A Cross Sectional Study on Imaging of Paediatric Intra-Abdominal Cystic Lesions

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ABSTRACT

BACKGROUND

Abdominal cystic lesions are not so uncommon in the paediatric age group. Ultrasonography (USG) is the initial investigation of choice for detection of lesions. Computed tomography (CT) and magnetic resonance imaging (MRI) further compliment the findings of USG and help in the final diagnosis of various abdominal lesions in this age group. Because of the overlap in imaging features, histologic analysis is usually necessary to establish a diagnosis. The major role of the radiologist is to document the cystic nature of these abdominal masses and to determine the origin. Our aim was to study the incidence of cystic abdominal lesions in the paediatric age group and role of imaging in the diagnosis of various types of cystic lesions.

METHODS

This is a cross sectional study of 60 children who have been referred to radiology department with abdominal symptoms, over a period of 18 months (from April 2018 to September 2019) in Niloufer hospital, Hyderabad. Children suspected to have abdominal lesions have been referred to radiology department. USG is the initial investigation done and further CT / MRI has been done according to the findings on USG. Paediatric patients of age day 1 to 12 years, both male and female suspected to have abdominal cystic lesions either clinically or sonologically have been included in the study. Retroperitoneal lesions are excluded from study.

RESULTS

Out of the 60 patients studied, 44 patients were females and the rest were males. The most affected age group was between 0 - 1 year which constituted to 50 percent of the total cases studied. The most common pathologies are ovarian cyst and duplication cyst which constituted about 49 % of the cases. Statistical significance has been observed between the gender and incidence of cystic lesions.

CONCLUSIONS

Imaging plays a key role in the evaluation of various types of cystic lesions in the paediatric age group and arrive at a particular diagnosis based on specific imaging features. The radiologist must consider patient age, clinical parameters and imaging findings to formulate the likely diagnosis of cystic lesions. USG being cost effective, widely available and with no risk of radiation has been chosen as the first modality for investigation.

KEYWORDS

Cystic Lesions, USG, CT / MRI, Ovarian Cyst, Enteric Duplication Cyst

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BACKGROUND

Abdominal cystic masses are common in children. Their etiopathogenesis, histology, localisation and clinical presentation differ significantly which could lead to diagnostic dilemmas. Patients usually present with mass per abdomen. Other symptoms include abdominal pain, early satiety, bowel obstruction, or fever if the underlying cause of the mass is infection. Various types of cystic lesions occur in this age group of which some of them have specific imaging features sonologically. On the basis of sonographic findings, selection of additional imaging modalities including CT and MRI can be applied more judiciously. CT and MRI provide additional information and help to narrow down the diagnostic possibilities.

Objectives

1. To study the imaging findings of various intraperitoneal cystic lesions that occur in paediatric age group.
2. To study the incidence of various types of intraperitoneal cystic lesions in paediatric age group.
3. To evaluate various cystic lesions and differentiate them based on their imaging findings.

METHODS

This is a cross sectional, hospital-based study conducted over a period of 18 months from April 2018 to September 2019 in the Department of Radiodiagnosis, Niloufer Hospital, Hyderabad.

Sample Size & Sample Technique

All the paediatric patients suspected to have intra-abdominal cystic lesions clinically, referred to radiology department, Niloufer hospital, Hyderabad between April 2018 - September 2019 were included in the study. Sample size calculation was time bound and sampling technique was whole sample study.

Inclusion Criteria

- The paediatric patients suspected to have abdominal cystic lesions either clinically or sonologically.
- Patients with antenatally detected intra-abdominal cystic lesions who have been referred for postnatal scan.
- Patients aged day 1 to 12 years have been included in the study irrespective of sex.

Exclusion Criteria

- Patients with solid intra-abdominal lesions on imaging.
- Patients with retroperitoneal lesions.
- Patients who did not give consent to be a part of the study.

Clearance was obtained from the institutional ethics committee. After obtaining informed consent, 60 patients were enrolled in the study. Patients initially underwent clinical and biochemical evaluation. Then USG has been done on Esaote Mylab50. Based on USG findings diagnostic possibilities has been arrived at, sonologically. The children were further subjected to CT / MRI if needed accordingly. MRI has been done on Philips 1.5 Tesla for biliopancreatic abnormalities with dedicated magnetic resonance cholangiopancreatography (MRCP) protocol, and CT has been done on Toshibha Aquilion 16. CT scan included plain and contrast study using intravenous iomeprol. Pedicloryl has been used for sedation of the patients. The lesions have been evaluated on CT in their entirety regarding size, extent, mass effect over adjacent organs and any complications if present. A note of any other incidental findings in the study have also been made.

Statistical Analysis

Data was entered in Microsoft Excel and analysis was done using SPSS version 20. Results on categorical measurements are presented as percentages. Significance is assessed at 5 % level of significance, $P < 0.05$ – statistically significant Fisher's exact test / chi square test was used to find out the significance of study parameters on a categorical scale between two groups.

RESULTS

Age (Years)	Frequency	Percent
≤ 4	43	71.7
5 - 8	11	18.3
9 - 12	06	10
Total	**60**	**100**

Table 1. Age Distribution

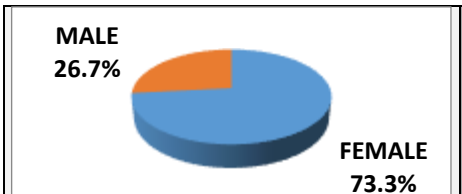

Figure 1. Sex Distribution

Cyst	Frequency	Percentage
Enteric Duplication Cyst	14	23.3
Ovarian Cyst	15	25
Choledochal Cyst	15	25
Lymphangioma	7	11.7
Omental Cyst	5	8.3
Meconium Pseudocyst	2	3.3
Simple Hepatic Cyst	2	3.3
Total	**60**	**100 %**

Table 2. Incidence of Various Cysts

The association between age and incidence of lesions was found to be statistically in-significant (P = 0.621).

The association between sex of the child and incidence of lesions was found statistically significant (P = 0.036)

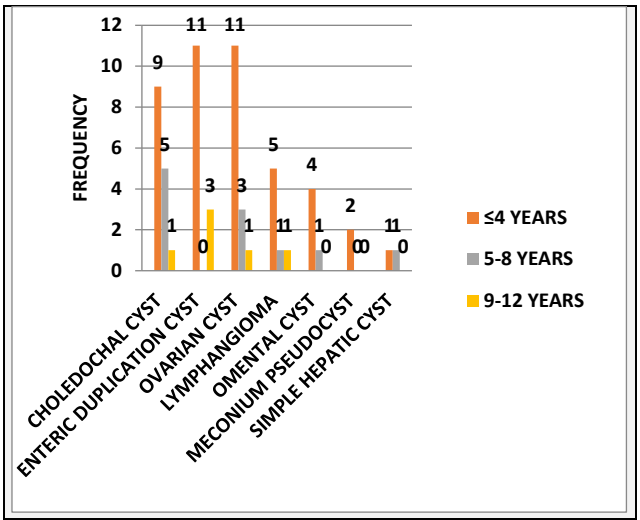

Figure 2. Correlation between Age and Incidence of Cysts

Chi-square = 9.939 df = 12 p = 0.621.

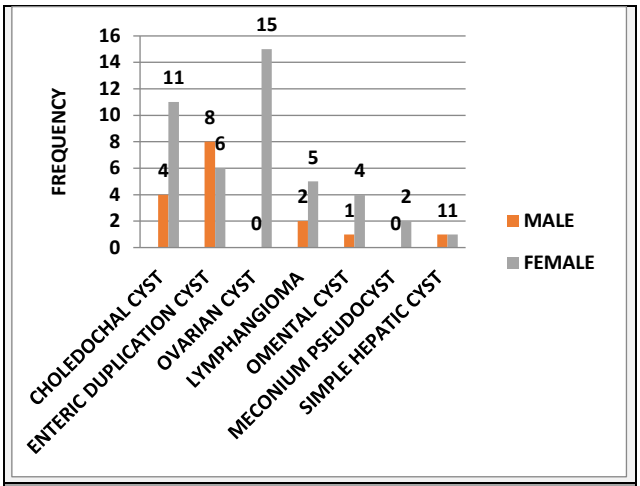

Figure 3. Correlation between Sex of the Child and Incidence of Cysts

Chi-square = 13. 515; df = 6; p = 0.036.

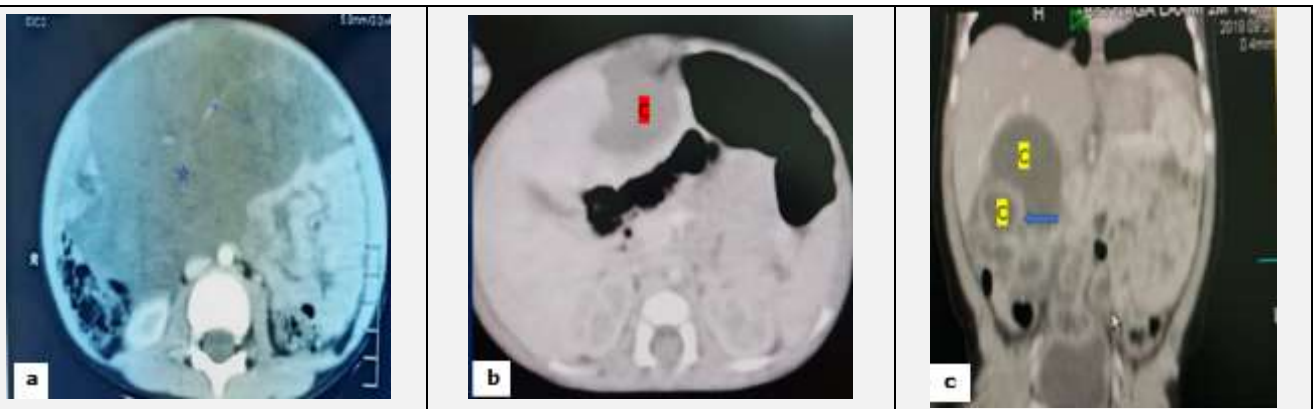

Figure 4. Post Contrast CT Images in Three Different Patients. a) Axial CT Image in a Six Year Old Child Showing Non Enhancing Hypodense Lesion ( ) Displacing the Bowel Loops with Encasement of Vessels ( ) Consistent with Mesenteric Lymphangioma. b) Axial CT Image in a Four Month Old Child Showing Non Enhancing Hypodense Lesion in the Subhepatic Location (c) With HU Value of Fluid Consistent with Omental Cyst. c) Coronal CT Image in a 45 Days Old Child Showing Two Well Defined Hypodense Lesions (c) In the Subhepatic Location Extending till RIF with Thick Enhancing Walls ( ) Communicating with Each Other Consistent with Enteric Duplication Cysts. The Diagnosis of Lesions is Confirmed Histopathologically.

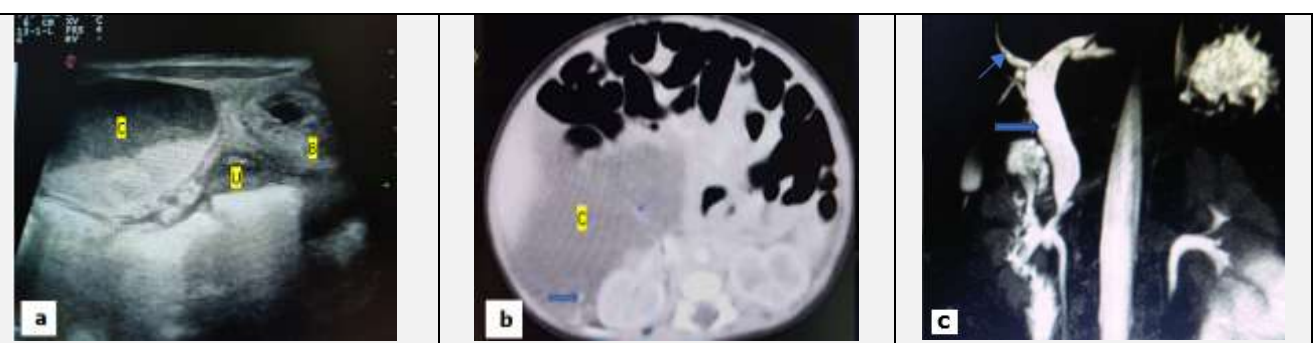

Figure 5. a) USG Image in a Neonate Showing Well Defined Cystic Lesion (c) In the Right Ovary with Fluid Debris Level Consistent with Haemorrhagic Ovarian Cyst (B-Bladder, U-Uterus). b) Axial CT Post Contrast Image in a One Month Old Child Showing Hypodense Lesion (c) In the Subhepatic Location with Foci of Calcifications ( ) in the Lesion and Fine Internal Septations ( ) Consistent with Meconium Pseudocyst and Proven Histopathologically. c) Thick Slab MRCP Image in a 5 Year Old Child Showing Diffuse Dilatation of Common Bile Duct ( ) and Normal Calibre of Intrahepatic Biliary Radicles ( ) Suggestive of Choledochal Cyst Type 1.

DISCUSSION

Abdominal cystic masses are not uncommon in paediatric patients. Children present with various symptoms and physical findings depending on size, location, and mass effect on the adjacent abdominal structures. The children can also present acutely if there is underlying torsion, infection or haemorrhage in the cyst. The first step in diagnosing a cystic abdominal mass is to determine the organ from which the mass originates. It can be difficult to ascertain the origin of the lesion when they are very large and fill most of the abdomen and distort the normal

anatomy. Based on origin of the mass, there are many differential diagnostic possibilities for paediatric abdominal cystic lesions. The treatment of choice for most of the lesions is surgical excision. In this article we will be discussing the salient features of the common cystic abdominal lesions.

Of the 60 cases included in the study, ovarian cysts and enteric duplication cysts constituted about 49 % of the cases. USG being widely available is done initially. USG is very useful in differentiating solid and cystic lesions and also to characterise the nature of the cyst including the contents of the cyst, presence of septations, calcifications, wall thickness.

Choledochal cysts and lymphatic malformations constituted 25 % and 20 % of the cases respectively. The incidence of choledochal cysts is usually 1 in 1,00,000 children. Choledochal cysts are characterised by anechoic cystic lesions dorsal to gall bladder, at the porta hepatis with the dilatation or non-dilatation of the intrahepatic biliary radicles according to the type of choledochal cyst classified by Todani.[1] The children were subjected to MRI after ultrasound to look for anomalous pancreatico biliary communication. Surgical resection of the entire cyst is the treatment of choice in view of complications associated with the cyst.[2]

Children with lymphangiomas usually present with vague pain abdomen and sometimes it can be an incidental finding. The incidence of mesenteric lymphatic malformations is about 1 in 20,000 cases. They can be associated with trisomy 18 and 21 and genetic syndromes such as Turner, Noonan syndrome. Lymphangiomas appear as unilocular or multilocular cystic lesions, with internal septations, anechoic or with internal echoes.[3] Ultrasound cannot clearly delineate the extent of involvement. Contrast enhanced CT has a promising role in depicting the extent of lesion. On CT they are hypodense and insinuate into the tissue planes, the attenuation values depend on the contents of the cyst, there will be mild enhancement of the septa and encasement of the vessels.[4,5] Due to the nature of insinuation it is very difficult to achieve complete excision of the lesion and the lesions are prone for recurrence.

Gastrointestinal duplication cyst is a spherical or tubular mass adherent to the gastrointestinal (GI) tract that sometimes communicates with it. The most common location is the terminal ileum, but it can occasionally be seen at the distal oesophagus, stomach and duodenum, and elsewhere. Most patients present within the first year of life, with symptoms including GI obstruction, palpable mass and abdominal distention. US differentiates the cystic nature of duplications from solid tumours and also demonstrates the intimate association between the duplication and the bowel wall. Reliable indicators of a duplication cyst include an inner echogenic rim of intestinal mucosa surrounded by a characteristic hypoechoic rim of muscle in the wall, indicating the various layers of the intestine, and internal debris or haemorrhage. CT can define its precise anatomic location. On CT they appear as hypodense lesions with enhancing wall.[6]

Ovarian cysts are the most common non neoplastic ovarian lesions in paediatric age group. 20 % of the female neonates have ovarian cysts of ≥ 1 cm at the time of birth. On USG they appear as cystic lesions with or without internal debris. They can be identified by pathognomonic daughter cyst sign in the wall.[7] Cysts less than 4 - 5 cm of size are usually kept on follow up. Cysts more than 5 cm are prone to torsion.[8]

Meconium pseudocyst, simple hepatic cyst constituted rest of the 5 % of the cases. Simple hepatic cyst is an anechoic round or oval lesion with imperceptible wall, post acoustic enhancement, lacking internal echoes and solid component. No vascularity on Doppler. No further investigation was done as the findings were consistent with simple hepatic cyst on ultrasound.

Meconium peritonitis is a sterile chemical peritonitis. The aetiology being intrauterine bowel perforation leading to extrusion of the bowel contents. Intestinal atresia and meconium ileus account for 65 % of the cases. Meconium ileus can be associated with cystic fibrosis. After in utero perforation, pseudocyst formation begins. Meconium pseudocyst is characterised by cystic lesion with peripheral calcification along the wall of the cyst. Calcifications may take weeks to appear on USG.[9] There can be calcifications along the peritoneal layer and along the bowel wall.[10] In a review of 12 cases of meconium peritonitis, intra-peritoneal calcifications were present in 60 % of the patients with cystic fibrosis and 100 % of patients without cystic fibrosis.

Other common intraperitoneal cystic lesions include lesions originating from solid organs like mesenchymal hamartoma of liver, splenic cysts, haematocolpos.

Hepatic mesenchymal hamartoma is a benign hamartomatous growth of mesenchymal tissue in the liver; it occurs in infants and young children less than 2-year-old. It can slowly grow to eventually compress the inferior vena cava or cause respiratory compromise; 80 % of lesions arise in the right lobe of the liver and 20 % are pedunculated. This well-defined tumour is avascular centrally and frequently contains septations and cysts of varying size. Solid portions are hyperechoic at sonography and show decreased attenuation compared with liver on CT. There can be marginal enhancement of the mass with contrast medium administration. Displacement of intrahepatic vasculature by the mass is an important differential diagnostic feature.[11]

Splenic cysts can be either congenital or acquired. Congenital splenic cysts (true or epidermoid cysts) contain an inner cellular lining. Acquired splenic cysts (false or pseudocysts) are usually posttraumatic and due to liquefactive necrosis. Both congenital and acquired splenic cysts usually appear as anechoic round lesions with imperceptible walls on ultrasound, although they can show internal echoes if they contain debris or haemorrhage. Post traumatic splenic cysts often have thicker walls that may be calcified, unlike the imperceptible walls of congenital cysts. There is no internal enhancement on contrast-enhanced CT images.

Haematocolpos is characterised by a fluid-filled, dilated vagina resulting from imperforate hymen, cervical stenosis, atresia or agenesis. US demonstrates a large spherical or ovoid cystic pelvic midline mass with a thin wall and internal echoes representing mucoid material and cellular debris. This mass almost always contains a fluid debris level. The average size is 5 – 9 cm.[12]

The children with cystic lesions may present either symptomatically or can be an incidental finding. Imaging plays a key role to differentiate between solid and cystic lesions in the abdomen. The radiologist must consider the patient age, history, clinical parameters, and imaging findings to formulate the likely aetiology of the cystic lesions.

CONCLUSIONS

Our experience shows that the cystic abdominal masses in children are not so uncommon. The differential diagnosis of the cystic lesions of paediatric age group is extensive. Taking into consideration the age, sex of the child, presenting features along with the above-mentioned characteristic features of most of the commonly occurring lesions, radiologists can arrive at a probable diagnosis in many of the cases. Ultrasound being widely available, cost effective, and non-ionizing modality stands as a most useful initial investigation of choice in any paediatric abdominal lesions and will guide the further line of investigation and management.

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