Case Report

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Benign adrenal and suprarenal retroperitoneal schwannomas can mimic aggressive adrenal malignancies: case report and review of the literature

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SUMMARY The suprarenal retroperitoneum and adrenal gland is a rare site of origin for benign schwannomas which frequently present as larger and more aggressive lesions than schwannomas identified elsewhere. These tumors are often surgically excised. We present a case of an 81-year-old asymptomatic man presenting with an incidental 10 cm left suprarenal retroperitoneal mass identified on CT. The mass was indiscernible from the adrenal gland, demonstrating heterogeneous enhancement with a centrally cystic/necrotic core, and punctate calcifications. Subsequent core needle biopsy demonstrated a benign adrenal schwannoma. The lesion has been managed conservatively with imaging follow up and without complication. DISCUSSION: Our review of the literature identifies 121 reported in vivo benign adrenal and suprarenal schwannomas published to date with imaging features available for 90 cases (74%). All cases were encapsulated with the average size measuring over 6.5 cm. Fifteen percent (13/84) of reported lesions measured over 10 cm at presentation. Punctate calcification was present in 50% (26/52) of reporting cases. Nearly 50% (40/86) of cases demonstrate cystic/necrotic appearances on imaging. Despite aggressive appearances, our case demonstrates that biopsy and surveillance may represent a reasonable alternative to surgery in suboptimal surgical candidates.

Keywords adrenal, schwannoma, retroperitoneal, suprarenal, malignancy, nerve

1. Introduction

Non-malignant masses account for around 20% of primary retroperioneal (RP) tumors with benign schwannomas representing a subset of only 5% of primary RP tumors (*1*). Adrenal and suprarenal RP schwannomas represent an even rarer origin subset. Schwannomas presenting in this location tend to be larger and more heterogeneous at time of presentation than schwannomas presenting elsewhere in the body (*2-5*). Surgical resection is often the treatment of choice for these tumors (*2*).

2. Case Report

An 81-year-old otherwise asymptomatic man presented *via* ambulance to our tertiary care hospital after falling from a ladder. He remained hemodynamically stable throughout his presentation. On account of his mechanism and multifocal pain, he underwent a trauma scan of his chest, abdomen, and pelvis. An incidental 8 × 5 × 10 cm (anteroposterior × transverse × craniocaudal) left suprarenal lesion indiscernible from the left adrenal gland was identified (Figure 1). The lesion demonstrated peripheral arterial and portal venous enhancement with a centrally cystic/necrotic core. There were punctate calcifications scattered throughout. The right adrenal gland was normal. No regional lymph node enlargement was present. No other primary or metastatic lesions were seen elsewhere throughout the body.

A 24-hour urine metanephrine study was negative for PCC. Bloodwork was otherwise non-contributory. A subsequent ultrasound-guided core needle biopsy was performed. Histopathology demonstrated a tumor composed of spindle cells with minimal atypia and/or mitotic activity (Figure 2). The spindle cells were dense, wavy, and with tapered ends. Hyalinized blood vessels were readily present. Subsequent immunohistochemical analysis demonstrated a diffusely positive S100 stain while markers for other RP tumors including MART1, HMB45, DOG1, CD117, MDM2, actin, desmin,

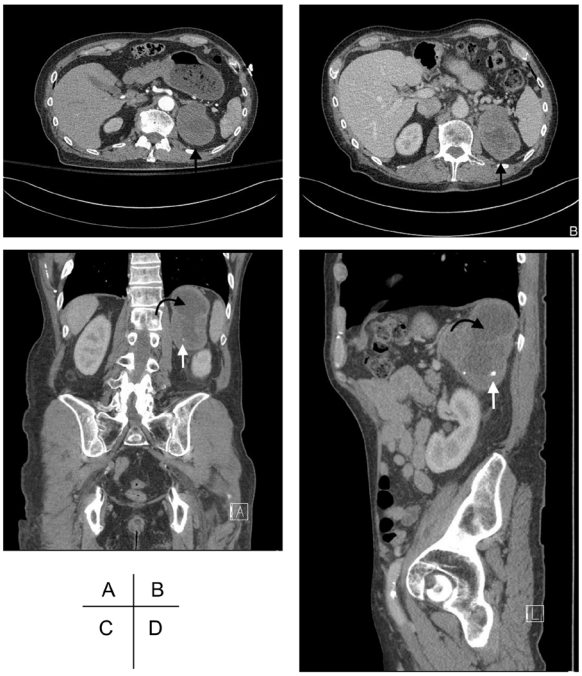

Figure 1. The 81-year-old male with left suprarenal schwannoma. Findings: CT images demonstrate a large heterogeneously enhancing aggressive appearing left suprarenal mass (arrow) with central necrosis (curved arrow) and punctate calcifications (white arrow). Technique: Arterial axial **(A)** CT imaging of the abdomen and portal venous axial **(B)**, coronal **(C)**, and sagittal **(D)** CT imaging of the abdomen and pelvis, variable (40-55) mAs, 120 kV, 2 mm slice thickness, 83 ml Omnipaque 350 IV contrast.

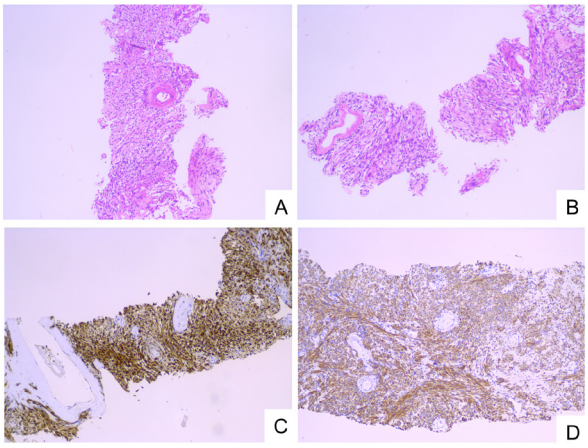

Figure 2. The 81-year-old male with left suprarenal schwannoma. Findings: Core needle biopsy demonstrating a tumor composed of dense wavy spindle cells with minimal atypia or mitotic activity **(A, B)**. Immunohistochemical analysis demonstrates diffusely positive S100 **(C)** and GFAP **(D)** stains. Pathology was consistent with a benign schwannoma of cellular subtype.

caldesmon, AE1/AE3, CD34 and STAT6 were all negative. Pathological features were consistent with a benign adrenal schwannoma. A glial fibrillary acidic protein (GFAP) stain was performed for the purposes of this report and was positive.

Following consultation with urology, the lesion was managed conservatively with observation. The patient has remained free of symptoms relating to the tumor. As of a six-month follow-up CT scan, no change in size or appearance of the lesion has been documented and the patient remained otherwise clinically asymptomatic.

3. Discussion

3.1. Literature review

An English language search of MEDLINE and Google Scholar from inception to July 24, 2019 with search terms including "schwannoma" AND ("retroperitoneal" OR "adrenal") was performed to evaluate for in vivo cases of adrenal or suprarenal RP schwhannomas. A total of 121 reported cases were identified with 90 cases documenting imaging characteristics (Table 1) (*2-44*). The rarity of these reports is demonstrated by Li *et al.* who identified only 19 adrenal schwannomas in a series of almost 4,000 adrenal lesions (26). Patients in our literature review ranged in age between 14-81, with our report representing the oldest known patient described to date. As seen in our study, male gender accounts for less than half of the identified reports.

3.2. Clinical and imaging findings

Clinical and imaging features are summarized in Table 2. Similar to more than half of reported cases, the RP schwannoma in our patient was identified incidentally when investigating for another purpose. Most patients who did present with symptoms complained of non-specific symptoms including flank and abdominal pain and rarely abdominal distention. It is possible that several of these patients' tumors were also identified incidentally with the symptoms attributable to an alternative otherwise undetected cause. This would correspond with a study by Zhou *et al*. assessing pathologic features of 31 patients with adrenal schwannomas identifying 84% of patients as presenting incidentally (Table 3) (*44*). The high frequency of incidental and often delayed presentation likely accounts for why the average size of suprarenal RP schwannomas is larger than the average size of schwannomas identified elsewhere. In our review, the average size of identified tumors was over 6.5 cm with 15% (13/84) of reporting cases demonstrating tumors at least 10 cm in size.

All reported cases including ours demonstrated well encapsulated margins typical of a benign schwannoma. Punctate calcifications described in our case were present in 50% (26/52) of reporting imaging cases. The number of cases with calcifications may even be under-reported as several studies evaluated lesions with only ultrasound and/or MRI features but lacking spatial resolution necessary to identify small calcifications. This would correspond with Li *et al.*'s study where 84% (16/19) of their patients had some calcification

Table 1. Clinical and imaging characteristics of suprarenal retroperitoneal schwannomas

Author, Year (*Ref.*)	Age/ Gender	Presentation	Size (cm)	Margin	Heterogeneity	Solid/ Cystic	Calcification	Suspected Diagnosis	Diagnosis
Abdessater 2018 (*2*)	50/F	Asymptomatic	10	En	Heg	Cystic	Present	ACC	Surgery
Adas 2013 (*3*)	32/F	Flank Pain	10	En	Heg	Cystic	NR	ACC	Surgery
Babaya 2017 (*4*)	69/M	Abdominal Pain	4	En	Hog	Solid	None	NAA	Surgery
Bakhshi 2011 (*5*)	34/F	Asymptomatic	9	En	Heg	Cystic	NR	NAA	Surgery
Bedard 1986 (*6*)	63/F	Abdominal Pain	6	En	Hog	Solid	NR	NC	Surgery
Damodaran 2015, Case 1 (*7*)	36/F	Flank Pain	9	En	Heg	Cystic	NR	ACC	Surgery
Damodaran 2015, Case 2 (*7*)	50/F	Flank Pain	NR	En	Hog	NR	NR	NAA	Surgery
Fernandez 2016 (*8*)	56/F	Asymptomatic	10	En	Heg	Cystic	NR	ACC	Surgery
Fu 2015 (*9*)	71/M	Asymptomatic	15	En	Heg	Cystic	NR	NC	Surgery
Garg 2007 (*10*)	50/F	Abdominal Pain	9	En	Hog	Solid	NR	ACC	Surgery
Gazula 2007 (*11*)	42/M	Flank Pain	12	En	Heg	Cystic	NR	ACC	Surgery
Goh 2006, Case 1 (*12*)	46/M	Asymptomatic	NR	En	Heg	Cystic	NR	ACC	Surgery
Goh 2006, Case 2 (*12*)	28/F	Asymptomatic	NR	En	Heg	Cystic	Present	ACC	Surgery
Goh 2006, Case 3 (*12*)	49/M	Asymptomatic	NR	En	Heg	Cystic	None	ACC	Surgery
Goh 2006, Case 4 (*12*)	58/M	Flank Pain	NR	En	Heg	Cystic	None	ACC	Surgery
Grasso 2015 (*13*)	45/M	Asymptomatic	12	En	Heg	Cystic	None	ACC	Surgery
Hsiao 2008 (*14*)	49/M	Asymptomatic	5	En	Hog	Solid	None	NAA	Surgery
Igawa 1998 (*15*)	45/M	Abdominal Pain	6.5	En	Hog	Solid	NR	ACC	Surgery
Ikemoto 2002 (*16*)	62/F	Abdominal Pain	12	En	Hog	Solid	None	NC	Surgery
Inokuchi 2006 (*17*)	35/F	Asymptomatic	7	En	Heg	Cystic	Present	ACC	Surgery
Jakowski 2008 (*18*)	51/F	Asymptomatic	5.5	NR	NR	NR	NR	NC	Surgery
Jeshtadi 2014 (*19*)	55/F	Flank Pain	6.5	En	Hog	Solid	NR	NC	Surgery
Khurram 2015 (*20*)	64/M	Asymptomatic	2	En	Hog	Solid	None	NAA	Surgery
Kleiman 2011 (*21*)	31/F	Asymptomatic	4.5	En	Heg	Solid	NR	NAA	Surgery
Konstantinos 2012 (*22*)	71/F	Flank Pain	8	En	Heg	Cystic	Present	ACC	Surgery
Korets 2007 (*23*)	70/M	Hematuria	3	En	Heg	Cystic	None	NC	Surgery
Kostakopoulos 1991 (*24*)	38/F	Abdominal Pain	18	En	Heg	Cystic	None	ACC	Surgery
Lau 2006, Case 1 (*25*)	73/M	Abdominal Pain	9	NR	NR	NR	NR	NC	Surgery
Lau 2006, Case 2 (*25*)	26/F	Abdominal Pain	10	NR	NR	NR	NR	NC	Surgery
Li 2015, Case 1 (*26*)	38/F	NR	7	En	Hog	Solid	Present	NAA	Surgery
Li 2015, Case 2 (*26*)	31/F	NR	4	En	Hog	Solid	Present	ACC	Surgery
Li 2015, Case 3 (*26*)	50/F	NR	4	En	Hog	Solid	Present	ACC	Surgery
Li 2015, Case 4 (*26*)	55/F	NR	6	En	Hog	Solid	Present	PCC	Surgery
Li 2015, Case 5 (*26*)	50/F	NR	9	En	Heg	Cystic	None	Schwannoma	Surgery
Li 2015, Case 6 (*26*)	23/M	NR	6	En	Hog	Solid	Present	PCC	Surgery
Li 2015, Case 7 (*26*)	54/F	NR	7	En	Hog	Solid	None	PCC	Surgery
Li 2015, Case 8 (*26*)	66/F	NR	6.5	En	Hog	Solid	Present	PCC	Surgery
Li 2015, Case 9 (*26*)	56/F	NR	5.5	En	Hog	Solid	Present	NAA	Surgery
Li 2015, Case 10 (*26*)	61/M	NR	6	En	Hog	Solid	Present	Schwannoma	Surgery
Li 2015, Case 11 (*26*)	65/F	NR	8	En	Hog	Solid	None	Teratoma	Surgery
Li 2015, Case 12 (*26*)	34/M	NR	5	En	Heg	Cystic	Present	ACC	Surgery
Li 2015, Case 13 (*26*)	64/F	NR	6	En	Hog	Solid	Present	NAA	Surgery
Li 2015, Case 14 (*26*)	44/F	NR	6	En	Hog	Solid	Present	Schwannoma	Surgery
Li 2015, Case 15 (*26*)	46/F	NR	6.5	En	Hog	Solid	Present	PCC	Surgery
Li 2015, Case 16 (*26*)	50/F	NR	7	En	Heg	Cystic	Present	ACC	Surgery
Li 2015, Case 17 (*26*)	40/F	NR	5	En	Hog	Solid	Present	NAA	Surgery
Li 2015, Case 18 (*26*)	32/F	NR	6	En	Hog	Solid	Present	Schwannoma	Surgery
Li 2015, Case 19 (*26*)	58/F	NR	7	En	Hog	Solid	Present	ACC	Surgery
Liu 2012, Case 1 (*27*)	14/M	Abdominal Pain	7	En	Hog	Solid	None	NAA	Surgery
Liu 2012, Case 2 (*27*)	51/M	Abdominal Distension	4	En	Heg	Cystic	NR	ACC	Surgery
Liu 2012, Case 3 (*27*)	57/M	Flank Pain	7	En	Hog	Solid	NR	NAA	Surgery
Oberoi 2019 (*28*)	50/F	Asymptomatic	12	En	Heg	Solid	NR	ACC	Surgery
Onoda 2008 (*29*)	62/M	Asymptomatic	4	En	Hog	Solid	NR	NAA	Surgery
Pittasch 2000 (*30*)	56/F	Abdominal Pain	12	En	Hog	Solid	NR	ACC	Surgery
Richter 2011 (*31*)	30/F	Abdominal Pain	14	En	Heg	Solid	NR	NAA	Surgery
Said 2017 (*32*)	64/M	Asymptomatic	9	En	Heg	Cystic	Present	ACC	Surgery
Shabana 2019 (*33*)	32/M	Flank Pain	5	En	Heg	Solid	NR	NAA	Surgery
Suzuki 2007 (*34*)	33/M	Asymptomatic	8	En	Hog	Solid	None	NC	Surgery
Tang 2018, Case 1 (*35*)	47/F	Asymptomatic	5.5	En	Heg	Cystic	None	NC	Surgery
Tang 2018, Case 2 (*35*)	65/F	Asymptomatic	5	En	Heg	Cystic	None	NC	Surgery
Tang 2018, Case 3 (*35*)	64/F	Asymptomatic	4	En	Heg	Cystic	None	NC	Surgery
Tang 2018, Case 4 (*35*)	50/F	Abdominal Pain	8	En	Heg	Cystic	None	NC	Surgery
Tang 2018, Case 5 (*35*)	31/F	Asymptomatic	3.5	En	Hog	Solid	None	NC	Surgery

NR: Not Reported; En: Encapsulated; Heg: Heterogenous; Hog: Homogenous; NC: not clear; ACC: adrenal cortical carcinoma; NAA: nonfunctional adrenal adenoma; PCC: Pheochromocytoma.

Table 1. Clinical and imaging characteristics of suprarenal retroperitoneal schwannomas (continued)

Author, Year (*Ref.*)	Age/ Gender	Presentation	Size (cm)	Margin	Heterogeneity	Solid/ Cystic	Calcification	Suspected Diagnosis	Diagnosis
Tang 2018, Case 6 (*35*)	30/M	Asymptomatic	6.5	En	Heg	Cystic	None	NC	Surgery
Tang 2018, Case 7 (*35*)	49/F	Asymptomatic	3.5	En	Heg	Cystic	None	NC	Surgery
Tang 2018, Case 8 (*35*)	34/F	Asymptomatic	3	En	Hog	Solid	None	NC	Surgery
Tang 2018, Case 9 (*35*)	35/M	Asymptomatic	4	En	Heg	Cystic	Present	NC	Surgery
Tang 2018, Case 10 (*35*)	58/F	Abdominal Pain	8	En	Heg	Cystic	None	NC	Surgery
Tang 2018, Case 11 (*35*)	56/F	Abdominal Pain	9	En	Heg	Cystic	None	NC	Surgery
Tang 2018, Case 12 (*35*)	28/M	Asymptomatic	2.5	En	Heg	Cystic	None	NC	Surgery
Tang 2018, Case 13 (*35*)	39/M	NR	5.5	En	Heg	Cystic	NR	NC	Surgery
Tang 2018, Case 14 (*35*)	35/F	NR	4.5	En	Heg	Cystic	NR	NC	Surgery
Tang 2018, Case 15 (*35*)	48/F	NR	3.5	En	Heg	Cystic	NR	NC	Surgery
Tang 2018, Case 16 (*35*)	46/F	NR	5.5	En	Heg	Cystic	NR	NC	Surgery
Tang 2018, Case 17 (*35*)	31/F	NR	3	En	Hog	Solid	NR	NC	Surgery
Tarcoveanu 2009 (*36*)	55/NR	Asymptomatic	4	En	Hog	Solid	NR	Metastasis	Surgery
Tezel 2005 (*37*)	46/F	Asymptomatic	8	En	NR	Solid	NR	ACC	Surgery
Thomas 2018 (*38*)	56/F	Abdominal Pain	5	En	Heg	Cystic	None	ACC	Surgery
Tommaselli 1996 (*39*)	44/M	Asymptomatic	4	En	Heg	Cystic	Present	ACC	Surgery
Wilson (Present Case)	81/M	Asymptomatic	10	En	Heg	Cystic	Present	ACC	Biospy
Xiao 2011, Case 1 (*40*)	38/F	Asymptomatic	3.5	En	Hog	Solid	NR	NAA	Surgery
Xiao 2011, Case 2 (*40*)	46/F	Asymptomatic	4.5	En	Hog	Solid	NR	NAA	Surgery
Xiao 2011, Case 3 (*40*)	39/M	Flank Pain	3.5	En	Hog	Solid	NR	NAA	Surgery
Xiao 2011, Case 4 (*40*)	43/F	Abdominal Pain	5	En	Hog	Solid	NR	NAA	Surgery
Xiao 2011, Case 5 (*40*)	47/M	Asymptomatic	6	En	Heg	Cystic	Present	PCC	Surgery
Xiao 2011, Case 6 (*40*)	30/F	Asymptomatic	3	En	Hog	Solid	NR	NAA	Surgery
Yang 2009 (*41*)	30/F	Flank Pain	NR	En	Heg	Cystic	NR	NC	Surgery
Yonou 1999 (*42*)	67/F	Abdominal Pain	6	En	Heg	Cystic	Present	ACC	Surgery
Yun 2016, Case 1 (*43*)	39/F	NR	1.4	En	Hog	Solid	NR	NC	Surgery
Yun 2016, Case 2 (*43*)	45/F	NR	4	En	Hog	Solid	NR	NC	Surgery

NR: Not Reported; En: Encapsulated; Heg: Heterogenous; Hog: Homogenous; NC: not clear; ACC: adrenal cortical carcinoma; NAA: nonfunctional adrenal adenoma; PCC: Pheochromocytoma.

Table 2. Summary table of retroperitoneal adrenal and suprarenal schwannomas based on a review of 121 reported cases

Etiology	• Tumors of Schwann cell origin.
Incidence	• All RP schwannomas represent 5% of RP tumors. • Suprarenal RP schwannomas are a rare subtype of RP schwannomas.
Gender Ratio	• ~1.8F:1M.
Age	• Range between 14-81.
Risk Factors	• Most are sporadic. There is an association with NF2.
Treatment	• Typically surgical resection. • Surveillance following pathology confirmation in suboptimal surgical candidates may represent a viable alternative.
Prognosis	• Slow growing benign lesions.
Imaging Features	• Often present larger and more aggressive appearing than schwannomas elsewhere. • Encapsulated. • Typically large (average size 6.5 cm; 15% >10 cm at presentation). • 45-50% demonstrate centrally cystic/necrotic cores. • ~ 50% demonstrate punctate calcifications .

RP: retroperitoneal; NF2: neurofibromatosis type 2.

present on pathologic assessment (*26*). Our case also demonstrated marked heterogeneity with a centrally cystic/necrotic core, a feature which has been described in nearly 50% (40/86) of reported suprarenal RP schwannomas. The high frequency of central cystic changes may relate to a frequently delayed presentation with increased size of these tumors at presentation. A study by Hirose *et al*. identify a higher proportion of GFAP positive schwannomas in the retroperitoneum compared to elsewhere (*45*). They attribute this to the origin and subtype of RP schwannomas and could provide an alternative reason for the more aggressive appearance of many suprarenal RP schwannomas at presentation. Of identified cases in our review, a GFAP stain was only performed prospectively by Fernandez *et al*. and retrospectively in our case with both cases

Table 3. Clinical and pathological characteristics of suprarenal retroperitoneal schwannomas published by Zhou *et al.* (*44*)

Cases	Age/Gender	Presentation	Size (cm)	Margin	Heterogeneity	Solid/Cystic	Calcification	Suspected Diagnosis	Diagnosis
Case 1	45/F	Asymptomatic	3	En	NR	Solid	None	NAA	Surgery
Case 2	53/M	Asymptomatic	8	En	NR	Cystic	None	NAA	Surgery
Case 3	66/M	Hypotension	5	En	NR	Cystic	Present	FAA	Surgery
Case 4	43/M	Asymptomatic	6.5	En	NR	Solid	None	NAA	Surgery
Case 5	62/F	Asymptomatic	5	En	NR	Solid	None	PCC	Surgery
Case 6	32/F	Asymptomatic	6	En	NR	Solid	None	NAA	Surgery
Case 7	42/F	Asymptomatic	6	En	NR	Solid	None	NAA	Surgery
Case 8	44/F	Flank Pain	5	En	NR	Solid	Present	FAA	Surgery
Case 9	26/F	Asymptomatic	3	En	NR	Solid	None	NAA	Surgery
Case 10	50/M	Flank Pain	4	En	NR	Solid	None	FAA	Surgery
Case 11	58/M	Asymptomatic	2.5	En	NR	Solid	None	FAA	Surgery
Case 12	56/F	Asymptomatic	1	En	NR	Solid	Present	FAA	Surgery
Case 13	38/M	Asymptomatic	3.5	En	NR	Solid	None	NAA	Surgery
Case 14	61/F	Asymptomatic	12	En	NR	Solid	None	NAA	Surgery
Case 15	57/F	Cushing Syndrome	6	En	NR	Solid	None	FAA	Surgery
Case 16	47/F	Asymptomatic	12	En	NR	Solid	None	NAA	Surgery
Case 17	48/F	Asymptomatic	8	En	NR	Solid	None	NAA	Surgery
Case 18	40/M	Asymptomatic	3	En	NR	Solid	Present	NAA	Surgery
Case 19	42/M	Asymptomatic	3	En	NR	Solid	None	NAA	Surgery
Case 20	42/F	Asymptomatic	4	En	NR	Solid	None	NAA	Surgery
Case 21	52/F	Asymptomatic	4.5	En	NR	Solid	Present	NAA	Surgery
Case 22	31/M	Asymptomatic	7	En	NR	Cystic	None	NAA	Surgery
Case 23	69/M	Asymptomatic	2.5	En	NR	Cystic	None	NAA	Surgery
Case 24	67/M	Asymptomatic	6	En	NR	Cystic	None	PCC	Surgery
Case 25	46/F	Asymptomatic	12	En	NR	Solid	Present	NAA	Surgery
Case 26	29/F	Abdominal Pain	2	En	NR	Solid	None	NAA	Surgery
Case 27	31/F	Asymptomatic	4	En	NR	Solid	None	NAA	Surgery
Case 28	54/M	Asymptomatic	8.5	En	NR	Solid	None	NAA	Surgery
Case 29	67/F	Asymptomatic	7	En	NR	Cystic	Present	NAA	Surgery
Case 30	71/M	Asymptomatic	1	En	NR	Cystic	None	NAA	Surgery
Case 31	33/F	Asymptomatic	4	En	NR	Solid	None	NAA	Surgery

En: Encapsulated; NR: Not Reported; ACC: adrenal cortical carcinoma; NAA: nonfunctional adrenal adenoma; FAA: functional adrenal adenoma; PCC: Pheochromocytoma.

Table 4. Differential diagnosis table for retroperitoneal adrenal and suprarenal schwannomas

Adrenal adenoma	• Typically small. • Typically homogenous. • Typically low density (HU < 10 on non-contrast imaging) and/or demonstrates washout characteristics (> 60% absolute washout; > 40% relative washout). • Increasing size raises concern for malignancy.
Adrenal cortical carcinoma	• Typically large (> 6 cm). • Irregularly shaped (main differentiating factor from RP suprarenal schwannomas). • Typically heterogeneous with central necrosis and/or hemorrhage. • Calcification in up to 30%.
Adrenal metastasis	• Variable appearance. • Typically < 50% washout.
Pheochromocytoma	• Typically large. • Typically heterogeneous. • Avid enhancement. • Calcification in < 10%. • Typically "light bulb bright" on T2 MRI sequence.
Suprarenal Schwannoma	• Typically large (mean 6.5 cm). • Encapsulated. • Nearly 50% are heterogeneous with central necrosis and/or hemorrhage. • Calcification in ~50%. • Can be indistinguishable from adrenal metastasis on imaging.

demonstrating positivity (*8*). Hirose *et al*. identified GFAP positivity in 92% of their RP cellular/fascicular type schwannomas, which would be consistent with GFAP positivity seen in our cellular type schwannoma.

3.3. Differential diagnoses

Irrespective of cause, our case and review of the literature demonstrates the high proportion of aggressive appearing

suprarenal schwannomas at imaging presentation. These tumors are frequently misattributed as malignant etiologies of adrenal origin such as adrenal cortical carcinoma and metastasis. Other adrenal lesions such as adrenal adenomas and PCCs are frequently considered as well. Solid lesions of retroperitoneal origin such as lymphoid tumors, sarcomas, teratomas, and other non-schwannoma neurogenic tumors can be considered but rarely represent the predominant differential in these lesions (*46*). Features for typical differential diagnoses for adrenal and suprarenal retroperitoneal schwannomas are described in Table 4.

4. Conclusion

Although rare, our case and review demonstrates that benign schwannoma is a differential consideration for suprarenal malignant lesions. All other known reported cases utilized resection for pathological diagnosis. While publication bias is likely a factor, resection may not be a preferable approach in older patients and/or poor surgical candidates. As in our case of an 81-year-old man reluctant to undergo aggressive surgery, a core needle biopsy and close imaging follow up may be sufficient for management despite the aggressive appearance on initial presentation.

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