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Role of Ultrasonography for Diagnosis of Pediatric Acute Abdominal Pain

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Abstract

Background: Ultrasound is very useful in assessment of acute abdomen in pediatric age groups, such as intussusceptions, acute appendicitis, acute cholecystitis, renal stones and mesenteric lymphadenitis. As equipment and techniques improve, its role in the examination of infants and children continues to increase.

Aim: The aim of this work is to evaluate the role of ultrasonography for diagnosis of pediatric acute abdominal pain.

Patients and methods: The study was conducted in Al-Azhar University from April 2021 to April 2022 and enrolled 30 cases of pediatric age group presented with acute abdomen 16 female and 14 male. The study was examined by the same radiologist using the LOGIC X8.

Results: The most frequent final diagnosis was acute appendicitis and its complications which show the highest percentage (40%), followed by intussusceptions (33.3%), mesenteric lymphadenitis (10%), acute cholecystitis (6.7%), renal stones (6.7%), and acute pancreatitis (3%).

Conclusion: Ultrasonography stays an exceptionally successful, correlative, harmless technique for assessing acute abdomen in children, especially acute appendicitis or intussusception.

Keywords: Abdominal pain, Appendicitis, Ultrasonography

1. Introduction

Acute abdominal pain is defined as pain of a nontraumatic source with maximum duration of 5 days. An accurate and early diagnosis results in proper management and, therefore, leads to better results and decreases hazard of morbidity.¹

Acute abdomen is a very common complaint for patients presenting to the emergency department and accounts for 5–10% of visits to the emergency department.²

Ultrasound is an ideal imaging modality in the pediatric population because it is noninvasive, painless and low cost examination.³

Acute abdomen is a common clinical complaint in the pediatric emergency department. Examination of the child with acute abdomen is challenging because of the wide range of potential diagnosis.⁴

This work aimed to evaluate role of ultrasonography for diagnosis of pediatric acute abdominal pain.

2. Patients and methods

2.1. Patients

This study was carried out during the period from April 2021 to April 2022 in radio-diagnosis Department, Al-Azhar University Hospitals and included 30 patients, ranging in age from 1 day to 12 years.

Study title: Role of ultrasonography for diagnosis of pediatric acute abdominal pain.

Type of the study: RCT (randomized control trial).

Study setting: Al Azhar University Hospitals.

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2.2. Study methods/design

This randomized, controlled prospective clinical trial will include 30 cases of pediatric age group less than 12 years, suffering from acute abdomen at pediatric – emergency outpatient department and examined by ultrasound. Ultrasound evaluation of those children was done utilizing different types of transducers especially 3.75 MHz transducer. Children were chosen based on strict inclusion criteria and only those children with acute abdominal pain and recently have no history of similar pain were included in the study.

2.3. Study population and eligibility criteria

Patients of pediatric age groups (<12 y), complaining of acute abdomen will be selected for this study. All relevant of the patient will be educated about the goal of the trial, the examination role and its advantages as well as risks and all relevant of the patients will be asked whether they are ready to participate in the trial.

2.4. Population of the study

All patients of pediatric age group (<12 y) who are admitted to Al Azhar University Hospitals presenting by acute abdomen, with the accompanying inclusion and exclusion rules:

2.4.1. Inclusion rules

Age: less than 12 years, complain of acute abdominal pain and no congenital anomalies.

2.4.2. Exclusion rules

Age: more than 12 years, no congenital anomalies and any complaint other than acute abdominal pain.

2.5. Ethics

The study will be approved from the ethical committee of the department of diagnostic radiology, faculty of medicine, Al Azhar University, informed consent will be taken from the relevant of all children before enrollment in the study with explaining the purpose of the study and any included child and his relevant has the right to withdraw from the study at any stage without reasoning and without being harmed or mis-managed by this withdrawal.

The selected cases subjected to the following: An informed consent, history taking, Clinical assessment, a) General assessment: pulse, temperature ... etc., b) Abdominal examination, Lab investigation:

Complete blood count (CBC), urine analysis ... etc., and Ultrasonography: Ultrasonographic evaluation is done utilizing different types of transducers especially 3.75 MHz transducer.

2.6. Technique of examination

Patients laid supine on the examination couch with extended legs. Child should be dressed in comfortable clothing for an ultrasound exam, scans were obtained with the transducer placed transversely and longitudinally. An ultrasound assessment is usually done within 5 min and if scanning was performed over an area of tenderness, gentle scanning was done and sometimes if there was great irritability, sedation was given by the clinician in order to be able to conduct ultrasound study.

2.7. Sample size justification

The included sample size has been calculated utilizing the G*Power Software (Universität Düsseldorf, Germany).

2.8. Statistical methods

Data was collected, classified, then analyzed utilizing IBM SPSS version 22 (IBM Corp. Armonk, NY). Normally distributed numerical data will be presented as mean and SD, and skewed data as median and interquartile range, qualitative data will be introduced as number and percentage. Skewed data will be compared utilizing the Mann–Whitney test. Categorical data will be compared utilizing χ^2 test or fisher's exact test, when appropriate and a two-sided *P*-value less than 0.05 will be approved as statistically significant.

3. Results

The most frequent final diagnosis was acute appendicitis and its complications which show the highest percentage (40%), followed by intussusceptions (33.3%), mesenteric lymphadenitis (10%), acute cholecystitis (6.7%), renal stones (6.7%), and acute pancreatitis (3%) (Tables 1–3).

Table 1. Description of age in all studied patients.

	Studied patients (N = 30)
Age (years)	
Mean \pm SD	5.53 \pm 3.9
Min – Max	0.2–11

Table 2. Description of sex in all studied patients.

	Studied patients (N = 30)	
Sex		
Male	14	46.7%
Female	16	53.3%

Table 3. Description of diagnosis in all studied patients.

	Studied patients (N = 30)	
Diagnosis		
Acute appendicitis	12	40%
Acute cholecystitis	2	6.7%
Acute pancreatitis	1	3.3%
Intussusception	10	33.3%
Mesenteric lymphadenitis	3	10%
Renal stone	2	6.7%

4. Illustrative cases

Case (1). Acute Appendicitis: 6 years old boy presented with right iliac fossa acute abdominal pain (Fig. 1).

Case (2). Intussusception: Male patient 9 months-old presented with acute abdominal pain, vomiting and red blood in stool (Fig. 2).

5. Discussion

Acute abdomen is a common clinical complaint in the pediatric emergency department. Examination of the child with acute abdomen is challenging because of the wide range of potential diagnosis Karen and colleagues.⁴

The localization of abdominal pain is not indicative of a specific pathology; atypical clinical

presentations, inability to give reliable history and extraabdominal causes often cause difficulties in achieving the exact diagnosis.

In current study, we expected that the commonest cause of pediatric acute abdomen by US examination was acute appendicitis and its complications which show the highest percentage (40%) followed by intestinal obstruction by (33.3%).

These results disagreed with Khalid and colleagues study⁵ which found that the most common reason of pain was nonspecific that accounted for (30%) by 44 cases followed by abdominal abscess by (21%) and acute appendicitis and intussusception both by (7%), However, the higher US diagnostic accuracy in our study compared with Khalid and colleagues study⁵ which found that ultrasound was diagnostic only in 45% of pediatric patients. This could be due to different US machines used in both studies as in the current study, Logic X8 machine and its different transducers was used, while Khalid and colleagues study⁵ used ADARA (Siemens) machine with 3.75 MHz and 8 MHz probes.

Also our results of this current study disagreed with the results of the study performed by Patel and Gedam⁶ to assess the role of ultrasound in pediatric age groups with acute abdomen which found that intestinal obstruction represented the most common reason (43%) of acute abdomen. Appendicitis represents 14.8% of cases. Mesenteric lymphadenopathy is rare (just 4%) reason. Laparoscopy (hazard of surgical invasiveness) and Computed Tomography (hazard of exposure to radiation in CT) are saved as second-line examination strategies. Diagnostic accuracy of Computed Tomography scan is superior to ultrasonography yet, urgent ultrasound has shown

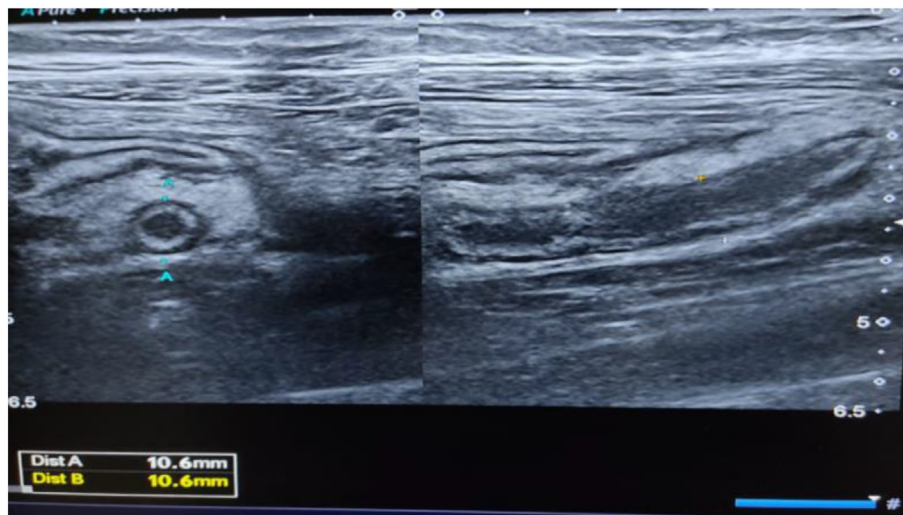


Fig. 1. Grey scale US of acute inflamed appendix showing tubular blind ended noncompressible nonperistaltic structure measuring 10.6 mm with thick wall closely related to the caecal domain, with echogenic fat and minimal free fluid collection at this region.

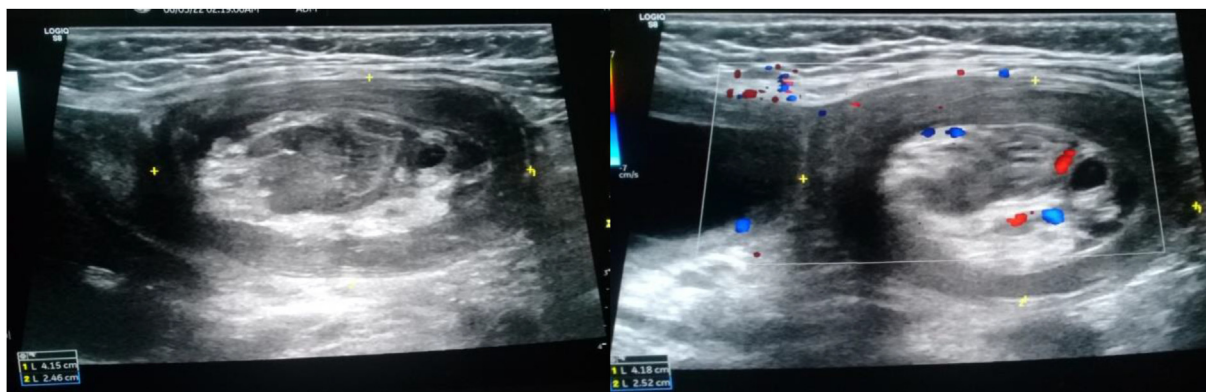


Fig. 2. US shows a cylindrical mass consisting of an outer hypoechoic ring surrounding a loop of bowel and intervening echogenic fat. The longitudinal views give the appearance of a pseudo kidney of the intussusception. Grey scale us axial view showing target sign of intussusception.

practically comparable outcomes in diagnosis of children with acute abdomen. In the same study diagnostic accuracy of ultrasonography alone was 65%.

Our results agreed with the results of the study performed by Reddan and colleagues⁷ which observed that the most widely recognized reason for acute abdomen was thought acute appendicitis, (63.9%) suspected by 110 children, followed by intussusceptions ($n = 35$, 20.3%).

Our results agreed with the results of the study performed by Yölmaz and colleagues⁸ which observed that the most widely recognized reason was appendicitis, which was found in 218 (86%) of the cases and disagreed with our results in intestinal obstruction which was (1.5%).

Also the results of current study disagreed with the results of the study performed by Uinarni and colleagues⁹ which found that the appendicitis was (6.34%), and agreed with our results in mesenteric adenitis was (12.68%). Abdominal ultrasound is valuable to detect presence of organ abnormality particularly to identify appendicitis. Abdominal ultrasound also decline the possibility to utilize abdominal radiograph.

Also the results of current study disagreed with the results of the study performed by Daya Shankar Mishra and colleagues¹⁰ to establish the exact role and limitation of ultrasound in pediatric age group acute abdomen, which was carried out on 50 children under the age of 14 years complaining of acute abdomen were assessed by ultrasonography and other imaging modalities and found that the commonest cause of acute abdomen in pediatric age groups is intussusceptions by 17 cases (34%) then acute appendicitis 13 cases (26%).

Therefore, Ultrasound is rapidly becoming the most important imaging method for assessment of

acute abdomen, especially in pediatric age group patients Niles and colleagues.¹¹

5.1. Conclusion

Ultrasonography stays an exceptionally successful, correlative, harmless technique for assessing acute abdominal pain in pediatric age groups, especially acute appendicitis or intussusception.

The most widely recognized reason of acute abdominal pain in pediatric age group is acute appendicitis.

In most of cases, ultrasonography is a perfect and ideal imaging modality in detection of pediatric age groups with acute abdomen and can provide specific and accurate diagnoses.

Even when the basic pathology is not recognized, ultrasonography will detect if there is need for additional examinations, investigations or surgical exploration and to prioritize one investigation over the others.

5.2. Limitations

Limitations of our study include that diagnosis of acute abdominal pain in children was based on the US findings. This could lead to excluding patients with early disease and those with atypical findings. In addition, no follow up has been done.

Authorship

All authors have a substantial contribution to the article.

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Conflicts of interest

Authors declare that there is no conflict of interest, no financial issues to be declared.

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