Egyptian Journal of Radiology and Nuclear Medicine

CASE REPORT

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Primary pancreatic Ewing sarcoma with metastases on FDG PET/CT

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Abstract

Background Ewing sarcoma (ES) is a highly aggressive malignant tumor most commonly affecting long bones. Extraskeletal Ewing sarcoma (EES) is a malignant tumor with aggressive behavior carrying bad prognosis with pancreas being an extremely rare primary site. We present a case of histopathologically proven EES of the pancreas in a young female who presented with abdominal pain. 18F-fluorodeoxyglucose positron emission tomography (18F FDG PET/CT) is a useful modality for detecting distant metastases in EES. It helps in diagnosis, localizing the primary, its extension, optimal treatment planning and evaluation of response to standard treatments available.

Case presentation An 18-year-old female presented with complaints of progressive abdominal pain and distention since 6 weeks. Physical examination was suggestive of a solid large mass in the upper left abdomen and decreased breath sounds with dullness in the left lower lung fields. On Contrast enhanced computed tomography (CECT) imaging, a large heterogeneously enhancing mass was seen arising from pancreas along with retroperitoneal lymphadenopathy. A moderate sized left sided pleural effusion with atelectasis of lower lobe of left lung was also noted. Histopathological analysis was suggestive of pancreatic ES following which the patient underwent five cycles of chemotherapy. Following this, she underwent 18F FDG PET/CT which showed hypermetabolic large mass arising from body and tail of pancreas with areas of internal necrosis along with left adrenal metastasis, retroperitoneal lymphadenopathy, a massive left pleural effusion and compressive atelectasis of left lower lobe. The patient expired within a week following PET/CT.

Conclusions EES most often presents in the late stage of the disease with vague symptoms. Timely diagnosis and initiation of treatment is of utmost importance considering the aggressiveness of the tumor. Establishing a diagnosis of Ewing sarcoma is especially difficult when the mass is arising from the pancreas. Imaging, histopathology and immunohistochemistry (IHC) play a key role in accurate diagnosis of such masses. 18F FDG PET/CT can be useful for detecting local and distant spread, operability, treatment planning and evaluation of response to chemotherapy.

Keywords Extraosseous, Extraskeletal Ewing sarcoma, Pancreatic mass, FDG PET/CT, Prognosis

Background

In 1921, James Ewing first described Ewing sarcoma and thereafter in 1969, Tefft described about extraosseous Ewing sarcoma/primitive neuroectodermal tumor (ES/PNET) [1, 2]. ES/PNET has unusual involvement sites such as the oral cavity, salivary glands, esophagus, stomach, lung, heart, biliary tract, pancreas and genitourinary system. The pancreas is a very rare primary site, with few cases that have been reported globally [3]. EES is a rare entity and less is known about its clinical behavior

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and optimal treatment than for its counterpart in bone [4]. PET/CT has been identified as a useful modality for detecting distant metastases in extraskeletal Ewing sarcoma. It helps to localize the primary, its extension, distant metastatic sites and to check the treatment response.

Here, we present a rare case of primary pancreatic Ewing sarcoma with retroperitoneal lymph nodes who underwent PET/CT scan for disease status evaluation. Patient expired after taking the first line of chemotherapy after PET/CT. Time between the clinical presentation and final diagnosis to start treatment was approximately 3 months.

Case presentation

An 18-year-old female presented to gastroenterology department with complaints of a dull aching and progressive upper abdominal pain radiating to the upper back for 8 weeks along with bloating and nausea. This was accompanied by rapidly progressive distention of the upper half of abdomen for 4 weeks. On general physical examination, the patient appeared pale and lethargic. The left upper half of her abdomen was grossly distended and the umbilicus was shifted to the right. On palpation of the abdomen, a hard ill-defined fixed mass was felt in the hypogastrium which did not move with respiration. The deeper extent of the mass could not be assessed by clinical examination. Her trachea was shifted to the right along with decreased breath sounds and dullness on percussion in left lung fields. Normal breath sounds were heard on the right. As a part of initial evaluation, patient was advised a CT study of the thorax and abdomen. It showed a 15.7×10.5×9.1 cm large lobulated heterogeneously enhancing predominantly solid exophytic mass arising from the body and tail of pancreas extending into gastrosplenic space superiorly and left upper retroperitoneal space inferiorly. It was found compressing the greater curvature of the stomach superomedially, the spleen superolaterally, the left kidney inferiorly and also the splenic and the left renal vessels. Multiple small sized retroperitoneal lymph nodes, largest being 13.0×9.5 mm, were also noted. Thorax images showed a moderate sized pleural effusion with contralateral shift of the mediastinum and passive atelectasis of the left lower lobe. CT guided biopsy of the abdominal mass showed the presence of fibrocollagenous tissue stroma infiltrated by small round tumor cells with round nuclei with finely stippled chromatin and scant eosinophilic cytoplasm. Homer Wright pseudorosettes were also identified

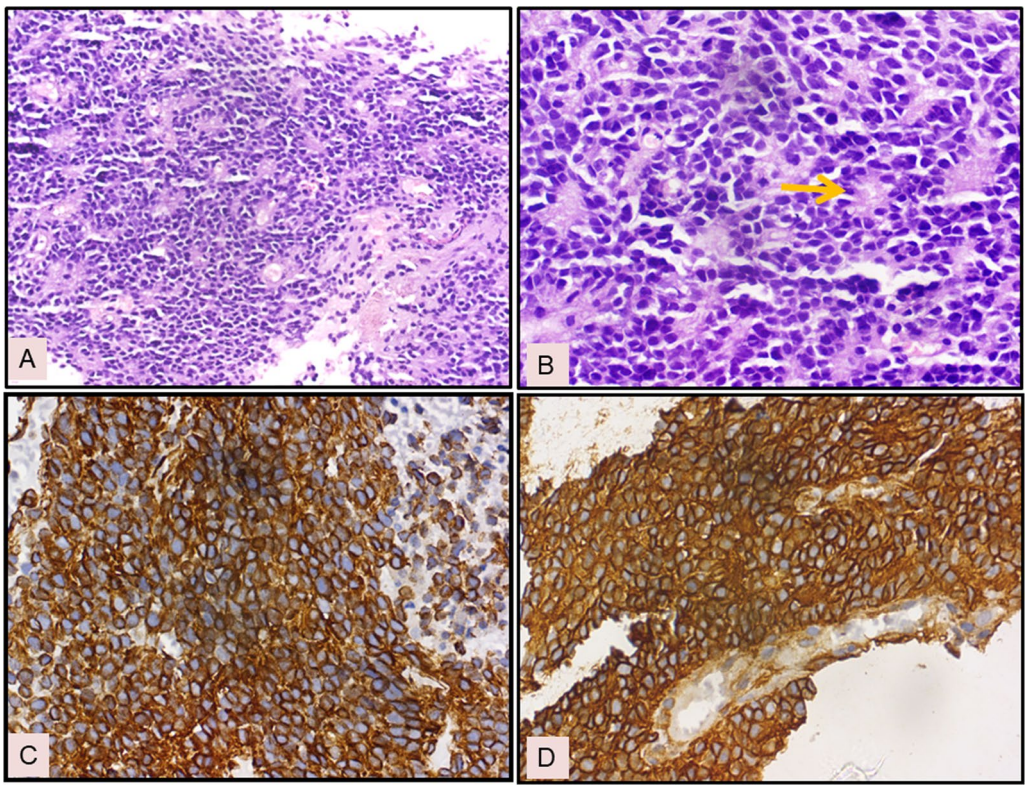

Fig. 1 Hematoxylin and eosin stain: showing monotonous population of small round cells and tumor cells arranged in sheets and rosettes (200X) (**A**), Homer Wright rosettes (arrow) consist of a central neutrophil surrounded by concentrically arranged tumor cells (400X) (**B**), Vimentin: strong diffuse staining in tumor cells (400X) (**C**) and CD99: strong and diffuse membranous staining in tumor cells (400X) (**D**)

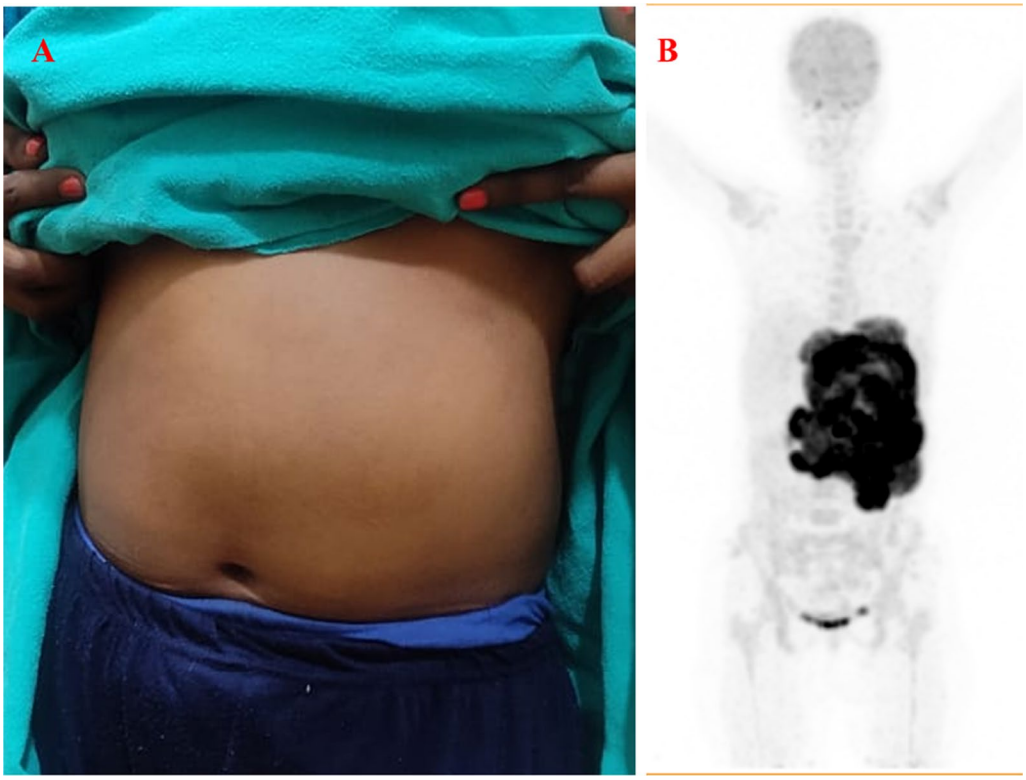

Fig. 2 A 20-year-old female, presented with left sided abdominal distention (**A**) and upper abdominal pain for 8 weeks. Maximum intensity projection (MIP) image of 18F FDG PET scan shows a large area of tracer uptake in the left side of the abdomen (**B**)

comprising of central fibrillary core surrounded by concentrically arranged tumor cells. Immunohistochemistry examination was strongly and diffusely positive for CD99 and Vimentin and negative for LCA, CK, CD56, Synaptophysin, WT1, INHIBIN, Myogenin, EMA, Desmin and S100 (Fig. 1). Based on the above findings, a diagnosis of pancreatic Ewing sarcoma was made, following which the patient underwent five cycles of first line chemotherapy comprising of vincristine, doxorubicin and cyclophosphamide. She was then referred to Nuclear Medicine department for 18F FDG PET/CT which showed a hypermetabolic well defined heterogeneously enhancing large lobulated mass (~17.7×16.1×23.7 cm, SUVmax 17.6) with areas of internal necrosis involving body and tail of pancreas. The fat planes with the adjacent left kidney were lost with compression of splenic and left renal vessels. Metabolically active preaortic (SUVmax 12.6), paraaortic and right common iliac lymphadenopathy were noted, the largest being the preaortic lymph nodes. Metabolically active left adrenal (SUVmax 11.2) metastasis was also noted. There was massive left pleural effusion resulting in passive atelectasis of the lower lobe left lung and ascites was also noted (Fig. 2, 3 and 4). Unfortunately, around one week after the patient underwent PET/CT, the patient succumbed to the disease.

Discussion

Primary pancreatic Ewing sarcoma is a very rare tumor. It should be considered in the differential diagnosis of an unusual pancreatic tumor especially in young adults. EES has an aggressive clinical course and early distant metastases [5].Usually presentation of EES patients is with bone, liver and lung involvement along with lymph nodal metastasis at time of diagnosis. Imaging plays a central role in the diagnosis, staging, restaging, treatment response and surveillance of EES. Conventional imaging (like CT, MRI etc.) can diagnose only 70% of the cases with distant metastasis [6]. MRI is the preferred imaging modality for primary tumor evaluation, diagnosis and local staging, while FDG PET/CT is used to detect metastatic disease. PET/CT is sensitive (87%) and specific (97%) for detecting distant metastasis with an accuracy of 94% [7].

FDG PET/CT helps localizing primary, staging and to check the response to standard treatment available. It also helps restating of disease and detection of recurrence prior to anatomic imaging [8–10]. Usually, EES are

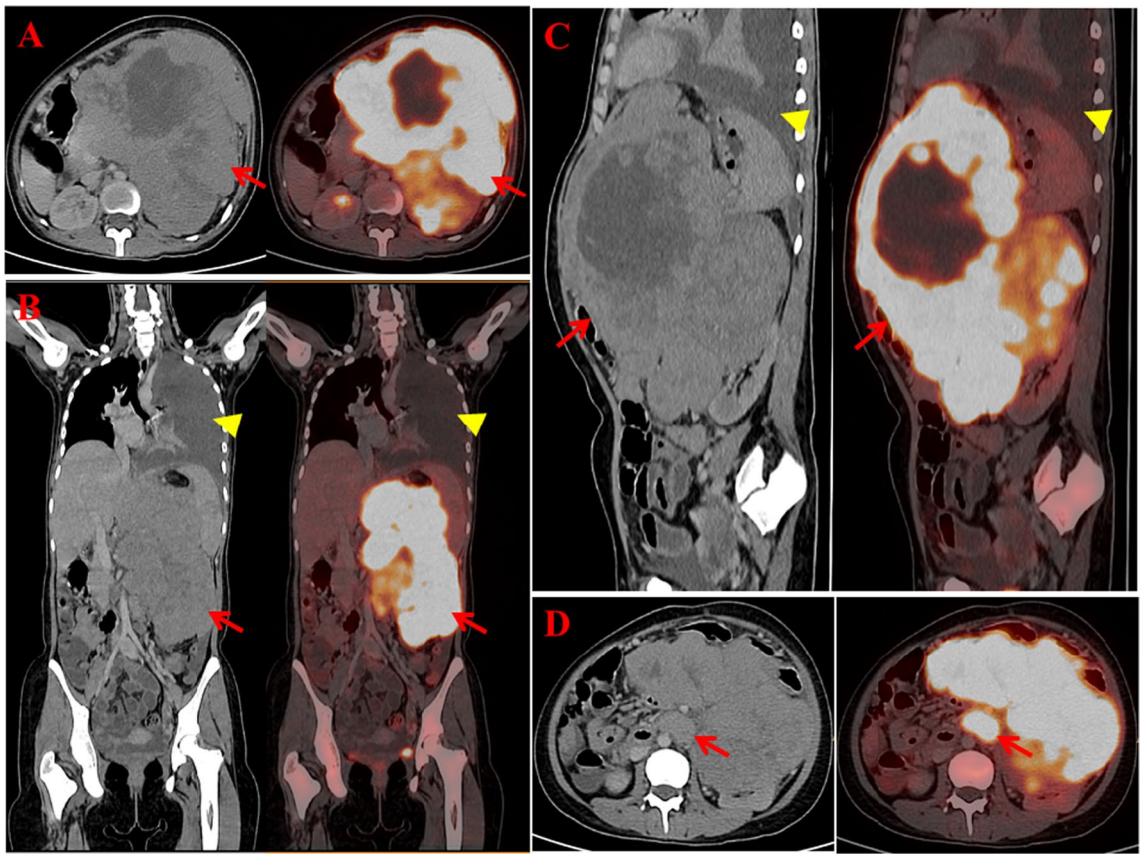

Fig. 3 Axial, coronal and sagittal CT and corresponding PET/CT images (**A**, **B** and **C**) showing metabolically active large heterogeneously enhancing lobulated mass (arrow) arising from body and tail of the pancreas with areas of internal necrosis, right pleural effusion (arrowhead) with passive atelectasis of right lung (in coronal and sagittal images). CT and corresponding PET/CT images showing metabolically active paraaortic lymph node (**D**)

aggressive and often unresectable tumors having distant metastasis at the time of diagnosis. Hence, PET/CT is useful modality detect distant metastases in such cases [11] and post-surgical recurrence with extremely high accuracy. PET/CT also provides the prognostic data.

Histopathology and immunohistochemistry are essential for making final diagnosis. It indicates need for early diagnosis and prompt treatment. Moreover, early definitive diagnosis of ES/PNET can produce better survival with current treatment modalities. Few studies have quoted that the prognosis of EES is more favorable compared to the skeletal subtype [12, 13]. The 5-year overall survival rate is superior for localized EES compared with localized skeletal Ewing sarcoma [14]. As PET/CT is valuable imaging method for diagnosis and staging of such patients, so it is time saving in initial diagnostic workup and initiation of treatment. PET/CT detects the tumor regression or progression before anatomical imaging like CT and MRI as functional/metabolic changes precede structural changes. PET/CT findings during therapy or after completion can aid in decision-making about continuation or change in treatment plan.

PET/CT helps in change in treatment plan in ESS [15]. There is paucity of literature on this because of rarity of EES and availability of PET/CT also matters.

Although in our case we had contradictory finding to the previous authors about the prognosis of EES [12, 13]. EES usually have vague or general symptoms. EES are aggressive tumors, often diagnosed in advanced stage and have poor prognosis. The probable reason behind the poor prognosis among these patients is that there is lagging in onset of symptoms to usual time of diagnosis; therefore, they are present with multiple metastatic sites and large tumor size at the time of diagnosis. In EES, tumor size is a predictor of overall survival. Tumor size $\geq$ 8 cm is a significant predictor of worse overall survival as reported by Tural et al. [16]. We have previously reported two cases of EES who died before the treatment initiation [8, 15] and the present case also has a very similar scenario. All patients had large tumor size and

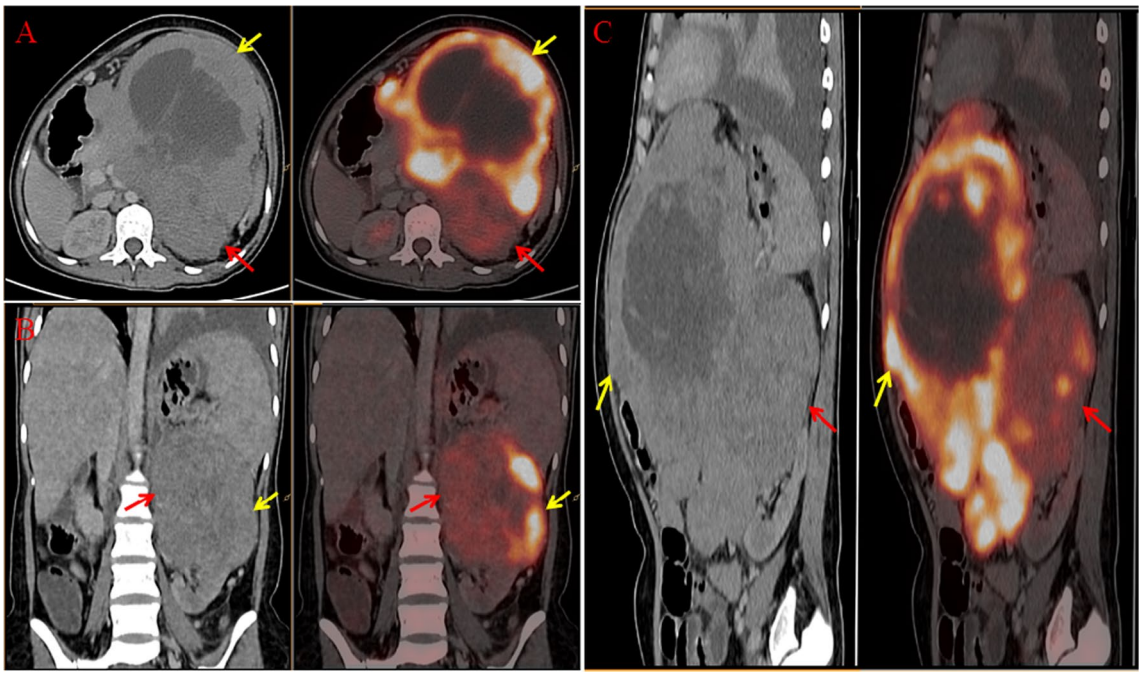

Fig. 4 Axial, coronal and sagittal CT and corresponding PET/CT images (**A**, **B** and **C**) showing metabolically active pancreatic mass (yellow arrow) along with relatively less metabolically active (as compared to pancreatic mass) left adrenal metastasis (red arrow)

multiple metastases. These patients require prompt and aggressive imaging and cytogenetic evaluation to reduce the time between onset of symptoms to usual time of diagnosis. It should be kept as primary differentials as these patients have vague symptoms, nonspecific imaging features and poor prognosis. PET/CT helps in early diagnosis, optimal treatment initiation as well as metabolic response to treatment before the anatomical changes.

Conclusions

Extraskeletal ES/PNET is a rare disease. The physicians, radiologist, as well as pathologists often face diagnostic dilemma because of vague signs and symptoms and nonspecific radiological features. Extraskeletal ES/PNET should be considered in the differential diagnosis of intraabdominal and extraintestinal masses. This problem is significantly critical when the tumor site of origin is rare, such as the pancreas. The 18F FDG PET/CT helps in diagnosis, staging, treatment planning, restaging, response evaluation and prognostication of EES. The timely and aggressive use of multimodality imaging, histopathology and immunohistochemistry aids in accelerating the diagnosis thus leading to an earlier treatment for a better outcome.

Abbreviations

ES/PNET	Extraskeletal Ewing sarcoma/primitive neuroectodermal tumor
ES	Ewing sarcoma
EES	Extraskeletal Ewing sarcoma
PET	Positron emission tomography
CECT	Contrast enhanced computed tomography
MRI	Magnetic resonance imaging
IHC	Immunohistochemistry

Acknowledgements
Not Applicable.

Author contributions
All authors have read and approved the manuscript.

Funding
No funding was obtained for this study.

Availability of data and material
The dataset used and/or analyzed during the current study available from the corresponding author on the reasonable request.

Declarations

Ethics approval and consent to participate
Written consent to participate.

Consent for publication
Written consent for publication from study participant.

Competing interests
The authors declare that they have no competing interests.

Received: 22 May 2023 Accepted: 20 August 2023
Published online: 06 September 2023

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