

# Schwannoma of the Kidney with Magnetic Resonance Images of Non-homogenous Renal Mass – a Case Presentation

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**Abstract:** Schwannomas are rare tumours that originate from the neural sheath and are usually located in the head and neck, extremities, and posterior mediastinum. Although 3% of schwannomas occur in the retroperitoneum, involvement of visceral organs is extremely uncommon. Schwannomas of the kidney are rare, with only a few reported cases. A 55-year-old woman was referred to our hospital with an abdominal sonography showing a spherical lesion in the upper pole of the left kidney that did not have the characteristics of a cortical cyst. The ultrasound had been recommended from her family doctor, due to a non specific pain in the hypogastrium in the previous 10 days. The final pathologic diagnosis was intrarenal benign schwannoma. Schwannomas are rare renal tumours with usually benign behaviour. Due to nonspecific symptoms and limited radiologic features for the diagnosis and assessment of the benign or malignant character of the tumour, the therapeutic approach is similar to other renal tumours. The definitive diagnosis is achieved with the help of immunohistochemistry.

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## Introduction

Neurinoma is a benign neoplasm of the nerve sheath, which consists of Schwann cells. These cells are normally responsible for the production of myelin that forms the nerve sheath, which in turn surrounds the peripheral nerves.

In 1908, Verocay reported the first case of a nerve sheath tumour and called it neurinoma, while in 1932, Masson described a tumour that originated in Schwann cells and assigned the term “schwannoma”. Stout in 1953 proposed the nomenclature, neurilemoma, as a compromise between these two terms. Subsequently it was also described as solid tumour of the nerve sheath and perineural fibroblastic tumour, until the World Health Organization characterized it officially schwannoma, according to the classification of neuroepithelial tumours.

Schwannomas can appear occasionally or as a manifestation of different hereditary syndromes like neurofibromatosis type 1 (von Recklinghausen disease) and type 2 and schwannomatosis (Handziç-Cuk et al., 1997; Goh et al., 2006).

The majority of schwannomas arise as solitary masses of either superficial or deep soft tissues, often in association with a nerve. Favored sites include cranial and spinal nerve roots, cervical nerves and nerves in the flexor compartments of the forearm and lower leg.

Although schwannomas arise not uncommonly in the retroperitoneum, usually in association with the lumbosacral nervous plexus, involvement of retroperitoneal parenchymal organs is very uncommon. In particular, schwannomas of renal origin are very rare and only 20 cases, including our patient, have been reported in English literature.

We report a case of a renal schwannoma which was found incidentally after an atypical abdominal pain evaluation and it was confirmed after pathological examination following the surgical removal of the affected kidney.

## Case presentation

A 55-year-old woman was referred to our hospital for further investigation of a solid lesion in the upper pole of the left kidney, incidentally found in an abdominal ultrasound. The ultrasound was recommended by her family doctor, because of an atypical pain in the hypogastrium.

Physical examination was unremarkable. No signs of neurofibromatosis type 1 (café-au-lait maculae, freckling in the axillary or inguinal regions, Lisch nodules) were identified. The laboratory studies, including complete blood count and blood chemistries were within normal values. Microscopic hematuria was revealed in urine analysis and urinary cytology was negative for malignancy.

A computed tomography (CT) was recommended. It revealed a solid and non-homogeneous mass at the upper pole of the left kidney.

Magnetic resonance imaging (MRI) pyelography was then performed in 3 sequences, before and after the administration of paramagnetic material (Figures 1–3). It revealed a 2.5×2.8×4 cm solid, non homogenous lesion in the

upper pole of the left kidney, covered by a fibrous capsule with elements of low density in the central areas. The mass protruded into the renal sinus, compressing the upper caliceal system. There was gadolinium enhancement of the tumour after intravenous administration.

The patient underwent a left radical nephrectomy and adrenalectomy. She got out of the hospital in the 4<sup>th</sup> postoperative day with no postoperative complications.

Gross examination of the excised kidney revealed a 6.5×3.2×2.3 cm mass, which was extended into the renal hilum and was surrounded by a whitish fibrous capsule with lobular external surface. Its cut surface appeared solid, lobular, yellowish and elastic in composition.

Immuno-histochemical stains were performed for the following markers: keratin AE1 and AE3, vimentin, markers of muscular differentiation (SMA, actin, desmin), markers of neural differentiation (S-100 protein, neurofilament), CD68, HMB45, CD10, CD34, c-kit  $\kappa\alpha\iota$  Ki67. The majority of tumour cells showed intense positivity with both S-100 protein and vimentin. In a percentage of <5% there was positivity for neurofilament. The positivity of cell proliferation marker Ki67 ranged from 0 to 5%. Granular cytoplasmic immuno-staining was reported for CD68. The study was negative for SMA, actin, desmin, AE1, AE3, CD10, CD34, c-kit and HMB45.

Based on the above findings, a benign schwannoma, consisted mainly of regions with Antoni A pattern, was diagnosed (Figure 4).

A 6-month follow-up CT scan revealed no pathological findings.

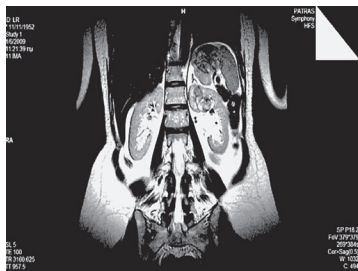


Figure 1 – Magnetic resonance imaging ( $T_1$ -weighted image).

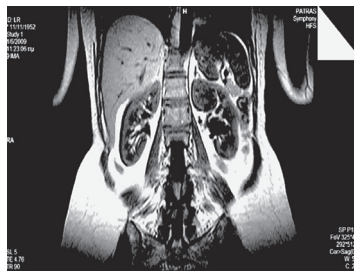


Figure 2 – Magnetic resonance imaging ( $T_2$ -weighted image).



Figure 3 – Gadolinium-enhanced magnetic resonance imaging scan.

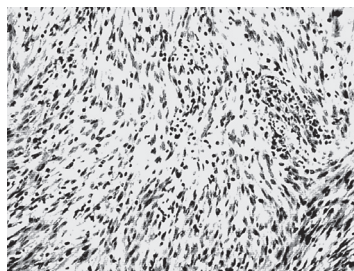


Figure 4 – Hypercellular Antoni type-A tissue (hematoxylin/eosin stain  $\times 100$ ).

## Discussion

Schwannomas are neurogenic tumours that arise from Schwann cells of the nerve sheath. They are common in large nerves of the peripheral and central nervous systems (acoustic neuromas), but rarely involve the kidney. They usually appear in the subcutaneous nerves of head and neck.

Typically, they appear as spherical, solid and well-circumscribed encapsulated lesions. Related to the tumour we can find areas of haemorrhage, cystic degenerations and calcifications. In this case we have the so-called ancient schwannomas (Bezzi et al., 1996). Ancient schwannomas are not considered as a distinct subtype of schwannoma, but rather long-standing tumours with degenerative nuclear and architectural changes. It seems that they do not differ clinically from conventional schwannomas.

Microscopically schwannomas are distinguished by the presence of tissues with high or low cell quantity, called Antoni A and Antoni B respectively (Ohigashi et al., 1999). Antoni A areas consist of round to oval nuclei in a hyalinised stroma, with the presence of Verocay bodies. They are found usually in small tumours. Antoni B pattern is characterized by areas of low cellular density and myxoid stroma. The tumour cells have strange nuclei and are separated by abundant oedematous fluid, which may form cystic spaces. The Antoni B areas are common in the ancient schwannomas (Lin et al., 1997).

Schwannomas can be divided in benign epithelioid, benign glandular, melanotic (Carney's syndrome and form psammoma bodies) and plexiform which are commonly found in neurofibromatosis. The most usual type is the acinar schwannoma which is exclusively composed of Antoni A areas and lacks Verocay bodies (Carney, 1990; Brooks and Draffen, 1992; Oda et al., 1994; Kindblom et al., 1998).

Immunohistochemistry is typical positive for S-100 protein. Tumour cells can be also reactive for calcineurin, NSE (neuron specific enolase), basal lamina components (laminin, type IV collagen and merosin), vimentin, lipocortin-1 and the receptor of NGF (nerve growth factor).

The vast majority of schwannomas are benign. The malignant degeneration of neurinomas is extremely rare, but if present the behaviour is similar to that of high grade sarcomas. They commonly appear with local relapse and rapidly give distant metastases. However, malignant schwannomas lack specific clinical characteristics. The malignant degeneration is diagnosed histologically by the number of mitoses, the nuclear pleomorphism and the infiltration of blood vessels.

Schwannomas of the kidney are usually found in middle aged patients. The male-to-female ratio is 1:2. The main nerves of the kidney consist of sympathetic and parasympathetic fibers that accompany the renal artery entering the renal hilum. This could explain the more frequent location of schwannomas at the renal hilum. However, the tumour can arise from the renal capsule or cortex with similar ratio in upper and lower pole, left and right. Their size is rarely more than 5 cm, but they

can be apparently big if their primary location is in the retroperitoneum. There is no correlation between the size of the tumour and the potential of malignancy.

The histological type of schwannoma of the kidney may be similar to that seen in other organs including the range of different morphologic patterns described above, even those of the ancient schwannomas.

Differential diagnostic considerations include low-grade malignant peripheral nerve sheath tumour, angiomyolipoma (positive staining for HMB45), tumour with sarcomatoid transformation, synovial sarcoma of the spinal column, solitary fibrous tumour, leiomyoma, low-grade leiomyosarcoma, rhabdomyosarcoma and angiosarcoma (positive CD34). The distinctive clinical, histologic and immunohistochemical findings usually allow a definitive diagnosis.

S-100 protein has been studied in the spectrum of epithelial tumours of the kidney and has been proposed to be a useful tool in the differential diagnosis among renal cell neoplasms, particularly in the differential diagnosis of chromophobe renal cell carcinoma vs. renal oncocytoma. S-100 protein is expressed in oncocytoma, papillary renal cell carcinoma and clear cell renal cell carcinoma. However, they are negative in chromophobe renal cell carcinoma (Martignoni et al., 2007). Renal schwannomas are always positive for S-100 protein and this is the case of our patient.

The presence of nuclear atypia or diffuse hypercellularity in a neurinoma may lead to an erroneous diagnosis of malignancy. It is critical to distinguish neurinoma of atypical or cellular type from malignant peripheral nerve sheath tumour. Unlike malignant peripheral nerve sheath tumours, neurinomas with degenerative nuclear atypia lack mitotic figures. Cellular neurinoma is distinguished from malignant peripheral nerve sheath tumour by the smaller cell size, infrequent mitotic figures and lack of significant cytologic atypia, nuclear pleomorphism and necrosis.

Renal schwannoma is difficult to diagnose preoperatively from the clinical symptoms and radiographic findings, with the diagnosis often made after pathologic examination. The MRI findings may give some clues, including isointensity on T<sub>1</sub>-weighted images and a high signal intensity on T<sub>2</sub>-weighted images. Gadolinium-enhanced T<sub>1</sub>-weighted images will show a strong and homogeneous enhancement in the solid part of the tumour (Tsurusaki et al., 2001). It has been reported that PET (positron emission tomography) scan can help in the differential diagnosis between benign and malignant neurogenic tumours (Ahmed et al., 2001; Hirai et al., 2001). However, these findings are just indications for the diagnosis of schwannoma.

Fine-needle aspiration or renal biopsy would be the ideal preoperative tool to differentiate benign and malignant renal masses and consequently prevent unnecessary nephrectomies. However renal biopsy is of limited value in the clinical practice mainly due to the danger of tumour spread and false negative results, since there is the chance for benign and malignant lesions coexistence (i.e. renal oncocytoma and chromophobe renal cell carcinoma). For the above reasons, the

main indications for needle aspiration or biopsy of a renal mass are when a renal abscess or infected cyst should be differentiated from renal tumour and when RCC (renal cell carcinoma) must be differentiated from metastatic malignant mass or renal lymphoma (Herts and Remer, 2000).

Partial or radical nephrectomy is the treatment of choice, as there are no reliable preoperative diagnostic methods. Open or laparoscopic methods are equally effective approaches. For small renal masses, a partial nephrectomy for the preservation of the healthy renal parenchyma is the standard of treatment (Ljungberg et al., 2010). This is not the case of our patient, since the total removal of the affected kidney and adrenal gland was decided by the consultant surgeon because of the upper pole location of the mass and the increased risk of adrenal invasion. Adjuvant chemotherapy for the malignant schwannomas did not change prognosis and, therefore, has not been added in the therapeutic plan (Pantuck et al., 1996).

## Conclusion

The vast majority of schwannomas are benign. Renal schwannoma is difficult to diagnose preoperatively from the clinical symptoms and radiographic findings, with the diagnosis often made after pathologic examination. Usually they appear as homogenous solid masses in CT and MRI imaging. The histological type of schwannoma of the kidney may be similar to that seen in other organs. The definitive diagnosis is achieved with the help of immunohistochemistry. Immunohistochemistry is typically positive for S-100 protein. Partial or radical nephrectomy is the treatment of choice since there are no reliable preoperative diagnostic methods.

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