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Ultrasonographic evaluation of pediatric abdominal masses

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ABSTRACT

Background: Intra-abdominal mass lesions are commonly encountered in pediatric patients in day-to-day practice. Ultrasonography is the most commonly used non-invasive imaging modality in the evaluation of pediatric abdominal masses. With advancements and refinements in technology, the development of high-resolution scanners with variable frequency transducers, modern ultrasonography makes possible the detection of subtle changes and leading to improvements in diagnostic yields. **Aims and Objectives:** The study aims to investigate various pediatric abdominal masses using ultrasonography. In this study, pediatric abdominal masses were evaluated using ultrasonography for a period of 1 year. Characterizations of lesions and the anatomic site of origin were done using gray-scale ultrasonography, and the findings were correlated with operative findings, fine needle aspiration cytology (FNAC), and histopathological examination (HPE) findings. **Materials and Methods:** The study was conducted in 25 pediatric patients with an abdominal lump or suspicious of such a process based on history and clinical examination, who were examined with real-time ultrasonography. Results were correlated with operative findings, FNAC, and HPE findings. **Results:** Results showed that renal masses were the most common etiology (36%), followed by gastrointestinal masses (24%), hepatobiliary masses (20%), non-renal retroperitoneal masses (12%), genital masses (4%), and parietal masses (4%). **Conclusion:** The study showed that ultrasonography can be used to localize and characterize abdominal masses in the pediatric age group with great accuracy.

Key words: Ultrasonography; Pediatric abdominal mass, Pediatric abdominal lump

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INTRODUCTION

Abdominal masses in infants or children are a commonly encountered and challenging diagnostic problem for radiologists in day-to-day practice.[1] It may occur at various sites of the abdominal cavity due to various causes. At present, ultrasonography alone, in some instances, provides enough diagnostic information to proceed with the treatment.[2] Sonography stays as the best initial imaging modality choice because of its high sensitivity, accuracy, non-invasiveness, quickness, flexibility, portability, availability, cost-effectiveness, and freedom from radiation hazards.[3] Sonography can detect pathological processes of the urinary tract, hepatobiliary system, the pancreas, the retroperitoneum, the bowels, etc., with a great degree of accuracy.

Aims and objectives

The study aims investigate various pediatric abdominal masses using ultrasonography. In this study, pediatric abdominal masses were evaluated using ultrasonography for a period of 1 year. Characterizations of lesions and anatomic site of origin were done using Grey scale ultrasonography and findings were corelated with the operative findings, FNAC and HPE findings.

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MATERIALS AND METHODS

Study design and settings: Patients (0–12 years) who presented to Assam Medical College and Hospital, Dibrugarh, with abdominal lumps were subjected to an ultrasonographic scan.

Inclusion criteria

All pediatric patients with palpable or clinical suspicion of an abdominal lump.

Exclusion criteria

Patients who did not give consent. Parents who did not want their children to be part of the study were also not included.

Abdominal lumps with clinical suspicion of intussusception, pyloric stenosis, and round worm bolus, etc.

Ultrasonographic protocol

Patients who presented to any department with palpable or clinically suspicious abdominal mass lesions were subjected to ultrasonography using real-time gray-scale scanners, using 3.5 MHz curvilinear transducers and 7.5–12 MHz linear transducers.

Patients were preferably kept nil orally by mouth for 6–8 h preceding the examination and about 3 h in cases of neonates. The patients were examined supine, but in some cases, oblique, decubitus, and supine positions were used. Characterizations of lesions were done using gray-scale ultrasonography.

Statistical analysis

A total of 25 children were evaluated in our study. Statistical analysis was done using software such as the Statistical Package for the Social Sciences and Microsoft Excel. $P < 0.05$ was considered statistically significant.

RESULTS

Benign masses (84%) were most commonly encountered in our study compared to malignant masses (16%). There was a slight male preponderance (56%) as compared to females (44%).

The study showed renal masses to be most common (36%), followed by gastrointestinal (GI) masses 24%, hepatobiliary mass 20%, non-renal retroperitoneal mass 12%, genital mass 4%, and parietal abscess 4%. Among the renal masses, hydronephrosis was most common, followed by Wilm's tumor. Appendicular abscess was the most common GI mass, and hepatic abscess was the most common hepatobiliary mass.

DISCUSSION

The preponderance of benign lesions as seen in the present study is in accordance with a study carried out by other authors.[4] In our present series, 84% of lesions were found to be benign. Table 1 reveals the clinical diagnosis of renal lump as the most common finding. Table 2 reveals that ultrasonographic diagnosis of renal mass lesions is the most common cause of abdominal lump in children.

Predominance of male children is in concordance with other authors.[5] In our study, the male-to-female ratio was found to be 1.3:1. Table 3 reveals a preponderance of increased incidence among males.

Renal masses were the most common of all abdominal masses, and such high numbers were recorded by other authors. These authors have also reported hydronephrosis (Figures 1 and 2), constituting a major proportion of renal masses, which has also been found in our study.[6] Our study found that ultrasonography has 100% accuracy in the diagnosis of hydronephrosis. In some articles, Wilms' tumor is the second most common cause of

Table 1: Clinical diagnosis in patients who presented with an abdominal lump

Clinical diagnosis	No of patients
Abdominal lump	7
Renal lump	10
Mass in the right iliac fossa	2
Hepatomegaly	3
Hepatic abscess	2
Pelvic abscess	1

Table 2: Categorization of patients based on ultrasonographic findings

Groups	No of patients
Renal mass lesions	9
Gastrointestinal mass lesions	6
Hepatobiliary masses	5
Non-renal retroperitoneal masses	3
Genital masses	1
Parietal lesions	1

Table 3: Sex distribution of abdominal masses in our study

Categorization of masses as per the organ of origin	Male	Female
Renal	5	4
GIT	4	2
Hepatobiliary	3	2
Female genital tract	0	1
Miscellaneous	2	2

GIT: Gastrointestinal tract

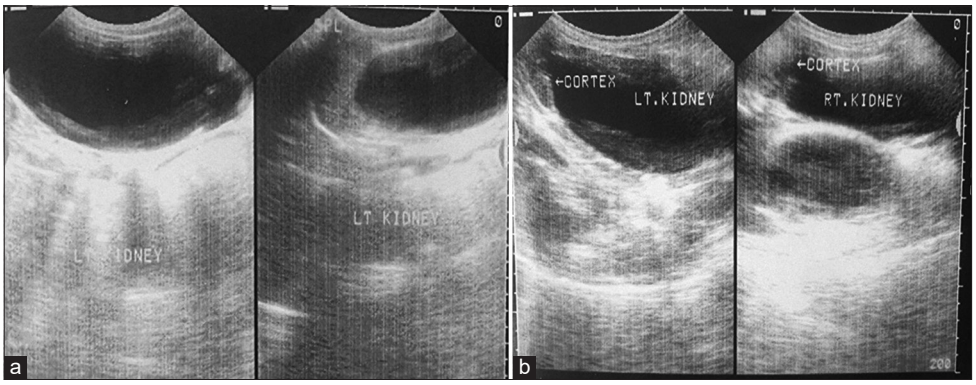

Figure 1: (a and b) Ultrasonographic (USG) image of hydronephrosis

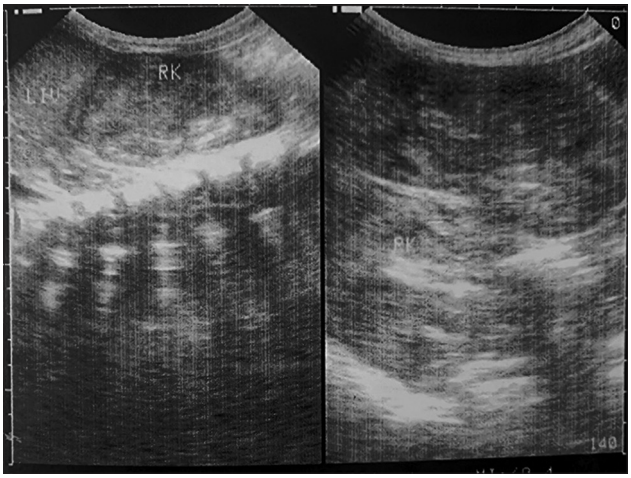

Figure 2: USG image of Wilms' tumor

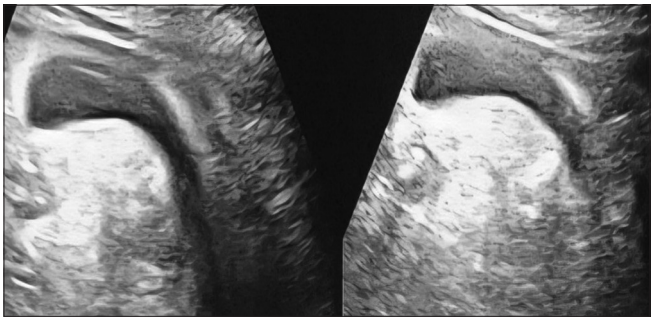

Figure 3: USG image of appendicular abscess

renal mass lesion, which is similar to our study result. We found Wilms' tumor (Figure 2) in 22% cases of renal mass lesions. Table 4 reveals hydronephrosis as the most common and Wilms tumor as the second most common lesion among children.

About 24% of cases in our study had GI lesions. Some articles have reported 18–22.3% of cases in their studies.[7] Appendicular abscess (Figure 3) was found in about 50% of cases, which is similar to the data in our study. Table 5 reveals that 50% cases had appendicular abscess in our study. Ileocecal tuberculosis was found in 33.3% cases of GI mass lesions in our study, and mesenteric cyst (Figure 4) constituted about 16.6%.

Hepatobiliary masses constituted about 20% of cases in our study.[7,8] About 40% of cases were due to pyogenic liver abscess in our study. Table 6 shows liver abscess as the most common group among hepatobiliary cases. Irregular margins were found in about 95% cases of pyogenic liver abscess, whereas in our study, we found it in about 100% of cases. They also found a hypoechoic

Table 4: Ultrasonographic diagnosis of renal masses

Age in years	Hydronephrosis	Wilms tumour	Multicystic dysplastic kidneys
0–1	3	0	1
1–5	1	2	0
5–9	1	0	0
9–12	1	0	0
Total	6	2	1

Table 5: Ultrasonographic diagnosis of GI masses

Age in years	Appendicular abscess	Mesenteric cyst	Ileocecal tuberculosis
0–1	0	1	0
1–5	1	0	0
5–9	1	0	1
9–12	1	0	1
Total	3	1	2

GI: Gastrointestinal

echo pattern in 100% of cases, which is also found in our study.[7,8] One case of hydatid cyst (Figure 5) was found in our study, which revealed multiple cysts in both lobes of the liver. One female child in our study had a choledochal cyst (Figure 6). Hepatoblastoma (Figure 7) was found in one case.

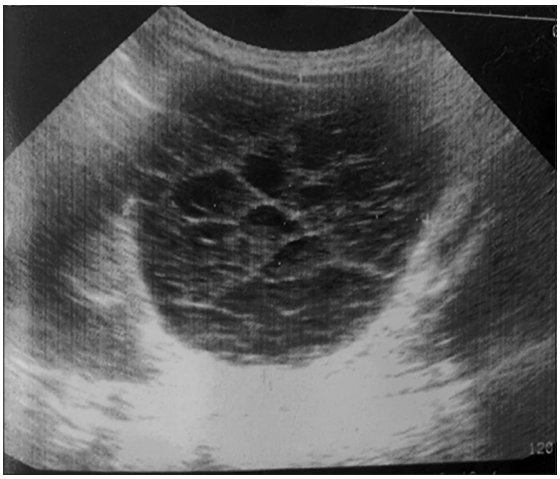

Figure 4: USG image of multiloculated mesenteric cyst

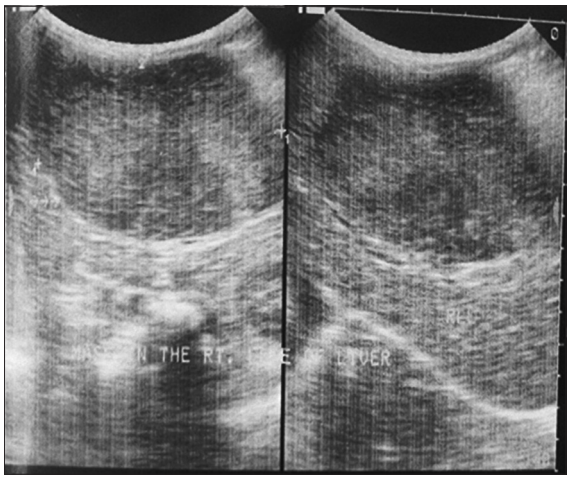

Figure 7: USG image of hepatoblastoma

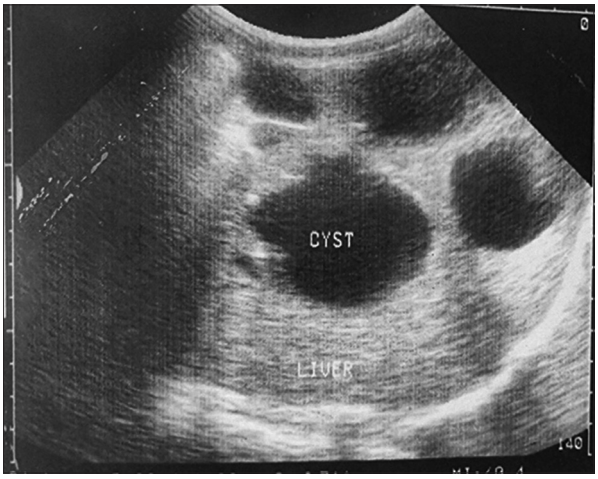

Figure 5: USG image of multiple hydatid cysts of the liver

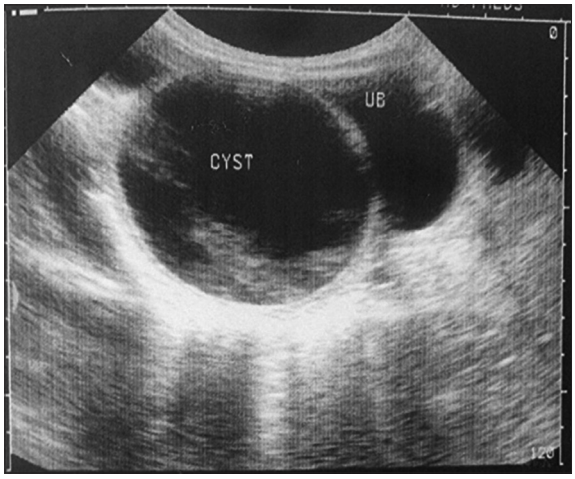

Figure 8: USG image of right ovarian cyst

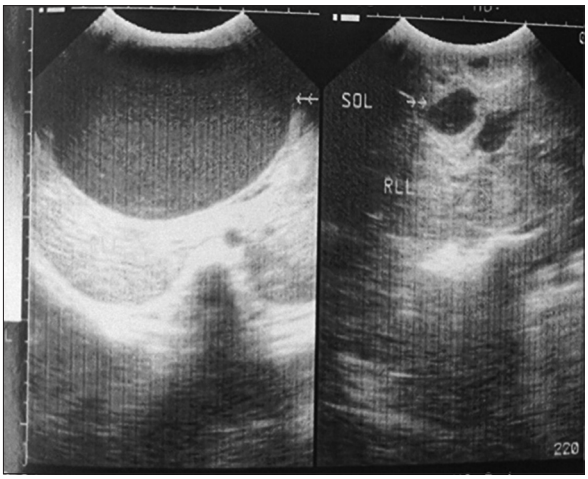

Figure 6: USG image of choledochal cyst

Table 6: Ultrasonographic diagnosis of hepatobiliary masses

Age in years	Liver abscesses	Hydatid cyst	Choledochal cyst	Hepatoblastoma
0–1	0	0	0	0
1–5	0	0	1	1
5–9	1	0	0	0
9–12	1	1	0	0
Total	2	1	1	1

Table 7: Ultrasonographic diagnosis in non-renal retroperitoneal mass

Ultrasonographic diagnosis	No of cases
Perinephric abscess	1
Retroperitoneal lymphadenopathy	1
Primary retroperitoneal abscess	1

About 12% of cases in our study had non-renal retroperitoneal mass lesions, which is similar to other studies.[9] One case of perinephric abscess was found in our study, and the causative organism was found to be *Staphylococcus aureus*. One case each in our study showed retroperitoneal lymphadenopathy and primary retroperitoneal abscess.[9]

Table 8: Miscellaneous causes

Ultrasonographic diagnosis	No of cases
Ovarian cyst	1
Parietal lump (Abscess)	1

One patient in our study had an ovarian cyst (Figure 8), presenting as an abdominal mass. It accounted for 4% of all cases. Similar figures were reported in other articles.[10] One patient in our study had a parietal abscess. Tables 7 and 8 show the causes of retroperitoneal and other miscellaneous causes of abdominal masses.

Limitations of the study

Sample size of the study was small. Computed tomography scan (CT scan) and magnetic resonance imaging (MRI) was not included in the study.

CONCLUSION

Ultrasonography, when used in combination with other clinical and laboratory data, proves to be of great diagnostic value and good enough at times to start the treatment. It can be of good use not only to tell the organ of origin, size, shape, and margins of the lesion but also to come to a diagnosis. The study helped in evaluating various abdominal masses using ultrasonography in children.

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Author's Contributions:
All authors have contributed significantly during the study. All authors have played an important role in the study design, analysis, preparation, and interpretation of the study. They have worked relentlessly during the course of the study voluntarily to make the study fruitful. **MH-** Definition of intellectual content, Literature survey, Prepared first draft of manuscript, implementation of study protocol, data collection, data analysis; **BJG-** Concept, design, clinical protocol, manuscript preparation and submission of article; **SSB-** Design of study, statistical Analysis and Interpretation.

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