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PICTORIAL ESSAY

# Perianal fistulas in Crohn's disease: MRI diagnosis and surgical planning

## MRI in fistulazing perianal Crohn's disease

Edyta Szurowska, MD, PhD,[1] Joanna Wypych, MD, PhD,[2]
Ewa Izycka-Swieszewska, MD, PhD[3]

[1]Department of Radiology Medical, University of Gdansk, Debinki St 7, 80-211, Gdansk, Poland
[2]Department of Gastroenterology and Hepatology, Medical University of Gdansk, Debinki St 7, 80-211, Gdansk, Poland
[3]Department of Patology Medical, University of Gdansk, Debinki St 7, 80-211, Gdansk, Poland

## Abstract

Crohn's disease is a chronic, transmural inflammatory process of the gastrointestinal tract. It often affects the colon with the perianal area. The most common intestinal manifestations include external and/or internal fistulas and abscesses. Assessment of the activity of perianal fistulas in the course of Crohn's disease seems to be an important factor influencing therapeutic approach. Fistula's activity is evaluated by such methods as magnetic resonance imaging, anal ultrasound and examination under anaesthesia. Usefulness of imaging methods in the diagnosis of fistulas still remains to be defined.MRI is used to present a wide spectrum of perianal fistulazing Crohn's disease. Additionally, it is an important instrument revealing location, extent and severity of inflammation. It is also very helpful to detect clinically silent sepsis related to small, local inflammation. The most common method used in MR imaging to assess topography of a fistula's track, is Parks' classification.Clinical indications to MRI may include follow-up studies of a diagnosed disease, classification of fistulas' subtypes in the course of Crohn's disease, determination of the extent of fistulas' tracts and spread of an inflammatory process what can guide surgical procedures.

**Key words:** Crohn's disease—Perianal fistulas—MRI—Digestive system

*Correspondence to:* Edyta Szurowska, MD, PhD; *email:* eszurowska@amg.gda.pl

Inflammatory bowel diseases (IBD), traditionally divided into Crohn's disease (CD) and ulcerative colitis (UC), are chronic conditions thought to result from an abnormal immunologic response to the normal bowel flora, whose etiology, diagnosis and treatment have not been fully recognized [1]. Histopathologically, Crohn's disease is an inflammatory process, characterized by discontinuous segmental manifestation and involvement of all the intestinal layers. In the latest years it has become increasingly diagnosed and managed in the industrialized countries. Etiopathogenesis of Crohn's disease still remains to be determined, although many genetic, environmental and immunological factors, closely related to its incidence have already been identified including higher incidence rates observed in the Jewish population [1].

Symptoms of Crohn's disease depend on location, extent and severity of inflammation. Crohn's terminal ileitis and ileo-colitis are the most common types of inflammation in the course of Crohn's disease.

The most characteristic symptoms of Crohn's disease are fistulas. According to Mayo Clinic series, the cumulative risk for developing a fistula is 33% at 10 years and 50% at 20 years duration ofthe disease [2]. It has been also reported that cumulative incidence of perianal fistulas in Stockholm County, Sweden during 20 years was 23%, in Olmsted County, Minnesota was 38% [2,3]. Moreover, when a patient develops a fistula, he requires very long time to achieve healing and in most cases relapses can be expected in future.

Perianal fistulas occur in 30-50% of CD patients at some stage during their lifetime. Most are anorectal fistulas. Location of Crohn's disease determines frequency of perianal fistulas. Rectum involvement is related with

almost 100% incidence of perianal fistulas [3]. Consequences of a fistula depend on its tract. There are several types of fistulas - internal and external, complex or simplex. This complication is associated with a significant morbidity of about 20% and is often very difficult to treat [2,4]. The anatomy of a fistula is closely related to the possibility of healing, number of required drugs and type of surgical approach. The first step in planning a therapeutic approach is to define the anatomy. Features of a fistula include the way through the anal sphinctric structures, their number and complexity, and the presence of abscesses [5, 6]. The most optimal way to accurately define a fistula's track is magnetic resonance imaging (MRI) of the pelvis, endo-anal ultrasound (AUS) and examination under anaesthesia (EUA) [7,8].

The primary treatment approach for a patient with CD and perianal involvement is combined medical and surgical management. Unfortunately neither of them is satisfactory. Assessing drainage upon gentle compression of the external orifice is often used to evaluate fistula's activity and monitor therapeutic response in clinical trials [9, 10, 11]. Sometimes this drainage is uncomfortable for a patient but is continued in order to decrease the risk for recurrent abscesses. However, it is not clear whether assessment of perianal disease activity has an impact on patient management but it is strictly associated with the type of surgical intervention. Assessment of fistula's activity has been limited because of insufficient evaluation methods but on the other hand perianal disease activity may influence prognosis and therapeutic response. There is a lack of simple and reproducible methods of fistula's track demonstration. MR imaging seems to be one of the best instruments to assess topography of a fistula's track and other changes like abscesses whose higher incidence is frequent when aggressive medical therapy is instituted. It also identifies clinically silent sepsis despite of visible closure of a fistula and lack of an abscess, what is one of the major advantages over the AUS [12]. Above all, MRI is an accurate test for determining fistula's anatomy in patients with perianal Crohn's disease and is the best method of demonstrating the supra-levator, recto-rectal and entero-anal spaces, which are often missed during conventional examination like AUS [12].

Surgical management of perianal fistulas depends on the nature of the primary fistula and any secondary ramifications or associated abscesses. Potential treatment of simple intersphincteric fistulas includes antibiotics, fistulotomy, antimetabolites and biologic therapy. Fistulotomy or fistulectomy are both used by surgeons to treat simple fistulas and result in high rate of healing. In a patient with a perianal abscess, a surgeon performs a simple incision and drainage. Pharmacological treatment of acomplex perianal disease is similar but surgical therapy in this case differs and is mainly palliative. This therapy requires an experienced colorectal surgeon and can be carried out by means of different techniques like dilation of anal strictures, placement of non-cutting setons, endorectal advancement flap, and proctectomy [13]. In some cases, surgical approach to fistulas changes due to MRI results. Preoperative imaging of perianal fistulas reduces the risk of postoperative recurrence in more complicated cases, and prevents fecal incontinence probably related to some surgical procedures [14].

Another important question is how to evaluate the activity of the disease. One of the most popular is Crohn's disease activity index (CDAI) which has been used to assess patients with refractory Crohn's disease [11]. The perianal Crohn's disease activity index (PDAI) has been proposed as a supplementary and complete measure of perianal fistula-related outcome. It includes five relevant features of a fistula: discharge, pain, restriction of activity, type of recurrent perianal disease and extent of the disease [15]. Another problem is connected with definition of the healing of a fistula's primary tract. Closure of a fistula is defined as an absence of drainage after light finger compression; remission is a closure of all fistulas which were detected during two consecutive visits. Improvement is a decrease of more than 50% of open draining fistulas during two consecutive visits [16]. Although PDAI is a useful clinical index, there has been a big discordance between the score representing clinical improvement and MRI evaluating track healing [9,11].

## Anatomy

The anal canal is defined by the proximal and distal ends and by the external and internal sphincter (or the level of the levator ani muscle). The anal canal varies in length, however is usually 3.5- 4.5 cm long. On its mucosal surface there are series of vertical columns - Morgani columns which become obscure in older patients. The anal columns are connected at their distal ends creating the anal valves which increase in volume with age. Spaces between the columns are called anal sinuses. The valves create a circumferential dentate line which is the mucocutaneous junction. The anal muscles include the internal anal sphincter, longitudinal layer of the rectum (intersphinceric fascial plane) and external anal sphincter made of three layers (Figs. 1, 2). The internal sphincter is involuntary and is composed of smooth muscle continuous with the circular smooth muscle of the rectum. It is responsible for about 85% of resting anal tone. The external sphincter, contributing to only 15% of resting anal tone, is composed of striated muscle and is continuous with the puborectalis and levator ani muscles.

The anal canal is densely innervated with somatic supply from the pudendal nerve and with the autonomic nerves. The anatomical spaces divided by the fascia in the perianal area are: perianal, intersphincteric, ischiorectal, deep postanal, supralevator, presacral, rectovesical (Fig. 3). There are several ways of communication be-

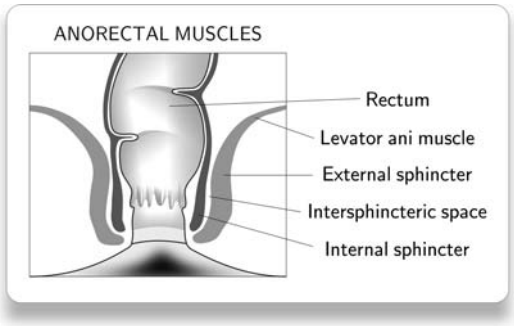


Fig. 1. The diagram anatomy of anal canal in the coronal plane.

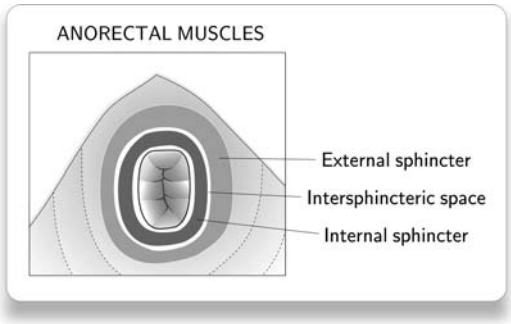


Fig. 2. The diagram anatomy of anal canal in the axial plane.

tween these spaces. Histologically the anal canal is divided in three zones: upper colorectal, middle anal transitional and lower squamous. Within the transitional zone there are anal glands or ducts opening to the anal crypts. The anal glands can penetrate also the internal sphincter.

Most often fistulas are complication of chronic intramuscular anal gland inflammation. However, perianal fistulas may be due to other conditions including Crohn's disease, tuberculosis, trauma, pelvic infection, pelvic cancer, and complications of radiation.

In Crohn's disease the anal canal is involved in 25–70% of patients with small intestine disease and 50–90% of those with colorectal disease. Anal lesions include skip lesions, linear ulcers, cobblestoning and fat wrapping fissures, fistulas, ulcers, abscesses and tags. Definitive diagnosis of Crohn's disease should be established on the basis of histopathological examination. Transmural intense inflammatory infiltrates, lymphoid aggregates, non-necrotizing granulomas and submucosal edema are encountered on microscopic examination.

The pathomechanism of development of perianal fistulas in Crohn's disease is complex. In about 70% of cases, inflammation may track down the intersphincteric plane to the skin. Inflammatory process may also permeate through both layers of the anal sphincter (trans-

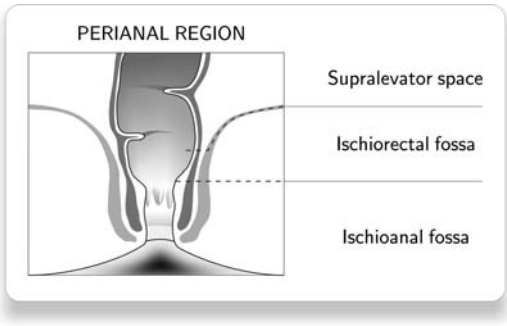


Fig. 3. The diagram anatomy of perianal region in the coronal plane.

sphincteric fistulization) to enter the ischiorectal fossa and this pattern occurs in about 20% of cases.

Trans-sphincteric fistulas are associated with ischiorectal fossa abscesses, since in rare cases, infection tracks upward over the sphincter complex to enter the ischiorectal fossa (suprasphincteric fistulization). Sepsis arising within the pelvis may track down to the skin through the ischiorectal fossa, resulting in fistulas that are referred to as extrasphincteric or translevator.

## Imaging of fistulas

Fistulas were traditionally studied by contrast fluoroscopic examination [17]. By a catheter situated in a fistulous external opening, contrast medium is injected and active fistula's track is enhanced. This method cannot precisely demonstrate a relationship between a fistula and the sphincter complex or levator ani muscle because these muscles are not directly presented. It is a useful examination in demonstrating superficial fistulas but fistulazing Crohn's disease is correctly depicted only in 16% [17]. Identification of connection between fistulas and the bowels seems possible in a delayed phase. In a similar way, double contrast barium enema can be sometimes used in this diagnosis.

CT scanning of the pelvis is a quite sensitive method to detect fistulas in patients with Crohn's disease [18], especially by demonstrating small amounts of air or contrast medium and showing an abscess as gas-containing mass localized over the lumen of the rectum and colon (Figs. 4, 5). However, internal fistula's opening visualization is not the main indication to this technique. Ultrasonography, because of its harmless character, low cost and easy approach is a helpful method in determination of perianal fistulas. Ultrasonography of the puboanal fossa can only provide information about main and secondary tracks and coexisting inflammation, but it is not sufficient to depict an internal opening and relationship between a fistula and sphincter muscles. On the other hand, anal and transrectal endosonografic studies show well resolution of anal and rectal anatomy but it is limited by severe anal pain in the majority of patients

Fig. 4. Native CT scan presents gas *(arrow)* within the right-sided extrasphincteric fistula localized near the internal obturator muscle.

Fig. 5. Non-contrast CT scan shows a gas-containing mass localized behind the lumen of the rectum and anteriorly to the sacrum. It is characteristic of clinically occult abscess in the presacral space *(arrow).*

with fistulazing Crohn's disease and by low ability to detect lesions in the suprasphincteric region and ischiorectal fossa [19]. In every day practice, endosonography is of similar importance as an examination under anaesthesia [19].

Clinical examination may be difficult to perform because of pain and this is the reason for making it under anaesthesia. It can be supplemented by injection of hydrogen peroxide to detect an internal opening and level as well as complexity of a fistula [20].

The most optimal way to define accurately pelvic anatomy is magnetic resonance imaging. MRI could be used as a reference standard for assessment of perianal fistulas in patients with Crohn's disease [21, 22].

## Methodology of magnetic resonance imaging

A 1.5 T system is recommended but also a 1.0 T machine can be used. The main disadvantage of the 1.0 T magnets is longer time of examination.

Endorectal coil can produce a very high signal from tissues around, but its principal limitation is not sufficient field of view (FOV). Tracts of fistulas and abscesses may be present or extend outside the FOV of this coil. The body coil, integrated in the MR gantry and located at some distance from the tissue being scanned, give a large FOV but not so good quality of imaging when performed using phased array coil which means low homogenous signal. For the above mentioned reasons external phased-array coils dedicated to examination of the pelvis are preferable to use in patients with Crohn's disease.

To assess anatomical structures of the anus and perianal area, high resolution MR is a method of choice enabling assessment of the anal canal wall and imaging of even tiny and thin tracks of fistulas. These fistulas are often branched, have numerous additional canals with uneven, lacerated edges which are difficult to be caught in one plane during the examination and which can be mistaken for the vessels.

MR-fistulography giving opportunity of spatial assessment of changes because of the data collection technique (hydrography) depicts wide fistulas' canals better while secondary sometimes very thin ramifications may stay undetected. So in order to evaluate them it is crucial to perform examination in three planes.The first sequence enabling to plan the remaining sequences of the examination is a fast spin echo sequence in T2-weighted images performed in the sagittal plane (Fig. 6). It is used not only to plan the examination but also to visualize a fistula because already in this first sequence, the major part of its canal can be seen (Fig. 7). The coronal plane is performed parallel to the long axis of the anal canal and the levator ani muscle, supralevator, ischiorectal and ischioanal spaces are easily assessed in the obtained scans. On T2-weigted images, both sphincters - internal and external can be differentiated. The internal sphincter is a homogenous structure of higher signal intensity than the internal sphincter.

Also fat-saturated T2-weighted sequence (especially STIR imaging) can be used to visualize active fistulas which, having damped fatty tissue as a background, should be better evaluated. However, smaller fistulas may not be seen. Some authors [14, 17, 23, 24] propose to widen the examination in the coronal plane by a Tl-weigted imaging without and after contrast medium injection (Fig. 8).

The axial plane in T2-weighted images is made perpendicularly to the anal canal and is of particular value in assessing relationship between a fistula together with


**Fig. 6.** T2- weighted MR image shows the sagittal plane through a male pelvis at the level of the anus *(arrow)* and rectum. It is the first sequence performed and used in planning axial and coronal sequences. This image also shows a little abscess in the ischiorectal fossa *(arrowhead)*.

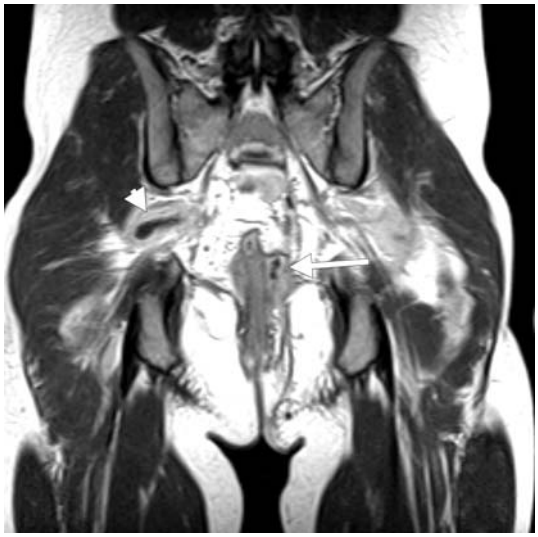

**Fig. 8.** Coronal post-contrast Tl- weighted MR image shows an irregular area of higher signal intensity in the supralevator space indicating presence of inflammatory tissue *(arrows)* and abscess *(arrowhead)*.

**Fig. 7.** Sagittal T2- weighted MR image presents a long hyperintense structure being an extrasphincteric fistula *(arrows)*.


**Fig. 9.** Axial post-contrast Tl- weighted MR image shows a rim's enhancement pattern characteristic of the abscess *(arrow)* in right ischiorectal fossa. Also note the enhancement of fistula's track in the left ischiorectal fossa *(arrowheads)*.

hypothetical abscesses and the complex of the anal sphincters. Use of contrast medium in this plane makes evaluation of the accompanying inflammatory infiltration easier (Fig. 9). Some authors [18, 23, 24] recommend performing a contrast-enhanced fat-saturated Tl-weigted sequence in order to differentiate abscesses and inflammatory changes because pus does not enhance after contrast administration, contrary to inflammatory infiltration (Fig. 10). It is also proposed to perform a twin, native sequence in order to exclude bleeding what in our opinion unnecessarily prolongs examination time (Fig. 11). Similarly as some authors, we suggest performing fat-saturated T2-weigted sequence in the axial plane as an optimal sequence for conspicuity of fluid and inflammatory changes [14, 17, 23, 24].

## Assessment of perianal fistulas

MR imaging is one of the basic examinations enabling making a right therapeutic decision and in case of qualification to a surgery - planning an extent and method of the procedure.

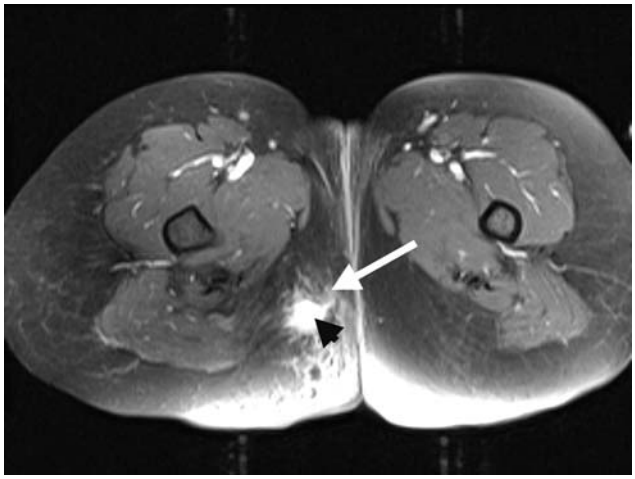

**Fig. 10.** Axial fat-saturated Tl-weighted MR image shows an oval enhanced structure *(arrow)* after iv. administration of contrast medium. It contains nonenhancing pus *(black arrowhead)* due to an abscess in the right perianal fossa. The inflammatory changes in the surrounding tissue are well visible in the right perianal fossa.

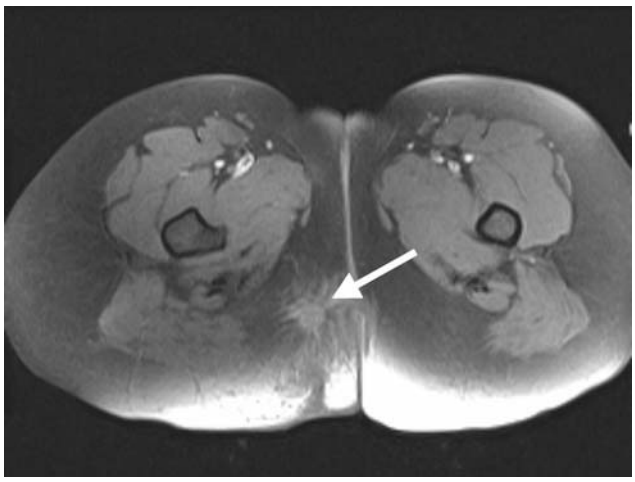

**Fig. 11.** The same patient and plan as presented on the **fig. 10**. Axial fat-saturated Tl-weighted MR image without contrast enhancement shows an oval lesion *(arrow)* surrounded by irregular area in the right perianal fossa. Because of absence of contrast administration, worse visualization and differentiation between an abscess and granulation tissue were observed.

In this subsection, we will present the way of assessing MR examination which will make communication between surgeons and gastroenterologists explicit. Performing MR examination of a patient with fistulazing perianal Crohn's disease, one must concentrate on the following problems:

1. Presence of fistulas and assessment of their activities
2. Visualization of the relationship between a fistula's track and the sphincter complex together with the levator ani muscle and grading of fistulas according to the Parks' classification [25]
3. Evaluation of an internal and external opening
4. Identification of associated abscesses and secondary tracks
5. Evaluation of long distance extensions, state of the ano-rectal wall and the perirectal space.

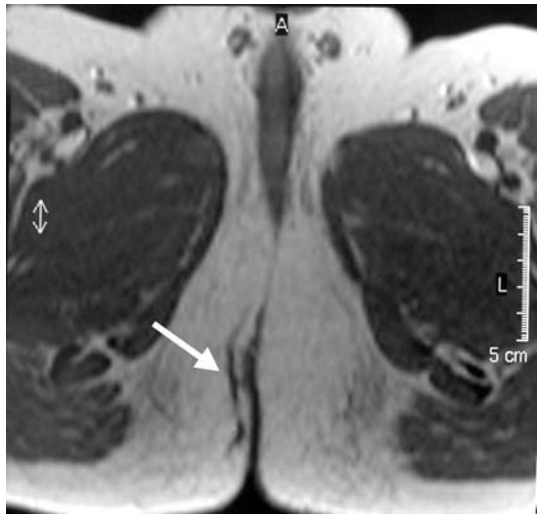


**Fig. 12.** Tl-weighted MR image shows an axial plane of a hipointense thin longitudinal lesion being a fistula's track *(arrow)*. It is well visible; contrast is present between a low signal intensity track and surrounding hiperintense fat in the right perianal fossa.

## *Presence of fistulas and assessment of their activities*

A perianal fistula is a narrow canal lined with granulation tissue having an internal orifice in the anal canal or anus and an external one on the skin surface.

On MR examination, fistulas are longitudinal, linear structures of different length [5, 21–24]. They may be single, multiple or possess ramifications. Fistulas passing through the ischiorectal or ischioanal fossa within the fatty tissue are well seen as hypointense lesions against a background of the hyperintense fatty tissue on Tl-weighted images (Figs. 12, 13). Even short secondary tracks are easily identified. But on Tl-weighted images a fistula activity can not be assessed.

Fistulas are defined as active when draining or having signs of local inflammation which is demonstrated as high signal intensity on T2-weighted images and/or gadolinium enhancement [5, 7, 21–24] (Fig. 14). Inactive tracks are visualized as linear hypointense structures on T2- weighted images.

Active fistulas are best seen on fat-saturated T2-weighted images and they appear as hyperintense linear lesions in contrast to the fatty tissue and muscles (Fig. 15). Occasionally, low signal intensity of a fistula's

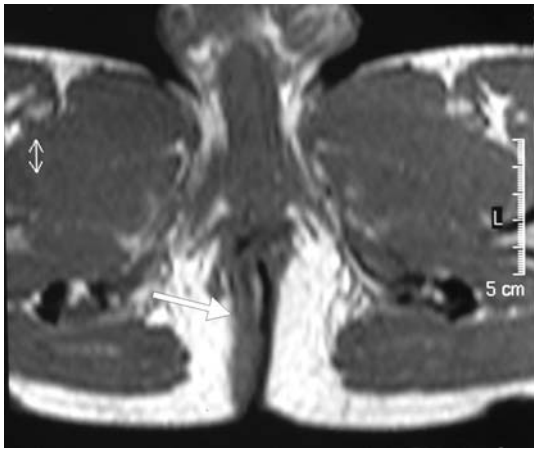


**Fig. 13.** Tl-weighted MR image is performed in axial plane and clearly visualizes longitudinal lesion recognized as a fistula *(arrow)* in the right ischioanal fossa.

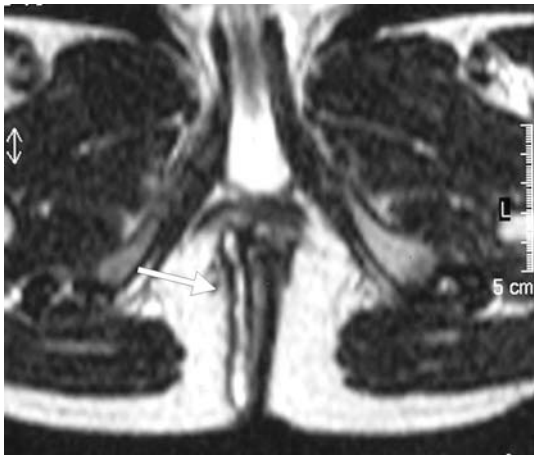


**Fig. 14.** T2-weighted MR image is performed in axial plane and shows a fistula's track *(arrow)* in the right perianal fossa. Note a high signal of the fistula due to fluid filled cavities.

track on T2- weighted images is consistent with presence of gas within the fistulazing track, which is more evident on a CT scan (Figs. 4, 16).

Location of a fistula's track and openings should be reported using a clock-face orientation referring to a patient in the classic lithotomy position [23, 24] (Fig. 17). It is also useful to name an orientation region (eg. right lateral, left posterior, etc.).

## *Parks' classification*

There are many different classifications of perianal fistulas which take into account location of internal and external openings and routes of their canals in relation to the position of the anal sphincter complex. At present, two classifications are used most often - the one proposed by Parks in 1976, created for surgical use, and St James'

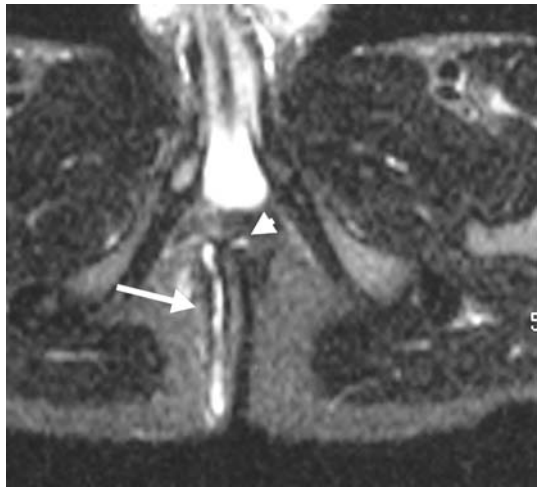

**Fig. 15.** The same patient and plan as presented on the **fig. 13 and 14**. Axial fat-saturated T2-weighted MR image shows a hyperintense linear lesion recognized as a fistula *(arrow)* in the right perianal fossa. Note an internal opening *(arrowhead)* into the anal canal at 12 o'clock.

**Fig. 16.** The same patient as presented in Figure 4. Axial T2 weighted MR image shows hipointense structure being gas *(arrow)* in a fistula's track in the left ischiorectal fossa.

University Hospital classification worked out on the basis of MR examination [23, 25]. Surgeons tend to use the first classification more often. This classification is based on the assumption that fistulas get created in the Morgani crypts and the route of a fistula's canal in relation to the sphincter muscles and levator ani muscle determines its name [25].

According to the Parks' classification [25], perianal fistulas were divided into five groups:

A. An intersphincteric fistula tracks between the internal and the external anal sphincters in the intersphincteric space (Figs. 18–20).

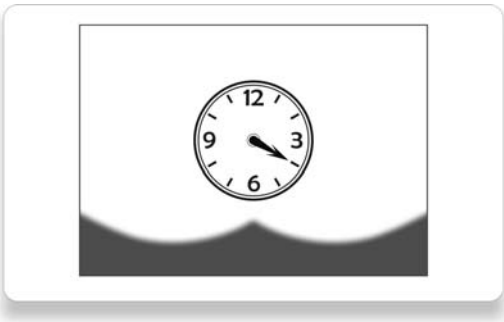


**Fig. 17.** Diagram illustrates the **anal clock**. A clock-face orientation referring to a patient in a classic lithotomy position is used to localize a fistula's track and opening. It is described as a 12 o'clock position in the anterior perineum and 6 o'clock points in natal left position.

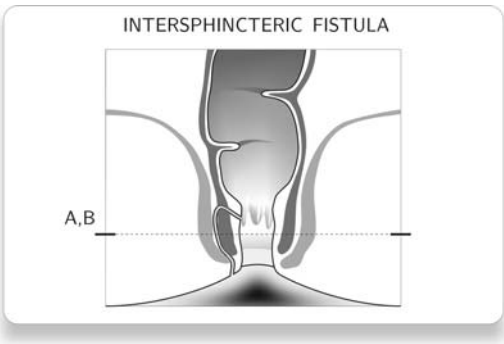


**Fig. 18.** Diagram of the coronal view shows an **intersphincteric fistula** tracked from the dentate line through the intersphincteric space down to the skin in the perianal region. Note an internal opening into the anal canal.

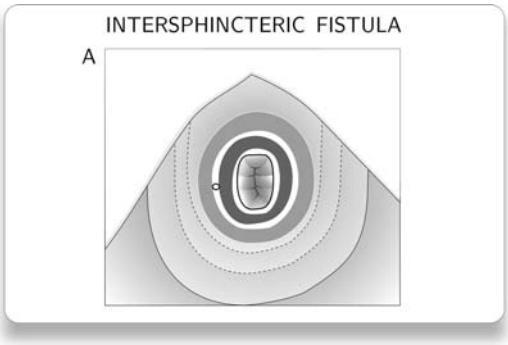


**Fig. 19.** Diagram of the transverse view shows an **intersphincteric fistula** tracking down in the intersphincteric space between the internal and the external anal sphincters.

B. A transsphincteric fistula pierces from the internal anal sphincter by the intersphincteric space through the external anal sphincter to the ischiorectal fossa (Figs. 21, 22).

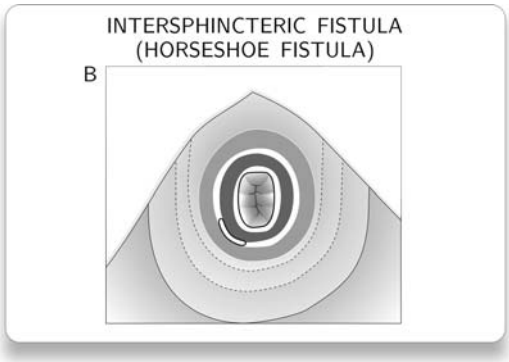


**Fig. 20.** Diagram of the transverse view shows an **intersphincteric fistula** between the internal and the external anal sphincters in the shape of a horseshoe and named a **horseshoe fistula**.

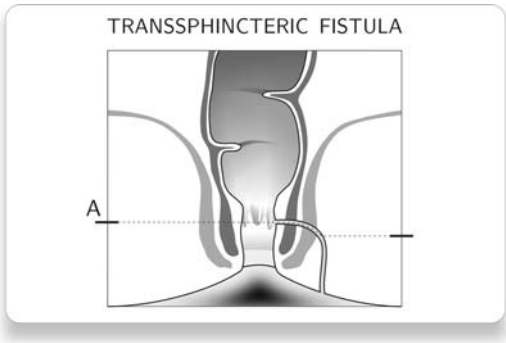


**Fig. 21.** Diagram of the coronal view shows a **transphincteric fistula** tracking from the internal anal sphincter by the intersphincteric space through the external anal sphincter to the ischiorectal fossa. Note the internal opening into the anal canal.

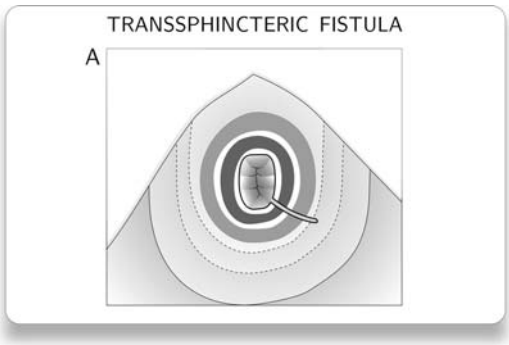


**Fig. 22.** Diagram of the transverse view shows a **transsphincteric fistula** perforated by the sphincter muscles internal and external.

C. A suprasphincteric fistula leaves the intershpincteric space over the top of the puborectalis muscle and penetrates the levator ani muscle before tracking down to the skin (Figs. 23, 24).

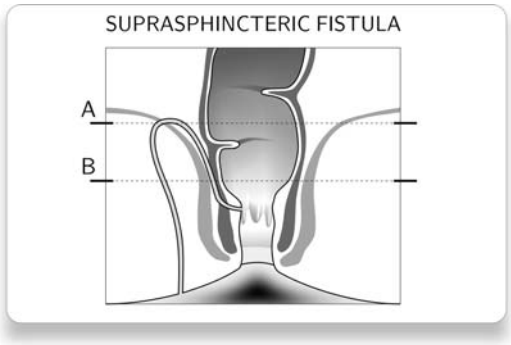


Fig. 23. Diagram of the coronal view shows a **supra-sphincteric fistula,** which leaves the intershpincteric space over the top of puborectalis muscle and penetrates the levator ani muscle before tracking down to the skin. Note internal opening into anal canal.

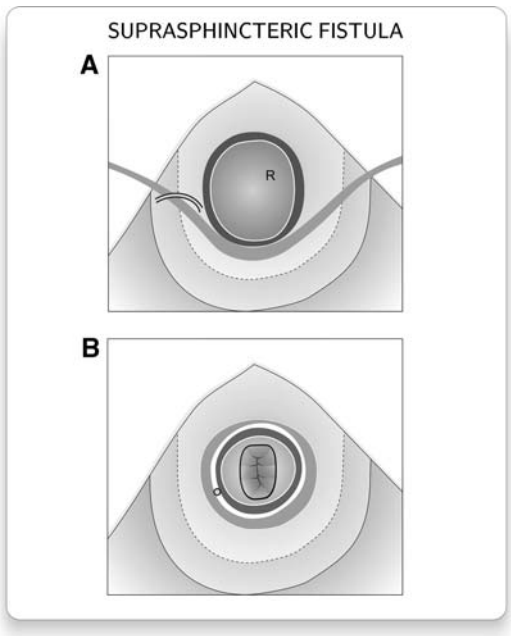


Fig. 24. A. Diagram of the transverse view shows a **su-prasphincteric fistula** penetrating the levator ani muscle at the level of the rectum and levator ani muscle. B. Diagram of the transverse view presents a **suprasphincteric fistula's** fraction in the intersphincteric space at the level of the anal canal.

D. An extrasphincteric fistula tracks outside of the external anal sphincter and penetrates the levator ani muscle into the rectum (Figs. 25, 26).
E. A superficial fistula tracks below the sphincter complex - both the internal and external anal sphincter in the ischioanal fossa (Figs. 27). If multiple fistulas were present, these were evaluated in the same way. In the absence of an internal opening, the track was classified as a sinus rather than a fistula [21].

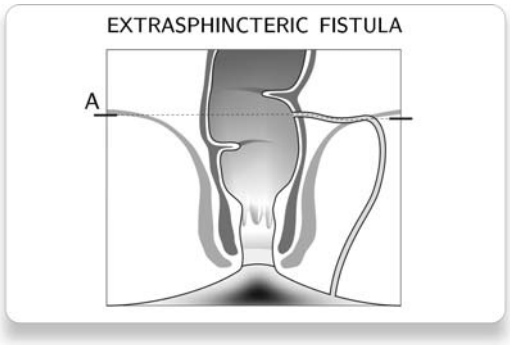


Fig. 25. Diagram of the coronal view shows an **extra-sphincteric fistula** tracking outside the external anal sphincter and penetrating the levator ani muscle into the rectum. Note an internal opening into the rectum.

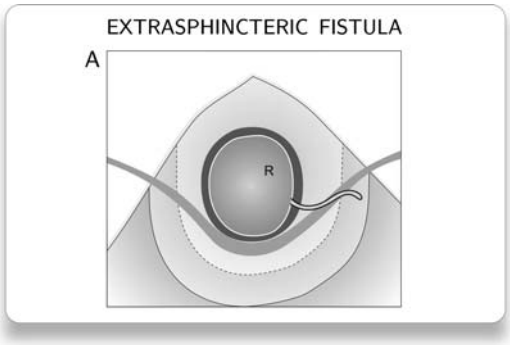


Fig. 26. Diagram of the transverse view shows an **extra-sphincteric fistula** at the level of the rectum and levator ani muscle. It penetrates the levator ani muscle into the rectum. Note an internal opening into the rectum.

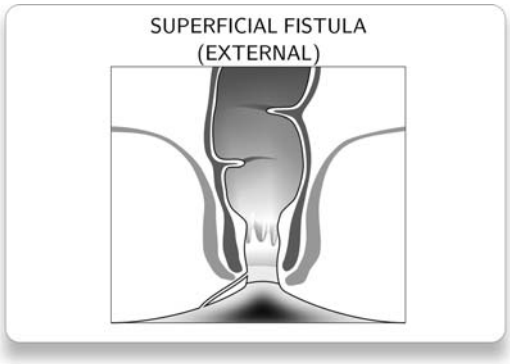


Fig. 27. Diagram of the coronal view shows a **superficial fistula** tracking below the sphincter complex - internal and external anal sphincter in the ischioanal fossa.

A right classification of visualized fistulas is a real challenge to a radiologist what was shown in the study by Buchanan et al. comparing efficacy of evaluation made by an experienced consultant and a resident [26].

Fig. 28. Coronal T2-weigted MR image shows a left-sided interspincteric fistula *(arrow)* penetrating the anal canal in the midline posteriorly.

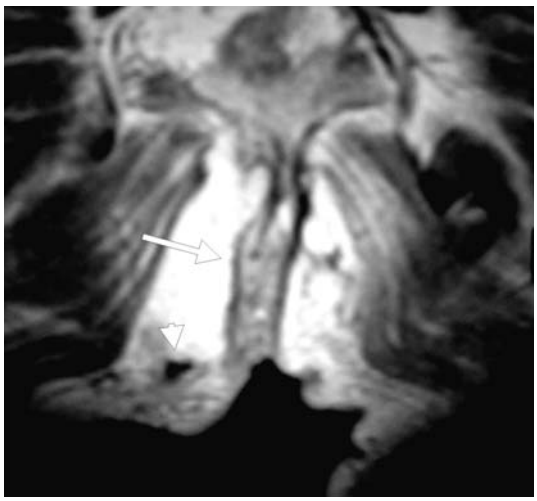

Fig. 29. Coronal Tl- weighted MR image after contrast enhancement shows a right-sided interspincteric fistula *(arrow)* entering the anal canal in the midline posteriorly and an abscess in the right ischioanal fossa *(arrowhed)*.


Fig. 30. Coronal T2-weighted image shows a right-sided transphincteric fistula *(arrow)* with a secondary track *(arrowheads)* running down and posteriorly.

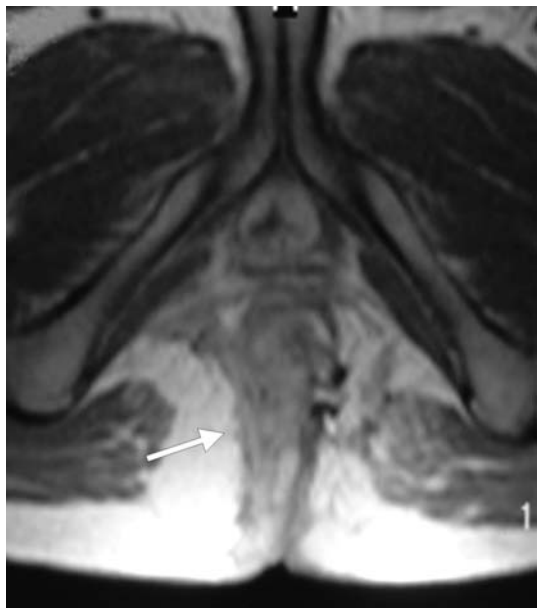


Fig. 31. Axial Tl-weighted MR image after administration of intravenous administration of contrast medium shows a right-sided transsphinteric fistula *(arrow)* penetrating and both sphincteric layers and tracking posteriorly to the right ischoanal fossa.

Difficulties in the differentiation of intersphincteric and transsphincteric fistulas present a frequent clinical problem (Figs. 28–31). To avoid a mistake we propose, after finding a fistula on images in the axial and coronal plane, to move to the second stage of the assessment and once again analyze T2-weighted images in the transversal plane. Crossing of the external sphincter through a fistula's canal is the main discriminant feature (Fig. 32). It will be possible to use the same sign in case of diagnostic doubts concerning a superficial fistula, however, with regard to its definition, it should have the beginning below the distal part of the external sphincter, but in practice it may be adjacent to the lower margin of the external sphincter muscle (Fig. 33).

Suprasphincteric and extrasphincteric fistulas, so called high fistulas, are much less frequent than those mentioned before. Their common feature is passage through the levator ani muscle and a differentiation criterion - presence of a fistula in the intersphincteric space what is characteristc of suprasphincteric changes (Fig. 34–36).

Fig. 32. Axial fat-saturated T2-weighted MR image shows a transsphincteric fistula *(arrow)* within the ischioanal fossa penetrating the external sphincter. Note a horseshoe *(arrowhead)* fistula fraction in the intersphincteric space. An internal opening *(empty arrowhead)* is well visible in the anal canal.

Fig. 33. Axial T2-weighted MR image shows a superficial fistula's track *(arrow)* within the ischioanal fossa localized closely to the external sphincter muscle without penetrating it. Secondary tracks are also *(arrowheads)* well visualized.

## *Evaluation of internal and external opening*

Visualization of a cutaneous opening seems clear to clinicians and radiologists. But having draining abscess surgeons are always interested in its relationship to the whole track and external opening especially in case of a complex fistula (Fig. 37). Location of internal openings usually becomes evident to a surgeon on EUA. However, MR imaging can provide new information useful in planning surgical approach by identification of an internal opening of a complex or a high fistula. An internal opening should be localized at the level of the anal canal or rectum. In theory, an internal opening is placed at the level of the dentate line, where the intersphincteric anal glands empty into the crypts, but practically it can also be found at other levels [14] (Fig. 38).

Fig. 34. Axial T2-weighted MR image at the level of the rectum shows a suprasphincteric fistula *(arrow)* penetrating to the left levator ani muscle before tracking to the skin. Note inflammatory changes *(arrowheads)* in the perirectal space.

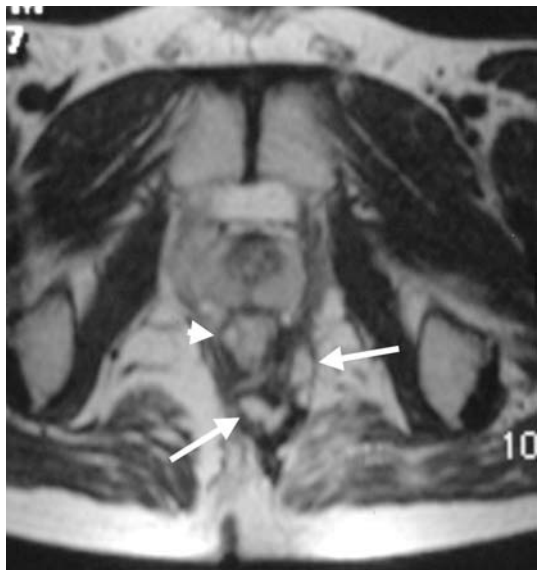

Fig. 35. Axial T2-weighted MR image at the level of the dentate line shows a suprasphincteric fistula penetrating the left levator ani muscle *(arrows)* and its intersphincteric fraction *(arrowhead)*.

## *Identification of abscesses and secondary tracks*

Perianal abscesses are the most common followed by ischiorectal, intersphincteric and supralevator (Fig. 39).

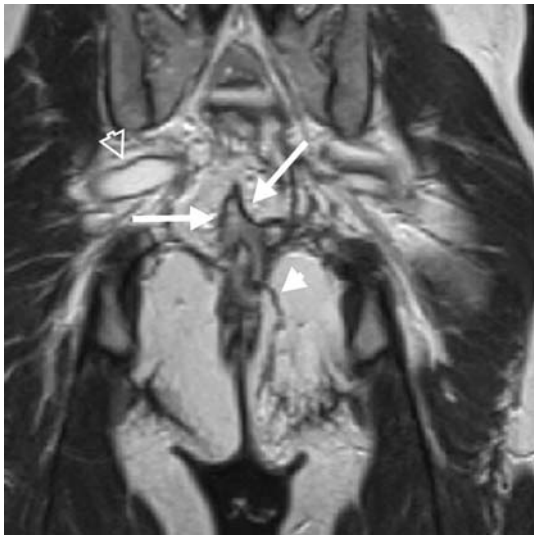

Fig. 36. Coronal T2-weighted MR image shows an extrasphincteric fistula *(arrow)* penetrating the left levator ani muscle and crossing the midline before tracking the rectum on the right side. Note a secondary track in the left ischorectal fossa *(arrowhead)* and an abscess *(empty arrowhead)* in the supralevator space.

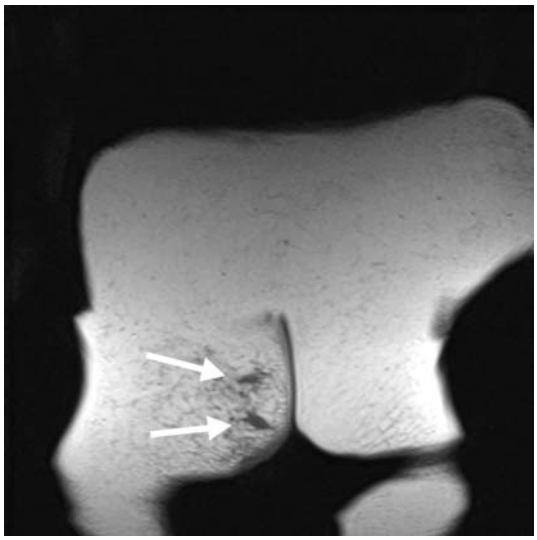

Fig. 37. Coronal T2- weighted MR image shows two external fistulas' openings *(arrows)* in the right ischioanal fossa.

Abscess cavity may develop along the route of a fistula's track. Characteristically, abscesses associated with intersphincteric fistulas are generally perianal or located within the intersphincteric space (Figs. 40, 41). Transphincteric fistulas are associated with ischiorectal fossa abscesses, since in rare cases, infection tracks upward over the sphincter complex and an abscess can be observed in the supralevator space (Fig. 42). Sepsis arising within the pelvis may track down to the skin through the

Fig. 38. The same patient as presented in the Fig. 32. Axial T2-weighted MR image shows a transsphinteric fistula *(arrowhead)* with a clearly visible internal opening *(arrow)*.

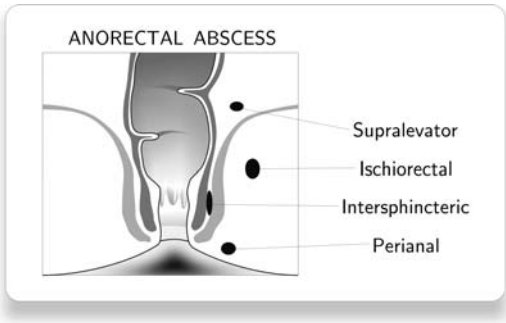


Fig. 39. Diagram of the coronal view shows a location of an abscess in the perianal region.

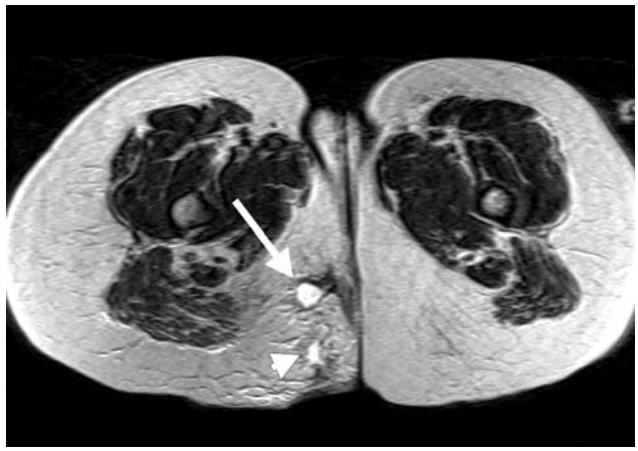

Fig. 40. Axial T2-weighted MR image shows an abscess *(arrow)* in the right ischioanal space. A secondary track is also visible within this fossa *(arrowhead)*.

supralevator space, the levator ani muscle and the ischiorectal fossa, which may result in pus collections. Abscesses and secondary tracks placed above the levator

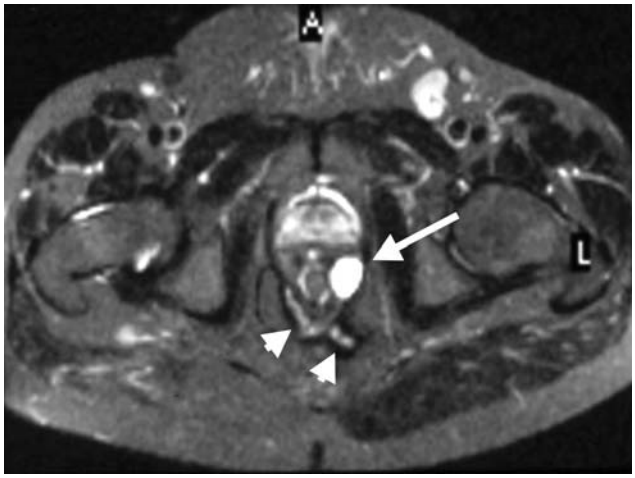


**Fig. 41.** Axial fat-saturated T2-weighted MR image shows the abscess *(arrow)* in the intersphincteric space at 3 o'clock and secondary tracks *(arrowheads)*.

**Fig. 42.** Sagittal T2- weighted MR image shows the abscess *(arrow)* in the perirectal space (posteriorly to the rectum) associated with an inactive fistula's track *(arrowhead)*.

plane used to be very difficult to recognize before introduction of MRI to clinical practice and their presence determines therapeutic approach.

An abscess possesses characteristic features on MR examination - it is a focal lesion of high signal in T2-weighted images and in STIR sequence, of low signal in Tl-weighted images, enhancing in the peripheral area after contrast medium injection. Ring-shaped enhancement on Tl-weighted images with and without fat-saturated sequence after contrast administration differentiates developed abscesses from inflammatory infiltrations (Fig. 43). Basically, MR imaging gives a very good picture of anatomical structures and perfect contrast resolution what makes recognition of these changes easier in clinically silent regions.

**Fig. 43.** Post-contrast axial fat-saturated Tl-weighted MR image shows a rim enhancement of an abscess *(arrow)* in the presacral region.

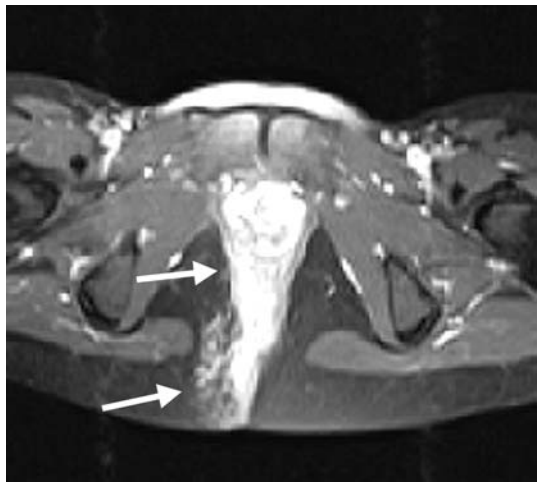

**Fig. 44.** Post-contrast axial fat-saturated Tl-weighted MR image shows a marked enhancement of the inflammatory changes *(arrow)* infiltrating both sphincter muscles and the vagina.

## *State of the ano-rectal wall and long distance extensions*

Status of the anal sphincters and its wall as well as condition of other organs (urinary bladder, reproductive organs) is crucial with regard to treatment options. In case of an advanced infiltrative process, stoma exteriorization should be considered. Extension of changes can be easily assessed on fat-saturated sequences, especially contrast-enhanced (Fig. 44). On MRI, sepsis is depicted as a high signal using STIR sequences and as a region of enhancement after contrast medium injection on

Tl-weighted images without and with fat-saturation, which well presents the relationship between the abnormality and surrounding structures.

Finally, it is necessary to make an evaluation of ancillary findings, such as lymphadenopathy, bone marrow oedema or cancer. When lymph nodes are larger than 10mm, a lymphoma and carcinoma must be excluded [18].

## Conclusion

MR imaging is a method of choice in the assessment of perianal and perirectal complications of Crohn's disease. MR study is a first quality technique in localizing and displaying topography of fistulas according to the Parks' classification and also abscesses what has an essential meaning in the planning of surgical intervention. Detecting an occult disease preoperatively may guide a surgeon in treating additional disease and diminish the risk of recurrent perianal fistulas.

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