

# *Ultrasound in the diagnosis of palpable abdominal mass in children*

## *Ultrasound in the diagnosis*

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**Abstract**—The present study was undertaken with an aim to evaluate the effectiveness of abdominal ultrasonography (USG) in the diagnosis of palpable abdominal mass and compare the results of USG with those of other method; whether USG can increase the diagnostic yield in case of palpable abdominal masses in paediatric age group and their consistency with histopathological diagnosis. For this purpose 30 cases were selected having palpable abdominal masses in different sites, age ranging from 6 months to 12 years. The results suggested that the predominance of male over female in the ratio of 3:2. In this study confirms that Wilm's tumor accounted for 30.00%. In this study the sensitivity of ultrasonogram is 96.30% and the specificity is 60.00%. The positive predictive value is 92.86% and negative predictive value is 75.00% and the overall diagnostic accuracy of this series is 90.62%. In this study false positive rate of ultrasonogram diagnosis is 6.66% and false negative rate of ultrasonogram diagnosis is 3.33%. Ultrasonography is a non-invasive, safe, inexpensive and rapid diagnostic tool in palpable abdominal mass in children. So it will be the first line of investigation in the evaluation of palpable abdominal mass in pediatric surgical practice.

**Keywords**—Ultrasonography, paediatric, Wilm's tumor, abdominal, palpable

## I. Introduction

A wide variety of abdominal masses can occur in infancy and childhood [1]. Lesions may be cystic or solid, and can be benign or malignant in nature [2]. Some masses are acquired, while others are present from fetal life and manifest themselves clinically at some time after birth [3-4]. Detail clinical history and meticulous physical examination of the infant and children are important; otherwise some of the masses might be missed. Additional diagnostic studies are often required to assess the nature of the mass accurately and to determine a program of therapeutic management. Advances in modern diagnostic technology have allowed for early recognition of a mass, its nature, organ of origin and extent [5]. Ultrasonography has become a very useful method for detecting abdominal masses [6].

Ultrasound is a noninvasive imaging modality that aids in diagnosis without the potentially damaging effects of ionizing radiation, a particularly important consideration in the evaluation of paediatric patients. This article focuses on the clinical and sonographic features of selected common abdominal masses in infants and children. The authors highlight the important clinical characteristic of these abdominal masses and specific sonographic imaging features that allow clinicians to differentiate among the common abdominal masses in paediatric patients [4]. Ultrasonography (USG) has also been found to be of immense help in planning radiotherapy and in following the growth or regression of a

mass after treatment. So ultrasonographic evaluation of palpable abdominal masses is justified as a preliminary tool. The present study was undertaken with an aim to evaluate the effectiveness of abdominal USG in the diagnosis of palpable abdominal mass in paediatric surgical practice and compare the results of USG with those of other method; whether USG can increase the diagnostic yield in case of palpable abdominal masses in paediatric age group and their consistency with histopathological diagnosis.

## II. Materials and methods

This was a descriptive cross sectional study. The study has been carried out among admitted patients in the department of paediatric surgery in Mymensingh Medical College Hospital, Mymensingh, Bangladesh and the study was conducted from June 2015 to September 2016.

### A. Sample size

Thirty (30) cases having palpable abdominal mass, among them Twenty-five (25) children were undergo both abdominal ultrasound and Laparotomy with tissue diagnosis and remaining five (05) children were inoperable and undergone abdominal ultrasound with enhanced abdominal CT and CT guided FNAC and tissue diagnosis. The inclusion criteria of the patient was as follows: i) patients presenting with palpable abdominal mass otherwise healthy child and ii) all patients aged 0 to 12 years. However, the exclusion criteria was i) patients having congenital abnormalities, ii) patients having life threatening co-morbidity, and iii) patient above the age of 12 years.

### B. Selection of patient

A total of thirty (30) patients with palpable abdominal masses in children were selected in this study. Among them eighteen (18) were males; twelve (12) were females. Age ranges from 6 months to 12 years. These patients were selected purposively having palpable abdominal masses within the age group of 6 months to 12 years in the department of paediatric surgery of Mymensingh Medical Hospital. Among thirty (30) patients twenty-five (25) were operated and remaining five (05) were inoperable and undergone enhanced abdominal CT scan with CT guided FNAC and tissue diagnosis.

### C. Data collection

In each case, data about the patients were obtained by using a questionnaire (Appendix-1) after obtaining the consent of the parents/guardians verbally. The clinical history was taken in every case with special attention to the duration, sites, and consistency of the palpable abdominal masses and any changed since it was noticed. A complete general examination, local examination and relevant systemic

examinations were performed in every case and thus clinical diagnosis was made. Abdominal ultrasound was performed in each case.

### **D. Investigations**

A routine investigation including complete blood count, Bleeding profile, LFT, RFT, Chest X-Ray P/A View, Imaging studies; Specially abdominal ultrasound, enhanced Abdominal CT and CT guided FNAC (where necessary), IVU, Isotope Renogram,

### **E. Statistically analysis**

Data were processed and analyses using SPSS (Statistical Package for Social Sciences) software version 20. The chi-square test and student "t" test were used to analyze the significance level of  $p < 0.05$ . Continuous scale data were presented as mean standard deviation and Categorical data were presented as number percentage. The summarize data were present in the table and chart.

## **III. Results and Discussion**

Age and sex distribution of the patient: The present study was undertaken with an aim to evaluate the effectiveness of abdominal USG in the diagnosis of palpable abdominal mass and compare the results of USG with those of other method; whether USG can increase the diagnostic yield in case of palpable abdominal masses in paediatric age group and their consistency with histopathological diagnosis. For this purpose 30 cases were selected having palpable abdominal masses in different sites, age ranging from 6 months to 12. The present study showed the highest incidence in 2 to 5 years in age (76.67%) and 0 to 2 yrs in age (13.33 %) with the second highest incidence (Table 1). Similar results was found Athameeneh et al. [7] study showed age ranged from 0 to 14 years with a median age of 5 years. Table 2 suggested that the predominance of male over female in the ratio of 3:2. Among the 30 case the highest incidence in male is 60% and female is 40%. Occurrence of palpable abdominal lump is higher in male child than female. Similar observation was showed in study of Athameeneh et al. [7] there were 42 males (66.00%) and 22 female (34.00%).

### **A. Ultrasonographical diagnosis**

Out of 30 cases, by ultrasound 9 cases were found Wilm's tumor which was 30.00%, where 7 cases of Wilm's tumour clearly delineated by ultrasound and diagnosed both clinically and sonographically another two (\*2) 6.66% was not well delineated and inconclusive. Among 3 (10.00%) cases of sonographically diagnosed lymphoma 2 (6.66%) cases were well delineated but another \*1 (3.33%) was not well delineated and inconclusive. Among 4 (13.32%) cases of sonographically diagnosed ovarian mass 3 (10%) cases were well delineated but another \*1 (3.33%) was not well delineated sonographically and was inconclusive.

### **B. Comparison of Clinical and ultrasonographic diagnosis**

Table 3 indicated that eight (8) cases were clinically suspected Wilm's tumour whereas 9 cases were diagnosed as Wilm's tumour by sonography, among 5 cases of clinically diagnosed hydronephrosis 4 cases were sonographically diagnosed as hydronephrosis, among 4 cases of sonographically diagnosed ovarian mass where 2 cases werw

clinically diagnosed, among 4 cases of clinically suspected lymphoma 3 were sonographically diagnosed. Among the Inoperable 2 (40.00%) cases of Wilm's tumor 1 (20.00%) was well delineated by enhanced CT and also proven by tissue diagnosis but another 1 (20.00%) was not well delineated by enhanced CT but proven by tissue diagnosis. Among the inoperable 2 (40.00%) cases of ovarian teratoma (Immature) 1 (20.00%) was well delineated by enhanced CT and also proven by tissue diagnosis but another 1 (20.00%) was not well delineated by enhanced CT but proven by tissue diagnosis. 1 (20.00%) inoperable case of Non-Hodgkin's lymphoma (suggestive in Ultra sonogram) was not well delineated by enhanced CT but proven by tissue diagnosis.

### **C. Comparison between sonographic diagnosis with operative findings and tissue diagnosis**

Table 4 demonstrated that eight (8, 26.64%) cases were clinically suspected Wilm's tumour whereas 9 (30%) cases were diagnosed as Wilm's tumour by sonography but 7 (23.33%) cases of Wilm's tumor were clearly delineated by ultrasound and another 2 (6.66) cases were not well delineated by ultrasound. Among 3 (12%) cases of sonographically diagnosed Mesenteric cyst, of them 2 (8%) cases were found peroperatively mesenteric cyst but 1 (4%) case was diagnosed as Non Hodgkin's Lymphoma by peroperative findings with tissue diagnosis. Among 2 (8%) cases of sonographically diagnosed Retroperitoneal mass, of them 1 (4%) was diagnosed as Retroperitoneal teratoma and another 1 (4%) was diagnosed as Rhabdomyosarcoma by peroperative findings with tissue diagnosis. All of the cases of Wilm's tumor, Hydronephrosis, Neuroblastoma, Dysgerminoma, Ovarian mass, Choledochal cyst and Pancreatic pseudocyst were same in peroperative findings and tissue diagnosis (where necessary) with sonographic diagnosis. This study also shows 96.30% sensitivity, 60.00% specificity, 92.86% positive predictive value, 75.00% negative predictive value and most importantly 90.63% efficiency.

In current study showed maximum number of patient examined in the present study is Wilm's tumor this accounted for 30.00% and out of 30 cases, sonographically 09 cases were found Wilm's tumor. In study of Light et al. [8] showed renal masses comprise the majority (55%) of abdominal masses in infants. Hydronephrosis is most common with other etiologies including polycystic kidney disease, mesoblastic nephroma, nephroblastomatosis - Wilms tumor spectrum, renal vein thrombosis, and ectopic kidney. GI tract masses account for about 15% of abnormalities. Common causes include duplication cysts and mesenteric or omental cysts, as well as meconium pseudocysts. Pelvic masses extending into the abdomen make up another 15% and include ovarian cyst, hematocolpos, and sacrococcygeal teratoma [9]. Non-renal flank masses make up 10% of cases and include adrenal hemorrhage (most common in neonates), neuroblastoma, and teratoma [10]. in another Annuar et al. [11] showed the majority (71 %) were retroperitoneal masses where two-thirds were of renal origin Eighty-six percent of Wilms' tumours, 80% of neuroblastomas, 50% of hepatoblastomas, 50% of choledochal cysts and 50% of ovarian cysts were correctly diagnosed. Wilms' tumours are echogenic renal masses whereas neuroblastomas appear as

echogenic extrarenal masses. The presence of calcific foci were observed in one-third of neuroblastomas.

In this study that sensitivity was found 96.30%, specificity was 60.00%, PPV 92.86%, NPV, 75.00% and efficiency of the test was found 90.63%. In study of Athameeneh et al. [7] the ability of ultrasound to determine the presence of absence of a lesion responsible for the mass in the whole group. In the 44 patients with a definitely palpable mass, a lesion was present in 36, and there was one false negative. In the 20 patients with possible mass, a lesion was present in 6 and there was one false positive ultrasound diagnosis. Positive diagnosis at final follow up for the whole group. The high positive predictive value was (97.00%) and negative predictive value was (95.00%) for the presence or absence of a lesion in study indicates that ultrasound is a credible test of exclusion for palpable abdominal mass. A study conducted by Joshi et al. [12] concluded that the use of gray-scale ultrasound morphology to characterize a pelvic mass may also be called "pattern recognition". Subjective evaluation of ovarian masses based on pattern recognition can achieve sensitivity of 88.00 to 100.00% and specifically of 62.00 to 96.00%.

## IV. Conclusion

Due to high diagnostic accuracy ultrasonogram can be used as a first line of diagnostic procedure to delineate a palpable abdominal mass in children. The neonate, infant or child with an abdominal mass needs rapid clinical evaluation. Age, history, and physical examination provide initial guideposts to diagnosis. Imaging studies particularly sonography, may provide a specific diagnosis. If the initial evaluation indicates possible malignancy, more complex testing of blood, bone marrow, serum chemistries, and urine may be required. Outcome varies widely depending on the malignant or benign nature of the existing mass. Ultrasonography has also been found to be of immense help in planning radiotherapy and in following the growth or regression of a mass after treatment. So ultrasonographic evaluation of palpable abdominal masses is justified as a preliminary tool.

### *Ethical consideration*

Ethical clearance was taken from Institutional Review Board (IRB) of Mymensingh medical college. All patients/guardians of patients informed about the study. Informed written consent has been taken from each patients/guardian. No experimental new drug was administered and no placebo was used here.

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TABLE I. TABLE TYPE STYLES

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TABLE 1. AGE DISTRIBUTION OF THE PATIENT HAVING PALPABLE ABDOMINAL MASS

Age in years	Frequency	Percentage
0 to 2	4	13.33
2 to 5	23	76.67
5 to 12	3	10.00
Total	30	100.00

TABLE 2. SEX DISTRIBUTION OF THE PATIENT

Sex	Frequency	Percentage
Male	18	60.00
Female	12	40.00
Total	30	100.00

TABLE 3. COMPARISON OF CLINICAL AND  
 ULTRASONOGRAPHIC DIAGNOSIS

Clinical diagnosis		Ultrasonographic diagnosis
Diagnosis	Frequency	Frequency
Choledochal cyst	1 (3.33)	1 (3.33)
Pancreatic Pseudocyst	1 (3.33)	1 (3.33)
Dysgerminoma	2 (6.66)	1 (3.33)
Retroperitoneal mass	2 (6.66)	2 (6.66)
Neuroblastoma	2 (6.66)	2 (6.66)
Ovarian mass	2 (6.66)	*4 (13.32)
Mesenteric cyst	3 (13.32)	3 (13.32%)
Lymphoma	4 (13.32)	*3 (6.66)
Hydronephrosis	5 (16.65)	4 (13.32)
Wilm's tumor	8 (26.64)	*9 (30.00)
Total	30 (100.00)	30 (100.00)

\*Figure with parenthesis indicate percentage

TABLE 4. COMPARISON BETWEEN SONOGRAPHIC DIAGNOSIS  
 WITH OPERATIVE FINDINGS AND TISSUE DIAGNOSIS

Diagnosis	Clinical diagnosis	Ultrasonographic diagnosis	Operative findings with tissue diagnosis
	Frequency	Frequency	Frequency
Rhabdomyosarcoma	00	00	1 (3.33)
Choledochal cyst	1 (3.33)	1 (3.33)	1 (3.33)
Pancreatic pseudocyst	1 (3.33)	1 (3.33)	1 (3.33)
Dysgerminoma	2 (6.66)	1 (3.33)	1 (3.33)
Retroperitoneal mass	2 (6.66)	2 (6.66)	1 (3.33)
Neuroblastoma	2 (6.66)	2 (6.66)	2 (6.66)
Ovarian mass	2 (6.66)	*4 (13.32)	4 (13.32)
Lymphoma	3 (13.32)	3 (10.00%)	4 (13.32)
Mesenteric cyst	4 (13.32)	*3 (10.00)	2 (6.66)
Hydronephrosis	5 (16.65)	4 (13.32)	4 (13.32)
Wilm's tumor	8 (26.64)	*9 (30.00)	9 (30.00)
Total	30 (100.00)	30 (100.00)	30 (100.00)