Role of computed tomography imaging in pediatric abdominal masses

ABSTRACT

Introduction : Abdominal masses are commonly encountered in the pediatric population, with a broad differential diagnosis that encompasses benign and malignant entities. The main goal of abdominal imaging in the context of a suspected pediatric abdominal mass is to confirm its presence, as nonneoplastic entities can mimic an abdominal mass, and to detect specific imaging findings that narrow the differential diagnosis. Computed tomography (CT) is currently the
most powerful and versatile imaging procedure for the evaluation of abdominal masses It plays an important role in characterizing the mass and extent of disease and assisting in presurgical planning.[1]

Aim: The purpose of this article is to describe the role of CT imaging in evaluation of pediatric abdominal masses.

Material and Methods: Five case reports of abdominal masses in pediatric age group have been discussed . All the five patients underwent CT scan on Philips brilliance 256 slice machine.
CT imaging findings with their histopathological diagnosis have been described.

Case summary:
Case 1 :Wilm's tumor
Case 2 : Rhabdomyosarcoma
Case 3 : Ewing's sarcoma of sacrum
Case 4 : Germ cell tumor of ovary
Case 5 : Pelvic myxoid chondrosarcoma

Conclusion : Abdominal masses in the pediatric age group include a spectrum of lesions of diverse origin and significance. CT imaging plays a key role in defining the characteristics and extent of mass lesions found in infants and children. Imaging with histopathological correlation can be very helpful in the management of the patient.

Key words: Pediatric, Abdominal mass, Computed tomography

INTRODUCTION :

"Pediatric abdominal masses comprise a varied group of conditions, attributable to different parent organs and manifesting themselves at different stages of prenatal life"[1].

"Abdominal masses are common in pediatric patients and frequently more than one imaging modality will be used to identify and diagnose a given abdominal mass. Hence, diagnostic evaluation of an abdominal mass in an infant or child is a challenging problem".[2]

"Plain radiograph of the abdomen remains an important component of the early investigation of an abdominal mass primarily for the purpose of detecting calcification and the effect of mass on surrounding structures such as bones or gastrointestinal tract"[3]

Ultrasonological examination can swiftly reveal critical information about the organs of origin as well as some tissue characterisation. As a result, it is frequently the preferred screening method for abdominal masses in children.

The primary drawbacks of ultrasonography include operator dependence and the possibility that abdominal gas can interfere with image quality. Nevertheless, ultrasonography will frequently confirm the diagnosis. Perhaps no additional imaging is required. For larger ill defined or poorly visualized mass, sectional imaging

in the form of computed tomography or magnetic resonance imaging can be helpful. Both modalities provide superior delineation of the margins and extent of abdominal masses.

"Computed tomography (CT) and magnetic resonance imaging (MRI) are superior in providing anatomical detail and pathological information of organs and vascular structures in the retro-peritoneum despite over lying gas and bone".[2]

CT offers superb demonstration of anatomy and allows detection of the organ of origin, assessment of the degree of organ involvement, local and nodal spread, vascular invasion and metastatic spread.

Though the hazardous effects of radiation in paediatric patients in whom there are more number of cells in a dividing state, are well known, computed tomography is still an ideal imaging modality due to its easy availability, lesser financial constraints and less time consuming

PRESENTATION OF CASES:

Five cases of pediatric patients with abdominal masses have been discussed.

All the patients underwent CT scan on Philips Brilliance 256 slice CT scan machine at New Civil Hospital, Surat. The informed written consent was taken from the parents/guardians of the patients.

All the patients were subjected to both non-contrast and contrast enhanced CT in axial planes with multiplanar image reconstructions in sagittal and coronal planes wherever necessary. The contrast was given in the concentration of 1-2 ml/Kg body weight. Non-ionic contrast media was used invariably in all patients. All the sections were studied in two window settings one for soft tissue and another in bone window to rule out any bony involvement or calcifications. CT scan findings with the final histopathological diagnosis have been illustrated.

CASE l :

A 2 year old female child presented with complaint of abdominal fullness, pain and hematuria. Patient's CT scan findings were suggestive of a large lobulated heterogeneously enhancing soft tissue density lesion with e/o areas of necrosis and with e/o multiple calcific foci within, arising from upper pole of right kidney and also crossing midline to left side and causing displacement of liver , bowel loops and abdominal vessels and urinary bladder.

Histopathological findings were suggestive of **Wilms's tumor**.

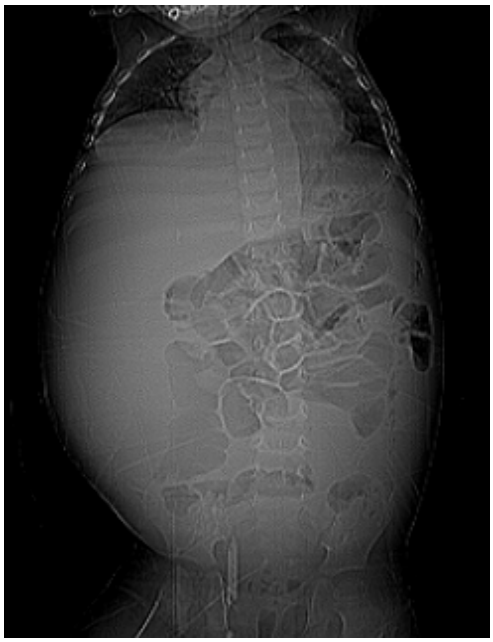


FIG. 1 plain abdominal radiograph showing soft tissue opacity in right lumbar and iliac region with contralateral displacement of bowel loops and superior displacement of liver.

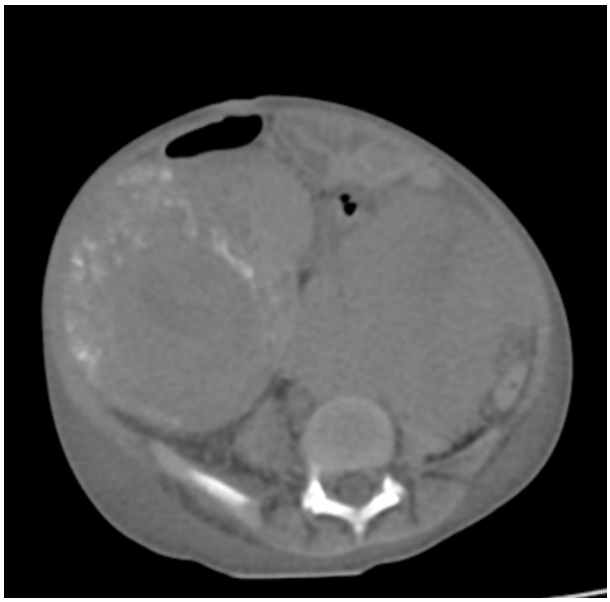
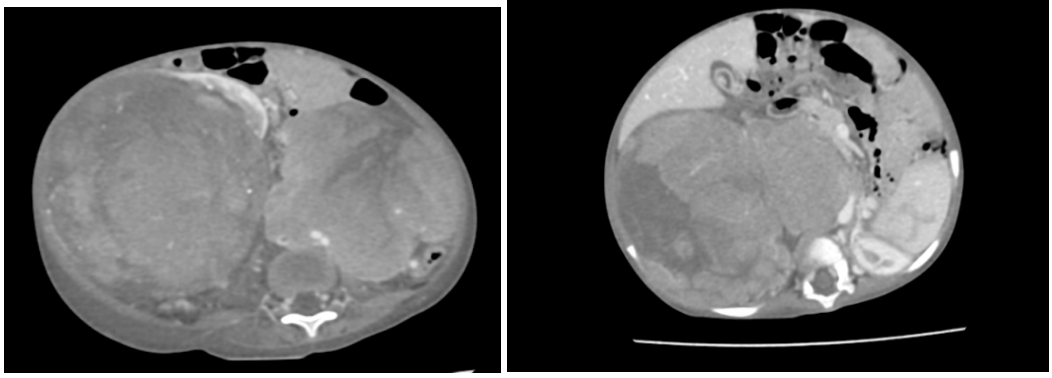
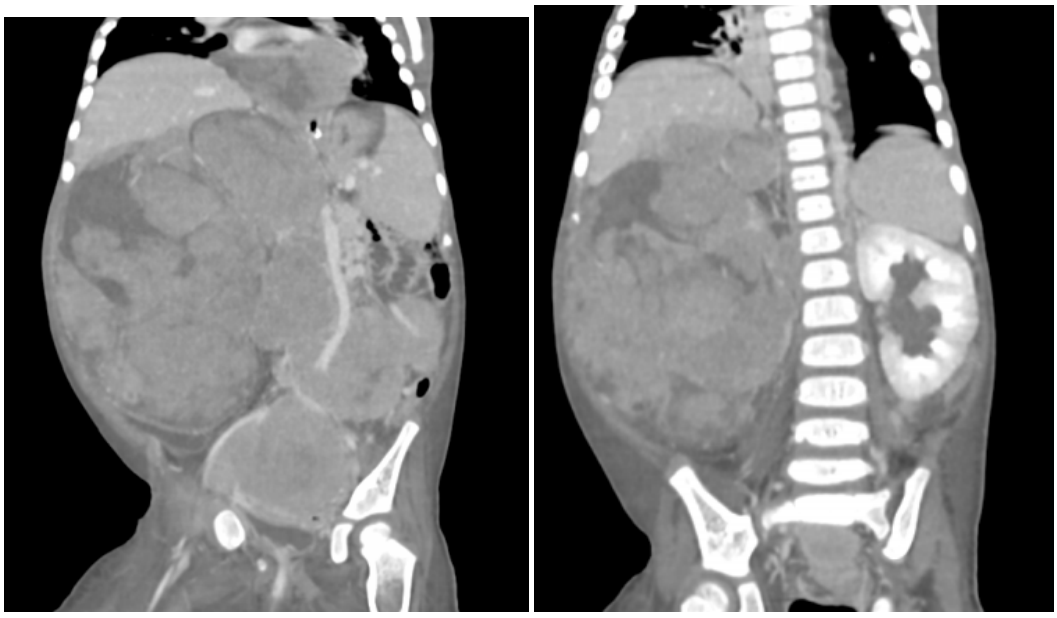


FIG 2 Plain CT abdomen (axial)- showing large mass with multiple foci of calcification within.



A. **B.**

FIG. 3 (A and B) - CECT abdomen (axial) - large heterogeneously enhancing mass arising from right kidney and crossing midline to left side.; shows preserved fat plane with liver. Residual right renal parenchyma is noted (arrow). Also the lesion is displacing the abdominal vessels towards left side.



A **B**

FIG. 4 (A and B) CECT abdomen (coronal)-lesion is causing contralateral displacement of aorta and with IVC not visualized separately (possibility of compression / thrombosis.) Left kidney appears normal.

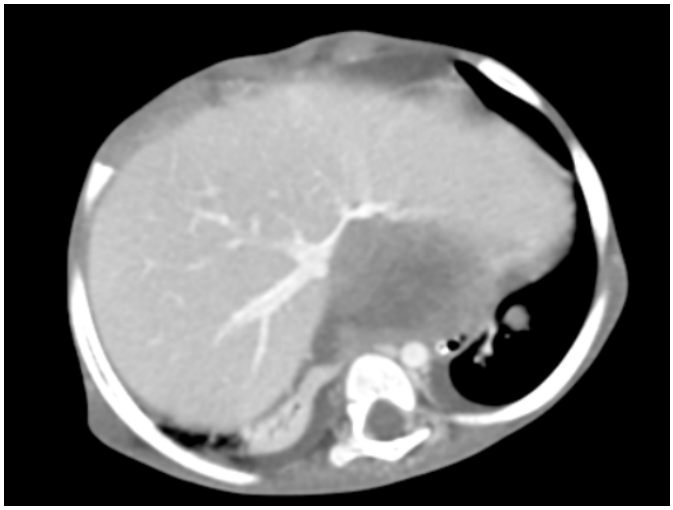


FIG. 5.
heterogeneously enhancing soft tissue density lesion is noted in basal segment of left lower lobe - s/o pulmonary metastasis

CASE II:

A 8 year old male child with complaint of abdominal fullness. CT findings were suggestive of a large multilobulated heterogeneously enhancing soft tissue density lesion involving right side of abdomen possibly arising from right posterior pararenal space and abutting inferior surface of liver and superior pole of right kidney with indistinct intervening fat plane.

Histopathological findings were suggestive of **rhabdomyosarcoma**.

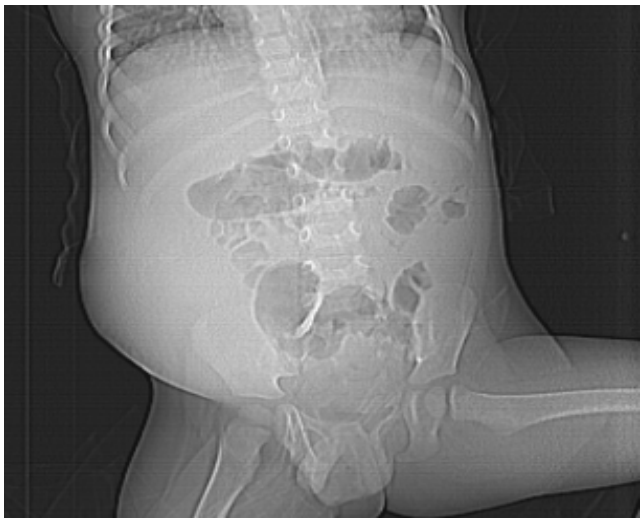


FIG.6 : Plain abdominal radiograph showing soft tissue opacity in right lumbar and RIF with external bulge noted on right side.

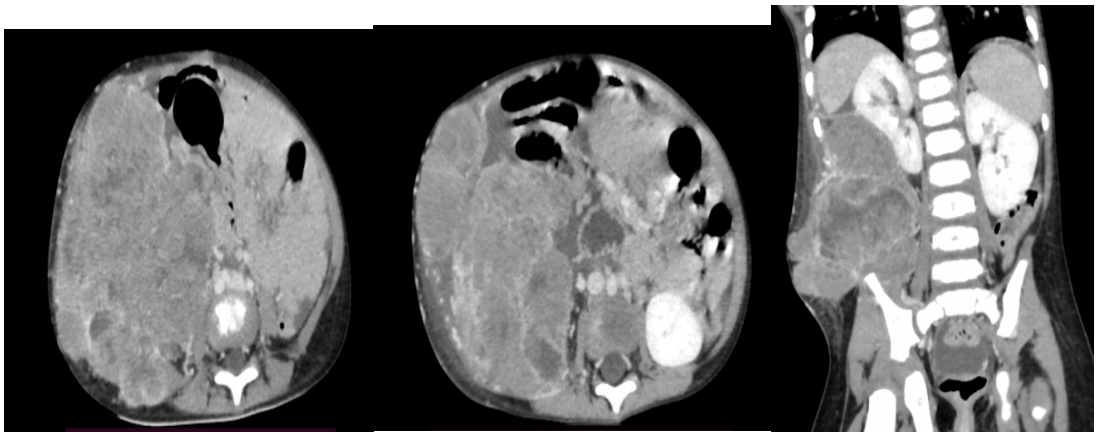


FIG. 7 : CECT abdomen -A & B (axial) and C (coronal) showing large heterogeneously enhancing mass on right side of the abdomen causing displacement of bowel loops to left side. Also it appears to abut and compress right renal parenchyma. The lesion is infiltrating into subcutaneous tissue in right lateral abdominal wall.

CASE III:

An 8 year old girl presented with complaints of abdominal pain and distension since 2 months. Patient had developed complaints of low backache associated with lower limb weakness followed by anal and urinary incontinence.

Histopathological findings were suggestive of **Ewings sarcoma of sacral origin**.

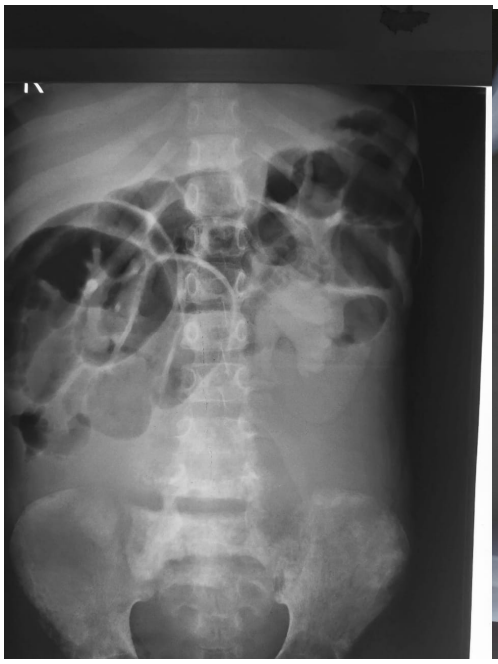


FIG. 8 (A) LS Spine AP radiograph: S1 and right sacral ala sclerosis with sclerotic changes in L5 pedicles

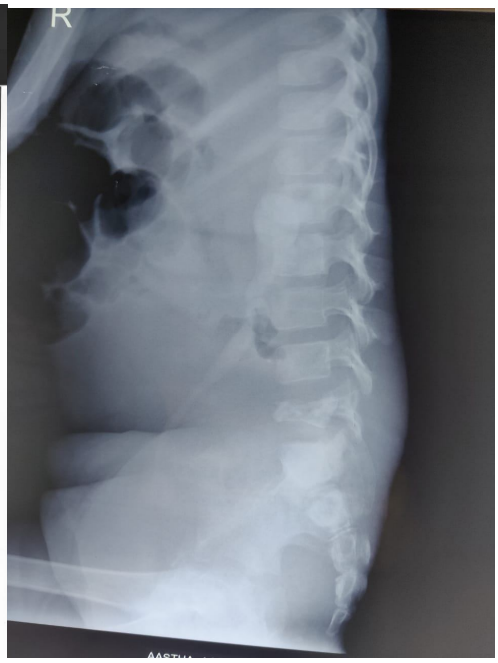
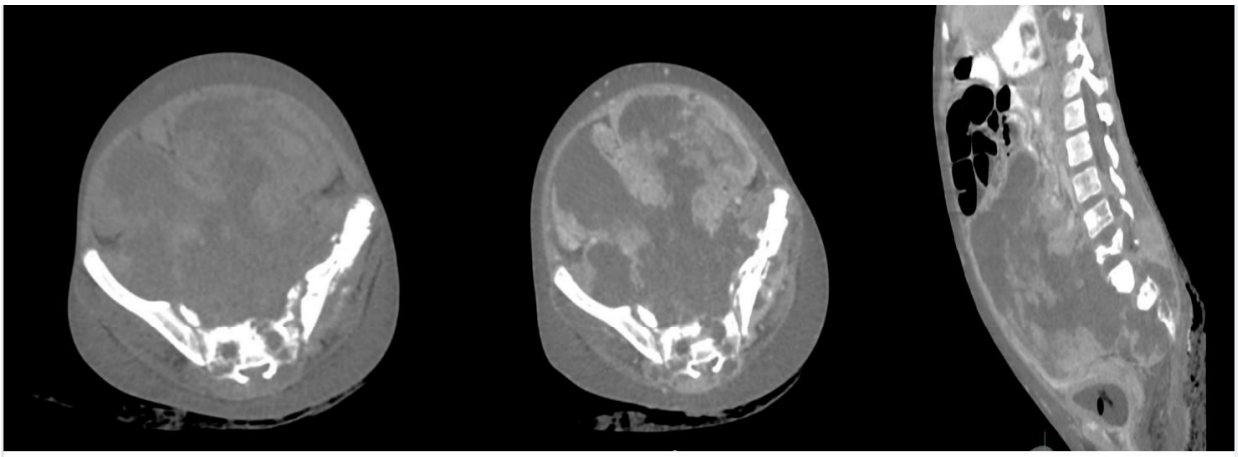


FIG 8 (B) LS spine – lateral radiograph L5 wedging with widening of presacral space and sclerosis of S1

- CT scan revealed mixed lytic and sclerotic lesion in L5 and S1 vertebral body with associated large multilobulated heterogeneously enhancing soft tissue density lesion extending into lower abdomen and pelvic cavity.
- Pleural based metastases, vertebral metastasis and bony metastasis in bilateral iliac wings, left superior pubic rami and head & neck of femur on left side were noted.

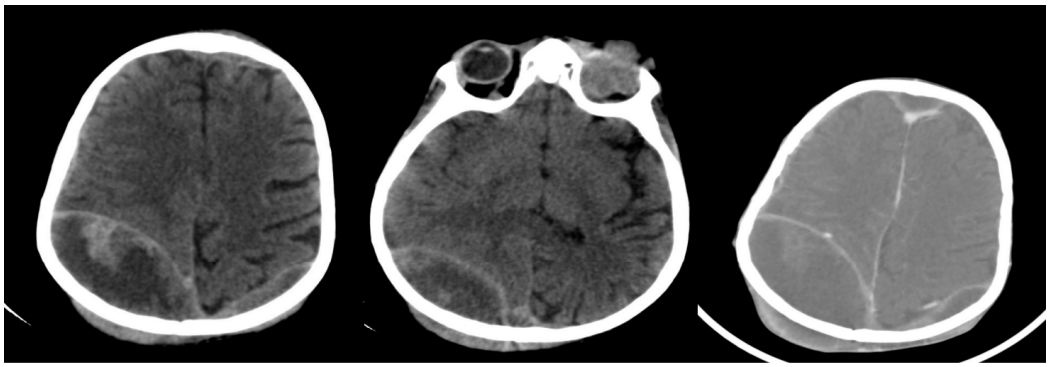
  CT scan BRAIN revealed Dural based metastasis, orbital metastasis, scalp metastasis and Dural venous sinus thrombosis



A. B. C.

CT abdomen(A.) PLAIN and (B.) POST CONTRAST AXIAL and (C.) SAGITTAL images showing mixed lytic and sclerotic lesion in L5 ans S1 vertebral body with associated large multilobulated heterogeneously enhancing soft tissue density lesion extending into lower abdomen and pelvic cavity.

Fig 9: CT abdomen(A.) PLAIN and (B.) POST CONTRAST AXIAL and (c.) SAGITTAL images showing mixed lytic and sclerotic lesion in L5 and S1 vertebral body with associated large multilobulated heterogeneously enhancing soft tissue density lesion extending inro lower abdomen and pelvic cavity.



A. B. C.

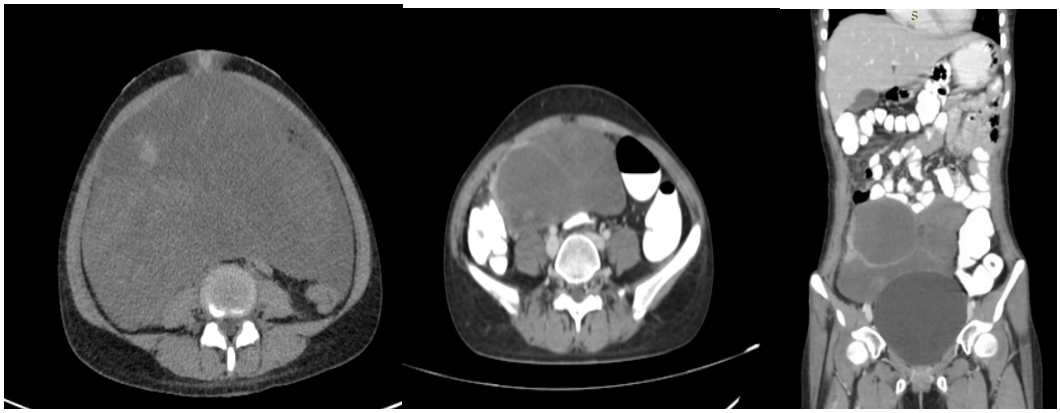
CT Scan BRAIN (A.)& (B.) PLAIN AXIAL and (C.) Post contrast images showing dural based lesions suggestive of dural based metastases and heterogenously enhancing soft tissue lesion in left orbit (s/o orbital metastases.)

Fig 10: CT scan BRAIN (A.) & PlAIN AXIAL and (c.)post contrast images showing dural based lesions suggestive of dural based metasteses and heterogeneously enhancing soft tissue lesion in left orbit (S/O orbit metasteses)

CASE IV:

A 12 year old female presented complaint of abdominal distension.

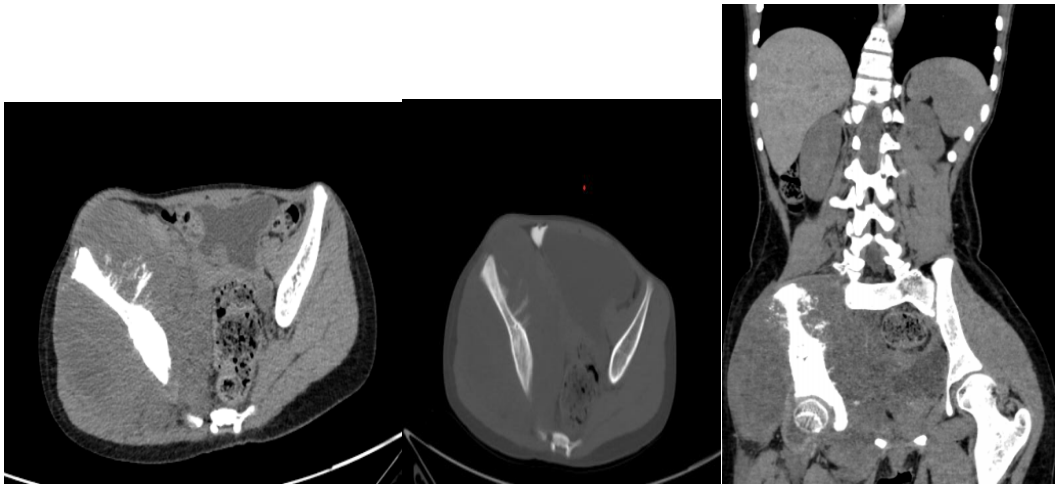
CT scan findings were suggestive of A large multiloculated solid-cystic lesion with multiple enhancing solid components and multiple thin enhancing septations within it, arising from pelvic cavity and extending into abdominal cavity occupying bilateral Iliac fossae, bilateral lumbar regions and reaching up to epigastric region with both ovaries not visualized separately from the lesion.
Histopathological findings were suggestive of **germ cell tumor of ovarian origin**.



A B C

FIG. 11 CT abdomen showing large mass occupying whole peritoneal cavity. B & C. are post chemotherapy follow up scan suggestive of marked reduction in the size of the mass lesion.

CASE V :
A 8 year old female patient presented with complaints of abdominal lump and difficulty in walking.
CT findings were suggestive of a lobulated soft tissue density lesion with underling ilium, ischium and pubic bone showing multiple sclerotic areas and spiculated solid periosteal reaction.
Histopathological findings were suggestive of **myxoid chondrosarcoma**.



A B C

FIG. 12 Large mass lesion with spiculated periosteal reaction in underlying ilium and ischium is noted.

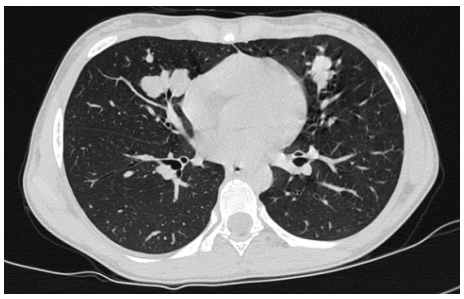


Fig 13: D - CT lung showing pulmonary metastasis

DISCUSSION :

"Wilms tumor, also known as nephroblastoma is the most common pediatric malignant renal neoplasm typically occurring in early childhood (1-11 years), with peak incidence between 3 and 4 years of age. The tumor usually arises in a single kidney. Synchronous bilateral or multifocal tumors occur in approximately 10% of patients and tend to present at an earlier age" [4].

"Majority of patients present with large tumors, which may be unresectable making neoadjuvant chemotherapy followed by surgery the preferred approach. Histology and staging are used for risk stratification. The imaging procedure of choice is CECT of thorax/ abdomen and pelvis, which should be done at presentation, as well as for re-evaluation" [5].

As in our case, patient presented with large abdominal mass which was crossing midline and showed pulmonary metastasis.

"CT is currently the technique of choice in the diagnosis and staging of renal masses in children, and is particularly relevant in recognition of size and site of lesion and densitometric patterns".[6] "It also provides an excellent visualization of contiguous structures like vessels and lymph nodes".[6]

Rhabdomyosarcomas, the commonest soft tissue sarcoma in pediatric age group, represent 5–10 % of all solid tumors in childhood. These tumors are rare in adult population. There are sporadic case reports of intra-abdominal rhabdomyosarcoma, but mostly in pediatric age group.

"They are well circumscribed but not encapsulated and often tend to infiltrate extensively into adjacent tissues.

Imaging of the primary site with US, MRI or CT is required in all patients at the start of the diagnostic work-up" [7]. Once the diagnosis has been confirmed histologically, the most frequently involved metastatic sites will be investigated; CT of the lungs and imaging of regional lymph nodes are recommended for every patient.

"Ewing's sarcoma is a malignant round cell neoplasm of bone. Spinal column involvement is infrequent; compromising 10% of bone lesions of primary Ewing's sarcoma. Sacral involvement is even rarer" [9].

"In Ewing's Sarcoma of the sacrum the CT scan and radiographs usually reveal lytic, sclerotic or mixed lesions involving paraspinal soft tissue and extra Dural space" [11] which were seen in our case.

"Differential diagnosis includes tuberculosis, pyogenic osteomyelitis, lymphoma, chordoma, osteogenic sarcoma and Ewing's sarcoma". [8,10].

Chondrosarcomas in children and adolescents are uncommon and constitute < 5% of all chondrosarcomas. The pelvis is the most common site, followed by the proximal femur.

"Chondrosarcoma arising from pelvis and extremity has higher propensity for malignant transformation" [11].

"In children and adolescents, GCTs represent the most common histological type of ovarian tumors and are benign in the majority of cases" [12,13]. "According to the World Health Organization (WHO), ovarian GCTs are classified into many histological subtypes including dysgerminoma, yolk sac tumors, embryonal carcinoma, polyembryoma, choriocarcinoma, teratomas and mixed GCTs" [14]. "The term mixed GCTs is applied to neoplasm containing a combination of malignant germ cell elements.

Radiologically, it appears as a voluminous mass with heterogeneous composition: cystic and solid components with areas of necrosis and haemorrhage" [15]. Similar radiological findings were noted in our case.

CONCLUSION :

Etiological detection of the pediatric mass lesions by CT is quite accurate when the protocol and patient preparations are standardized. Hence CT scanning should be the ideal investigation of choice in evaluation of lesions presenting as pediatric abdominal masses. It is particularly effective in detecting, characterizing, and assessing the degree of disease processes. Also, it has a significant role in early detection as well as post treatment follow up imaging

Consent

As per international standard or university standard, parental(s) written consent has been collected and preserved by the author(s).

Ethical Approval:

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

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