Original Research Article

Study of computerised tomography (CT scan) in diagnosis of paediatric intra-abdominal masses at VIMS, Pawapuri, Nalanda(Bihar)

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Abstract

Background: Paediatric abdominal masses comprise a varied group of conditions, attributable to different parent organs and manifesting themselves at different stages of postnatal life. Abdominal masses are common in paediatric patients and frequently more than one imaging modality is used to identify and diagnose a given abdominal mass. **Materials and Methods:** A prospective study of 25 paediatric cases of clinically suspected abdominal masses was conducted in the department of Paediatrics with the help of department of Radiodiagnosis at Vims, Pawapuri,Nalanda during the period from July 2019 to January 2020. The study included 13 male children and 12 female. Age of the patients ranged from neonates 10 days of age to adolescents of 15 years. CT scan of pediatric patients with abdominal masses were done. All the 25 cases were subject to both non-contrast and contrast (both oral and intravascular) enhanced CT in axial planes with multiplanar image reconstructions in sagittal and coronal planes wherever necessary. **Results:** In this study, 7 cases of Wilm's tumours were detected. These cases showed large spherical heterogenous soft tissue density intrarenal mass lesions which enhanced after intravenous administration of contrast media but usually to a lesser degree than the adjacent normal renal parenchyma. A single case out of 7 cases showed minimal calcification which is within 15% of cases. Extension through capsule to perinephric space was seen in one case (15%), which are in conformity, with the study of Griscom and Kirks. **Conclusion:** In this study it was found that the etiological detection of the pediatric abdominal mass lesions by CT was up to 90% when the protocol and patient preparations are standardized. Hence CT scanning should be the ideal investigation of choice in evaluation of lesions presenting as paediatric abdominal masses. It is most useful in detecting, characterizing and determining the extent of disease process. In this study, as the new spiral mode CT machine was used it was found that due to capability of the spiral mode to collect extensive contiguous volume data the detection of small lesions is possible than the older conventional CT scanner.

Key Words: Paediatric abdominal mass, CT, perinephric space

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INTRODUCTION

Paediatric abdominal masses comprise a varied group of conditions, attributable to different parent organs and manifesting themselves at different stages of postnatal life. Abdominal masses are common in paediatric patients and frequently more than one imaging modality is used to identify and diagnose a given abdominal mass. Hence, diagnostic evaluation of an abdominal mass in a neonate, in an infant or in a child is a challenging problem. 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 astructures such as bones or

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gastrointestinal tract. Ultrasonological examination can quickly provide important information regarding the organs of origin and some degree of tissue characterization. Therefore, it is usually the screening procedure of choice for abdominal masses in children. The main drawbacks of ultrasound are that, it is operator dependent and the abdominal gas can interfere with the quality of images. Nevertheless in many cases ultrasound will establish the diagnosis. Further imaging may not be necessary. 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 details and pathological informations of organs and vascular structures in the retro peritoneal space despite over lying gas and bone. Vascular involvement is best demonstrated in MRI and Ultrasound Doppler examinations. Angiography is currently indicated for abdominal masses only if a precise knowledge of segmental vascular anatomy is required before operation. 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.

MATERIALS AND METHODS

A prospective study of 25 paediatric cases of clinically suspected abdominal masses was conducted in the department of paediatrics with the help of department of Radio-diagnosis at Vims, Pawapuri, Nalanda during the period from July 2019 to January 2020. The study included 13 male children and 12 female. Age of the patients ranged from neonates 10 days of age to adolescents of 15 years. A complete evaluation of these patients was done in following format.

a. Detailed birth history
b. Detailed clinical history
c. Clinical examination of abdomen
d. Routine investigations like haemogram, blood smear, serum urea, serum creatinine, stool routine and microscopy, urine routine and microscopy.
e. Abdomen radiographs
f. Ultrasound examinations of abdomen.
g. CT scan of abdomen (Plain and Contrast)

Cases were followed up to reach the confirmatory histopathological diagnosis wherever it was possible.

CT scan Technique

CT scan of pediatric abdominal masses were done with GE high speed dual slice CT . All the 25 cases were subjected to both non-contrast and contrast (both oral and intravascular) enhanced CT in axial planes with multiplanar image reconstructions in sagittal and coronal planes wherever necessary. Contiguous thin sections of 5mm in the infant and older children with thinner slices through small areas of interest were done in conventional CT. Spiral CT with its rapid sub second data acquisition and appropriate optimization of contrast obviated the need for sedation in some older cooperative children. 3D reconstruction of spiral volumetric data acquisition and dual phase contrast imaging enhanced accurate anatomic evaluation of the specific organs of interest. 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. The specific Hounsfield unit (HU) values of the region of interest were thoroughly studied. The results obtained from clinical examination, routine investigation, disease specific biochemical markers for imaging and pathology correction. CT scan study, surgical and post surgery histopathological findings were analyzed and were correlated with observations of similar studies by other workers. Summary and conclusions were drawn as regard to the accuracy and utility of CT scan in evaluating pediatric abdominal masses in the neonates, infants and children by analyzing the above findings and on basis of comparison with report from other literatures.

RESULTS

Table 1: Age distribution of the cases presenting with abdominal mass in neonates and younger infants

Age	Male	Female	Total
0-2 months	4	1	5
2-6 months	1	2	3
6 months-1 year	1	1	2
Total	**6**	**4**	**10**

Table 2: Age distribution of the cases presenting with abdominal mass in older infants and children

Age	Male	Female	Total
2-5 years	4	2	6
5-10 years	3	3	6
10-15 years	1	2	3
Total	**8**	**7**	**15**

Table 3: Distribution pediatric abdominal masses according to anatomical organ of origin in neonates and younger infants found on CT

Organ of Origin	Male	Female	Total	Percentage
Renal	3	3	6	60%
Non renal	1	1	2	20%
GI	1	0	1	10%
Hepatospleno biliary	1	0	1	10%
Genital	0	0	0	0%
Total	**6**	**4**	**10**	**100%**

In this study, 7 cases of Wilm's tumours were detected which showed large spherical heterogenous soft tissue density intrarenal mass lesions which enhanced after intravenous administration of contrast media but usually to a lesser degree than the adjacent normal renal parenchyma. A single case out of 7 cases showed minimal calcification which is within 15% of cases. Extension through capsule to perinephric space was seen in one case (15%), which are in conformity, with the study of Griscom and Kirks. In this study, 2 neuroblastoma cases were found which appear on CT as heterogonous paraspinal suprarenal soft tissue density masses with lobulated margins and enhancing less than the surrounding normal tissue. Calcifications were found in both the cases (Stippled calcification in one case and mottled calcification in the other). These findings correlate well with the findings of Boechat MI. In all cases of paediatric abdominal masses included in this study, the lesions were accurately localized, involvement of adjacent anatomical structures were clearly demonstrated and the presence of lymphadenopathy, adjacent visceral metastasis and midline crossing of mass could be established. The overall accuracy in characterizing the lesions causing paediatric abdominal masses was 90%. In only one case, the diagnosis was missed as small Wilm's tumour was near the upper pole of left kidney which was later confirmed with other multiplanar imaging and surgery as neuroblastoma. Similar observations have been made by Donaldson JS, Feshman EK and Luker GD.

DISCUSSION

In the national Wilm's tumour study group 5 (NWTS5) the tumour stage is determined operatively. The grade is established on pathologic examination. The preoperative imaging protocol in NWTS 5 includes abdominal and pelvic sonography, abdominal and pelvic CT, Chest CT and conventional chest radiography. Ultimately the data will be analyzed to determine what modalities of treatment are most beneficial to patient. Griscom NT, showed that 55% of paediatric abdominal masses were of renal masses both in the early and late age group. In this study, it was found that 14 cases (56%) were of renal origin. So it is in conformity with the study of Kirks in which renal masses was the most common cause of abdominal mass in paediatric age group. Again by the same study group Griscam NT and Kirks around 25% cases of paediatric (neonates and young infants) abdominal masses was due to hydronephrosis and in 20% cases in older infants and children. In this study it was found that 3 cases of abdominal masses due to hydronephrosis in neonates and young infants and one case in older age group which is in conformity that hydronephrosis presenting as abdominal mass was more common in the neonates and young infants age group than the older children. Nimkin K. Teeger S. study shows that adrenal haemorrhage is the most common cause of an adrenal mass in the neonate occurring as a result of perinatal stress and less common in older infants and children and usually is the result of trauma. Smith EL study shows that neuroblastoma is the most common malignant abdominal tumour in children usually affecting children under age of 4 years and more than half of all neuroblastoma originate in the abdomen and two thirds of these arise in the adrenal gland. In this study it was found that 2 cases of adrenal haemorrhage were found in which the patients were in the age group of 6 months and 4 cases of neuroblastoma presenting as abdominal masses were found in which the patients were in the age group of 1-4 years. So it is conformity with above two studies.

CONCLUSION

In this study it was found that the etiological detection of the pediatric mass lesions by CT scan was up to 90% when the protocol and patient preparations are standardized. Hence CT scanning should be the ideal investigation of choice in evaluation of lesions presenting as paediatric abdominal masses. It is most useful in detecting, characterizing and determining the extent of disease process. In this study, as the new spiral mode CT machine was used, it was found that due to capability of the spiral mode to collect extensive contiguous volume data the detection of small lesions is possible than the older conventional CT scanner. Though there is always a risk of radiation hazard for the pediatric patients, utility of the CT scanning to evaluate a pediatric abdominal mass is bound to increase. But we have to do more research work in relation of radiation hazards with diagnostic specificity of CT scanning. Finally with technical advancement and improvement of CT scanners like invent of multi row detector CT scanners like 64 and 256 slices, they should be compared for a specific lesion and should be optimized keeping three things in mind i.e. Technology, radiation hazard and diagnostic specificity.

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