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Case Report

Peripheral nodular enhancement in adrenal and renal hematomas: A report of 3 cases ☆

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ABSTRACT

There are a wide range of benign and malignant pathologies that the radiologist may encounter in the adrenal glands and kidneys, often incidentally when imaging is performed for other indications. Many imaging modalities including CT, MR, and US are often used in an attempt to characterize these lesions. A definitive radiological diagnosis, however, is not always possible. This is at times due to atypical presentations of typical lesions which may be mistaken for more aggressive or concerning pathologic conditions. Adrenal lesions that do not demonstrate characteristic benign imaging features might require surgical excision. Similarly, cystic renal lesions that demonstrate nodular enhancement are concerning for Bosniak IV lesions and require surgical management. We report 3 cases in 3 different patients of incidentally discovered hematomas with peripheral enhancement, 2 involving the adrenal gland and 1 involving the kidney. All 3 of these histologically proven hematomas demonstrated similar radiological manifestations of peripheral nodular progressive enhancement, mimicking neoplastic conditions, and necessitating surgical removal.

Introduction

Adrenal and renal hemorrhage can occur in a variety of traumatic and atraumatic conditions. Adrenal hematomas often have a round or oval mass-like appearance [1]. Renal hemorrhagic cysts are likely more common than hematomas, and on imaging they demonstrate blood density or signal intensity, with no internal enhancement [2]. Adrenal hematomas and hemorrhagic renal cysts are often asymptomatic and incidental findings, which may not be discovered until long after the initial inciting event. On imaging, both characteristically show no internal contrast enhancement and can be easily differentiated from neoplastic adrenal or renal masses. Classically, any type of enhancement has been used as radiological evidence against a simple hematoma suggesting either

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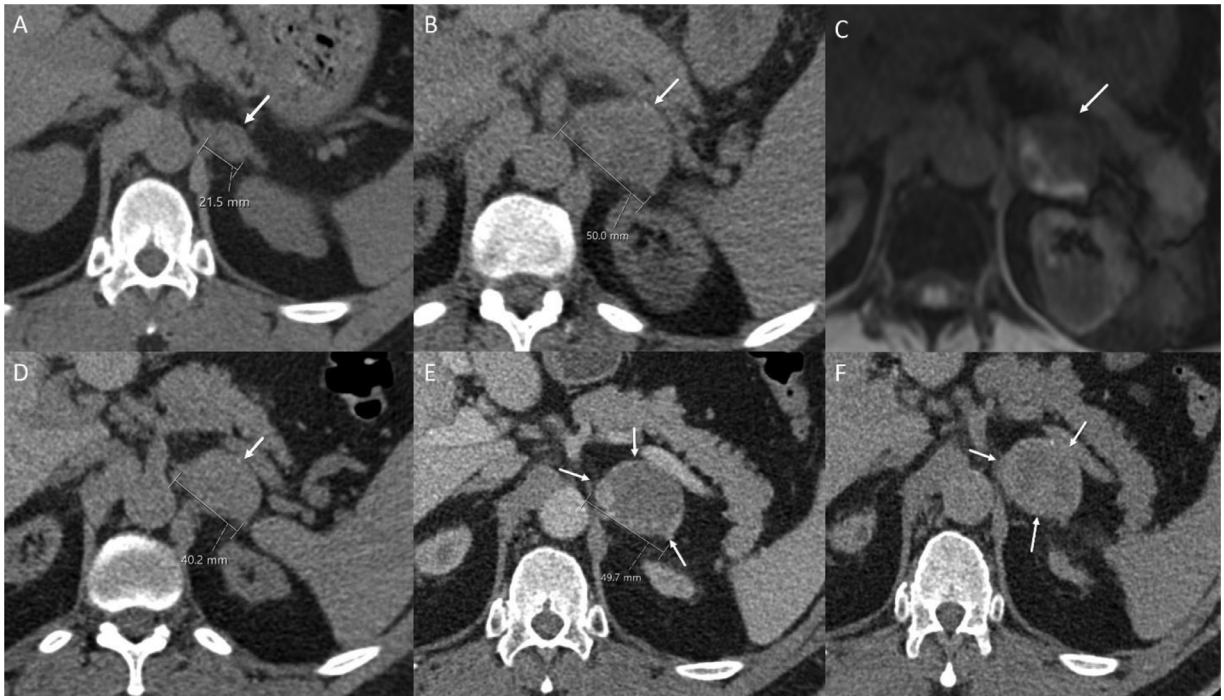

Fig. 1 – Noncontrast CT image from 9 years prior demonstrating a solitary indeterminate left adrenal lesion (arrow, A). Noncontrast CT at the time of presentation to the emergency department demonstrated increased size of this lesion (arrow, B). Noncontrast T1-weighted MRI performed 2 weeks later showed similar size of the lesion which remained indeterminate with areas of T1 hyperintensity consistent with hemorrhagic products (arrow, C). Follow-up noncontrast CT 4 months later showed decreased of the lesion (arrow, D). Follow-up contrast-enhanced adrenal protocol CT 1 year later demonstrated increased size of the lesion with peripheral enhancement on portal venous phase (arrows, E) with partial fill in on delayed phase (arrow, F).

an enhancing mass or an enhancing mass with intratumoral hemorrhage [1–4]. The following cases illustrate pathology proven hematomas with peripheral predominant enhancement which were mistaken for enhancing masses.

Case 1

A 47-year-old male with history of a recent deceased donor kidney transplant presented to the emergency department with fever, chills, and diarrhea. A CT of the abdomen and pelvis without contrast was obtained due to poor transplant renal function, revealing expected postoperative changes about the transplant kidney and an incidental 5.0 cm left adrenal mass with a CT density of 27 Hounsfield units and peripheral hyperattenuating components, rendering it indeterminate by imaging characteristics. The lesion was present on a CT scan performed 9 years prior to the time of presentation where it measured 2.0 cm and was characterized as an adenoma due to some areas of low density (although its CT density was heterogenous), but had increased in size in the interim (Fig. 1A and B).

A subsequent noncontrast MRI performed 2 weeks later demonstrated a left adrenal mass with areas of heterogeneous T1 hyperintensity (Fig. 1C), heterogeneous T2 hypointensity and hyperintensity, no macroscopic fat, and no intravoxel lipid which were again indeterminate imaging features that were not specific for any particular etiology, and not consistent with a benign lipid rich adenoma. A short-term follow-up noncontrast CT was performed approximately 4 months later which showed that the indeterminate mass had decreased in size from 5.0 cm to 4.0 cm (Fig. 1B and D). A follow-up adrenal protocol CT with and without contrast 1 year later demonstrated reincrease in the size of the left adrenal mass which demonstrated peripheral enhancement with partial fill in on delayed images which was concerning for malignancy, particularly a cystic pheochromocytoma (Fig. 1E and F).

Patient underwent biochemical testing which included normal serum aldosterone, serum cortisol, serum and urine metanephrines, and serum DHEA-S. The patient subsequently underwent left adrenalectomy with pathology showing adrenal gland with nodular hyperplasia, and a hematoma with secondary papillary endothelial hyperplasia (PEH). There was no evidence of malignancy.

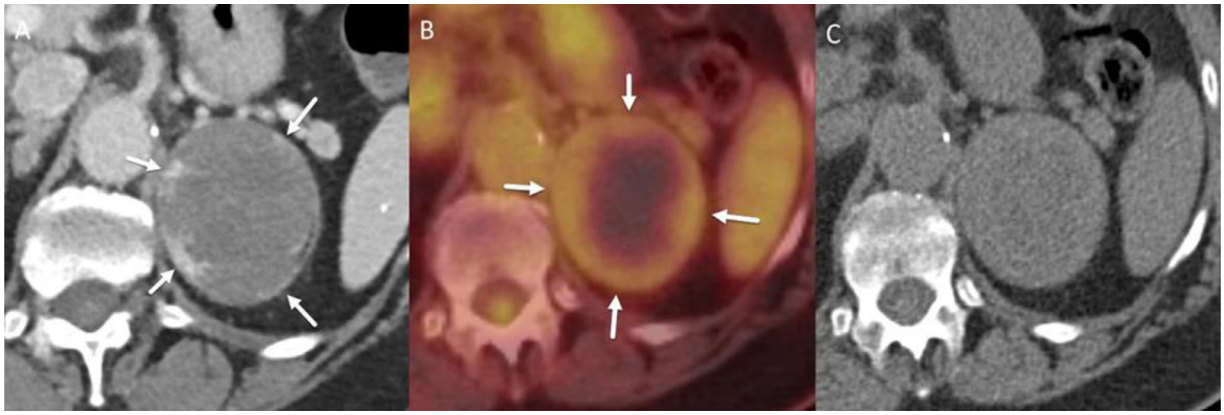

Fig. 2 – Single phase contrast-enhanced CT images at the time of presentation to the emergency department demonstrated a large incidental left adrenal mass with peripheral nodular areas of enhancement (arrows, A). Follow-up PET-CT demonstrated mild peripheral FDG avidity (arrows, B) and central photopenia. CT only images from the PET-CT show no intrinsic hyperdense components in the adrenal mass (C).

Case 2

A 75-year-old female presented to the emergency department with nausea, vomiting, and diarrhea. A CT of the abdomen and pelvis with intravenous contrast in the portal venous phase was obtained which demonstrated enteritis and a large 6.5 cm indeterminate left adrenal mass with peripheral hyperattenuating foci (Fig. 2A). A follow-up PET-CT approximately 1 month later demonstrated mild peripheral FDG avidity and central photopenia which was suspicious for neoplasm with central cystic change or necrosis, though indeterminate for a benign vs malignant etiology (Fig. 2B). The noncontrast CT images acquired with the PET/CT showed that the adrenal lesion had no internal hyperdense components, indicating that the hyperdense components on the contrast-enhanced CT represented areas of internal enhancement (Fig. 2C).

Patient underwent biochemical testing. Serum cortisol was mildly decreased; however, serum aldosterone, serum cortisol, serum and urine metanephrines, and serum DHEA-S was normal. The patient underwent left adrenalectomy 3 months later which showed adrenal gland with hemorrhage associated with organization and papillary endothelial hyperplasia. There was no evidence of malignancy.

Case 3

A 58-year-old male with alcohol use disorder presented from an outside hospital 2 days after a fall. CT with contrast, and MR without and with contrast, performed at an outside hospital demonstrated a 4.5 cm hemorrhagic left renal lesion with peripheral hyperattenuating foci on CT (Fig. 3A) but limited evaluation for small foci of enhancement due to significant motion degradation of postcontrast MRI images by motion artifacts (Fig. 3B-D). A subsequent contrast-enhanced ultrasound (CEUS) was performed approximately 4 months later which demonstrated irregular nodular enhancement of the wall of a complex cystic lesion (Fig. 3E and F) thought to be most consistent with a cystic renal cell carcinoma. Patient underwent a partial left nephrectomy 4 months later with pathology revealing a hemorrhagic cystic lesion with a thickened hyalinized wall which has a spindle, fibromuscular cellular proliferation without associated malignancy. The differential considerations from surgical pathology were hemorrhagic cyst with surrounding stromal reaction or an angiomyolipoma with massive hemorrhage but imaging features were not supportive of angiomyolipoma.

Discussion

We present 3 cases of adrenal and renal hematomas with peripheral progressive nodular enhancement. Incidental adrenal and renal masses are common findings, seen in approximately 5% of individuals undergoing CT [4]. In addition, up to 70% of all renal malignancies are detected incidentally on an imaging study that was obtained for an unrelated reason [5]. Conventionally, the presence of enhancement in these masses precludes the diagnosis of a simple hematoma [1–4,6].

The underlying etiology for the presence of peripheral enhancement in the cases we have is histologically consistent with organization and endothelial proliferation, more prominent in the periphery of the hemorrhagic lesion. In the first 2 cases, pathology demonstrated PEH predominantly in the periphery of the lesions, with central areas of hemorrhage. PEH, also known as Masson's tumor, is a reactive process seen in stages of organization and recanalization of a hematoma/hemangioma or any vascular malformation [7]. PEH is benign and is most frequently seen in the skin and integument of the head, neck, and extremities, but may involve any of the visceral organs [8–13]. In the third case, pathology did not show any areas of PEH, but instead very dense peripheral areas of organization comprised of thickened fibromuscular cellular proliferation without atypia or increased mitoses, along with hemosiderin-laden macrophages, and multiple ar-

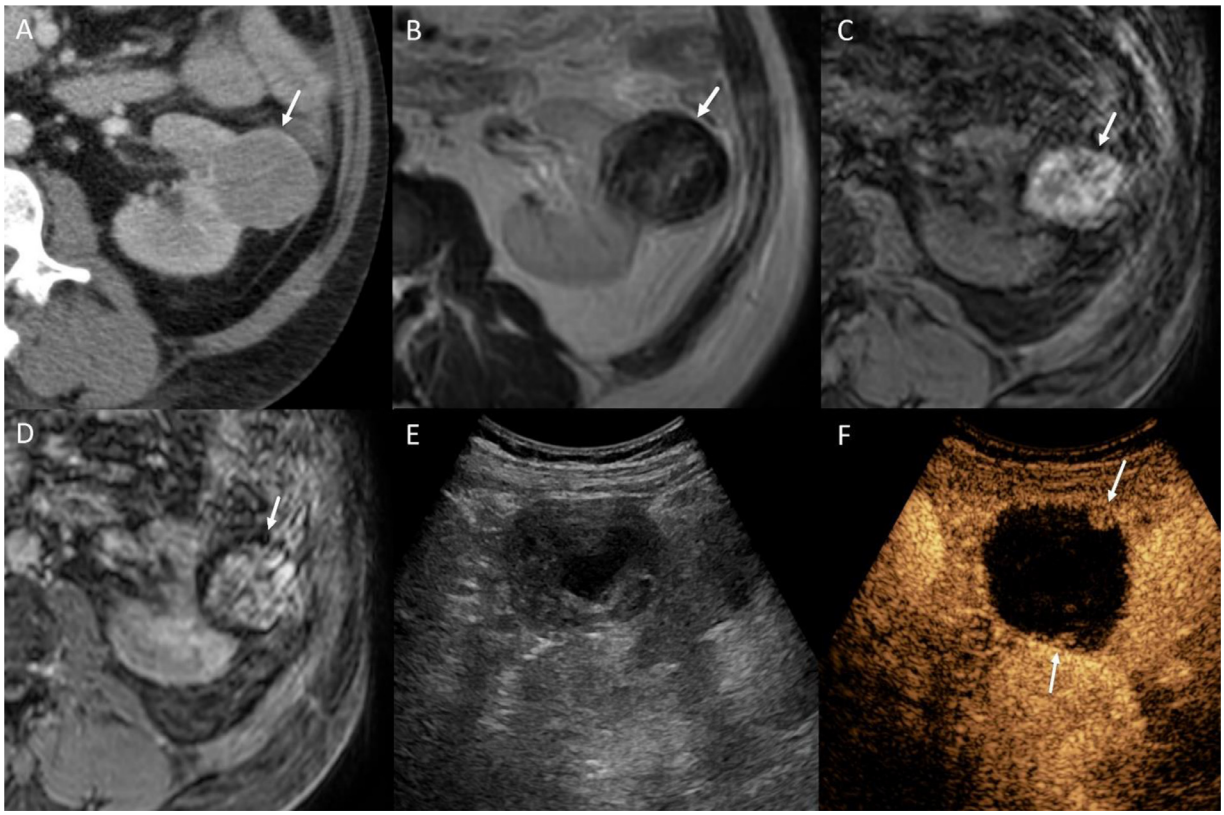

Fig. 3 – Contrast-enhanced CT images from an outside hospital at the time of transfer demonstrated and indeterminate renal mass with questionable peripheral enhancement (A). Motion limited T2-weighted MRI demonstrated T2 hypointensity (arrow, B), T1-weighted noncontrast image demonstrated central T1 hyperintensity (arrow, C) suggestive of hemorrhagic products, and T1-weighted postcontrast image demonstrated no definite enhancement but could not rule out small foci of enhancement (arrow, D). Due to the limited quality of the available MRI, contrast-enhanced ultrasound (CEUS) was performed for further characterization. B-mode ultrasound image demonstrated internal echogenic contents (E) with areas of peripheral nodular enhancement on CEUS (arrows, F). This was concerning for a cystic renal cell carcinoma.

eas of calcification. The histologic review of these cases is consistent with peripheral organized changes that can explain the areas of peripheral enhancement on imaging.

To our knowledge, only 8 adrenal PEH cases have been reported in the literature to date, and ours are the ninth and tenth [8]. While the enhancement patterns of adrenal IPEH have not been thoroughly characterized in the radiology literature, at least 2 articles by Kawashima et al. and Constantinou et al. have described heterogeneous enhancement [1,6]. This is unsurprising given that PEH is a vascular proliferative process that is known to enhance elsewhere in the body, predominantly in a peripheral pattern [14] and has been referred to as pseudoangiosarcoma [15]. This enhancement could conceivably lead to these lesions being misinterpreted as an adrenal malignancy such as adrenocortical carcinoma [1,16]. PEH has also been rarely encountered in renal vasculature [17].

The initial inciting event of hemorrhage in the adrenals glands and kidneys is variable and can occur due to both traumatic and nontraumatic conditions. The adrenal glands are susceptible to hemorrhage given their unique blood supply. There are 50-60 small adrenal artery branches from 3 main adrenal arteries which form a subscapular plexus that is drained by relatively few venules. Unsurprisingly, this so-called “vascular dam” can be overwhelmed resulting in nontraumatic hemorrhage from stress, shock, hemorrhagic diathesis or coagulopathy, underlying tumors, and idiopathic causes [1,18]. These hematomas may then create an environment for which extravascular PEH may rarely form.

In cases where hematoma is suspected and no enhancement is present, there is likely no diagnostic dilemma and a hematoma can be confidently diagnosed radiologically. In cases like the ones we have presented, it may be challenging to differentiate hemorrhage from other incidentally found pathologic conditions of the adrenal gland or kidney as these lesions can mimic more serious pathology such as adrenal cortical carcinoma, pheochromcytoma, or renal cell carcinoma. In such cases, evaluation of the periadrenal fat may be of benefit as periadrenal infiltration or haziness may be visualized from hematoma extension [4]. Further, a decrease in lesion size (as seen in case 1) or long-term stability is more suggestive of a hematoma or at least a benign entity and usually does not occur in malignancy (in the absence of treatment). Finally, all 3 of the presented cases have had peripheral progressive enhancement and a relatively homogeneous

central area of nonenhancement as opposed to malignant conditions which may appear more heterogeneous and demonstrate washout. It would be reasonable to consider a diagnosis of hematoma with organization or PEH when a peripherally enhancing hemorrhagic lesion has long-term stability or shows decrease in size. In such cases, including this entity in the differential may prompt a conservative management route rather than surgical excision.

Conclusion

Adrenal and renal masses are commonly encountered on imaging. Hematomas of these organs are classically nonenhancing; however, they may rarely demonstrate peripheral enhancement as we have shown in the above cases. The etiology of this enhancement is not straightforward with papillary endothelial hyperplasia being a rare potential cause that shares radiological similarities to more malignant appearing masses. While it may not be possible to confidently diagnose these types of hematomas prospectively, knowledge of this imaging pattern in the correct clinical and radiological context may allow the radiologist to suggest a more conservative management route.

Patient consent

Written informed consent for the publication of this case report was obtained from all 3 patients.

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