

CMEARTICLE

Clinics in diagnostic imaging (143)

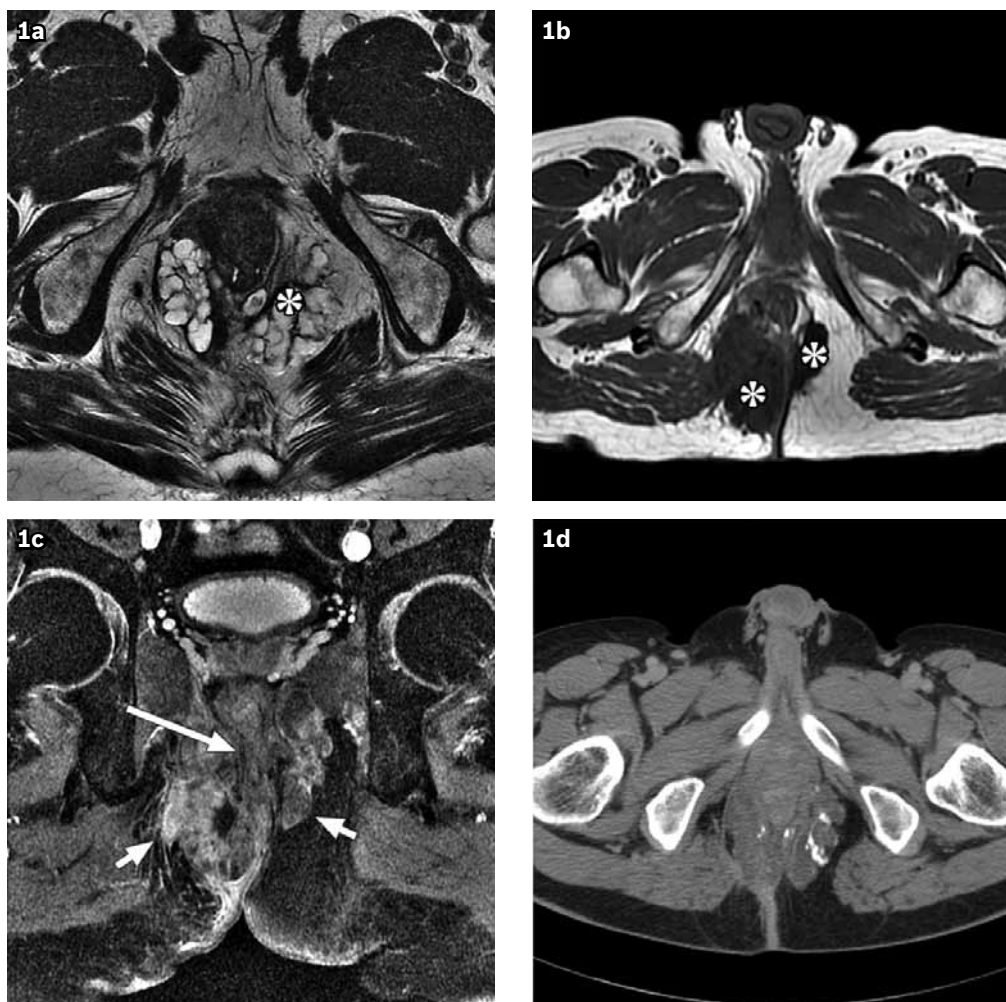
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Fig. 1 MR images of the anorectal canal depicting the anal canal and ischioanal fossa in (a) axial T2-W and (b) axial T1-W sequences prior to the introduction of gadolinium. (c) Coronal T1-W sequence with fat suppression after gadolinium administration. (d) Corresponding axial CT image.

CASE PRESENTATION

A 43-year-old man with a known history of perianal hidradenitis and bilateral recurrent anorectal fistulae was surgically treated with Seton placement and at least three fistulotomies over a period of three years. He subsequently defaulted treatment from the surgical department, but was referred back six years later due to complaints of a recurrence of symptoms over the last two years. He experienced perianal pain with occasional whitish or bloody discharge. Continence was maintained, and there

was otherwise no other altered bowel habits or constitutional symptoms. On examination, he was noted to have right perineal induration and mild tenderness, as well as multiple predominantly right-sided perianal fistulous openings. A provisional clinical diagnosis of complex fistula-in-ano was made. Contrast-enhanced magnetic resonance (MR) imaging of the anal canal, rectum and pelvis was performed to evaluate the perianal fistula prior to surgery. What do these images (Figs. 1a–d) show? Is this likely to be benign? What is the diagnosis?

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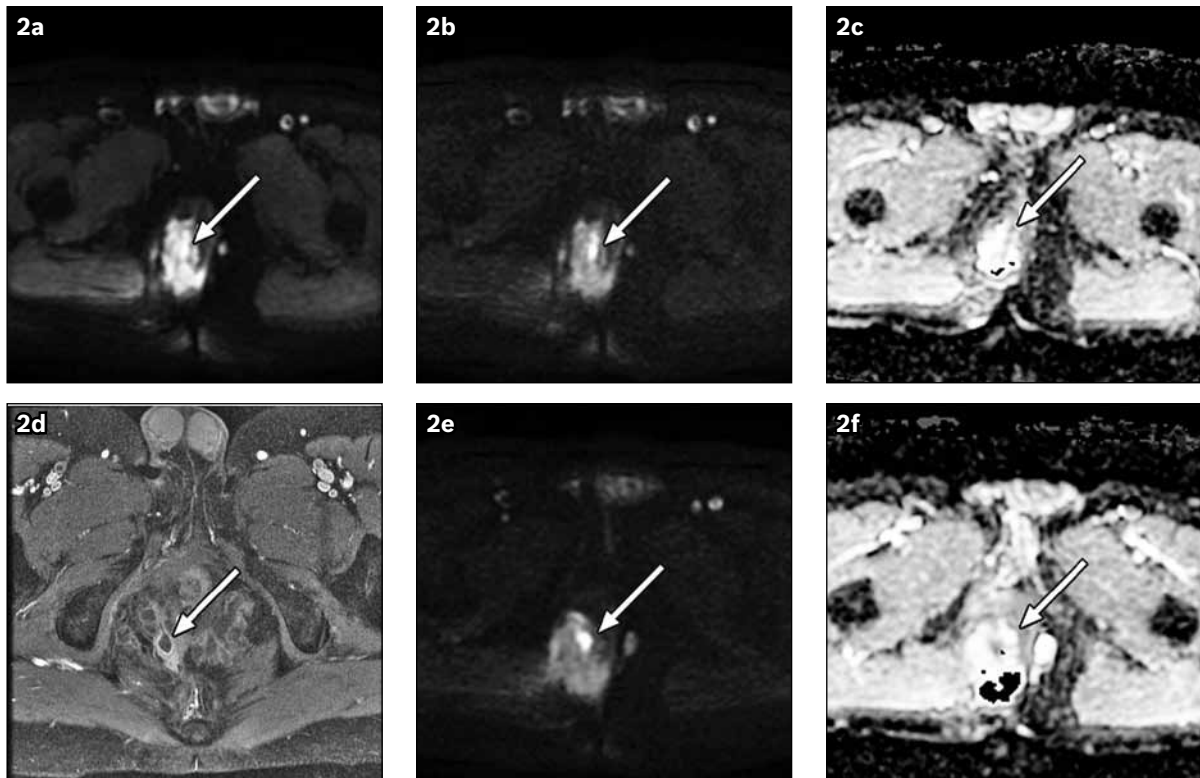


Fig. 2 MR images of the anal canal with DWI performed at b-value of (a) 500 s/mm² and (b) 1,000 s/mm² show a hyperintense fistulous tract at the 7 o'clock position of the anal canal, surrounded by the tumour in the right ischioanal fossa. A corresponding low signal tract is seen on (c) the ADC map. (d) Oblique axial T1-W MR image of the anal canal after fat suppression and gadolinium shows a rim-enhancing abscess in close proximity. Hyperintense DWI signal and low ADC signal are also demonstrated in this abscess on the (e) DWI at b-values of 1,000 s/mm² and (f) the ADC map.

IMAGE INTERPRETATION

High resolution MR imaging performed using an external phased array coil shows a large multiloculated predominantly cystic mass that measures at least 4 cm in size, surrounding the anal canal in the ischioanal fossa and encasing a complex chronic fistula-in-ano. The lesion was caudal to the levator ani muscles, with no intraperitoneal involvement. Axial MR imaging prior to gadolinium administration shows multiple locules (asterisks) of high T2-weighted (Fig. 1a) and varying T1-weighted (Fig. 1b) signals in both ischioanal fossae; those with higher T1-weighted signal are due to more concentrated proteinaceous contents. There are thin septations and a thick fibrous wall that shows low signal intensity. The fibrous wall is deficient on the left (Fig. 1a). Coronal T1-weighted MR image with fat suppression after gadolinium administration (Fig. 1c) shows the eccentric mass predominantly in the right perianal space, causing deviation of the natal cleft towards the left. The solid components were slightly hypointense to locules of mucin pools on the T2-weighted images and slightly hyperintense to locules of mucin pools on the T1-weighted images prior to gadolinium administration. Enhancement (white arrowheads, Fig. 1c) was demonstrated in both the solid components and the septations within the lesion. In the corresponding computed tomography (CT) image (Fig. 1d), the calcification is better visualised.

The mass encases a fistula (white arrow, Fig. 1c), with an opening to the upper anal canal. This corresponds to the nonenhancing linear focus of fluid signal seen at the 7 o'clock position of the

anal canal. On the diffusion-weighted imaging (DWI) performed at a b-value of 500 s/mm² and 1,000 s/mm² (Figs. 2a & b), the fistula consistently shows a higher signal than the mass. The corresponding image of the apparent diffusion coefficient (ADC) mapping (Fig. 2c) shows a low signal. In close proximity to the fistulous tract, a small and separate abscess cavity (Fig. 2d) shows the typical appearance of a nonenhancing cavity with a thin rim of enhancement. Similar to the fistulous tract, the abscess also shows intense DWI signal and low ADC signal (Figs. 2e & f).

When compared to the abscess wall, the solid component of the mass shows marginally less enhancement (Fig. 3a), intermediate ADC signal (Fig. 3b) and less intense DWI signal (Figs. 3c & d, at b-value of 1,000 and 500 s/mm², respectively). The thin septations show relatively faint enhancement (Fig. 3a), but these remain well-visualised against the nonenhancing mucin pools and against the adjacent ischioanal fat with suppressed fat signal. The mucin pools also show slightly increased DWI signal, but demonstrate T2-weighted shine-through phenomenon (Figs. 3c & d) without a low ADC signal due to its inherently high T2-weighted signal.

Differences are observed between the DWI signal of the fistula and a small abscess cavity versus that of the tumour that engulfs both the fistula and the abscess. This difference becomes more visibly apparent on images with a higher b-value of 1,000 s/mm². The solid component and walls of the septations show increased DWI hyperintensity, which persists in b-values

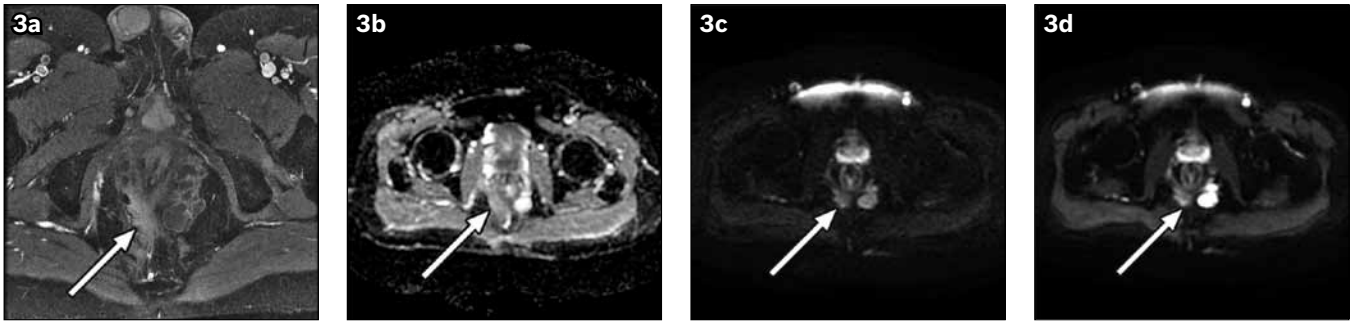


Fig. 3 MR images of the solid enhancing component of the tumour in the right ischioanal fossa seen on (a) T1-W post-gadolinium sequence with an intermediate (b) ADC signal. This also shows increased signal against the suppressed background of the ischioanal fat on DWI at b-values of (c) 1,000 s/mm² and (d) 500 s/mm².

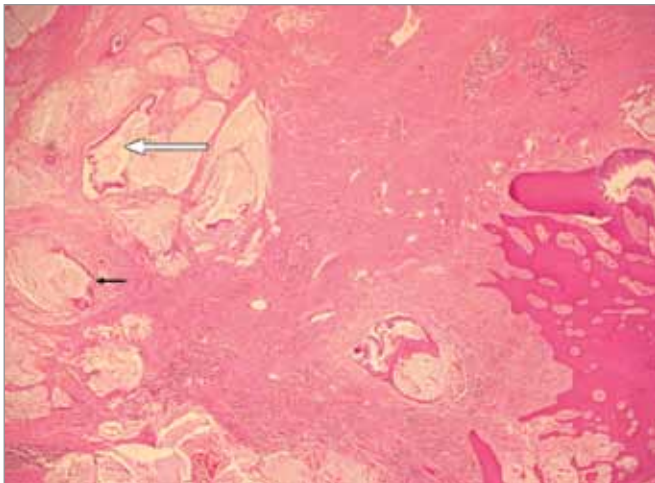


Fig. 4 Photomicrograph shows perianal squamous epithelium that is chronically inflamed (on the right). Also seen are pockets of mucin (centre and left), some containing low-grade malignant colonic glands (arrows), which are compatible with perianal mucinous adenocarcinoma (Haematoxylin & eosin, × 20).

of 1,000 s/mm². An intermediate ADC signal, measuring $1.7 \times 10^{-3} \text{ mm}^2/\text{s}$, is seen in the solid component, whereas the abscess and fistula show low ADC values of $1.2 \times 10^{-3} \text{ mm}^2/\text{s}$ and $1.4 \times 10^{-3} \text{ mm}^2/\text{s}$, respectively. The mucin pools, however, show a high ADC signal of $2.4 \times 10^{-3} \text{ mm}^2/\text{s}$.

DIAGNOSIS

Perianal mucinous adenocarcinoma arising from chronic fistula-in-ano (Fig. 4).

CLINICAL COURSE

The patient underwent an examination under anaesthesia. Hydrogen peroxide was injected through multiple external openings on the right perineum, and visualisation was performed under rigid sigmoidoscopy. The internal opening could not be directly visualised. Saucerisation of the lesion was subsequently performed, showing mucinous material within the ischioanal collection. Histological examination confirmed the imaging diagnosis of malignancy. This revealed perianal tissue with abundant superficial and deep-seated extravasated mucin, some of which were associated with low-grade atypical mucinous glands with a mild degree of nuclear pseudostratification and mitotic activity. The overall features were compatible with mucinous adenocarcinoma. Thereafter, the patient elected for

abdominoperineal resection with wide excision of the tumour. Unfortunately, he succumbed to the disease due to postoperative complications.

DISCUSSION

Perianal involvement is rare, constituting about 2% of colorectal cancers.⁽¹⁾ Of these, mucinous adenocarcinoma represents about 2%–19%.⁽²⁾ As a result, clinical, pathological and imaging descriptions are scanty. This condition is slightly more common in males, and the average age of the patients is 55 years.⁽²⁾ The key features that differentiate mucinous adenocarcinoma of the perianal region from the usual solid carcinomas are the prominent ducts and abundant colloidal production, with organised mucin pools that infiltrate the perianal soft tissue seen on imaging and histology.⁽³⁾ Although mucinous adenocarcinomas have been reported in association with chronic fistula-in-ano, the lack of prior imaging precludes the accurate determination of a causal effect. Hence, it is often uncertain whether the mucinous adenocarcinoma causes fistulation or the chronic fistula itself predisposes to the occurrence of mucinous adenocarcinoma.⁽²⁾ In a case series reported by Hama et al, all 11 patients with perianal mucinous adenocarcinoma showed fistulation between the mass and the anus on MR imaging.⁽⁴⁾

Typically, affected patients undergo clinical and imaging-based staging using endoscopic colonoscopy and contrast-enhanced MR imaging of the anal canal. Endoscopic examination remains the mainstay for assessing superficial luminal disease, while MR imaging is the standard for assessing deeper disease. Where advanced disease is suspected, whole body CT imaging is preferred. Positron-emission tomography (PET)-CT may be limited in the assessment of mucinous adenocarcinoma and its metastatic involvement due to poor 2-[fluorine-18]-fluoro-2-deoxy-D-glucose (FDG) uptake.

On cross-sectional imaging, perianal mucinous adenocarcinoma typically presents as a multiloculated mass with a variable amount of solid components. The cystic component consists of locules of mucin pool in varying sizes, often separated by thin septations that give a mesh-like or latticed appearance. Mucinous adenocarcinoma is usually low in attenuation and does not typically enhance significantly on CT. Septal calcifications may be present, which are best depicted on CT. Endoluminal ultrasonography can be useful in assessing for solid

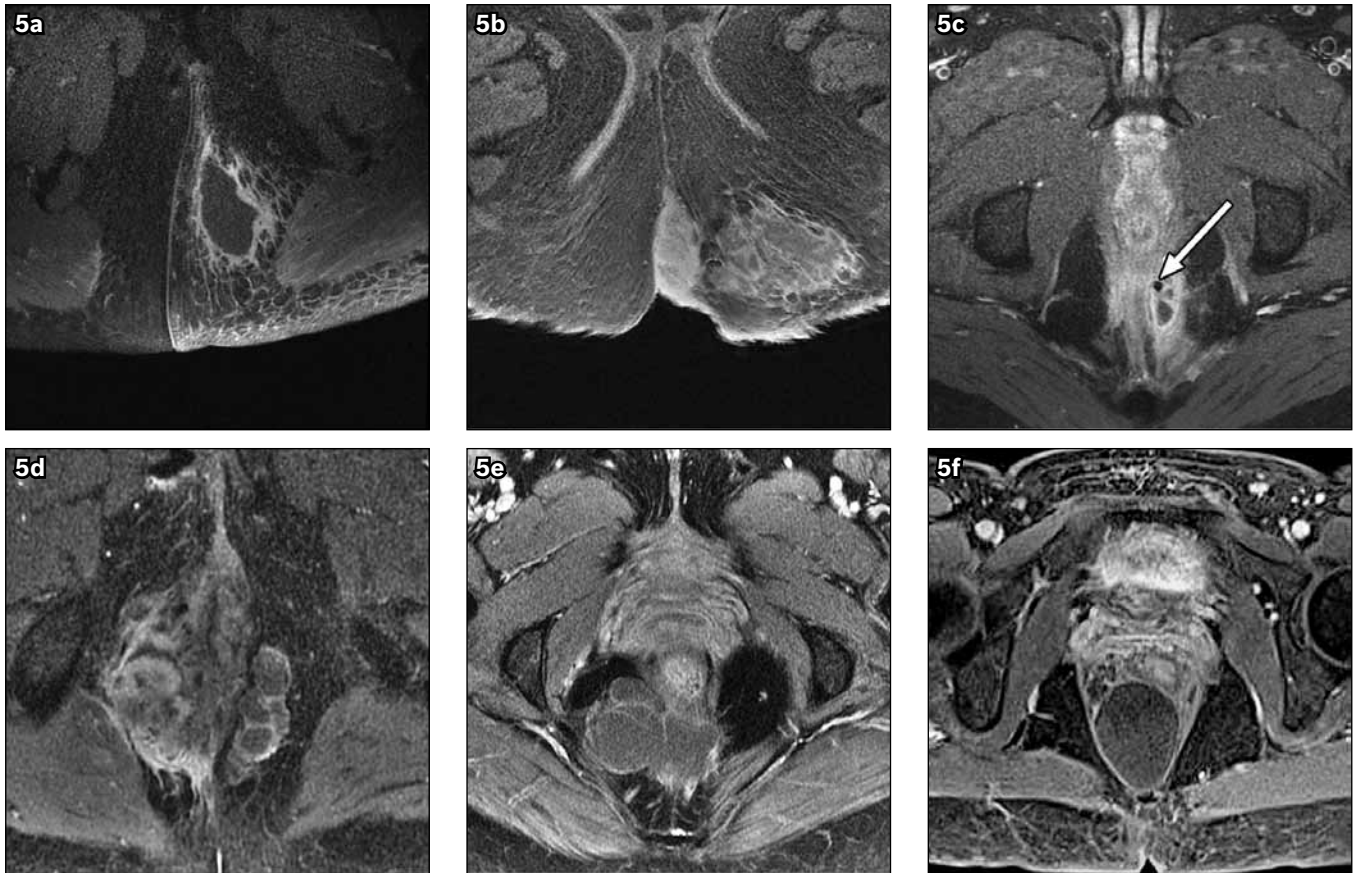


Fig. 5 MR images of perianal abscesses in three different patients, which can present with (a) a simple loculation or (b) a multiloculated cystic mass. (c) The presence of air pockets (white arrow) further supports the diagnosis of an abscess. No solid component is seen in the perianal abscesses as compared to (d) perianal mucinous adenocarcinoma. Other benign conditions such as (e) tailgut cyst and (f) cystic teratoma also show no solid component.

or cystic component in the wide variety of perianal or perirectal lesions, and may demonstrate internal echogenic foci within the cystic lesion if there are gelatinous material, inflammatory debris, haemorrhage or infection. This, however, requires the necessary expertise and is often difficult to perform if there are painful perianal conditions such as fistulation. When the mucin is thickened and concentrated with proteinaceous contents, they typically present as hypoechoic material with fine or complex internal echoes on ultrasonography, and appear hyperattenuated on CT and variably hyperintense on T1- and T2-weighted MR images.⁽⁵⁾

On MR imaging, mucinous adenocarcinoma is characterised as a multiloculated cystic, T2-weighted, hyperintense mass with mesh-like enhancement. The nonenhancing pools of mucin show increased T1-weighted signal of varying intensities in each locule.⁽²⁾ A thick fibrous capsule of low-intensity signal on T1- and T2-weighted MR images is often seen around the tumour. This capsule may be incomplete or markedly deficient, correlating to the invasive nature of mucinous adenocarcinoma, where deposition of the mucin pools occurs prior to the fibrotic reaction and formation of the thick capsule.⁽⁴⁾ These imaging features, which have been observed in previous studies, are also evident in our case. The inherently high T2 signal of mucin allows ready differentiation of the hypointense solid tumour components from the mucin pools.

The most common differential to perianal mucinous adenocarcinoma encountered in routine clinical practice is that

of a perianal abscess. This is also often present in association with chronic fistulas, notably in patients with Crohn's disease. Perianal abscesses may have a unilocular (Fig. 5a) or multilocular (Fig. 5b) appearance. The mass-like morphology of the solid tumour component in mucinous adenocarcinoma can be differentiated from the thin enhancing rim of the abscess wall. Findings of internal gas pockets further support this diagnosis (Fig. 5c).

Other differentials for a perianal cystic mass include tailgut duplication cyst, epidermoid cyst, dermoid cyst, lymphangioma, cystic gastrointestinal stromal tumour, cystic neurogenic tumour, cystic metastases and sacral lesions (sacrococcygeal teratoma, necrotic chordoma and anterior sacral meningocele). Delineating the epicentre of the mass and its relations to the bowel wall or sacrum are helpful in narrowing down the differential. Furthermore, dermoid cyst, epidermoid cyst, anorectal duplication cyst and anterior meningocele tend to be unilocular.⁽⁶⁻⁸⁾ Cystic lymphangioma and tailgut cyst, on the other hand, can be considered in the differentials of multilocular lesions,⁽⁶⁾ and may potentially mimic mucinous adenocarcinoma. Tailgut cysts may also show high T1-weighted signal due to internal mucin. Calcifications may occur in mucinous adenocarcinoma, gastrointestinal stromal tumours, dermoid cyst, tailgut cyst and sacrococcygeal teratoma, and these are best depicted on unenhanced CT. A history of longstanding chronic perianal fistula, with features of solid mass component and mesh-like loculations (Fig. 5d) would, however, favour mucinous adenocarcinoma over



Fig. 6 MR images of perianal mucinous adenocarcinoma in another patient show (a) rim-enhancing abscess (b) harbouring very poorly enhancing tumour mass (c) in the presence of a complex fistula. DWI and ADC were not performed for this patient.

these differential conditions.⁽⁴⁾ Likewise in perianal abscesses, the absence of a solid-enhancing component in these cystic perianal lesions suggests benign conditions (Figs. 5e & f).

Another useful MR imaging parameter for assessment is DWI. In our institute, this is routinely performed at two b-values – 500 s/mm² and 1,000 s/mm² – in MR imaging for fistula-in-ano. DWI takes advantage of the phenomenon of differences in the degree of thermally induced movement of the water molecules in different tissues to aid in the localisation and characterisation of lesions of interest. This has been an ongoing field of research for multiple disease pathologies encompassing acute infarct and haemorrhage, infective-inflammatory lesions and hypercellular neoplasm. A pus-containing abscess or a tumour mass with hypercellular tissue would retain its signal at a high b-value of restricted diffusivity, and via a pixel-by-pixel greyscale depiction of ADC values of a corresponding DWI, an ADC map can be generated to depict a corresponding focus of low ADC signal. DWI can be performed quickly without breath-holding and the need for contrast agents in patients with renal impairment.

In imaging of the anorectal region, the standard axial DWI planes of the pelvis may differ from the post-contrast image obliquely aligned to the axis of the bowel. This occasionally poses a challenge to accurate anatomical localisation, as DWI has an inherently low spatial resolution. However, sizeable lesions can still be conspicuous in the ischioanal fat if they demonstrate high DWI signal against the low signal background. The addition of DWI to T2-weighted imaging increases the confidence scores in the assessment of fistula-in-ano. When performed with T2-weighted imaging, DWI shows no statistically significant difference in diagnostic sensitivity compared to those with T2-weighted and post-gadolinium sequences.⁽⁹⁾ Hence, it is useful in all patients, with or without contraindications to gadolinium.

Inflammatory conditions such as abscesses and fistulation show restricted diffusion. The ADC value in areas of active inflammation in the perianal tissue measure $0.908 \pm 0.171 \times 10^{-3} \text{ mm}^2/\text{s}$,⁽¹⁰⁾ but this may be difficult to measure in small abscesses. Restricted diffusion is seen in three of our other patients with perianal abscesses (Figs. 5a–c); their corresponding ADC values are $0.7 \times 10^{-3} \text{ mm}^2/\text{s}$, $0.9 \times 10^{-3} \text{ mm}^2/\text{s}$ and $1.2 \times$

$10^{-3} \text{ mm}^2/\text{s}$, respectively, which are all lower than the solid component in the mucinous adenocarcinoma of our patient. None of these benign abscesses show the mass-like solid-enhancing component that is seen in mucinous adenocarcinoma (Fig. 5d).

Malignancy may also show restricted diffusion. Nasu et al,⁽¹¹⁾ who compared the ADC and DWI findings between 15 mucinous adenocarcinomas and 66 tubular adenocarcinomas, found that mucinous adenocarcinomas showed higher mean ADC and lower DWI signal as compared to tubular adenocarcinomas. The mean ADC for mucinous carcinomas was $1.49 \pm 0.34 \times 10^{-3} \text{ mm}^2/\text{s}$, while that for tubular adenocarcinomas was $0.80 \pm 0.15 \times 10^{-3} \text{ mm}^2/\text{s}$.⁽¹¹⁾ It was postulated that the presence of mucin and low cellularity causes a relatively higher ADC, and therefore, a relatively less intense signal on diffusion-weighted images.⁽¹²⁾ The relatively lower DWI signal of the tumour relative to the inflammatory fistulous tract and the abscess wall, as demonstrated in our case, is consistent with the relative hypocellularity of the mucinous tumour. The higher ADC value of mucinous adenocarcinoma compared to solid tumours and even abscesses is a potential false negative for malignancy in DWI, and this entity should thus be considered with the pitfalls in mind.

In our case, the differences in morphology, enhancement, DWI signal and ADC values can be visualised between the abscess wall and the fistulous tract versus the solid component of the mucinous tumour, while the nonenhancing mucin pools show T2-weighted shine-through and high ADC signal. These findings, coupled with the identification of solid mass component and the awareness of longstanding inflammation in this entity, had enabled accurate imaging diagnosis and expedited earlier management. The histological specimen of our patient after abdominopelvic resection had demonstrated a similarly sized tumour, which straddled the anorectal junction but did not appear to be connected to the overlying mucosa, and it was found to be communicating with one of the fistulous tract, consistent with the imaging findings.

In a separate case of perianal mucinous adenocarcinoma (Fig. 6) that developed along a chronic fistulous tract, MR imaging performed at another institute for the clinical suspicion of perianal abscesses showed a much less well-visualised enhancement of

the solid component. DWI was not performed as a routine in this patient. The large multiloculated lesion in the right ischioanal fossa, which communicated with the skin and bowel, and demonstrated peripheral enhancement and nonenhancing loculations of high T2-weighted signal, was initially believed to be an abscess but was later proven to be a neoplasm. This depicts the occasional difficulty in differentiating these two disease pathologies and the potential value of multiple assessment parameters via T1- and T2-weighted signal characteristics, contrast enhancement and diffusivity, each of which may have limitations as a standalone due to the lack of conspicuity, the overlapping of features with other benign conditions and the lack of awareness of imaging features of mucinous tumours. Therefore, knowledge of the clinical presentation, the radiological morphology and the various imaging parameters are all essential to increase the accuracy of imaging interpretation and diagnostic confidence.

Local recurrence, serosal and lymphovascular invasion, and nodal and distant metastases are reportedly more common in mucinous adenocarcinomas than the more commonly seen nonmucinous type.⁽⁵⁾ Thus, the prognosis of mucinous adenocarcinomas also tends to be poorer. The difficulty of examination in the midst of adjacent ischioanal fat and the deep location of the tumour along a fistula, as well as lowered clinical suspicion of malignancy masked by symptoms associated with chronic fistulation, further contribute to late detection and advanced stage at diagnosis. While there is a lack of large-scale randomised trials conducted on the treatment of this disease due to its low prevalence, the primary treatment of choice is still surgical resection. Due to its locally invasive nature and typically late presentation, an abdominoperineal resection with a wide local excision of the perirectal and perianal soft tissue is often essential, especially if the extent of the tumour does not allow continence to be preserved. The use of neoadjuvant chemoradiotherapy remains controversial. There is a reported survival of 2–48 months,⁽¹³⁾ with 80% of the cases with a tumour larger than 5 cm in diameter having a poor prognosis.⁽¹⁴⁾ However, if the tumour is detected and treated at an early stage, the prognosis is good without the need for adjuvant chemoradiotherapy.⁽¹⁵⁾

CONCLUSION

Perianal mucinous adenocarcinoma is rare and is associated with chronic fistula-in-ano. While there are overlapping features with other benign conditions, the presence of a solid component amidst a multiloculated cystic mass in the appropriate clinical context should raise the suspicion of perianal mucinous adenocarcinoma. This paper has detailed the imaging features that led to the correct diagnosis of a perianal mucinous adenocarcinoma, which likely arose from a chronic fistula. We have also highlighted DWI findings that may assist radiologists in differentiating this neoplasm from perianal abscesses, both of which otherwise have some overlapping MR imaging features. MR imaging is the mainstay of pelvic imaging and the salient imaging features of this condition are elucidated in this article.

ABSTRACT We report a case of mucinous adenocarcinoma arising in the perianal soft tissue in association with chronic fistula-in-ano in a 43-year-old man who had a relapse of perianal pain and bloody discharge after six years of defaulted follow-up. He underwent magnetic resonance (MR) and computed tomography imaging with correct identification of the disease entity on imaging. Mesh-like septations and an enhancing solid component with high diffusion-weighted imaging (DWI) and intermediate apparent diffusion coefficient signals were observed. He underwent abdominoperineal resection of the tumour but succumbed due to postoperative complications. Literature on the MR imaging features of this tumour remains scarce. We highlight the MR imaging features, including those seen on DWI, which were useful in making the correct diagnosis. Though uncommon, this would be an important condition to recognise since assessment of fistula-in-ano by MR imaging is considered to be the standard of care in current clinical practice. The clinical features of this entity are also briefly discussed.

Keywords: cystic, diffusion-weighted imaging, fistula-in-ano, MRI, perianal mucinous adenocarcinoma

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SINGAPORE MEDICAL COUNCIL CATEGORY 3B CME PROGRAMME

(Code SMJ 201212B)

Question 1. Concerning mucinous adenocarcinoma of the large bowel:

- (a) There is a predisposition in young females with early menarche.
- (b) It is more commonly seen in the anal canal than the right-sided colon.
- (c) It is commonly cystic with low attenuation.
- (d) The presence of calcification precludes the diagnosis of mucinous adenocarcinoma.

Question 2. Predisposing risk factors of perianal mucinous carcinoma include:

- (a) Endometriosis.
- (b) Chronic perianal fistula.
- (c) Prolapsed haemorrhoids.
- (d) Crohn’s disease.

Question 3. Concerning imaging modalities for perianal cystic tumour:

- (a) Endoscopic examination is more sensitive than CT and MR imaging in assessing luminal disease.
- (b) Endorectal ultrasonography should always be done to assess the depth of the tumour.
- (c) CT should be the primary imaging modality to assess local extent of disease.
- (d) PET is useful in detecting distant metastases from perianal mucinous adenocarcinoma.

Question 4. Concerning the imaging features of perianal mucinous adenocarcinoma:

- (a) Perianal mucinous adenocarcinoma most commonly presents as a unilocular cystic mass.
- (b) Solid component in a perianal cystic mass is highly suspicious for malignant neoplasm.
- (c) Perilesional enhancement is affirmative for local invasion.
- (d) The presence of fistulation is helpful in differentiating it from other perianal cystic lesions.

Question 5. Concerning the MR imaging features of perianal mucinous adenocarcinoma:

- (a) It typically shows low T1- and T2-weighted signals on MR imaging.
- (b) It typically enhances significantly in the arterial phase, similar to stromal tumour.
- (c) Occasionally, this tumour shows areas of high T1-weighted signal due to fat component.
- (d) It shows a higher DWI signal than the adjacent fistula and abscess due to hypercellularity.

True	False
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