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## Case Report

# Primary Ewing sarcoma of the adrenal gland: A rare cause of abdominal mass

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## ABSTRACT

Ewing sarcoma is a malignant tumor that more commonly affects the long bones. Primary Ewing sarcoma of the adrenal gland is a rare diagnosis. We report an unusual case of primary Ewing sarcoma of the adrenal gland in a 34-year-old man who initially presented with abdominal as well as flank pain and abdominal mass. Computed tomography and magnetic resonance imaging showed a heterogeneous, hemorrhagic right adrenal mass with inferior vena cava extension and thrombosis. Thus, a major open surgery including right adrenalectomy, right nephrectomy, inferior vena cava thrombectomy with resection, and a retroperitoneal lymph node dissection was necessitated. Early recognition with radiological imaging and treatment of extraosseous Ewing sarcoma of the adrenal gland with a multimodality approach reduces morbidity and mortality.

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## Introduction

Ewing sarcoma (ES) is a rare round cell malignancy. It is the second most common primary osseous malignancy in children and young adults, second in incidence to osteogenic sarcoma [1]. However, ES represents an even rarer finding in older adults and it is estimated that 30% of cases occur in adults over the age of 20 [2]. First described by Ewing in 1921, it primarily affects the long bones of the skeletal system and seldom presents in the bones of the head, neck, or abdomen. Moreover, extraosseous ES represents a rare finding. The very

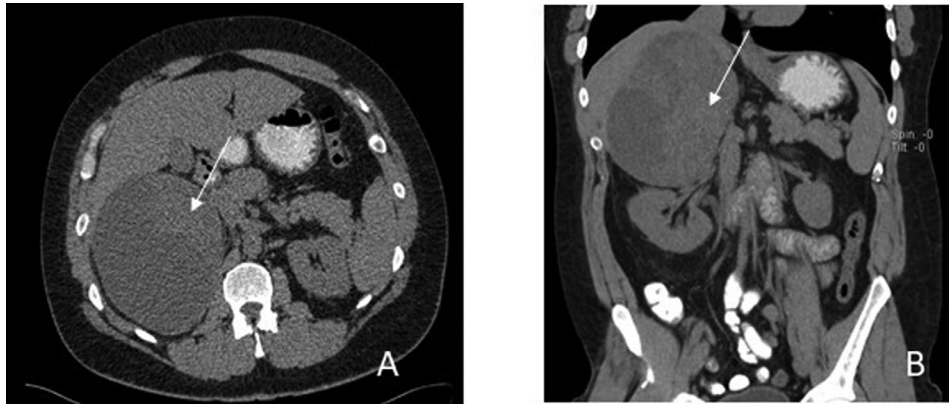
first finding of extraskeletal ES was first described in 1969 [3]. Since then, ES has been reported in extraskeletal sites such as the chest wall, paravertebral region, gluteal region, and retroperitoneum [4]. Even fewer primary ES cases have been reported in the lungs, gastrointestinal tract, prostate, brain, prostate, endometrium, and adrenal gland [5,6]. Cases of metastatic spread to the adrenal gland from a primary osseous ES have been reported; however, primary ES of the adrenal gland represents an even rarer finding [7]. Thus, increased awareness for the possible presentation of ES in the adrenal gland may help ensure early detection and diagnosis of the aggressive tumor in a patient who presents with abdominal pain, abdominal mass, and flank pain.

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**Fig. 1 – Precontrast axial (A) and coronal (B) CT showing heterogeneous right adrenal mass with high density medial component (arrow and mass effect on liver and right kidney).**



**Fig. 2 – Precontrast axial (A), arterial phase (B), and late portal venous phase (C) CT showing mild enhancement of the medial component of the lesion.**

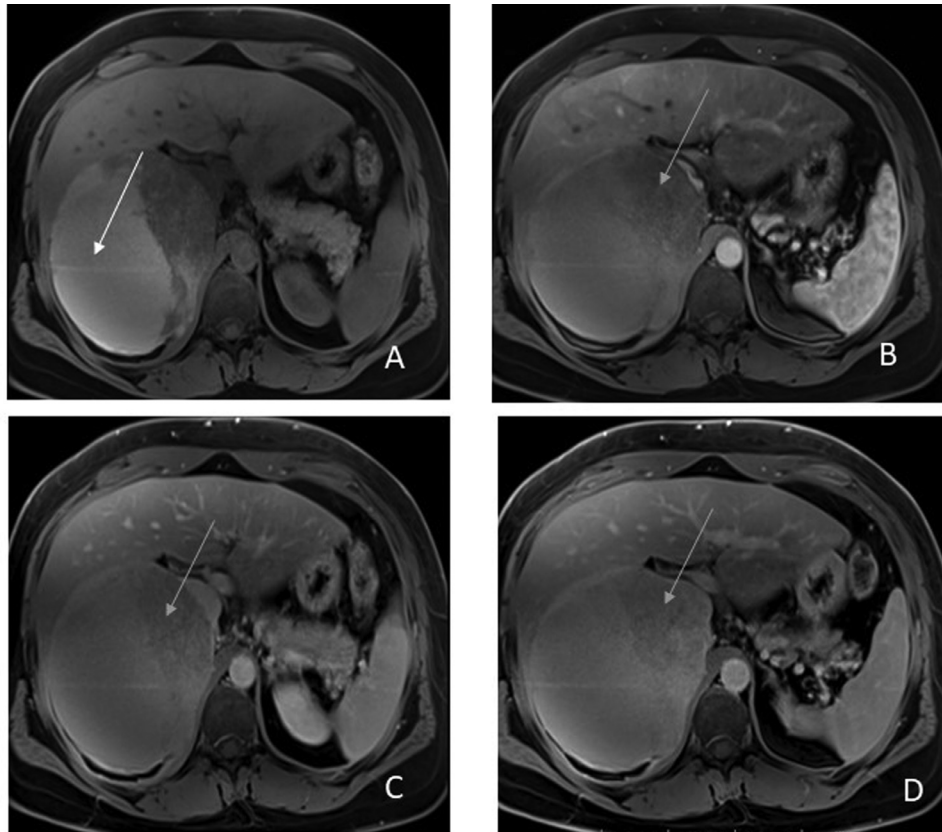
## Case report

Our case is a 34-year-old male patient who had initially presented to his primary care provider with a 2-week onset of abdominal pain and flank pain. He additionally reported symptoms of dark stools. His vitals were stable and physical exam was unremarkable at initial presentation. CT abdomen and pelvis without and with contrast revealed a well-circumscribed mass which appeared to arise from the right adrenal gland, measuring at 13 cm in transverse, 14.5 cm cephalocaudal, and 13.3 cm in anteroposterior dimension. The mass appeared to have both low-density components and had higher densities on precontrast images suggestive of intraleisional hemorrhagic component (Fig. 1). The lesion produces mass effect with displacement of the right kidney caudally and produces a mass effect on the posterior liver surface on its cranial aspect (Fig. 1). There was no associated calcification or fluid level in the mass. The left kidney and left adrenals were found to be normal.

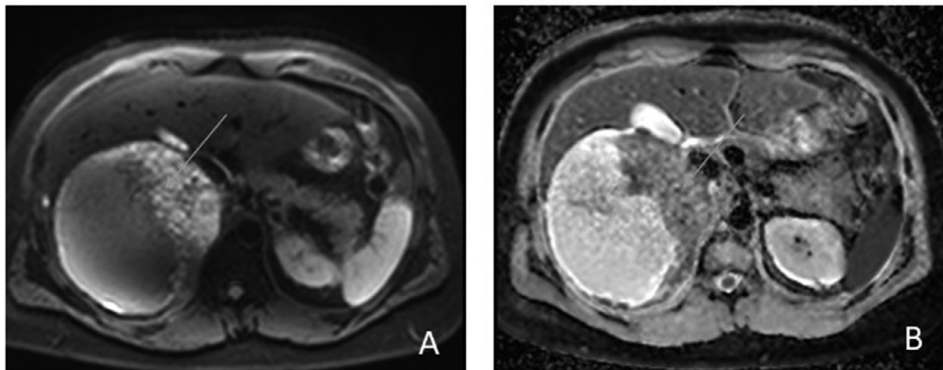
There was no appreciable change in density measurement in the arterial phase. However, mild increase in density was observed in the medial aspect of the lesion on the late portal venous phase (Fig. 2). A hematoma was initially con-

sidered given the patient had reported a remote history of trauma. However, adrenal hematoma could not account for the demonstrable enhancement. The right hepatic vein and superior intrahepatic inferior vena cava were not well visualized reinforcing the possibility of compression or possible thrombosis. Initial differential consideration includes adrenal cortical carcinoma, pheochromocytoma, retroperitoneal sarcoma, adrenal coalition tumor among others.

Further imaging helped elucidate the extent of the mass. MRI abdomen without and with contrast confirmed the large heterogeneous right adrenal mass with associated mass effect, and mild perinephric edema. Medially, the mass demonstrated progressive delayed enhancement (Fig. 3) with restricted diffusion (Fig. 4). And laterally the lesion demonstrated T1 hyperintensities concerning for possible hemorrhage (Fig. 3). Of particular concern was the finding that the right adrenal mass was extending into the intrahepatic inferior vena cava. This is seen on the T2 images, raising suspicion of tumor invasion into the inferior vena cava or tumor thrombus. CT angiography of the abdomen following administration of IV contrast confirmed the right adrenal mass extending into the inferior vena cava proximal to the heart (Fig. 5). Contrast-enhanced CT thorax with contrast was subsequently performed and revealed no evidence of



**Fig. 3 – Axial MRI without contrast (A) and with contrast (B-D) showing T1 hyperintense component of the right adrenal lesion (white arrow) and progressive delayed enhancement of the medial component of the lesion.**



**Fig. 4 – Axial MRI showing restricted diffusion within the medial aspect of the right adrenal lesion (arrows).**

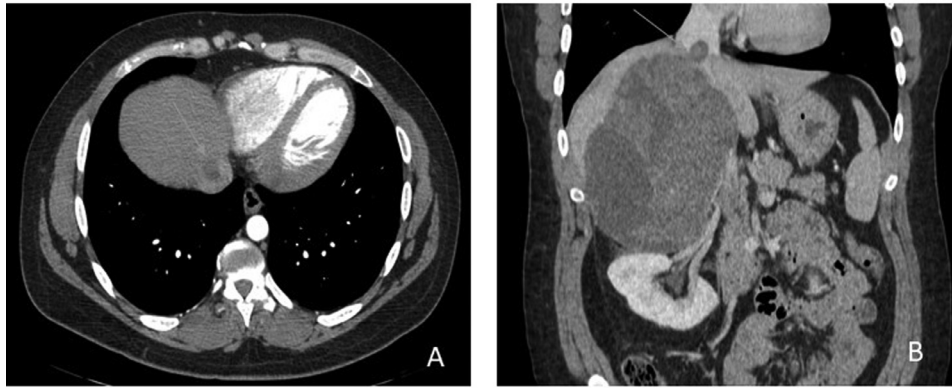
intrathoracic metastatic disease. Moreover, the patient also underwent bone scintigraphy which excluded osteoblastic osseous metastatic disease (Fig. 6). There was no pre-op CT/PET or pre-op needle biopsy done.

Following multidisciplinary discussion, our patient was admitted for resection of the adrenal mass with a right adrenalectomy, right nephrectomy, inferior vena cava thrombectomy, and a retroperitoneal lymph node dissection. He also had an open cholecystectomy, resection of the right diaphragm, partial hepatectomy, and chest tube placement in the right hemithorax. The patient received inferior

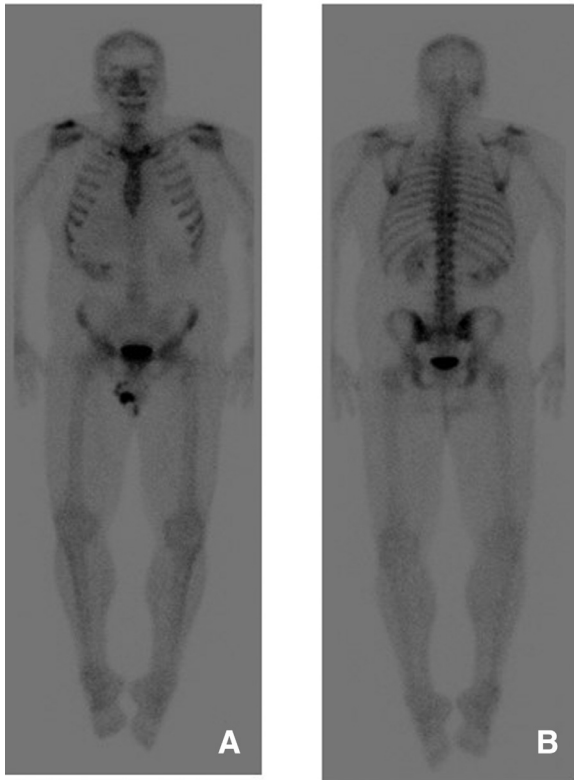
vena cava thrombectomy with transection and repair of the inferior vena cava for tumor thrombosis. His surgery required 3 surgical teams.

The patient's surgery was complicated by intraoperative cardiac arrest and hypotension. He ultimately required emergent cardiopulmonary bypass and cardiopulmonary resuscitation with sternotomy, direct cardiac massage, as well as management of pulseless electrical activity and ventricular fibrillation. Postoperatively, the patient required intensive unit care. His hospital course was also further complicated by atrial fibrillation with rapid ventricular response, acute





**Fig. 5 – Axial (A) and coronal (B) CT angiogram showing filling defect in the inferior vena cava.**



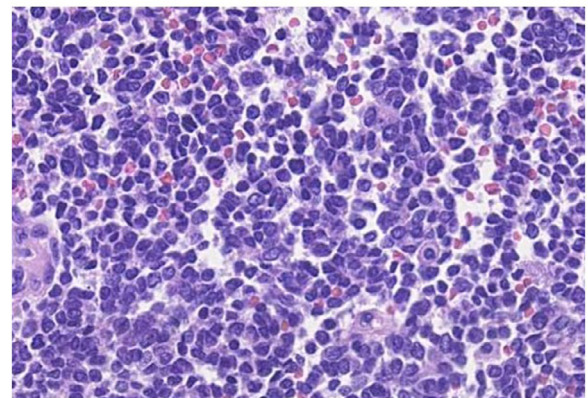
**Fig. 6 – Whole body bone scan in the anterior (A) and posterior projection (B) showing normal radiopharmaceutical concentration in kidneys, urinary bladder, bone marrow, and soft tissues.**

tubular necrosis requiring hemodialysis, and bilateral deep venous thrombosis in the common femoral, popliteal, posterior tibia, and peroneal veins.

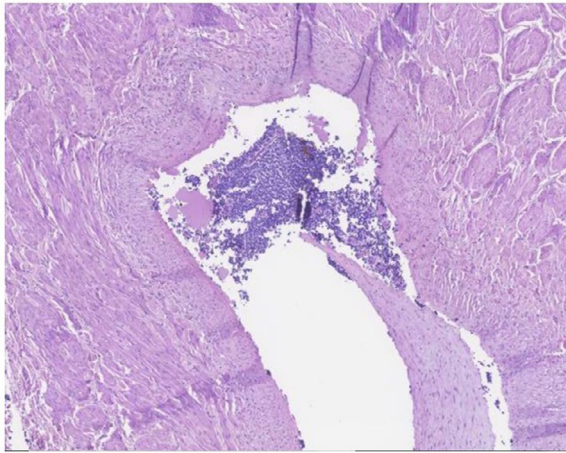
Surgical pathology of the right adrenal gland showed extraskeletal ES 9 days after resection of the mass. Additionally, molecular and immunohistochemical analysis further established the diagnosis of ES. Fluorescence in situ hybridization results showed a EWSR1 gene break-apart rearrangement



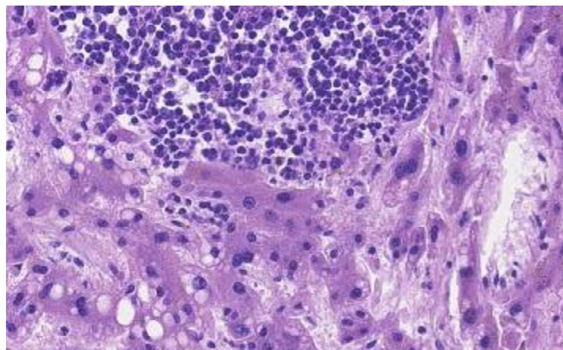
**Fig. 7 – Gross image: (from left to right) kidney, adrenal gland replaced by tumor, and liver.**



**Fig. 8 – Uniform population of “small round blue cells” with finely dispersed chromatin and scant cytoplasm.**



**Fig. 9 – Tumor cells within the inferior vena cava.**



**Fig. 10 – Tumor cells invading into liver parenchyma.**

on chromosome 22q12. Pathology sections revealed malignant small round tumor composed of sheets of tightly packed small round cells. The tumor appeared to invade into the liver and inferior vena cava. Additionally, immunostains on the tumor were strongly positive for vimentin and CD99, weakly positive for NB84a and synaptophysin, and negative for keratin AE1/3, keratin cam 5.2, inhibin, chromogranin, CD20, CD3, LCA, and ERG/FLT1. Altogether, these findings supported the diagnosis of an extraskeletal ES. After his operation, the patient received adjuvant chemotherapy with improvement in his symptoms. A PET/CT 3 months after his operation showed no evidence of disease recurrence.

## Discussion

ES is a malignancy that arises from cells of neuroectodermal origin with a characteristic translocation  $t(11;22)$ . It is aggressive and tends to metastasize early [8]. Furthermore, hematogenous metastases to lungs and bones are also common. Recurrence is also frequent even after resection. Thus, given the aggressiveness of the malignancy and poor prognosis, early detection and treatment of ES are important in order to improve patient outcomes.

This case report is of particular interest for it illustrates the finding of primary ES in the adrenal gland where it is atypically found. Few cases are reported in the literature thus far. To our knowledge, there are less than 40 cases of primary ES of the adrenal gland that have been described [7–9]. Most previous cases of adrenal ES were described in pediatric, adolescent, and young adult populations with even rarer cases in older adults greater than 40 years of age [10]. To date, the youngest case of adrenal ES was seen in a 4-year-old male and the oldest case was a 63-year-old male [9]. Our patient was 34 years old. There is only 1 other case reported of primary ES of the adrenal gland for an individual in their fourth decade of life [9]. The individual was a 31-year-old male found to have ES of the right adrenal gland that required total resection. Moreover, Eddaoualline et al. in a case review found a female predominance for ES of the adrenal gland. This is in contrast to osseous ES, which is slightly more common in males. From our review of the literature, most cases of primary ES of the adrenal initially presented with abdominal pain and flank pain, which is consistent with the initial presentation of our present case [11].

This case report demonstrates the importance for early detection and diagnosis of ES of the adrenal gland with radiological imaging. In our case, diagnosis of the adrenal lesion was readily made with CT and magnetic resonance imaging. CT aided in the initial detection of the tumor. MRI best defined the tumor's local extension and eliminated the possible metastatic nature of the tumor. Moreover, bone scan ruled out underlying osseous lesions. Interestingly, the imaging characteristics of our case are mostly consistent with what has been reported in literature thus far. Prior cases of adrenal ES have typically detailed its presentation on pre-enhanced CT images as well defined, round or oval, suprarenal mass with possible areas of hemorrhage, and necrosis [7,12]. Additionally, adrenal ES has been typically described as a heterogeneous mass on imaging. Similarly, our case demonstrated a well-circumscribed round heterogeneous mass on CT, and T1 hyperintensities on MR abdomen showed concern for hemorrhage. Tissue characteristics like cystic degeneration or calcification have also been commonly reported in literature. Our present case however did not appear to have cystic degeneration or calcifications on imaging. Xiaoping et al. in a retrospective analysis of 18 cases of intra-abdominal and retroperitoneal neuroectodermal tumors reported mean tumor diameters of 7.2 cm. Our present case was more than double that size, measuring at 14.5 cm at its greatest diameter. They also found that contrast-enhanced computed tomography revealed multiple feeding arteries within the masses and mild ring enhancement in several cases they examined. They believe these imaging features may be characteristic of intra-abdominal and retroperitoneal neuroectodermal tumors [13]. Mild ring enhancement was observed in 40% of cases. Three of those cases were neuroectodermal tumors of the adrenal glands. However, our case did not demonstrate such mild ring enhancement or feeding arteries on CT. CT with contrast showed no appreciable tissue density change in the arterial phase, and in the later portal venous phase, there was enhancement of the medial aspect of the lesion. For our case, the morphologic and heterogeneous enhancement features we observed on CT are most consistent to what has been re-



ported by Zhang et al. [12]. Hence, we are of the belief that adrenal ES may be considered on the differential for a large well-defined, heterogeneous suprarenal mass with or without cystic components and calcifications seen on imaging.

For our patient, CT angiography of the abdomen also proved to be an effective modality to assess the local invasiveness of the tumor. CTA confirmed inferior vena cava involvement in our patient and prompted the need of inferior vena cava thrombectomy with partial resection. Interestingly, inferior vena cava by direct extension of tumor thrombus in adrenal ES has only been reported in 4 prior cases of adrenal ES [12,14].

In summary, it is clear that while imaging characteristics of intra-abdominal ES can be suggestive, the presentation on imaging is still quite varied. Immunohistochemistry and molecular analysis is required for definitive diagnosis. Positivity of CD99 is highly specific for ES and is seen in our present case [15]. Additionally, there is no general consensus or uniform therapeutic protocol as of yet for the management of adrenal ES, given its rare occurrence. However, such adrenal malignancies have historically been managed with a combination of surgery, chemotherapy, and radiotherapy. Surgical resection for initial debulking and local control of the tumor with adjuvant chemotherapy and radiotherapy has shown favorable outcomes, given the inherent radio- and chemosensitivity of the tumor. However, neoadjuvant chemotherapy has also shown promising outcomes as well [7]. Tumor locoregional recurrence has been previously observed in cases of ES of the adrenal gland that had lacked adjuvant or neoadjuvant chemotherapy. A comprehensive multimodal therapeutic approach is generally thought to be indicated for extrasosseous forms of ES, similar to that of osseous ES [7]. Historically, adrenal malignancies have been managed with radical open surgical techniques; and several cases of ES of the adrenal gland have been reported to have safe and effective, favorable outcomes with a laparoscopic approach. Given the complexity of our case with large tumor size and invasion into the inferior vena cava, our patient required more aggressive open surgical approach, and the procedure was met with several intra- and postoperative complications. However, our patient continues to improve with adjuvant chemotherapy and has not experienced tumor recurrence as determined by PET/CT 3 months after surgery.

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