

Adrenal-Renal Fusion Giving Rise to an Intrarenal Adreno-Cortical Adenoma: A Novel Case Report with Review of Current Literature

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Abstract

Adrenal-renal fusion is a rare developmental anomaly in which adrenal tissue extends into the renal parenchyma without separate encapsulation of the two organs. Of the few cases described in the literature, clinically significant adrenal-renal fusion has been associated with adrenal cortical adenomas, which appear to be solid masses with enhancing and infiltrative features on radiographic studies. Only three cases of adrenocortical adenoma associated to adrenal-fusion have been published. We describe an additional and unique case in a 70 year old woman who had an incidentally discovered ectopic adrenal tissue that gave rise to an adrenal cortical adenoma in the setting of adrenal-renal fusion.

Keywords: Adrenal-renal fusion; Adrenal cortical adenoma

Introduction

Adrenal-renal fusion is a rare entity that can be congenital or acquired in origin. The congenital form was initially described by Rokitsky [1] to distinguish it from fusions, which may occur secondary to cystic and inflammatory changes of the adrenal gland [2]. Rarely, adrenocortical adenomas have been described in this setting [3-5]. To our knowledge, however, this is the first case in the literature where both adrenal-renal fusion and ectopic adrenal tissue are present, with the ectopic adrenal tissue-giving rise to a non-functional adrenocortical adenoma within the kidney. The adherence of adrenal tissue to the renal parenchyma through fusion gives an impression of infiltration into the renal parenchyma by a malignant lesion on imaging studies. Gross and microscopic examinations are also challenging in order to arrive at the correct diagnosis.

Case Presentation

A 70 year-old woman presents with an incidental left renal mass found on chest CT. The patient was asymptomatic and denied dysuria, hematuria, fever, and flank or pelvic pain. She had no history of prior urinary tract infection or pyelonephritis. Medical history was significant for hypertension and peripheral arterial disease. She smoked one pack of cigarettes per day with a significant history of alcohol use consisting of 42 ounces per week. No family history of malignancy reported. On physical examination, no palpable masses were identified. MRI scan of the abdomen with and without IV contrast material showed a 3.4 × 3.3 × 2.2 cm mildly lobulated, ovoid mass involving the upper pole of the left kidney. The mass changed the contour of the kidney, focally replacing the renal cortex but it did not show a "claw sign." Additionally, the epicenter of the mass is extrinsic to the kidney, and the mass abutted the lateral limb of the adrenal

gland. The origin of the mass, therefore, was equivocal. It may have been an adrenal mass invading the kidney, a renal mass invading the adrenal, or a renal surface/retroperitoneal mass invading both organs. The mass was hypointense to kidney parenchyma on T2 weighted images and nearly isointense to kidney of noncontrast T1 weighted images. On chemical shift imaging, the mass showed loss of signal on opposed-phase images with a signal intensity index of 19% (Figure 1). These signal characteristics are highly specific for a lipid-rich adrenal adenoma. The lesion mimicked a primary renal tumor when presented and therefore led to the decision of a partial nephrectomy. The patient underwent an uncomplicated partial nephrectomy and a subsequent uncomplicated hospital stay prior to discharge.

Pathologic examination

The specimen was a 72 gram 4.2 × 3.7 × 2.5 cm portion of kidney with attached perinephric fat and a 4.0 × 1.5 × 1.1 cm adrenal gland. On gross examination the portion of kidney contained a 3.7 cm well circumscribed yellow-tan mass that abutted the inked renal parenchymal resection margin, which was examined intraoperatively by means of a frozen section. The attached adrenal gland was in contact with the underlying kidney forming a bridge (Figure 2). A rim of normal kidney parenchyma surrounded the majority of the mass.

Light microscopy

Formalin-fixed, paraffin-embedded tissue and hematoxylin-eosin stained sections showed that the adrenal tissue forming the bridge with the kidney contained all three layers of the adrenal cortex, which resembled cells of the native adrenal cortex. In addition, the portion of the intrarenal ectopic adrenal tissue that gave rise to the mass also contained all three layers of the adrenal cortex with cells that contained abundant intracytoplasmic lipid droplets, closely resembling the zona fasciculata of the adrenal cortex.

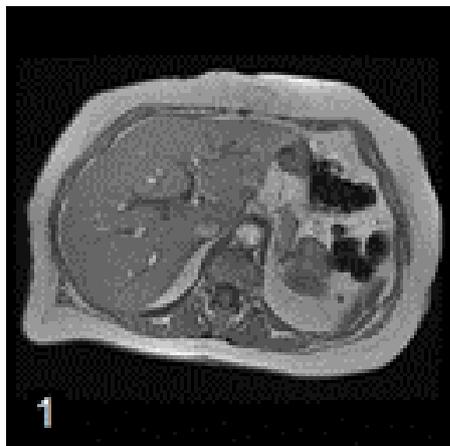


Figure 1: Axial in-phase MR images shows a mass abutting the adrenal gland and the upper pole of the left kidney. The mass exhibits decrease in signal intensity on the paired out-of-phase image (not shown).

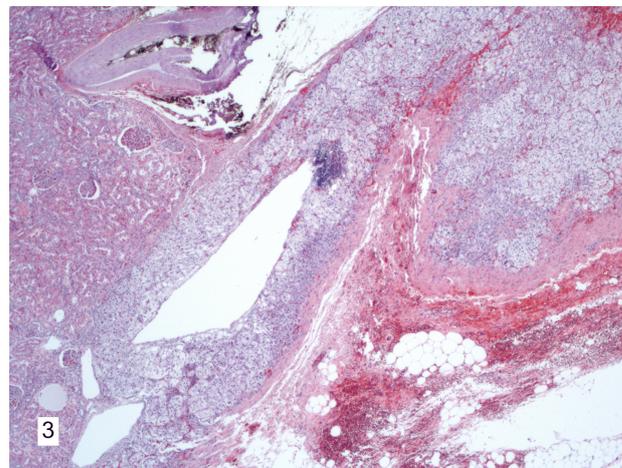


Figure 3: The bridge of adrenal gland tissue enters the kidney without adipose separating both organs (hematoxylin and eosin; 50X).



Figure 2: The adrenal gland forms a vascularized bridge entering into the kidney to blend into a mass.

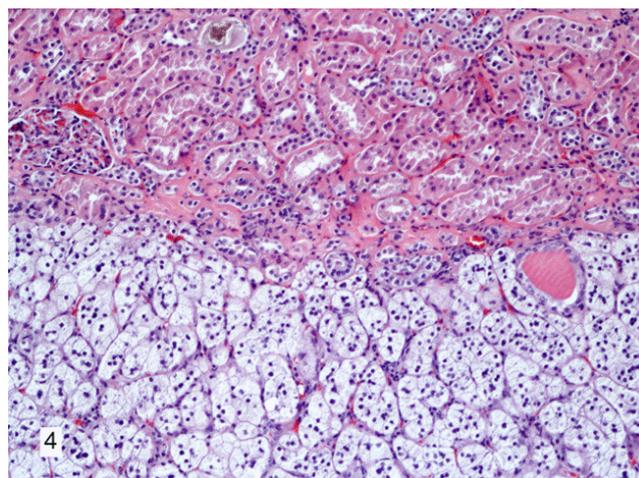


Figure 4: The non-encapsulated area of the adrenal cortical adenoma pushes the surrounding renal parenchyma (Hematoxylin and eosin; 100X).

The mass had smooth pushing edges in areas surrounded by a thin membrane, but in others, it was percolating between the renal parenchyma. It was composed of cords and nests of cells with finely vacuolated droplets of lipid-rich cytoplasm admixed with cells showing eosinophilic cytoplasm and lipofuscin pigment. The nuclei were single, round to oval mostly of central location. Occasionally the nuclei were hyperchromatic and mildly enlarged and irregular showing rare pseudoinclusions. No mitotic activity, necrosis, or vascular invasion was present. Focally, myelolipomatous metaplasia was observed (Figures 3 and 4). Thickened blood vessels were seen within it and some of the vessels appeared to be feeding the tumor from the overlying adrenal gland in juxtaposition with the renal capsule. Also, entrapped renal tubules within the adrenal cortical adenoma were observed (Figure 5). The morphology was consistent with a cortical adenoma.

Immunohistochemical staining showed that the tumor was positive for Calretinin, MART1 and synaptophysin, whereas it was negative for PAX8, CD10, and EMA. A mirror-opposite image was observed for the surrounding non-involved kidney. This pattern was very supportive of the presence of adrenal cortical tissue from which a cortical adenoma within the kidney arose. The histomorphology and immunophenotype argued against a renal cell carcinoma and an adrenocortical carcinoma.

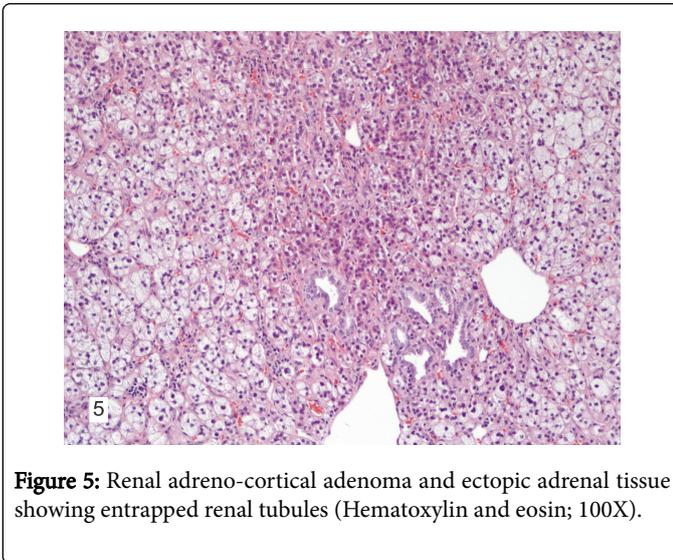


Figure 5: Renal adreno-cortical adenoma and ectopic adrenal tissue showing entrapped renal tubules (Hematoxylin and eosin; 100X).

Discussion

Adrenal-renal fusion is a rare entity that can be congenital or acquired in origin. The congenital form was initially described by Rokitsansky in 1855 to distinguish it from fusions, which may occur as a secondary change [1]. For instance, the case described by Fan et al. [2], would be an example of an inflammatory process in which there was a cystic degeneration with necrosis of the ectopic adrenal gland eliciting a fibrous reaction that extended to the underlying kidney causing a fibrous union between both organs. For the congenital form, as in our case, it is postulated that failure to stimulate adrenal capsule formation by the retroperitoneal mesenchyme along with functional defects of the peri-adrenal mesenchyme, provides a local environment where variable parenchymal mixing occurs. Along with the failure of differentiation of adipocytes, a physical barrier separating the two organs fails to form thus, leading to adrenal-renal fusion [6]. The true incidence of this anomaly is unknown, and however, six cases of adrenal-renal fusion were described out of 1,500 autopsies [7]. Since then, no other study on the incidence of it has been published.

In a related concept, Schetter [8] made emphasis in what constitutes true heterotopia if during development the primordial adrenal does not separate from the coelomic epithelium; it may become partly or wholly incorporated in the contiguous kidney. As such, the adrenal heterotopia can be complete or partial according to whether none or a portion of the adrenal remains in its normal position. In a study of 5,000 autopsies, O'Crowley et al. [9] described eight cases of either complete or partial adrenal-renal heterotopia. Compared to adrenal-renal fusion, ectopic adrenal tissue is a more common condition encountered clinically. Ectopic adrenal tissue occurs in up to 50% of neonates but in only 1% of the adult population, indicating that the lesions may regress with time [8,10,11].

Ectopic adrenal tissue arises from fragmentation of adrenal tissue along the course of migration of the coelomic mesoderm and is associated with implantation in visceral organs and tissues, such as the kidneys, and less commonly, in the testes, and spermatic cord. Depending on the presence of neural crest cells at the time of separation, ectopic adrenal tissue may be composed of adrenal cortex and medulla, or pure adrenal cortical tissue [8]. Typically, ectopic adrenal tissue is an incidental finding on autopsies and surgeries, and

usually of no clinical significance. Occasionally, it may create diagnostic difficulties if such diagnosis is not entertained in particular when ectopic tissue becomes hyperplastic or neoplastic.

To our knowledge, this is the first case in the literature where both adrenal-renal fusion and ectopic adrenal tissue are present, with the ectopic adrenal tissue-giving rise to a non-functional adrenocortical adenoma within the kidney. The case in Ye H et al. had an adrenocortical adenoma arising from the adrenal-renal fusion, but there were no separate foci of ectopic adrenal tissue within the kidney [5]. In our case, the adrenal cortical adenoma arises from the adrenal tissue present within the kidney that was preceded by an adrenal-renal fusion. This is unique and as such, it has not been reported in the literature. Additionally, there have been a limited number of previous cases of an adrenal adenoma in the setting of adrenal-renal fusion; however, these cases lacked the presence of ectopic adrenal tissue within the kidney [3-5].

The benign nature of the lesion, appreciated upon histological and immunohistochemical analysis, indicated that a conservative option might have been an appropriate course of action in this patient.

On MRI imaging, the mass of our patient was homogeneous and showed loss of signal on opposed-phase images with a signal intensity index of 19%. This imaging appearance would have been diagnostic for an adrenal adenoma if the mass had been definitively arising from the adrenal gland [12]. However, because the mass seemed to be arising from or invading the kidney, malignancy was suspected. Clear cell renal cell carcinoma [13] and adrenocortical carcinoma [14] can also show loss of signal on opposed-phase imaging due to the presence of intracytoplasmic fat and thus, these were the primary considerations. In one of the cases reported by Ye et al, the adrenocortical adenoma in the setting of adrenal-renal fusion appeared to invade the renal parenchyma on radiographic imaging, suggesting an adrenocortical carcinoma [5].

In the cases mentioned, current imaging modalities including CT and MRI, lack the ability to clinically differentiate these benign lesions from their malignant counterparts [9]. In our case, the subsequent characterization of the incidental renal mass also suggested an enhancing lesion with an infiltrative nature based on radiographic findings, conferring a high likelihood of malignancy. As a result, the management plan included a partial nephrectomy with an intraoperative frozen section, to determine if more margins would be needed.

Among the cases reported of adrenal-kidney fusion with intrarenal occupying space mass, three were adrenal cortical adenomas [3-5], one was a cyst [2], and one was a papillary renal cell carcinoma [5].

None of the previous cases of adrenal-renal fusion had pre-operative diagnosis on imaging studies. Even after histological examination, the diagnosis is difficult if the pathologist is not alert to this possibility. Moreover, intraoperative evaluation of the tumor or margins of excision in partial nephrectomies can be mistaken as renal cell carcinoma as occurred in our case. Nonetheless, given the challenging diagnosis, even if one is considering a heterotopia with the development of an adrenal cortical adenoma within the kidney, the prudent call is to err in the safe side and allow for complete removal of the lesion, as the degree of uncertainty can be high in this setting.

The differential diagnoses included renal cell carcinoma and adrenocortical carcinoma. The histopathology and immunophenotype distinguished these lesions from a cortical adenoma. The cells lacked

the neoplastic features of nuclear atypia, such as pleomorphism, increased nuclear to cytoplasmic ratio, hyperchromatic nuclei, mitotic activity, atypical mitoses, loss of polarity, and necrosis. Furthermore, immunohistochemical stains were negative for CD10, PAX-8, EMA, and RCC, findings, which argue against renal cell carcinoma. The ectopic adrenal tissue forming the parenchymal bridge with the kidney contained all three layers of the adrenal cortex. Additionally, the layers were highlighted by the immunohistochemical stains as seen with synaptophysin, a neuroendocrine marker used to differentiate the adrenal medulla from the cortex. The portion of the intrarenal ectopic adrenal tissue that gave rise to the adrenocortical adenoma also contained all three layers of the adrenal cortex with cells that contained intracytoplasmic lipid droplets, resembling the zona fasciculata of the adrenal cortex. The cells of the adenoma were well differentiated and contained small nuclei that demonstrated mild nuclear pleomorphism, but necrosis and vascular invasion were not present. All of these features argued against an adrenocortical carcinoma. With the benign histopathological findings and the lack of immunohistochemical reactivity to support a malignant neoplasm of adrenal or renal origin, the differential diagnoses of adrenal cortical carcinoma and renal cell carcinoma were excluded.

Conclusion

This case demonstrates the importance of considering an adrenal cortical adenoma arising from intrarenal ectopic adrenal tissue in the setting of adrenal-renal fusion in the differential diagnosis of an enhancing renal mass with infiltrating features on imaging studies in an asymptomatic patient. The adherence of adrenal tissue to the renal parenchyma through fusion gives an impression of infiltration into the renal parenchyma by a malignant lesion on imaging studies and interpreted as either, renal cell carcinoma or adrenal cortical carcinoma. Ideally, a correct interpretation would not lead to an unnecessary resection. An increased awareness of the existence of this entity masquerading as a malignant neoplasm can greatly influence the management of patients suspected with this, and other similar lesions.

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