

Imaging Classification of Perianal Fistula Using the Ultrasound

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ABSTRACT

INTRODUCTION: Perianal fistula is defined as a tract lined by granulation tissue which may have external opening, internal opening or both external and internal openings.

AIM: The study aimed to classify and assess the whole course of perianal fistula using the combined ultrasound transperineal, endoanal and endovaginal approaches.

MATERIAL AND METHODS: Referred 480 patients were clinically diagnosed as a perianal infection (fistulas or abscesses) All were subjected to transrectal ultrasound (TRUS), transperineal and additionally if females transvaginal ultrasound.

RESULTS: 30 cases detected with anal abscesses, among them 10 cases diagnosed as perianal abscesses, 5 cases with inter sphincteric plane abscesses, 11 cases with ischio anal fossa abscesses, 3 cases with horse shoe abscesses and 1 case with pelvi-rectal abscess. 450 cases detected with perianal fistulas were evaluated for the whole course of the fistula tract by combining transperineal, Transrectal and in females, Transvaginal ultrasound and could be classed according to the etiology, sphincteric course, extrasphincteric course, internal opening varieties, external opening varieties and the expected post-operative risks.

CONCLUSION: The combined ultrasound technique using the endoanal or transvaginal and transperineal ultrasound approaches can be applied to fully evaluate the whole course of perianal fistula and it can contribute to minimize the incidence of postoperative recurrence and postoperative fecal incontinence.

INTRODUCTION

The perianal collection is a localized collection related to the anal canal of many types. It may be perianal abscess, submucosal abscess, ischeo-rectal abscess, low inter muscular abscess, or pelvi-rectal abscess^[1].

Perianal fistula is defined as a tract lined by granulation tissue which may have external opening, internal opening, or both external and internal openings. Perianal fistula may be high level, which opens at or above the level of anorectal ring, or lower level, which opens below the level of the anorectal ring^[2].

Management of perianal fistula aimed to relieve the patient symptoms with low recurrence rates and preserving the fecal continence. Low type perianal fistula can be treated with lay open surgical procedure while high type fistula can be treated with sphincter saving procedures as a rectal advancement flap, fistula plug, fibrin glue and Seton, management of perianal abscess depends on surgical drainage under general anesthesia^[3].

The diagnosis of perianal fistula can be made out through examination under anesthesia, X ray fistulography, endoanal ultrasound and magnetic resonance imaging. Fistulography is inaccurate in assessing the level of internal openings with high false results of rectal openings and in assessment of acute tracks. Endoanal ultrasound can be utilized to assess the sphincteric course of perianal fistula and to expect the site of internal opening, simply can't evaluate the extrasphincteric course due to limited field of view. MRI is utilized for evaluation of complex fistula tracks and to differentiate

between pilonidal sinus tracts and perianal fistulas however, it is an expensive technique which can't be used as a screening tool^[4].

The most widely used classification of perianal fistula is Parks' classification which includes intersphincteric, transsphincteric, extrasphincteric and suprasphincteric types^[5], however the limitations of Parks' classification that subcutaneous or superficial fistulas were not included^[3], the classification mainly concerned with the sphincteric course of perianal fistula, it didn't evaluate the state of the extra-sphincteric fistula course, the state of external openings, the state of anal sphincters prior to surgery and the predicted outcome of the surgery was only limited to its sphincteric course.

The assessment of perianal fistula prior to surgery should include the state of internal and external openings, the fistula course, the side branches and the associated complications^[6].

The purpose of the work

The study aimed to classify and evaluate the whole course of perianal fistula using the combined transperineal, endoanal and endovaginal ultrasound approaches.

METHODS

Referred 480 patients to the radiology department of my institution over a period of 7 years, all were clinically diagnosed as a perianal infection (Fistula or abscesses), their age ranged from 12 months to 70 years and the mean age was 30 years, their BMI was ranging from 18 to 27, duration of symptoms was ranging from 1 month to 4 years and the mean was 17 months, There were 80 females and 400 males.

All except 5 pediatric patients were subjected to routine endoanal ultrasound, transperineal and additionally if married females transvaginal ultrasound using high frequency mechanical transrectal rotating probe for endoanal approach, high frequency superficial linear probe (5 to 12 Mhz) for transperineal approach and if recommended high frequency transvaginal probe for endovaginal approach in female patients, using Voluson 530 D ultrasound machine with 3 dimensional (3D) capabilities (Kretz technique, Austria), Sono x8 ultrasound machine (Medison, Korea) or Siemens versa pro ultrasound machine (Germany). The pediatric patients were only examined with transperineal ultrasound using the superficial linear probe

All patients were examined with single highly experienced radiologist in left lateral decubitus position and for females additional examination performed in the dorsal lithotomy position with an endovaginal ultrasound exam.

The patients were examined through transperineal approach to ascertain the presence of perianal abscess or to evaluate the extra sphincteric course of perianal fistula.

In cases with perianal abscess we assessed the size, the volume, the site and extensions of abscess around and within the anal canal wall. Also, we assessed the presence of an inter sphincteric plane or submucosal localized collections.

In cases with perianal fistula we assessed the course, the thickness, the length, the side branches, the degree of surrounding soft tissue changes and eventually the site of crossing the external anal sphincter.

Female patients could also be subjected to transvaginal ultrasound, which delivers the advantage of assessment the extra and intra-sphincteric course of the fistula in one approach, however with less degree of picture resolution.

In all ultrasound approaches images were acquired in axial and sagittal planes and with 3 dimensional (3D) ultrasound an additional

coronal plane and 3D reconstruction with surface rendering and Niche mode could be received.

Final Images were analyzed to assess the whole course of perianal fistula from the position of external opening to the site of internal opening. In cases with no internal opening observed injection of dilute hydrogen peroxide into the track was tried.

Patients were followed up and the results of the study were based on the correlation between the image findings and the preoperative injection of methylene blue into the fistula tract to demonstrate the site of internal openings, the results of surgical exploration and intraoperative probing of the fistula tracts.

RESULTS

30 cases detected with anal abscesses (Figure 1A, B, C) among them 10 cases diagnosed as perianal abscesses, 5 cases with inter sphincteric plane abscesses, 11 cases with ischioanal fossa abscesses, 3 cases with horse-shoe abscesses and 1 case with pelvi- rectal abscess.

450 cases detected with perianal fistulas were evaluated for the whole path of the fistula tract either extra sphincteric or sphincteric course by combining transperineal, Transrectal and in females Transvaginal ultrasound.

Perianal fistula could be classified according to the etiology, sphincteric course, extrasphincteric course, internal opening varieties, external opening varieties and the expected post-operative risks.

Classification of perianal fistula (Table 1).

According to the etiology: Perianal fistula can be classified into cryptoglandular, recurrent cryptoglandular and non cryptoglandular^[7].

Cryptoglandular perianal fistula (342 cases-76%) (Figure 2, figure 3A, B) can be established by their internal openings situated at level of dentate line or ending within the inter sphincteric plane at level of dentate line

Cases of recurrent cryptoglandular perianal fistula (90 cases-20%) showed past history of operative management to previously diagnosed cryptoglandular fistula

Cases with non cryptoglandular perianal fistulas (18 cases-4%) detected with their internal openings above or below the levels of dentate line and mainly caused by Crohn's disease, tuberculosis, previous anorectal surgery, hidradenitis Suppurativa, Trauma and foreign bodies.

Table 1 Imaging Classification of perianal fistula.

Perianal Fistula is classified according To	Types	Number of cases	%
The etiology	Cryptoglandular	342	76
	Recurrent cryptoglandular	90	20
	Non cryptoglandular	18	4
Sphincteric course	Sumbmucosal	9	2
	Intersphincteric	108	24
	Transsphincteric	315	70
	Extrasphincteric	9	2
Extrasphincteric course	Superficial	9	2
	Branching, kinked, obstructed.	18	4
	With abscess	9	2
Internal opening varieties	Absent	23	5
	Level.....above dentate line	45	10
	At dentate line	371	82.5
External opening varieties	Below dentate line	11	2.5
	Absent	9	2
	Risky for postoperative recurrence	89	20
Postoperative risks	Risky for postoperative incontinence.	84	18.5

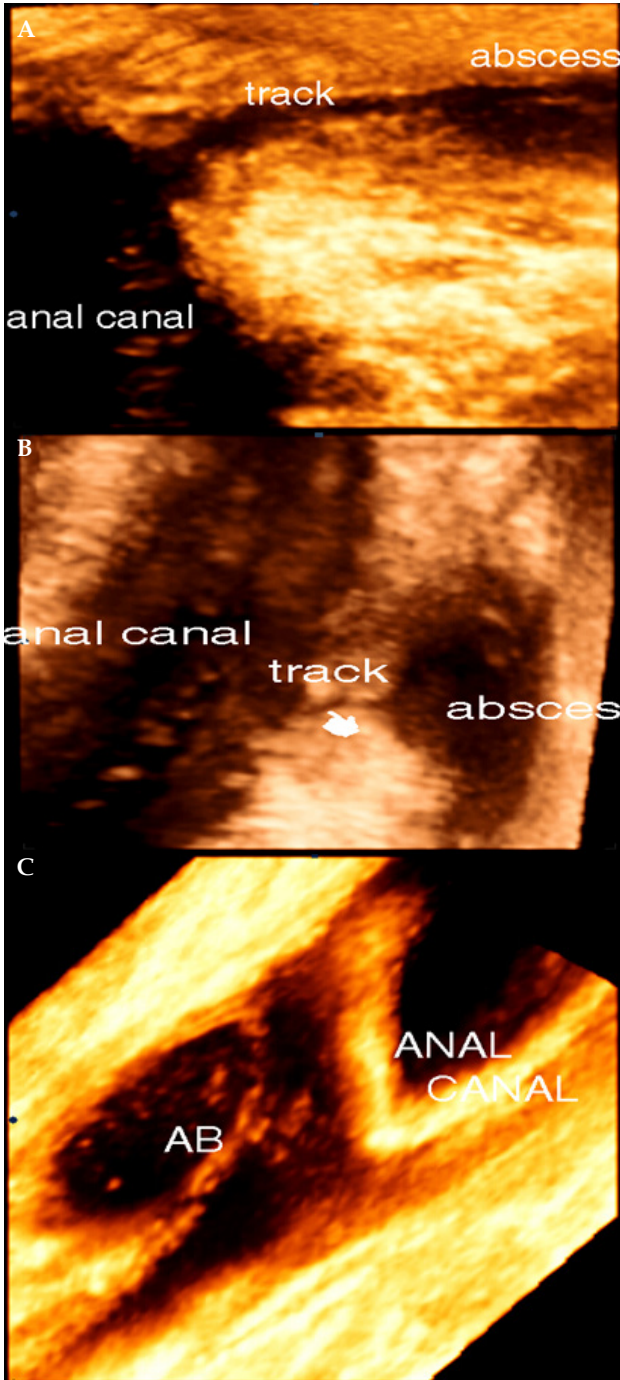


Figure 1 A: Transperineal ultrasound with 3D surface rendering of perianal abscess seen communicating through the track with the anal canal wall; B: Transperineal ultrasound with 3D surface rendering of ischioanal fossa abscess seen communicating through thin and short tract with the anal canal wall at mid anal canal level; C: 3D surface rendering of perianal abscess (AB).

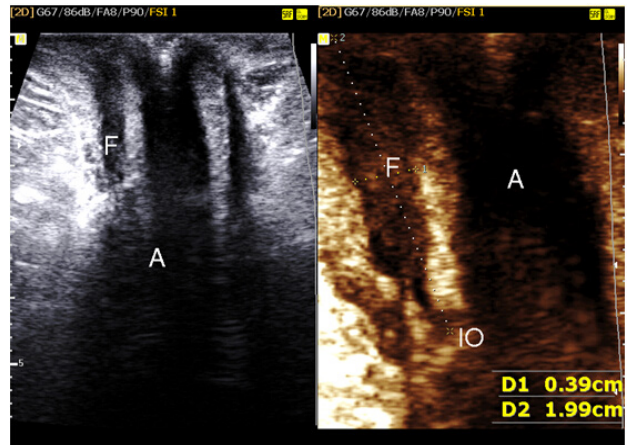


Figure 2 Transperineal ultrasound showing the whole course of cryptoglandular perianal fistula (F). Anal canal (A). Internal opening (IO).

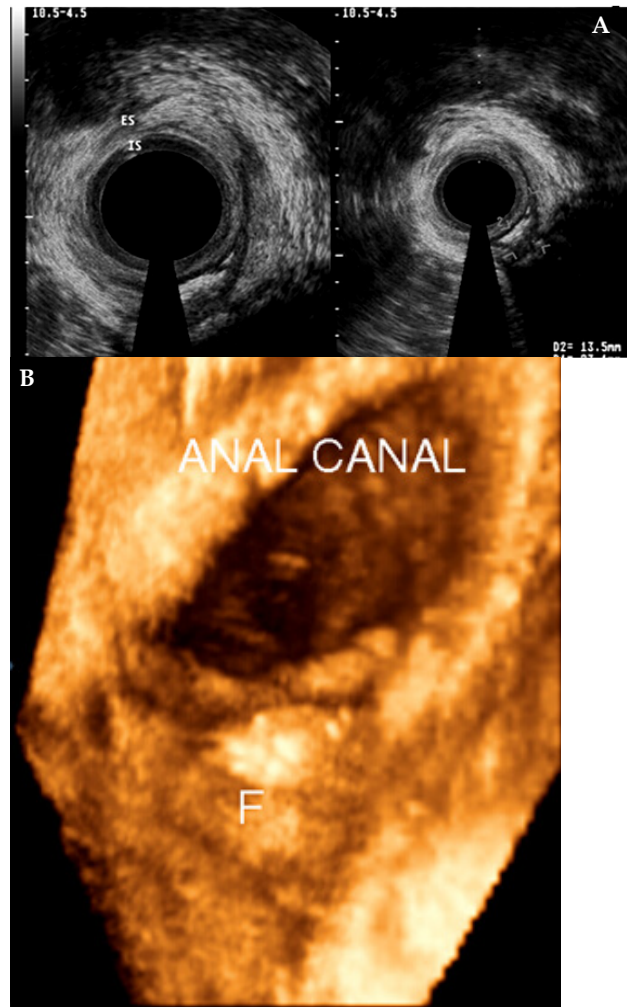


Figure 3 A: Endoanal ultrasound of posterior intersphincteric plane fistula; B: 3D surface rendering of an intersphincteric plane fistula (F).

According to the sphincteric course: the following types of perianal fistula observed

Submucosal fistulas (9 cases-2%): were caused by cryptoglandular. Infection or Chron's disease and were depicted in either upper or lower anal canal above or below the level of dentate line where the mucosal ligament present

Inter sphincteric perianal fistula (108 cases- 24%) (Figure 3A, B): May extend downward (type A), upward {type B), upward and suprasphincteric (type C) or circumferential (Horse-shoe fistula or type D). In type A the fistula tract extended in a downward direction to reach the perianal skin, in type B it extended in an upward direction with blind termination or with a second internal opening in the anorectal wall, Type C the supra sphincteric type of perianal fistula in which the track ascend in inter sphincteric plane to above puborectalis level and descend in between the puborectus and levator ani muscles to ischio anal fossa and perianal skin, In type D it extended in the circumferential direction to form a horseshoe fistula (Figure 4A, B) with its internal opening at the mid line posteriorly. Posterior inter sphincteric horse-shoe fistula can extend upward to high anal canal level without external opening, but can't extend downward due to the presence of anococcygeal ligament, the horse-shoe fistula tract also can extend to the ischioanal fossa and perianal skin.

Transsphincteric perianal fistula (315 cases-70%) (Figure 5A, B, C): Can be subclassified into 2 types according to the site where they cross the sphincters. Type A at or above the puborectalis muscle (36 cases- 8%) or type B below the puborectalis level (279 cases-62%). In type A all perianal sphincters including the puborectalis muscle are in danger. In type B the puborectalis muscle and the deep external sphincter are spared. Each of them may show abscess formation at the ischioanal fossa.

Extrasphincteric fistula (9 cases-2%) (Figure 6): The fistula track pass outside the sphincters to terminate at anorectal wall, it can be caused by Crohn's disease, recurrent cryptoglandular fistula, TB, pelvirectal abscess and diverticulitis. It could be subclassified into: Type A with blind termination, type B with internal opening in rectal wall, type C with abscess near rectal wall, type D with abscess at ischioanal fossa.

Superficial or subcutaneous fistula (9 cases-2%): Pass from skin to beneath the sphincters edges and the internal opening lies below the dentate line and were seen with cases of previous anorectal surgery or hiradenitis Suppurativa.

According to the varieties of internal opening

The presence of internal opening: Ultrasound correctly identified the site of internal opening in 88% of cases and among the remaining 12%, 23 cases(5%) showed no internal opening could be identified at surgery. Internal opening could be present or absent either due to blockage or destruction of internal opening or could be seen as tiny holes,

Level of internal opening: Below the dentate line (11 cases-2.5%), above the dentate line (45 cases-10%) or at the dentate line (371 cases- 82.5%). Fistulas with their internal openings below the dentate line were seen due to hiradenitis Suppurativa, Crohn's disease T.B. Fistulas with their internal openings at the dentate line were cryptoglandular in origin, Fistulas open above the dentate line may be due to Crohn's disease, TB or postoperative recurrence.

Number of internal openings: More than one internal opening could be seen (4cases-1%) in recurrent cryptoglandular fistulas and in Crohn's disease.

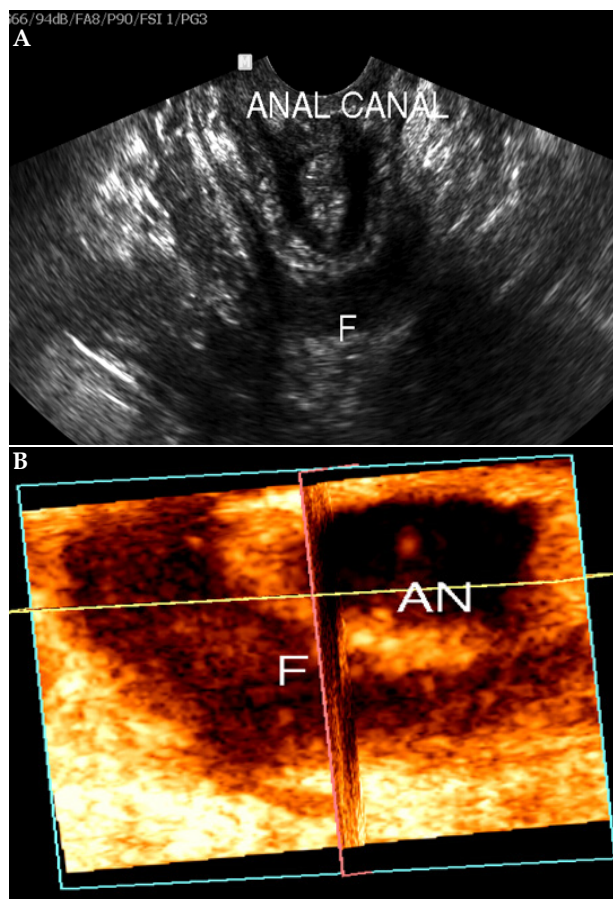


Figure 4 A: Transvaginal ultrasound showing high anal canal horseshoe perianal fistula (F); **B:** Transperineal ultrasound, 3D niche mode showing horse-shoe perianal fistula (F). Anal canal (AN).

According to the varieties of external opening: External opening could be single or multiple. Multiple external openings could be seen with branching fistula or with multiple fistulas. External opening could be situated very close to the anal verge and suggest intersphincteric fistula or could be away from the anal verge and suggest transsphincteric or extrasphincteric fistula. It could be absent in many cases and suggest sinus tract or fistula in progress (9 cases-2%)

According to the extra sphincteric course: It Could be kinked, curved, obstructed, branching (18 cases-4%), non-branching, and may show abscess formation (9 cases-2%).

The extra sphincteric course of fistula tract may be abnormally long to communicate with pilonidal sinus tract (2 cases), to reach the root of scrotal sac and in one case seen extended to the inner aspect of the thigh.

According to the postoperative risks

Risky for postoperative recurrence: - (89 cases-20%)

The followings are at increased risks for recurrence. An abnormal extra sphincteric course, like multiple branches, abnormal kinks and blocking of tracks.

Tracks with no internal opening.

Certain types of fistulas as horse-shoe fistula, high transsphincteric, extra sphincteric and supra sphincteric fistulas.

Some general conditions as diabetes or Crohn's disease^[7-10].

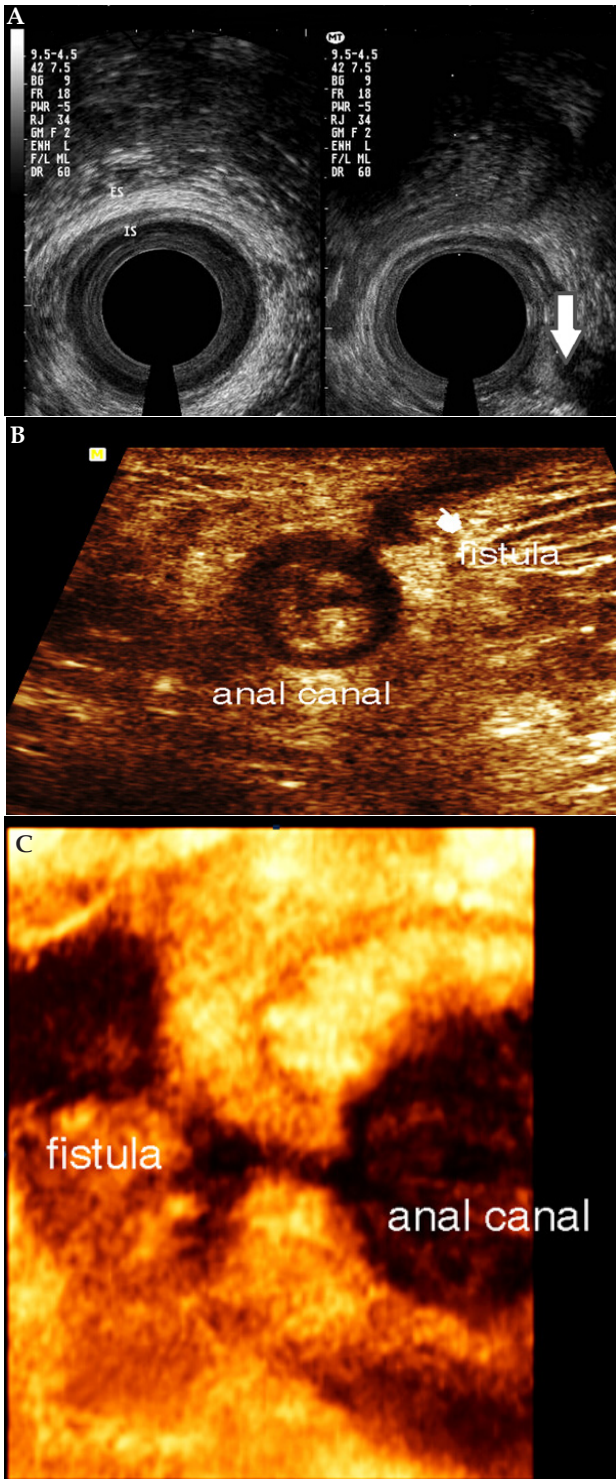


Figure 5 A: Endonal ultrasound showing postero-lateral wall transsphincteric fistula (arrow); B: Transvaginal ultrasound showing anterior transsphincteric fistula (F); C: Transperineal ultrasound with 3D surface rendering showing transsphincteric perianal fistula.

Risky for postoperative incontinence:- (84 cases-18.5%)

The followings are at increased risks:

Patients > 45 years old due to abnormal sphincteric weakness caused by either increased thickness of internal sphincter or decreased thickness of the external sphincter

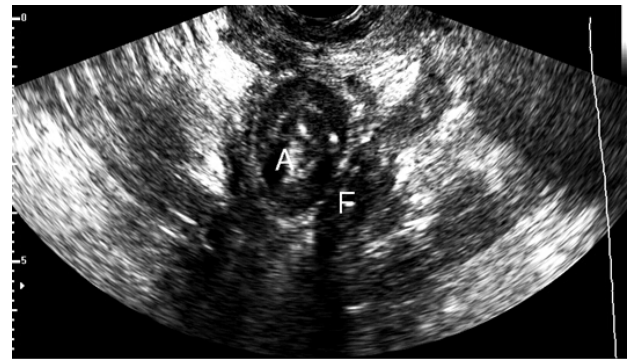


Figure 6 Endovaginal ultrasound showing extrasphincteric Fistula(F). Anal canal (A).

Females are more susceptible to incontinence more than males due to a substantial reduction in squeeze pressure and smaller external sphincter mass.

Females during the childbearing period due to occult sphincteric injuries and pudendal neuropathy occurring during delivery.

Certain types of fistulas as high transsphincteric, horseshoe, extra sphincteric and supra sphincteric fistulas due to unavoidable operative danger to the anal sphincters and puborectalis muscle.

Preoperative base line incontinence

Certain etiological factors as Crohn's disease and TB^[10-14].

The sensitivity of combined transperineal, endoanal and transvaginal ultrasound in evaluating the perianal fistula

Table 2 demonstrates the sensitivity of ultrasound in evaluating the sphincteric and extrasphincteric course of perianal fistula compared with the surgical results with an estimated sensitivity 97% in assessing the extrasphincteric course, 93% in detecting the internal opening and showed an estimated sensitivity ranging from 78% to 100% in evaluating the sphincteric course being most sensitive in assessing the superficial fistula and the low type of transsphincteric fistula(100% sensitivity) and of lower sensitivity 78% in assessing the extrasphincteric type of perianal fistula.

120 patients could be followed for 2 years after operative management, among them 100 patients were managed with fistulotomy and 20 patients were risky for postoperative fecal incontinence and were managed with sphincter saving procedures, 3 patients suffered from minor incontinence (2.5%) and 6 patients suffered from a recurrence of fistula tracts (5%).

Table 2 Sensitivity of ultrasound in diagnosing the perianal fistula.			
Final diagnosis confirmed with surgery	Total number of cases	Number of cases Correctly demonstrated by Ultrasound	Sensitivity of ultrasound
Sphincteric course			
Superficial fistula	9	9	100%
Submucosa fistulal	9	8	87%
High trans-sphincteric	36	33	92%
Low trans-sphincteric	279	279	100%
Extrasphincteric	9	7	78%
Intersphincteric	108	104	96%
Extrasphincteric course (branching, non branching, obstructed.....)	450	436	97%
Detection of internal opening	427	396	93 %

DISCUSSION

In spite that it is preferred for any classification to be brusque with a few items and easy to recall, it should be also covering all items that may influence the outcome of management, it should respect the complexity of the disease and the troubles which may face the surgeon during handling the disease.

Not only the sphincteric course of perianal fistula influences the surgical management, but also other components like the etiology, the state of internal and external openings, the extra-sphincteric course and the postoperative risks, all should be considered when intending to classify the perianal fistula. Cryptoglandular fistula tends to be more benign than Crohn's perianal fistula, branching fistula is more hard to treat than the non-branching fistula, the absence of internal opening or its multiplicity increase the incidence of postoperative failure, the absence of external opening and the number of openings may alter the method of surgical intervention, also the expected postoperative outcome can change the style of intervention from fistulotomy to sphincter saving procedures. So the preoperative assessment of perianal fistula should consider all the fore mentioned factors.

The present classification depends on image findings confirmed with surgical results, which throws an estimate about the level of benefits of the combined endorectal and transperineal ultrasound approaches for projecting the whole course of perianal fistula from the external to the internal opening.

The endoanal ultrasound approach was entirely helpful for evaluating the sphincteric course of fistula, but gives no mind about the extrasphincteric course which made magnetic resonance imaging more acceptable technique for evaluating perianal fistula since it presents an estimate about the extrasphincteric course. Notwithstanding the current study showed that ultrasound, which is inexpensive, widely available imaging modality that carries no danger of vulnerability to radiation or risks of contrast media using the combined endoanal, the transvaginal approach in females with transperineal ultrasound gives a full evaluation of the extra and the sphincteric course of the fistula track.

Optimizing the combined ultrasound approaches, we can inject saline with little air or dilute hydrogen peroxide into the fistula track which helps to discover the site of internal opening by detecting gas bubble emerging from its site and to detect multiplicity of internal opening^[15].

Adding to the advantages of the technique is the real time imaging of saline mixed with air bubbles or hydrogen peroxide flowing inside the track, which helps to detect obstructed tracks that may contribute to false passage during probing.

Assessing the whole course of fistula with the combined ultrasound approaches can contribute to minimize the postoperative recurrence by detecting tracks with multiple side branches, kinked, obstructed tracks, tracks with no visible internal or external opening, tracks with multiple internal openings, tracks with the abnormal sphincteric course, as supra sphincteric fistula, extra sphincteric fistula and the horseshoe fistula.

The endoanal ultrasound technique can be utilized equally well to minimize the postoperative fecal incontinence (FI) by evaluating the anal sphincters as regard to the sphincter thickness and the presence of occult sphincteric defects which is essential and mandatory part of the exam as operating on weak or damaged sphincters can lead to increased incidence of fecal incontinence.

Certain types of perianal fistula like high transsphincteric, extra-

phincteric, suprasphincteric and the horse-shoe fistulas leads to increased incidence of postoperative FI and can be assessed accurately by ultrasound.

80% of the patients in the current study were given a history of abscess drainage prior to the development of fistula tract and in all cases present with anal abscesses there were either very narrow or wide communication between the abscess and anal canal wall. So based on an image findings supported by the pathological findings previously described by Parks^[16]. Incision and external drainage of perianal or ischioanal fossa abscess is nothing but a mean to transform the anal abscess into a fistula as we open the communication with the exterior leaving the septic focus within the intersphincteric plane in place. Ultrasonography can be applied to direct the surgeon to the site of septic focus within the intersphincteric plane close to the expected site of internal opening.

The reported sensitivity of endoanal ultrasound was comparable to that of MRI in assessing the perianal fistula (87%) for each with the MRI being of more specificity^[17]. The combined ultrasound approaches in the current study showed an estimated sensitivity 93% in detecting the internal opening, 97% in assessing the extrasphincteric course and 100% sensitivity for assessing the low type of transsphincteric fistula and superficial fistula but being less sensitive in assessing the extrasphincteric type of perianal fistula.

Preoperative evaluation of perianal fistula using the current imaging classification helped in minimizing the incidence of postoperative fecal incontinence among 120 patients could be followed up for 2 years to 2.5% (3 cases) suffered from only minor incontinence after identifications of those patients who were risky to postoperative FI and were managed with sphincter saving procedures. The reported incidence of postoperative FI was 12% after fistulotomy^[7].

Since fistulotomy is considered as the best surgical method, in the treatment of perianal fistula carried in a larger proportion of patients suffering from intersphincteric and mid/low transsphincteric fistulas, with a much less incidence of recurrence than the other methods of treatment but carry more risks of postoperative FI. The proper exclusion of patients who are risky for postoperative FI after preoperative evaluation using the combined ultrasound technique and include patients with baseline FI, patients with sphincter defects subsequent of old sphincter tear, patients with abnormal sphincter thickness, anterior transsphincteric fistula in females, transsphincteric fistula penetrated widely through the external anal sphincter and transsphincteric fistula of upper 1/3 of anal canal, resulted in more safe fistulotomy.

Also, it served to minimize the incidence of recurrence to 5% of cases with the reported incidence of recurrence of 8%^[7]. In another study, recurrence observed in 7% of cases treated with fistulotomy and 21% for high transsphincteric fistulas treated with rectal advancement flap^[18]. Taking into consideration that the 5 cases suffered recurrence in our current study were surgically challenged cases as 2 cases were high intersphincteric horse shoe fistulas, 1 case suprasphincteric, 1 case extrasphincteric and 1 case was branched perianal fistula associated with Crohn's disease.

CONCLUSION

The combined ultrasound technique using the endoanal or transvaginal and transperineal ultrasound approaches can be applied to fully evaluate the whole course of perianal fistula and it can contribute to minimize the incidence of postoperative recurrence and postoperative fecal incontinence.

CONFLICT OF INTERESTS

Conflict of interest: The author declares that he has no conflict of interest.

Informed consent: All patients provided written informed consent to enrolment in the study and to the inclusion in this article of information that could potentially lead to their identification.

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