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PICTORIAL ESSAY

Transperineal ultrasound for assessment of fistulas and abscesses: a pictorial essay

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Abstract
Perianal fistulas and abscesses may be cryptogenetic or associated with inflammatory bowel disease (IBD), specifically Crohn's disease. Proper identification and classification of these lesions are paramount for correct therapeutic management. Current diagnostic modalities include MRI (magnetic resonance imaging), EUS (endoscopic ultrasound), EUA (exam under anaesthesia) and recently, transperineal ultrasound (TPUS). The latter has been proposed as a noninvasive, easily available and cost-effective technique to diagnose, assess and follow up perianal disease particularly in IBD patients. This pictorial review focuses on the role of TPUS in clinical practice, highlighting the features of fistulas and abscesses.

Keywords Perianal ultrasound · Fistula · Abscess · Pictorial review · Clinical practice

Introduction

Transperineal ultrasound (TPUS) is a dynamic diagnostic technique for real-time assessment of the perianal and anorectal regions for detecting and evaluating fistulas and abscesses. It is a noninvasive, quick-to-use and cheap procedure that has specific advantages in monitoring perianal lesions when endoanal ultrasound (EUS) and magnetic resonance imaging (MRI) are contraindicated, unavailable, or unsuitable (e.g., fistulas or abscesses in patients with anal strictures or inaccessible to transrectal ultrasound because the fistulas open far from the anus in the gluteus or in the scrotum). Nowadays, MRI and EUS are considered the reference standard procedures for perianal imaging. MRI is well validated and, thanks to its panoramic view, is indispensable in complex perianal disease, especially in IBD patients. However, it is expensive, not so widely available and thus less suitable or convenient for tight monitoring of the lesions. EUS provides highly precise diagnostic imaging of the anus, but it is less accurate—if not unsuitable—for completely assessing fistulas or abscesses extending far from the anus or associated with anal stenosis or painful perianal lesions [1].

TPUS is a modality capable of overcoming some of the above limitations and has the potential to add colour Doppler and I.V. contrast-enhanced ultrasound (CEUS) to increase its accuracy in detecting vascularity of perianal lesions and distinguishing active inflammation, phlegmons and abscesses and thus can be used as complementary investigation to EUS and MRI to assess and follow up perianal disease.

In this pictorial review, we highlighted the most common TPUS features of perianal fistulas and abscesses detected in patients with suspected and known perianal disease and in the follow up of these lesions.

Background and technique

TPUS was initially developed in 1983 as an alternative to anal and vaginal endosonography and MRI, specifically in paediatric and pregnant populations [2–4]. It has numerous advantages, including high-resolution images, multiplanar and real-time performance, noninvasive approach and cost effectiveness. However, it has also limitations in detecting and imaging deep lesions, because of the scarce and proper penetration of ultrasonic beam (usually < 5–6 cm) and the potential interference from air entrapped by anal skin folds.

Transperineal sonography may be performed using a high-resolution probe (4–8 MHz) properly set to combine

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the maximum penetration and definition. The use of a microconvex probe is preferable because it is easy to move and rotate in the perianal region. However, conventional linear or convex transducers appropriately set may also be used [1].

Preparation is not required for the examination. The probe may be covered with a glove for hygienic reasons, filled with gel and in turn covered with contact gel. With the patient in the dorsal lithotomy or left lateral position, the probe is placed directly above the anus (usually in sagittal plan), or if a fistula is present on its external orifice, to then follow its course up to the internal opening. Standard images are obtained from axial and longitudinal viewpoints on the perineal body or above the anus by angling the probe posteriorly, anteriorly or laterally to entirely assess the anal canal and the perianal fistulous tracts and potential collections. High-resolution images may be also obtained from the transvaginal/transvulvar approach (Fig. 1).

The TPUS allows the identification of key perianal anatomical landmarks, including the anal canal, anal sphincters, symphysis pubis, urinary bladder, prostate or vagina. The internal anal sphincter is characterised by an approximately 3-mm-thick hypoechoic symmetric band. This is surrounded by the external anal sphincter, which is a circular structure of mixed echogenicity, short anteriorly in women and slightly

Fig. 1 Preparation of the microconvex probe (**a**) and its placement above the anus in sagittal (**b**) and transversal (**c**) scans in a patient in left lateral position

thicker, extending approximately 1 cm beyond the internal anal sphincter (Fig. 2). The deep external anal sphincter is fused with or intimately related to the puborectalis muscle. Anteriorly, it is closely related to the superficial transverse muscle of the perineum and perineal body.

Perianal fistulae and abscesses

Transperineal ultrasound is highly accurate in detecting and monitoring perianal fistulas and abscesses. Perianal fistulas are usually described as abnormal communications formed between the anus and perianal skin, characterised by persistent purulent drainage or intermittent perianal swelling and tenderness. However, from the macroscopic and microscopic points of view, the fistula is also characterised by a wall made by fibroconnective tissue with inflammatory granulation tissue with reactive endothelial cells and lined by heterogeneous cells whose features vary on aetiology, duration of disease and presence of infection.

According to their nature, perianal fistulas are distinguished in cryptoglandular fistulae, the most common type (up to 90%), usually a complication of an intersphincteric abscess originating from a cryptoglandular infection unable to drain into the canal anal and fistulas associated with IBD, mainly Crohn's disease (CD). The former is usually treated with surgery, while the latter with antibiotics, immunosuppressive agents or anti-tumour necrosis factor alpha, but after having ruled out the presence of abscesses [5, 6]. These fistulas differ significantly from the pathological point of view [7].

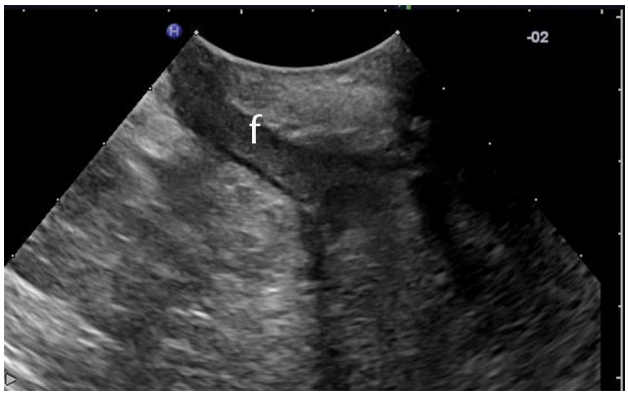

Fig. 3 Perianal fistula (f) commonly detected as hypoechoic tract. It may also contain air bubbles or a small amount of fluid and is visible between the anus or rectum and the perianal skin or vagina. *f* fistula

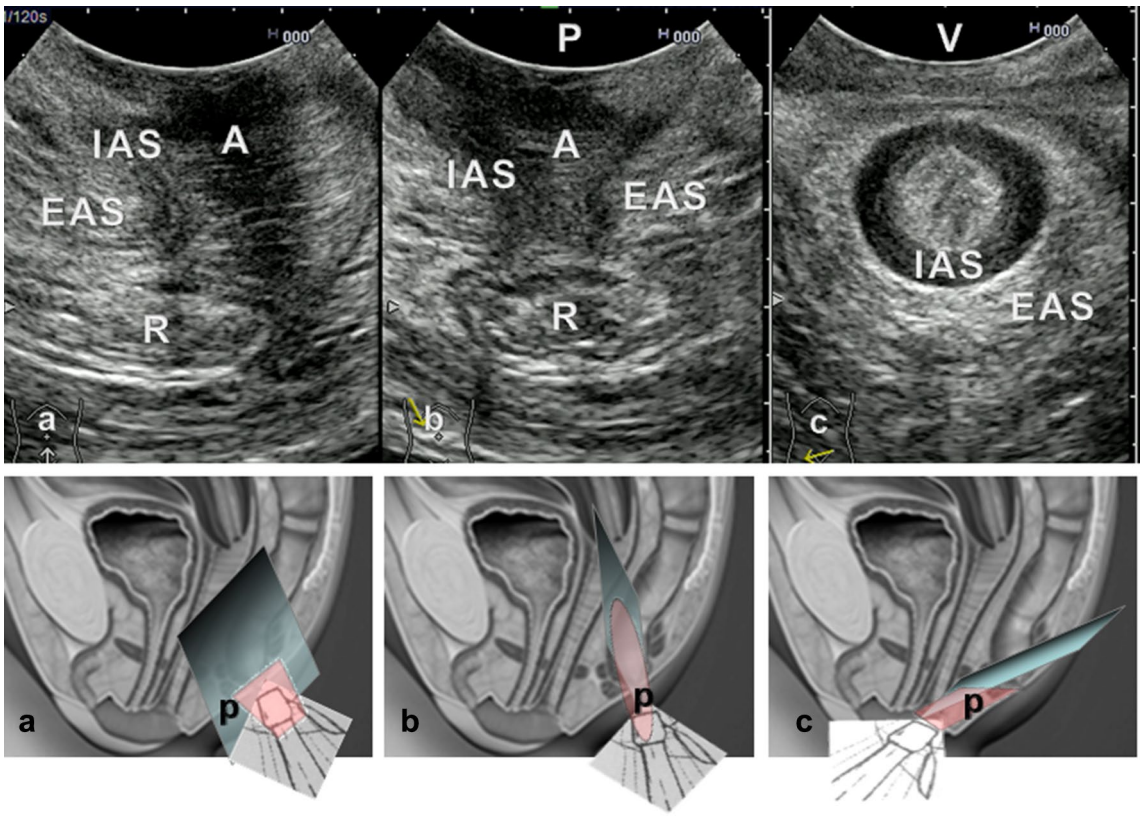

Fig. 2 Sagittal (**a**), coronal (**b**) and transversal or axial (**c**) approaches of the anus with its sonographic views. Perianal anatomical landmarks: *A* anus, *IAS* internal anal sphincter, *EAS* external anal sphincter, *R* rectum, *V* vagina, *p* probe

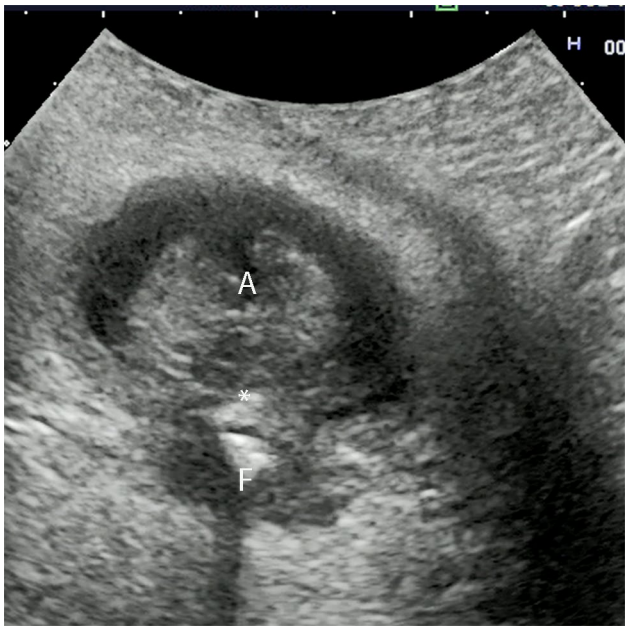

Fig. 4 Internal opening (asterisk) of an intersphincteric fistula (F) clearly visible at 6 O'clock position hypoechoic focus with gaseous content in the intersphincteric space that abuts the internal sphincter

An accurate diagnosis of these lesions is mandatory for proper management, since incorrect or inappropriate treatment may lead to irreversible functional consequences and recurrence of the fistula.

A systematic review with meta-analysis showed that TPUS has high sensitivity in detecting perianal fistulas (98.3%) and their internal openings (90.6%) and in classifying the fistulas (92.8%) and that it is also accurate in detecting perianal abscesses (sensitivity of 86.1% and PPV

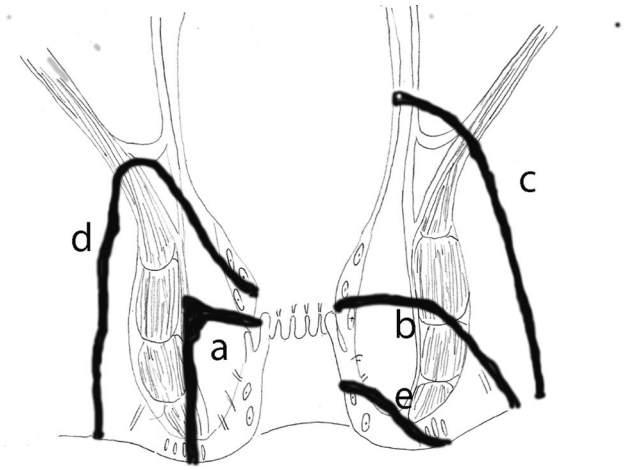

Fig. 5 Parks criteria (1975) to describe the anatomical course of the fistulas in relation to the sphincters: (a) intersphincteric, (b) transsphincteric, (c) extrasphincteric and (d) suprasphincteric (e) superficial

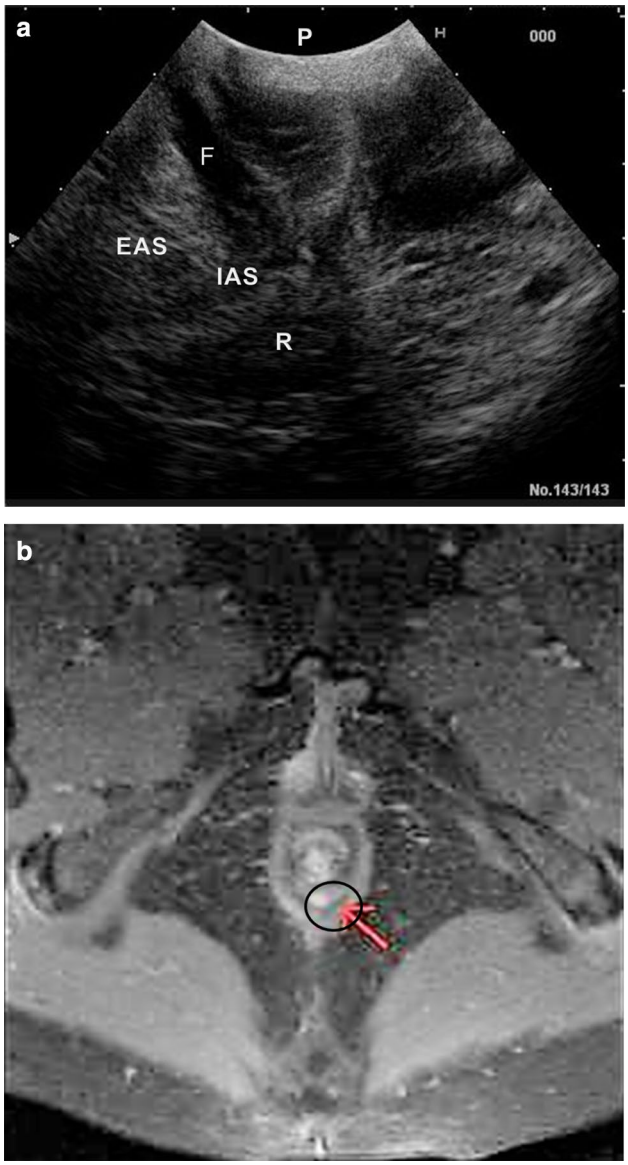

Fig. 6 **a** Sagittal or longitudinal view of an intersphincteric fistula detected as hypoechoic tracts within the internal sphincter or not exceeding 30% of the width of the external sphincter. **b** The same intersphincteric fistula at MRI; *arrow* fistula, *F* fistula, *IAS* internal anal sphincter, *EAS* external anal sphincter, *R* rectum

of 88.4%) [8]. Data taken from the EUS experience suggest that TPUS may be also useful in discriminating cryptogenic fistula from IBD-related fistulas, the latter being more frequently characterised by presence of fistulous debris and fistula bifurcation [9].

On account of its pathological findings, TPUS shows perianal fistulas as hypoechoic tracts, sometimes with air within, between the anus or rectum and the perianal skin or vagina in almost all patients [1] (Fig. 3). Most fistulas have irregular tracks, with blind end, ramifications or extensions.

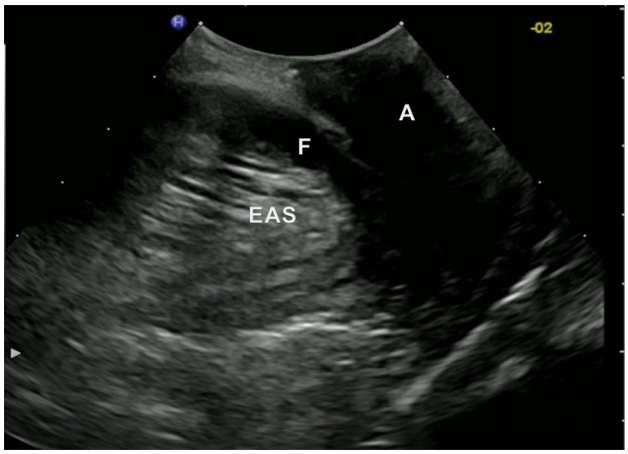

Fig. 7 Transsphincteric fistula as hypoechoic tracts that cross the external sphincter; *F* fistula, *EAS* external anal sphincter

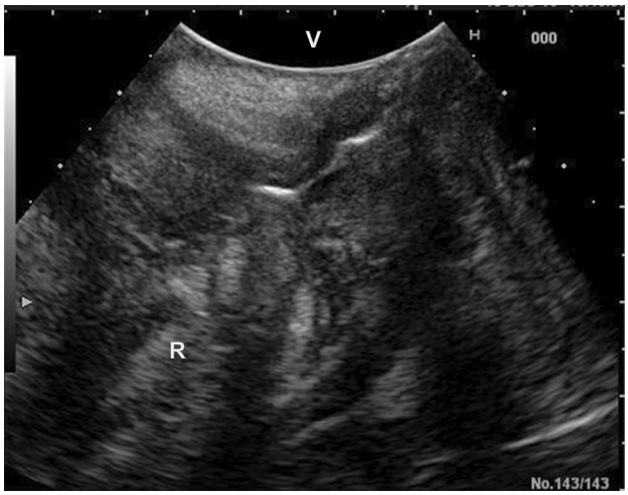

Fig. 9 Rectovaginal fistula; *V* vagina, *R* rectum, *F* fistula

The internal opening of the fistula appears as a hypoechoic focus in the intersphincteric space that abuts the internal sphincter, more clearly visible when filled with air bubbles (Fig. 4). Starting from the internal opening, the hypoechoic track of the fistula can be followed along its anatomical course, in relation to the sphincter's complex, allowing its correct classification according to the Parks criteria [5] in inter-, trans-, supra- and extrasphincteric fistula (Fig. 5) with sensitivity greater than 85% [8].

Parks classification describes the anatomical course of the fistulas in relation to the sphincters and is particularly useful from the surgical point of view. Intersphincteric fistulas are visualized as hypoechoic tract within or closer to the internal sphincter, usually not exceeding 30% of the width of the external sphincter (Fig. 6), and the transsphincteric fistulas appear as hypoechoic tracts that cross the external sphincter (Fig. 7). Supra- and extrasphincteric fistulas usually do not cross the internal anal sphincter and originates at the level of anorectal junction or just above (Fig. 8). Along with these kinds of fistulas, superficial fistulas and rectovaginal or anovulvar fistulas are also considered (Fig. 9).

Another classification differentiates simple fistulas, which include low trans- and intersphincteric fistulas crossing < 30% of the external sphincter, from complex fistulas, which include high transsphincteric fistula with or without a high blind tract, suprasphincteric and extrasphincteric fistula, horseshoe or rectovaginal fistula and fistula associated with abscesses or anal stricture. However, the accuracy of

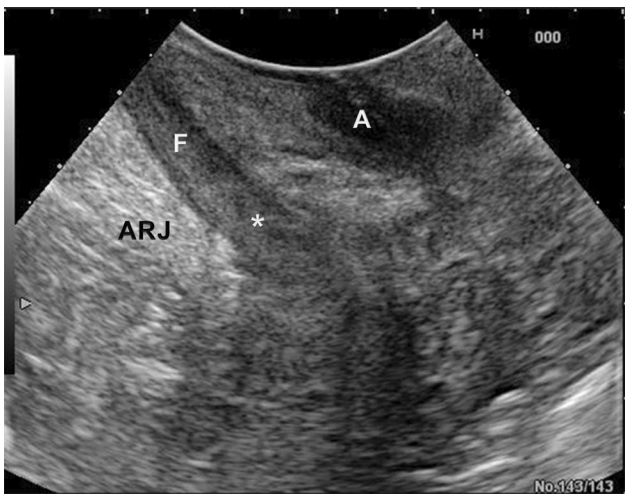

Fig. 8 Extrasphincteric fistula originating just above the anorectal junction; *F* fistula, *ARJ* posterior side of the anus close to the anorectal junction, *asterisk* proximal tract of the fistula, *A* part of the anus

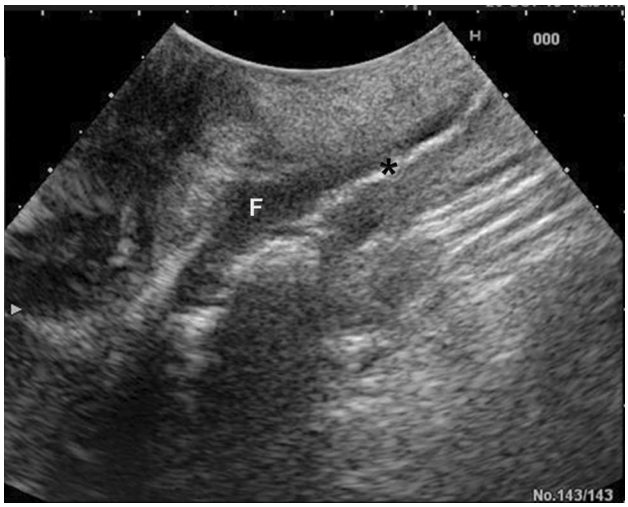

Fig. 10 Transsphincteric fistula better detected following the injection of a contrast agent (e.g., diluted hydrogen peroxide) into the external orifice; *F* fistula, *asterisk* contrast agent

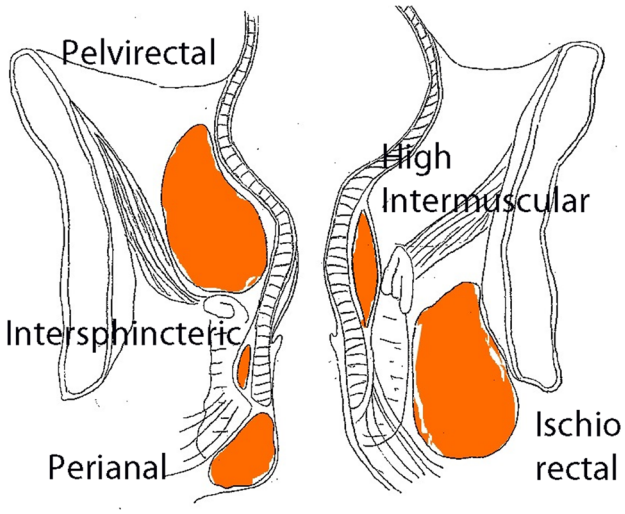

Fig. 11 Classification and site of perianal abscesses

TPUS in describing complex fistulas involving the external anal sphincter, levator and/or obturator muscles is still limited, and in the suspicion of this condition, the exam should be followed by other examinations, such as MRI or EUS, which have a more panoramic view and are more accurate in defining internal opening and extensions.

To enhance and better define the fistula course and its classification, its internal opening and ramifications, the visualization can be improved by the injection of contrast agents (e.g., diluted hydrogen peroxide) into the external orifice (Fig. 10).

TPUS can also detect perianal abscesses. These are variable in size and shape and, according to their site, are usually described as pelvirectal, intersphincteric and ischiorectal and as superficial perianal abscess (Fig. 11). The TPUS detection of deep pelvirectal abscess and of those located above the levator ani may be difficult (Fig. 12).

TPUS may be also useful in monitoring perianal disease, especially the patients under treatment with anti-TNF alpha, both to assess the response and to promptly detect the occurrence of abscesses that usually complicate the treatment in up to 10% of cases [6, 10]. Usually, the low echogenicity of a perianal fistula is suggestive of an active fistula, whilst the attenuation of echogenicity is associated with favourable outcome and persistent closure of the fistula [6, 11].

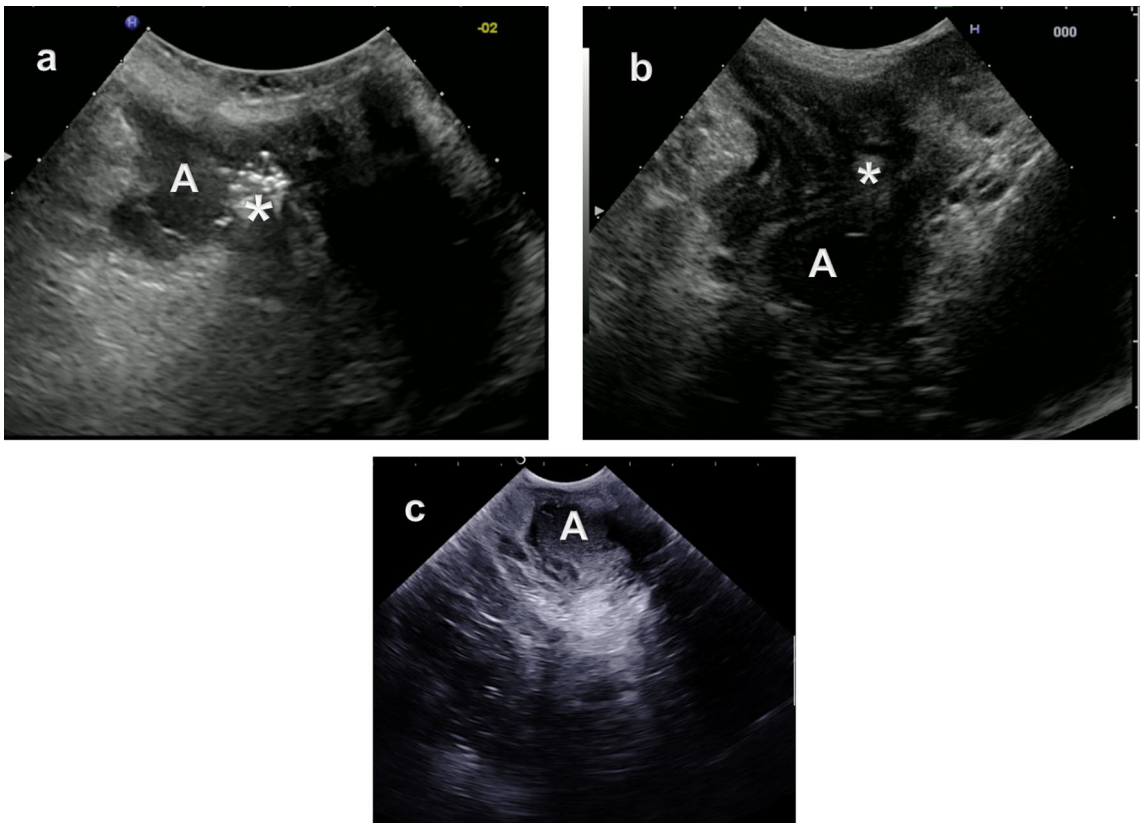

Fig. 12 Perianal abscess detected as hypo-anechoic lesions containing echoic fluid and sometimes gas bubbles. **a** Pararectal abscess: *A* abscess, *asterisk* bubble gas; **b** intersphincteric abscess: *A* abscess, *asterisk* air; **c** ischiorectal abscess: *A* abscess

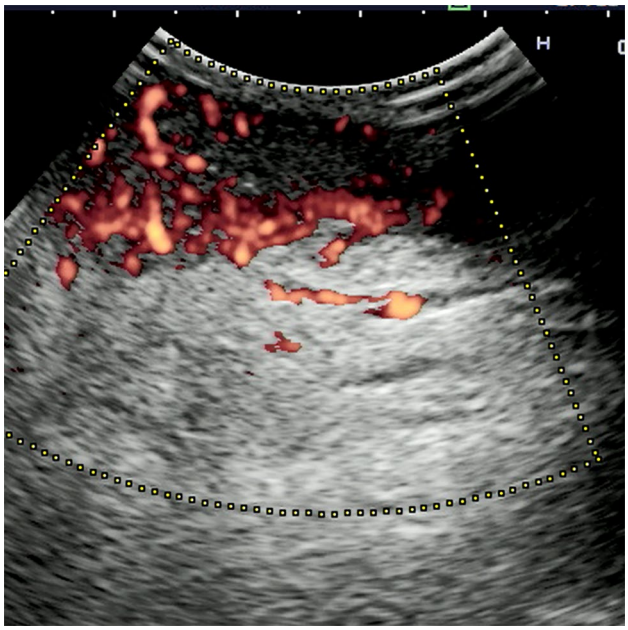

Fig. 13 Colour Doppler depicting the vascularity of the fistula, suggesting the presence of granulating tissue and likely its activity

The TPUS assessment of perianal lesions can be appropriately improved using colour Doppler, contrast-enhanced ultrasound, 3D sonography and sonoelastography. Colour Doppler and CEUS allow to depict the vascularity of the fistula and may provide some information regarding its inflammatory activity (Fig. 13). CEUS is also very useful in detecting abscesses and small liquid collections within perianal inflammatory masses and fistulas (Fig. 14). Sonoelastography can discriminate sclerosing fistulas, which appear stiff (harder) in comparison with those with acute inflammations, which usually are compressible (softer) (Fig. 15). But TPUS data are still scanty [12].

In any case, TPUS, even if coupled with colour Doppler, CEUS or sonoelastography, does not provide important information to discriminate tumours within the fistula track.

Therefore, from a practical point of view, TPUS should be used as a preliminary tool in patients with suspected perianal fistulas and abscesses [13, 14] to discriminate between perianal folliculitis and fistulas (Fig. 16) and to evaluate the behaviour of perianal fistulas during biological therapy in CD. The regular assessment of perianal fistula by TPUS during treatment may identify unsuspected fluid collections and can show the persistence of the fistulous track despite its clinical healing and closure of the external opening after short-term biological therapy. Both these findings may change the management of these lesions, stopping or driving the duration of biological therapy. Finally, TPUS may be also used to plan interventional or surgical therapy and can be used as a practice guidance method during interventions and abscess drainage.

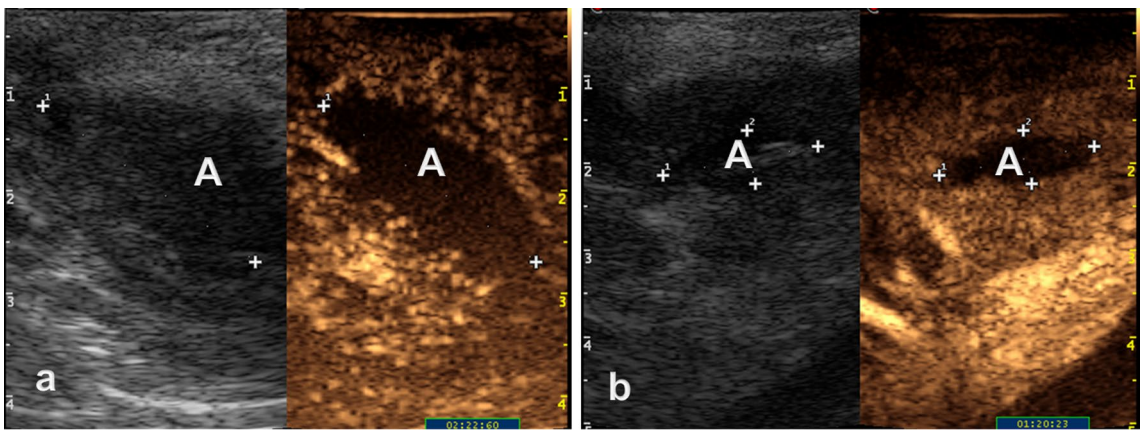

Fig. 14 CEUS detection of an abscess as small liquid collections within an inflammatory vascularised mass; *A* abscess

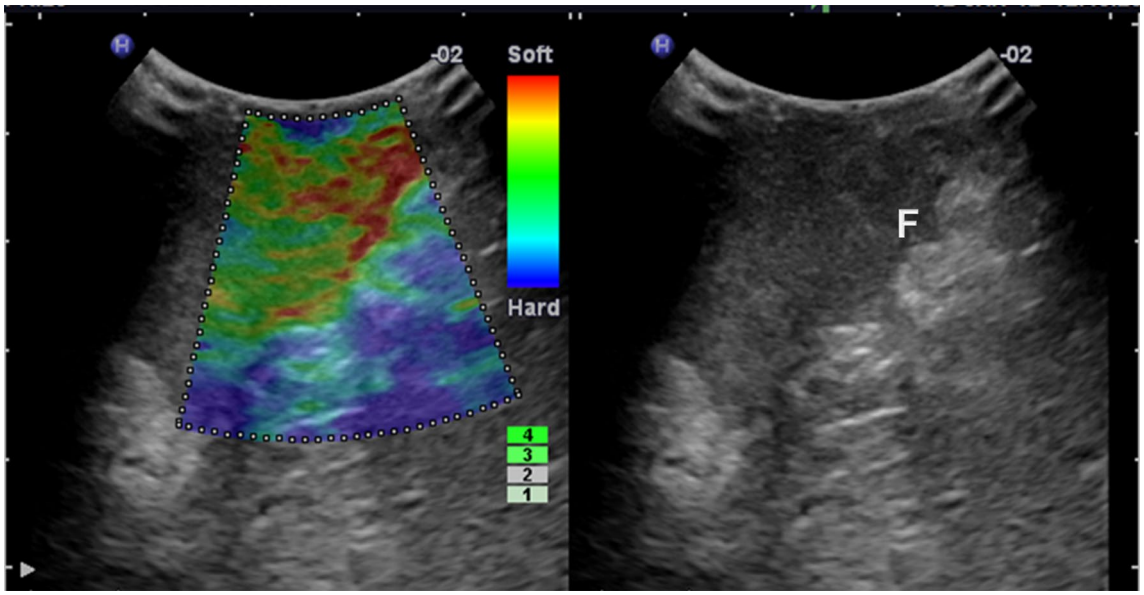

Fig. 15 Sonoelastography discriminating inflammation, (usually softer: green–red) from sclerosing fistulas (harder: blue); *F* inflammatory mass originating from a fistula

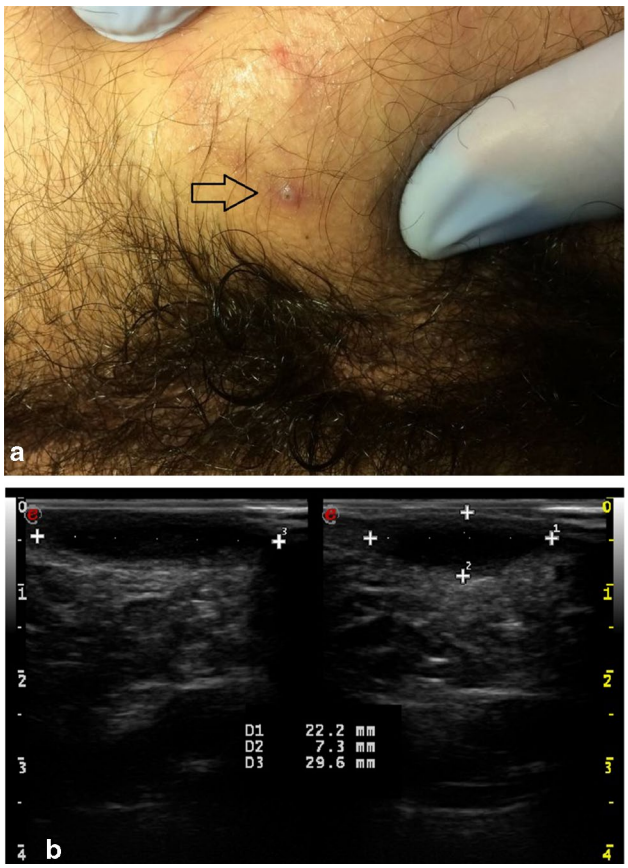

Fig. 16 **a** Perianal skin lesion of uncertain origin in a CD patient; **b** TPUS reveals small hypoechoic lesion in transverse (left) and longitudinal (right) scans that was not in conjunction with the anus and therefore quite suggestive for folliculitis

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest with this manuscript.

Ethical approval This article does not contain any studies with human participants or animals performed by any of the authors.

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