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Tumour pathology of the bladder: The role of MRI

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Abstract  Bladder cancer occurs frequently and is serious. Although ultrasound and CT examination are essential, magnetic resonance imaging is more effective for staging large tumours and in atypical cases, in particular submucosal lesions. CT and MRI are equally effective in examining the lymph nodes. The examination technique is simple. The prospects for using MRI, in particular with diffusion imaging, are being evaluated.

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Magnetic resonance imaging (MRI) is the best imaging technique for exploring the pelvic cavity because of its high contrast resolution and its optimal spatial resolution, due to the current phased array coils with parallel imaging techniques. Diagnosis of a bladder tumour, suspected from the ultrasound examination, is confirmed by cystoscopy and histopathological analysis of the material sampled, which provides information regarding the histological type and how deeply the tumour extends. The main role for MRI is in pre-treatment staging, but it is also important in post-therapeutic monitoring and in atypical cases or certain rarer circumstances.

Technique [1–5]

The examination is performed with a phased array coil.

The bladder must be moderately full. If the bladder is considerably distended, apart from discomfort for the patient and the consequent risk of uncontrollable movements, the thinness of the bladder wall makes analysing it impossible. On the other hand, if the bladder is empty, the tumour will be barely visible.

Injection of an antispasmodic (Glucagen®) just before starting the examination reduces artefacts due to movement of the digestive tube; it is essential in slim patients where the

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loops of the small intestine are in contact with the bladder wall. It is effective for about 20 minutes.

Slice thickness varies from 3 to 4 mm.

The examination combines a number of T2-weighted spin-echo sequences (T2-weighted SE) in at least three orthogonal and/or oblique planes, so as to be perpendicular to the wall of the tumour to reduce the partial volume phenomenon to a minimum, and a T1-weighted spin-echo (T1-weighted SE) axial sequence for the lymph node axes, possibly with the addition of another fat saturation plane to be able to assess the contours of the bladder. A tumour of the dome is explored in the sagittal and frontal planes, while a tumour of the lateral surface is explored in the axial and frontal planes. The tumour and the bladder wall are analysed by a dynamic T1-weighted gradient-echo (T1-weighted GE) sequence with injection of gadolinium and temporal resolution lower than or equal to 20 seconds, at best with fat saturation and orientation perpendicular to the implantation base of the tumour.

It has been suggested that an endorectal coil should be used for tumours of the base, the trigone and the posterior wall. Diffusion imaging is being evaluated [1].

**Semeiology of tumour of the bladder**

**T1-weighted sequence**

In T1-weighted SE, the tumour has an intermediate to low signal, similar to that of the bladder wall (Box 1). It is iso- or slightly hyperintense relative to muscle, hyperintense relative to urine and hypointense relative to peri-vesical fat.

**T2-weighted sequence**

In T2-weighted SE, the signal from the tumour is much lower than the signal from urine, is higher than the hype-signal from the wall and lower or the same as that of fat (Figs. 1 and 2). Polypoid tumours have an implantation pedicle containing connective tissue and capillaries, as well as inflammatory cells with oedema. This pedicle is visible in 75% of cases as a linear structure with poorly defined contours, with a lower signal than that of the tumour in T2 weighting, and becomes enhanced later than the tumour following injection, which shows its fibrous nature. The smooth muscle part

**Box 1** UICC 2002 TNM classification.

*T Primary tumour*

- **Tx**: primary tumour cannot be assessed
- **T0**: no evidence of primary tumour
- **Ta**: non-invasive papillary carcinoma
- **Tis**: carcinoma in situ; flat tumour
- **T1**: tumour invades subepithelial connective tissue
- **T2**: tumour invades muscularis propria
  - pT2a: tumour invades superficial muscularis propria (inner half)
  - pT2b: tumour invades deep muscularis propria (outer half)
- **T3**: tumour invades perivesical tissue
  - pT3a: microscopic invasion
  - pT3b: macroscopic extravasal invasion
- **T4**: tumour invades a neighbouring structure
  - **T4a**: tumour invades prostatic stroma, vagina or uterus
  - **T4b**: tumour invades pelvic or abdominal wall

*N Regional lymph nodes*

- **Nx**: lymph nodes cannot be assessed
- **N0**: no regional lymph node metastasis
- **N1**: lymph node metastasis only < 2 cm
- **N2**: lymph node metastasis only > 2 cm and < 5 cm
- **N3**: lymph node metastasis > 5 cm

*M Distant metastases*

- **Mx**: metastasis cannot be assessed
- **M0**: no distant metastasis
- **M1**: distant metastasis
  - 1: mucosa; 2: sub-mucosa; 3: superficial muscle layer; 4: deep muscle layer. This classification only concerns urothelial carcinomas of the bladder.

Figure 1. **MRI** of a tumour of the bladder, stage pT1: a: T2-weighted SE, axial plane. Polypoid mass with intermediate signal located in the left part of the trigone. Hyposignal from the intact muscle of the wall. No dilatation of the ureter; b: T2-weighted SE, frontal plane. Hyposignal from the intact muscle part.
of the wall is sometimes attracted towards the implantation pedicle (Fig. 3).

The presence of a hyposignal border (muscle layer) at the base of the tumour indicates a stage T1 tumour. An irregular internal contour indicates a stage T2a tumour and the hyposignal border being interrupted by a hypersignal, with no infiltration of perivesical fat, indicates a stage T2b tumour. Finally, a lesion with an irregular internal contour and striations in the perivesical fat is evidence of a stage T3b tumour (Figs. 1 and 2).

T1-weighted sequence with injection of gadolinium

The injection of a contrast agent increases the sensitivity of MRI for detecting small tumours and improves analysis of parietal invasion. Since the tumour is hypervascularised, it takes up the contrast agent early and intensely, with more rapid wash-out than in non-tumour tissue. Consequently the tumour can be identified by its hypersignal between 15 to 25 seconds following injection, while the signal from the muscle layer remains hypointense (Fig. 4). After that, the signal from the tumour diminishes, the signal from the wall increases and the high intensity of the contrast agent in the bladder will mask small tumours.

The intensity of enhancement is proportional to the degree of tumour vascularisation; it reflects the density of the microvessels [6–11]. In theory, the tumour is enhanced earlier than oedema or granulation tissue, but there are several causes of false-positives that one needs to be aware of: inflammatory peritumoral neovascularisation with no histological extension, post-biopsy restructuring, and after endovesical instillation, or even post-radiotherapy fibrosis, if the examination is conducted too soon (less than 3 months afterwards). An additional difficulty is due to the frequently atypical tumours (60% of cases) which give a signal identical to or barely different from the signal from the wall, or are even surrounded by a hyposignal border in T2-weighted SE or in the injection sequence [6–10].

The spatial resolution of current machines makes it possible to visualise polypoid tumours that are 7 to 8 mm in size or more.

In the literature, dynamic sequences with injection of contrast agent are variably effective ranging from 75 to 92% for differentiating a T1 stage or below from a T2 stage or higher, with overall efficacy for all types of 52 to 93% [9]. In Hayashi’s study [6] with an endorectal coil for better analysis of the submucosal layer, efficacy in differentiating a T1 stage or under from a T2 stage or more was 87%. Tekes et al. [7] report sensitivity and specificity of 86% and 94% respectively for distinguishing a pT2 stage or below from a pT3 stage or higher (Fig. 4). Using the three types of sequence combined, diagnostic efficacy of stage pT3 or above is 94% [8].

Diffusion imaging

Diffusion imaging has excellent sensitivity for detecting lesions, with, as in any tumour process, slowing of diffusion seen in diffusion imaging as a hypersignal and a low apparent diffusion coefficient (ADC) (< 1000 x 10⁻³ mm²/sec), easy to detect on the ADC map (Figs. 5 and 6). In the literature, it is reported that the intensity of the fall in the ADC provides useful information for evaluating the tumour stage, in particular for differentiating stage T1 or below from stage T2 or higher. The ADC value of G3 grade tumours would be significantly lower than values for G1 and G2 grades [10].

As in CT, ureteral dilatation indicates parietal invasion of the meatus. Identifying an intraluminal tumour is facilitated...
by injection, but thickening of the circumference of the wall is not specific to tumoral invasion.

**Extension to neighbouring organs**

**T2-weighted sequence**

The T2-weighted SE sequence provides excellent contrast with the zonal anatomy of the various pelvic organs and the pelvic wall (Fig. 7). Analysis in the sagittal or frontal planes is best for staging, particularly towards the pelvic walls and floor. A lesion extending into a neighbouring organ or the pelvic wall in T2-weighted SE and following injection indicates stage T4.

**Seminal vesicles**

Invasion of the seminal vesicles is judged using morphological criteria in T1-weighted SE, because their signal is not modified: hypertrophy of a vesicle with replacement of the interseminal vesicle fatty hypersignal by a hyposignal. In T2-weighted SE, there is a localised or diffuse fall in the hypersignal from the seminal vesicle, replaced by a signal which evolves on injection just like the signal from the tumour. The sensitivity of this signal is good, but its specificity is mediocre because the seminal vesicles can produce a weak signal in certain physiological circumstances (an elderly patient, severe alcoholism, a history of infection, local radiotherapy or amyloidosis of the vesicles). In these cases, the hyposignal is diffuse and bilateral, and the vesicles are small in size.

**Prostate**

Invasion of the prostate is assessed in the frontal or sagittal plane and in T2-weighted SE, based on two criteria: disappearance of the clear limit between the bladder and the prostate, and a mass in the parenchyma of the prostate with a signal identical to that from the bladder tumour. Urethral invasion is impossible to confirm.

**Uterus and vagina**

Extension to the vaginal fornix, cervix and uterine body are studied in the sagittal plane in T2-weighted SE. The invasion criteria are identical to the criteria suggested for men.
Figure 4. MRI of a tumour of the trigone, stage pT4a, revealed by acute urine retention: a: T2-weighted SE, sagittal plane. Tissue thickening of the trigone with disappearance of the hyposignal from the wall (black arrow) and infiltration of the anterior wall of the vagina. Note the thickening of the superior posterior wall (white arrowhead); b: T1-weighted GE with injection of contrast agent; 15 seconds; sagittal plane. The tumour mass of the trigone is interrupting the muscle wall and infiltrating the vesicovaginal space then the anterior vaginal wall (white arrow). Linear enhancement on the posterior surface of the dome, without parietal infiltration on injection of contrast agent, corresponding to stage pT1 (white arrowhead); c: T2-weighted SE, axial plane. The mass is invading the two ureteral meatus (black arrows); d: b-1000 diffusion sequence. Hypersignal from the tumour (white arrow); e: ADC map of the diffusion sequence. Slowing of diffusion in the tumour process (white arrow).
Pelvic wall

Invasion of the pelvic wall is assessed in T2-weighted SE. Loss of the fatty border between two structures does not mean infiltration. The only reliable criterion is the existence in the muscle of a signal identical to the signal from the tumour. Disappearance of the cortical bone with medullary infiltration indicates extension into the bone.

The overall reliability of MRI varies on the whole from 73 to 96% for local tumour staging.

Uro-MRI

Analysis of the upper excretory system uses uro-MRI techniques. They require a surface coil covering the entire upper excretory tract. Depending on the patient’s morphotype, it will not be performed at the same time. There are two types of uro-MRI: with (in T1 weighting) and without (in T2 weighting) injection of contrast agent. If there is no dilatation of the excretory system, this must be potentiated by the injection of Lasilix®. If the option of T2 weighting without injection is chosen, multiple thin slice 3D acquisition is more sensitive for detecting small lesions on native slices than thick slice 2D acquisition. MIP reformation provides a morphological representation of the entire urinary tree, but can mask small masses.

Comparison of CT and MRI for T stage

The main indication for CT or MRI is not in detecting a tumour of the bladder but in its pre-treatment staging, mainly in looking for any perivesical spread for the stages above T2a (the case of tumours which have already been diagnosed and the histological type and location of which is known).

The overall reliability of MRI is greater than that of CT, which is explained partly by the better contrast resolution and partly by its ability to produce slices more adapted...
to the morphology of the bladder, allowing tumours of the
dome and base to be explored. In practice, it is only essen-
tial if extension to neighbouring organs is suspected, from
the pT3b stage.

Uro-CT is currently the most reliable technique for
exploring the upper urinary tract if renal function is
satisfactory.

**Lymph node extension**

**Morphological abnormality: increase in the short axis**

MRI and CT use the same main morphological analysis
criterion based on size to distinguish lymph nodes from
adenopathy. Adenopathy is diagnosed when additional tissue
has formed around the vascular axes.

Normal lymph nodes are commonly visible on a routine
basis. The main problem is to define the size beyond which a
lymph node is considered to be pathological. There has been
a great deal of work on this, with studies reporting figures
that vary because of the heterogeneity of the equipment and
the protocols. The standard value is defined as the value of
the shortest axis, taken perpendicular to the longest axis
in the transverse axial plane, or the minimal axial diameter
(or short diameter). The ‘mean’ consensus threshold value
beyond which a lymph node is considered to be pathologi-
cal is 10 mm for retroperitoneal lymph nodes and 8 mm for
pelvic cavity lymph nodes [12].

This size criterion does not differentiate an inflamma-
tory adenopathy from a metastatic adenopathy, in particular if
the lesion is small. False positives are however a great deal
rarer than false negatives due to metastatic invasion into
normal size lymph nodes or even micrometastases.

Diagnosis is very easy when formations are voluminous, if
there are many of them and in different stages of develop-
ment, or if they are grouped together forming a mass with
a polycyclic external contour. This mass can cause venous
compression or even thrombosis. The entire vascular axis
being pushed aside is rarer. When the mass is very large
it becomes difficult to differentiate between local tissue
recurrence, a lymphatic mass and invasion of the muscle.
The better contrast in MRI sequences produces this distinc-
tion.

**Signal abnormality**

Without injection, lymph nodes or adenopathies have clear
contours, usually uniform content, tissue density in CT, and
in MRI a weak to intermediate signal in T1 weighting and an
intermediate to high signal in a T2-weighted sequence, con-
trasting with the lack of signal from the vessels (except for

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**Figure 6.** MRI of a tumour of the dome of the bladder: a: T1-weighted GE following injection of gadolinium (30 seconds), axial plane. Tumour of the dome (black arrow) combined with a small suspect right external iliac lymph node; b: diffusion sequence: ADC map 2 cm below. Slowing of diffusion in the tumour of the dome with a clear hyposignal.

**Figure 7.** MRI of an extensive bladder tumour, pT4. T2-weighted SE, frontal plane. Large volume tumour mass of the dome involving the wall of the sigmoid.
flow phenomena). The contrast agent is taken up intensely and uniformly in CT and MRI. Modification of lymph node density (or of the signal) possibly indicates the node’s structure has been modified. A T1-weighted sequence is used to look for adenopathy. Uniform adenopathies have the same characteristics: neither the density value nor the signal intensity or uptake of the contrast agent is sufficiently discriminating to distinguish malignant adenopathy from inflammatory adenopathy or even from a common lymph node.

There are several possibilities when the content found is heterogeneous:

- sclerolipomatosis is commonplace and frequent in a pelvic or retroperitoneal lymph node. It is seen as more or less considerable central hypodensity or a hypersignal on a T1-weighted sequence, with an intermediate signal on a T2-weighted sequence. It does not become enhanced following injection. The signal is cancelled on the sequence with suppression of the fat signal;
- necrosis is shown by a more or less dense centre or fluid signal before injection, without enhancement after injection, but with more or less regular peripheral uptake of contrast agent. Its existence provides a positive predictive value of 100% for diagnosing metastatic adenopathies, but it is only present in adenopathies of at least 2 cm. It should be remembered that necrosis is also observed in tuberculous adenopathies;
- an excellent criterion for malignancy is the existence of modification of perilymphatic fat density due to infiltration, which indicates extracapsular spread and local carcinosis; it is however rarely observed.

The sensitivity and specificity values reported in the literature depend on technical parameters (field of view,
matrix size and slice thickness in CT and MRI, type of sequence and number of excitations in MRI, etc.), as well as on the choice of diameter threshold above which a lymph node is considered as pathological. Figures estimating the reliability of CT and MRI vary widely, with rates reported of 67 to 97% for CT and 77 to 98% for MRI. The negative predictive value of the two methods is still low, owing to micrometastases in normal size lymph nodes and sensitivity estimated at between 48 and 75%. Based on this criterion of size, the overall diagnostic performance of MRI is no better than that of CT and is estimated at 85%. Four per cent of normal volume lymph nodes are thought to be metastatic.

Diffusion imaging is currently being evaluated for lymph node extension and seems promising [13] (Fig. 5c).

**Monitoring following treatment**

In the post-therapeutic period, MRI is the examination of choice for detecting recurrence. This is frequent in male patients treated by radical cystoprostatectomy or in women treated by anterior pelvectomy, and estimated at 45% in some series [14]. Isolated pelvic masses appear in the operative bed, or more often associated with adenopathy. These masses invade the muscle wall and the remaining organs, more rarely the rectum. Uro-MRI is also useful for assessing ureterointestinal anastomosis. Lymph node related recurrence is primarily pelvic, and secondly retroperitoneal. Dynamic sequences with injection and the diffusion sequence are the most useful.

**Figure 9.** MRI of a bladder leiomyoma. T2-weighted SE, sagittal plane. The mass gives a uniform hyposignal, indicating its muscle nature. Note the lifting of the mucosa which is still normal, with an obtuse contact angle (white arrow).

**Figure 10.** MRI of a leiomyosarcoma of the bladder: a: T2-weighted SE, frontal plane. Heterogeneous hypersignal of the mass, which occupies the entire bladder, with complete infiltration of the wall; b: T1-weighted SE after injection. The lesion is partly necrosed.

**Figure 11.** MRI of vesical endometriosis. T2-weighted SE, axial plane. Clear hyposignal from the mass indicating its mainly fibrous nature. It is invading the bladder wall and gradually pushing back the mucosa, producing an extravesical process (black arrow). It is attracting the uterine cervix and the left ovary.
Clinical forms

Tumour that has developed in a bladder diverticulum

Slice imaging provides evidence of the nature of the tissue owing to early contrast agent uptake (Fig. 8). Locoregional staging is more precise with MRI than with CT.

The prognosis is very poor, with less than 10% survival at 5 years, because the muscle wall of the diverticulum is thin or inexistent, which encourages rapid progression of the tumour from a superficial stage to a stage T3b.

Urachal tumour

Urachal tumours make up approximately 0.2% of all bladder tumours. Although the urachus is usually covered by an epithelium, 90% of these cancers are adenocarcinomas, and are usually mucinous. They appear to arise from metaplasia of the epithelium of the urachus.

The tumour occurs in middle-aged men and is usually located in the juxtavesical part of the urachus. It grows rapidly. Extension to the bladder occurs early, via the anterior surface of the bladder, then affects the peritoneum after crossing the retropubic space and the abdominal wall. Asymptomatic and insidious at the onset, these adenocarcinomas are discovered in 80% of cases at a late stage when haematuria or a hard subpubic mass occurs, or when, rarely, a haemorrhagic umbilical fistula is found.

The topography is distinctively suggestive: a medial or paramedial mass in the prevesical space, with development predominantly outside the bladder upwards along the urachus.

In MRI, a T2-weighted SE sagittal sequence is best for analysing the topography and parietal extension.

The main differential diagnosis is an infected urachal cyst, which should be considered when the clinical symptoms include infection, the patient is young and there is no uptake of the contrast agent in CT. However, if the adenocarcinoma is already chronic, it appears like a more or less necrosed tumoral mass.

Non-epithelial tumours of the bladder

These tumours constitute about 3% of all bladder tumours (Figs. 9 and 10). They include very diverse histological types, both benign and malignant. Imaging methods, combined with a set of topographical and also clinical facts, may produce the diagnosis of a suspected non-epithelial tumour. Cystoscopy generally provides more information, but the definitive diagnosis is often made from histopathological analysis of the ablated material.

Leiomyoma of the bladder is rare (0.04–0.5% of all bladder tumours), but it is the most common non-epithelial bladder tumour making up almost this entire group.

The relationship of the mass to the bladder is best analysed in MRI in the sagittal and frontal planes. Leiomyoma is diagnosed when the mass is homogeneous, giving an intermediate to low signal in a T1-weighted sequence and a hyposignal in a T2-weighted sequence. More rarely, it is heterogeneous, with zones giving a high signal corresponding to mucoid or fibrohyaline degeneration (an appearance similar to a uterine leiomyoma). Following injection, it is variably enhanced.

Vesical endometriosis

The bladder is the most common site of endometriosis in the urinary tract, followed by the ureters and kidneys (Fig. 11). It is usually a question of simple infiltration of the serosa or of small disseminated nodules, more rarely a vesical mass. It favours a location on the dome or posterior surface of the bladder, and is responsible for haematuria, cyclical with menstruation, and/or dysuria. It occurs in women during the period of reproductive activity.

Cystoscopy shows submucosal lesions, similar to the chocolate or bluish cysts described around the ovary in coelioscopy, located in the vesicouterine pouch.

In MRI, this mass will have an intermediate to low intensity signal in T1 weighting, often with small areas of hypersignal due to recent haemorrhagic foci. Its size varies. In a T2-weighted sequence, the signal is mainly of low intensity because of the fibrous tissue, with or without small areas of hypersignal indicating recent haemorrhagic phenomena. It displaces the epithelium, sometimes the seat of an inflammatory reaction seen as a hypersignal. Its external contours are irregular, it fixes on and invades the anterior part of the uterine body, and its morphology is pathognomonic. It is almost always associated with other sites of pelvic endometriosis.

TAKE-HOME MESSAGES

- Dynamic sequences of MRI enable better analysis of the bladder wall than CT.
- MRI is superior to CT for locoregional staging; it is indicated in pre-treatment staging of large tumours.
- MRI is superior to CT for staging an atypical lesion and in some cases (endometriosis, leiomyoma) provides a definitive diagnosis.
- Diffusion imaging is particularly sensitive for tumour examination and staging.
- The performance of CT and MRI is identical for investigating lymph nodes.

Clinical case

This 36-year-old female patient complained of dysuria that she had had for about 1 year. She presented with an episode of bacterial cystitis 2 months previously, which was treated with oral antibiotic therapy. She had no medical or obstetric history (one normal pregnancy 10 years previously).

The clinical and pelvic examinations were normal. The only physiological abnormality was the existence, found using a test strip, of microscopic haematuria. Cystoscopy, performed in another centre, only showed lifting of the anterior bladder wall. A subpubic (Fig. 12a) and endovaginal (Fig. 12b) ultrasound examination was undertaken.
Figure 12. Subpubic (a) and endovaginal (b) ultrasound examination.
Figure 13. a–g: MRI of the pelvis.
MRI of the pelvis was performed (Fig. 13a–g).

**Questions**

1. What additional ultrasound investigation would you suggest?
2. Would you have conducted this examination in the first place?
3. Give details of the different MRI sequences.
4. What might have improved the iconographic quality?
5. How many lesions can you identify? What is their topography?
6. What diagnostic hypotheses can you suggest and which one would you choose?

**Answers**

1. Doppler examination (no vascularisation was detected).
2. Yes.
3. a and b: T2 FSE; c: diffusion; d: ADC mapping; e: T1 FAT-SAT; f: early phase T1 Gd; g: late phase T1Gd.
4. Injection of an antispasmodic such as Glucagen® to reduce intestinal peristalsis, the origin of artefacts (in addition to respiratory movements).
5. Two: a bladder wall mass and a common leiomyoma of the uterus.
6. There are two main hypotheses:
   - endometriosis, but the signal is intermediate on T2, homogeneous, with no microcyst or continuity with the uterus; the location is unusual and there is no clinical recrudescence during menstruation; however the lesion is typically submucosal, raising the echogenic border of the epithelium;
   - a tumour of the bladder wall:
     - a phaeochromocytoma and a haemangioma are eliminated because the signal does not concur,
     - a leiomyoma of the bladder wall can be considered in view of the low signal, the reduction in diffusion indicating a compact lesion with little intercellular space, the homogeneous nature of the mass with poor uptake of contrast agent; there may be a fibrous component given the late uptake of contrast agent.

Final diagnosis: a rare benign neurofibroma of the bladder wall (diagnosis by partial cystectomy).

These fibromas and neurofibromas arise from the vesico-prostatic and vesicovaginal nerve plexuses close to the trigone, the ureters and the urethra. They are encountered almost entirely in Von Recklinghausen’s fibromatosis. The clinical symptom is more often obstruction than haematuria. Sarcomatous degeneration is possible. In CT, it is seen as a not very dense uniform mass, becoming enhanced following injection of the contrast agent. In MRI, the signal is intermediate to low in a T1-weighted sequence, but higher than the signal from muscle. In T2-weighted SE, its signal is intermediate to high and slightly higher than that from fat. It is intensely enhanced on injection.

A ganglioneuroma is exceptional, readily encountered in Von Recklinghausen’s disease. It is a benign, slow growing tumour, composed of nerve fibres and mature ganglion cells. It affects children and adolescents. It locates on the posterior wall or the base and therefore is readily revealed through urinary obstruction. Tumourous calcifications are present in half of cases, whereas they are very rare in neurofibromas. Differential histological diagnosis can be difficult.

**Disclosure of interest**

The authors declare that they have no conflicts of interest concerning this article.

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