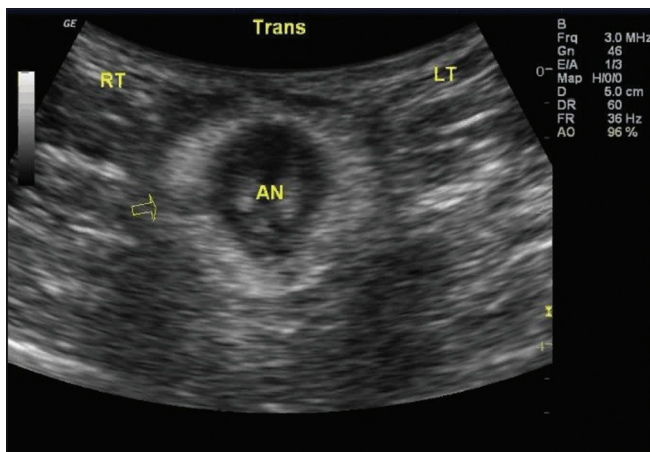


Figure 3: Trans illustration shows “anal clock” when viewed with patient supine in lithotomy position. Fibrosed tract is seen at 9 o'cl (arrow)

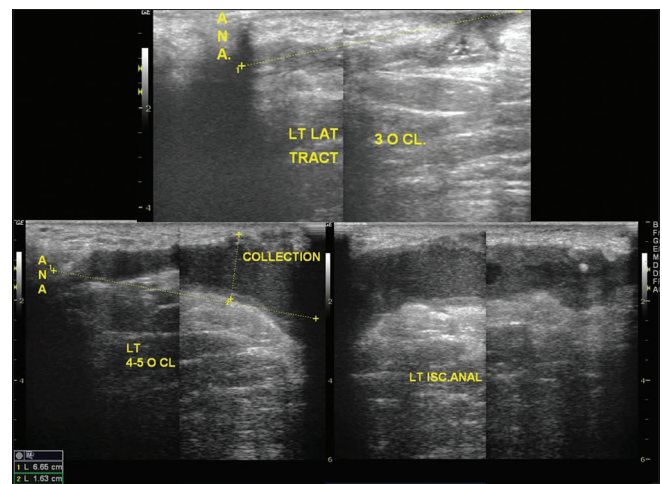


Figure 4: Transverse oblique scan showing hypoechoic active trans-sphincteric fistula with air echoes within extending from 3 o'clock. towards left lateral external opening. There was another active sinus opening internally at 4-5 o'clock. extending towards left postero-lateral ischioanal region with mobile fine internal echoes and extrasphincteric abscess without any external opening with thick walls and perifocal echogenic induration

normal on clinical examination as well as proctoscopy done by surgeon, suggesting 100% NPV in our study.

A perianal abscess [Figure 7] is defined as a hypoechoic fluid collection with mobile particulate material (internal echoes) with or without gas bubbles moving on mild pressure and showing posterior acoustic enhancement with thick irregular walls and increased perifocal induration and vascularity. Abscesses are divided into intersphincteric and extrasphincteric [Figure 8]. Extrasphincteric includes perianal, gluteal, and ischioanal abscesses.

Transperineal ultrasound is 100% accurate in diagnosing active and inactive tracts (sinus as well as fistula) with the help of mobile internal echoes. It is highly sensitive and specific for low-lying active fistula and sinuses with high NPV. Most importantly, it helps in differentiating between simple and complex fistula and providing preoperative roadmap of tracts and abscesses to surgeon for better

management and prognostication of pts at much cheaper rate and less time than perianal MRI.

However, perineal sonography in poor in differentiating course of high fistulas is due to its inherent limitations. In obese pts, pts with uneven anatomy of perianal region for placement of sonography probe, pts with severe perianal pain and time to lie in lithotomy position, sonography with probes used in this study, sometimes becomes difficult and cumbersome for both pt and operator. However, different positions such as right lateral or prone can be tried for perineal sonography but reported as the anatomy in lithotomy position. For high fistulas and difficult pts with obesity, high-end sonography machines with good quality probes and larger range of frequencies in linear probe and

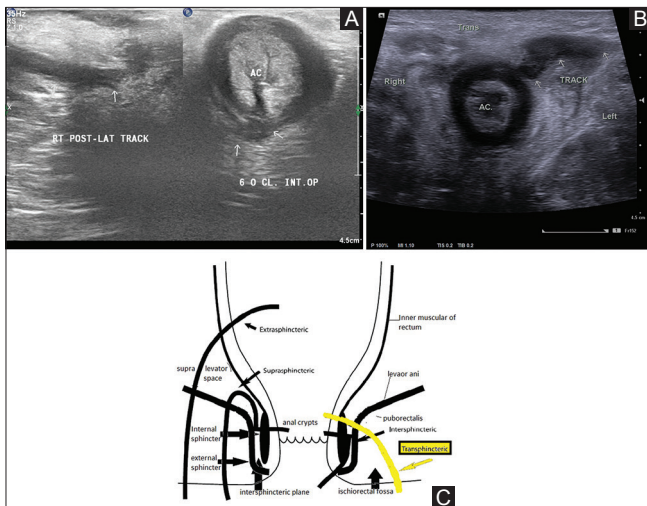


Figure 5 (A-C): Trans-spincteric fistula. (A) Transverse and oblique sagittal images revealing hypoechoic tract extending from right postero-lateral region and opening into anal canal at 6 o'clock through both external and internal spincter. (B) Transverse images revealing anterolateral tract opening into anal canal at 1-2 o'clock through both external and internal spincter. (C) Representative diagram with highlighted Trans-spincteric tract

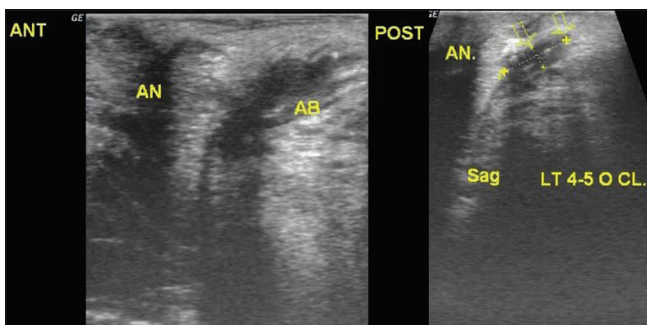


Figure 7: - Sagittal images revealing left postero lateral intersphincteric abscess at 4-5 O cl. echogenic air focus (---->) which reduced in size on follow up after 7 days on medical treatment

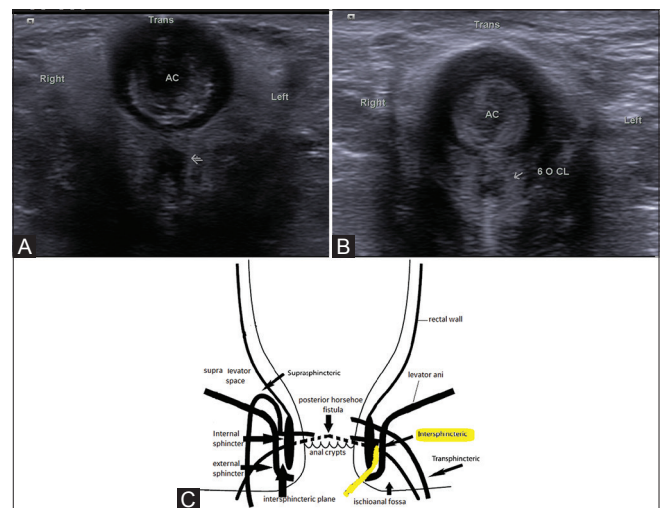


Figure 6 (A-C): Inter-spincteric fistula. (A and B) Transverse images revealing hypoechoic tract opening into anal canal at 6 o'clock through only distal most internal spincter and external spincter is not visualised. (C) Representative diagram with highlighted interspincteric tract

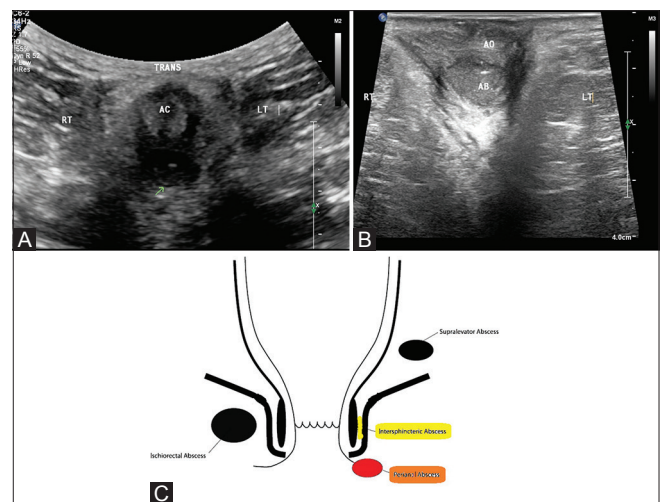


Figure 8 (A-C): Abscesses. (A) Intersphincteric abscess, (B) Perianal abscess. (C) Representative diagram with highlighted Intersphincteric (yellow) and perianal abscess (red)

better resolution can be tried, or can be directly suggested perianal MRI. Last but not the least, to get acquainted with sonography appearances of perianal anatomy, authors' suggest sonography of at least 50 patients before reporting.

Conclusions

Transperineal ultrasound should be performed as first-line imaging modality for suspicion of low perianal fistula with high sensitivity, specificity, and NPV at much lower cost and less time as compared to perianal MRI. It helps in providing preoperative roadmap of tracts and abscesses to surgeon, which is required for surgeries to prevent recurrence.

Further recommendation

Transperineal ultrasound with instillation of saline into tract can be further evaluated; however, it causes more pain to patients.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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