

Complications in Iraqi Children Suffering from Appendicitis Detected by Clinical Suspicion and Ultrasound

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Abstract

Background: Ultrasound is very useful for the study of appendicitis and its diagnostic approach because it is easily available and harmless, which makes it the main technique or method of choice in the imaging study of all appendicitis in children. Objective: This study assessed and analyzed the clinical outcomes of complications for Iraqi children with appendicitis, which were detected by clinical suspicion and ultrasound. Patients and methods: We presented a cross-sectional study of patients who underwent laparoscopic appendectomy surgery. We conducted a special examination using ultrasound and other methods for 120 patients whose ages ranged between (4 -

11) years. Clinical, surgical, and demographic data for patients were collected from different hospitals in Iraq for a period between February 6, 2022 to August 23, 2023. This study identified surgical patient data in terms of duration of surgery, bleeding rate, mortality rate, pain rate, complication rate, recovery, hospital stay, and quality of life of pediatric patients after laparoscopic appendectomy surgery. Results: Our clinical results for patients during and after surgery were recorded, as we found the time of laparoscopic appendectomy to be 70.28 ± 9.01 in the group that underwent ultrasound examination and 80.67 ± 22.89 in the group that underwent examination by the traditional method, cases that had bleeding during surgery included two cases in the group and 9 cases in the second group, duration of hospital stay was (4.64 ± 1.48) days in the first group and (5.21 ± 1.90) days in the second group, recovery period was (9.82 ± 2.53) days in the first group and (18.68 ± 4.86) days in the second group, the follow-up period (NOV%) included 2 cases in the first group and 5 cases, and in the second group, the death rate was 0 cases in the first group and 6 deaths in the second group, and the complications rate for patients was 3 cases in the first group and 15 cases in the second group where the most prominent complications were infection, postoperative bleeding, intra-abdominal abscess, and ductal fistula, the common quality of life widely in findings where the physical factor, which was recorded at (80.92 ± 9.77) in the first group and (72.72 ± 5.93) in the second group, and the psychological aspect, which was recorded at 89.41 ± 8.54 in The first group. The first group and 60.59 ± 13.80 in the second group. Conclusion: Ultrasound technology plays an effective, positive role in reducing the complication rate and pain rate and improving the quality of life of patients after the appendectomy operation.

Key words: Appendicitis; Ultrasound technique; Postoperative complications; Quality of life.

Introduction

Appendicitis is an unusual entity in infants and young children; it is estimated that its annual incidence is 1.1 per 10,000 children under four years of age [1]. The diagnosis is generally difficult because the initial clinical presentation is usually non-specific, patients have significant limitations in describing their symptoms, and abdominal physical examination in search of oriented signs is particularly problematic in this age group [2,3]. This is why most children under four years of age with appendicitis are diagnosed late [4]. Late diagnosis frequently leads to complications such as appendicular perforation, peritonitis, and abscess formation, with high rates of post-surgical morbidity and mortality. [5]

Diagnostic errors range from 28% to 57% in children aged 2 to 12 years and rise to almost 100% in children under two years, despite the use of laboratory tests and ultrasound. Computed tomography and magnetic resonance imaging are not routinely used in the initial outpatient assessment of these patients due to operational difficulties, availability, and the potential risk of radiation emission. [6 – 8]

Ultrasound is very useful for the study of appendicitis and its diagnostic approach because it is easily available and harmless, which makes it the main technique or of choice in the imaging study of all acute abdominal pain in children, with more emphasis on the one located in the right iliac fossa [9]. From a clinical approach to acute appendicitis, and more specifically, the one that is intensifying in the right iliac fossa, we will make a correct differential diagnosis of the acute appendicitis process, which will benefit from the contribution of the knowledge of the ultrasound technique by the paediatrician responsible for the small patient [10,11]. Its limitations depend to a

high degree on the experience of the operator and the difficulty of performing graduated compressions before the diagnosis of appendicitis. [12]

Appendicitis is the most frequent surgical pathology in children; we will make a description of the technique of its ultrasound examination and a review of both the ultrasound findings on which its diagnosis is based and those findings that facilitate its differential diagnosis with other pathologies causing acute abdominal pain. [13 – 15]

Acute appendicitis is the cause of multiple diagnostic errors because its clinical presentation can be very varied, and therefore, its diagnosis, in some cases, can confuse experienced clinicians. [16]

In 70% of cases of acute appendicitis [17], the clinical diagnosis coincides with the surgical findings, but there are still 30% of negative appendicitis.

Appendicitis is the cause of multiple diagnostic errors because its clinical presentation can be very varied, and therefore, its diagnosis, in some cases, can confuse experienced clinicians. [18]

Acute appendicitis can occur at any age, but especially in children older than 11 or 12 years. It is rare in infants younger than two years [19]. It is in these children under two years where their diagnosis is more difficult, and therefore, more complications occur, which justifies our effort to present this work to help their early diagnosis and reduce the number of complications. [20]

Patients and methods

We performed a cross-sectional study of patients who underwent laparoscopic appendectomy. Clinical, demographic, and surgical data were collected for 120 patients with appendicitis, whose ages ranged between (4 - 11) years, from different hospitals in Iraq, for a period between February 6, 2022, and August 23, 2023. The demographic and preoperative data included age, gender, and comorbidities, symptoms, duration of symptoms prevalent in patients, ASA classification, as well as the social, educational, employment, and economic status of parents of children with appendicitis. Furthermore, this study identified histopathology data for children with appendicitis that included appendiceal diameter (mm), anatomic position, appendiceal wall layers, free abdominal fluid, diffuse free intraperitoneal fluid, and free intraperitoneal fluid in the area surrounding the appendix. Also, this study distributed patient outcomes and determined the diagnosis of patients by ultrasound examination or traditional examination.

Regarding the clinical results of patients during and after surgery, patients with appendicitis underwent both types of examinations or diagnostics, which were divided into two groups. Where the first group was patients subject to ultrasound examinations, which included 60, while the second group was divided into two groups, where the first group was patients who were subjected to examinations in the traditional method, which included 60, as all patients underwent laparoscopic appendectomy surgery. Regarding intraoperative and postoperative data, this study recorded the results of patients' clinical data, which included the time of laparoscopic appendectomy, bleeding rate, general anesthesia, duration of initiation of general anesthesia, length of hospital stays, recovery time, follow-up time, nausea and vomiting, mortality rate, and postoperative complication rate.

In addition, we evaluated the pain scores of patients with appendicitis during the 4-week follow-up using the VAS scale, where 0 represents no pain, and 10 represents the presence of severe pain. Also, this study determined quality of life standards in which all pediatric patients were evaluated on a questionnaire scale that all children underwent with a range ranging between (0 - 100) where 0 represents the worst in the quality of children's general health while 100 represents the best in the quality of children's general health, as the parameters included physical

function, psychological function, social function, and daily activities. This study determined inclusion and exclusion criteria, as the inclusion criteria included both children with high obesity and pediatric patients with comorbidities such as high blood pressure and diabetes, while this study excluded pediatric patients or patients who had undergone previous surgeries or had serious and chronic diseases. All patient clinical data results were designed using SPSS version 22.0.

Results:

Table 1: Clinical demographic and preoperative characteristics of patients with appendicitis.		
Characteristics	Number of patients [120]	Percentage [%]
Age		
4 – 7.9	42	35%
8 – 11	78	65%
Sex		
Male	90	75%
Female	30	25%
Comorbidities		
Hypertension		
Yes	72	60%
No	48	40%
Diabetes		
Yes	30	25%
No	90	75%
Cerebrovascular disease		
Yes	6	5%
No	114	95%
Obesity		
Yes	72	60%

No	48	40%
Symptoms		
Abdominal pain	34	28.33%
Loss of appetite	12	10.0%
Nausea and vomiting	13	10.83%
Fever	21	17.50%
Diarrhea or constipation	15	12.50%
Painful urination	25	20.83%
Duration of symptoms (hours)		
<24	36	30%
24–48	60	50%
>48	24	20%
ASA classification, %		
I	23	19.17%
II	33	27.50%
III	26	21.67%
IV	38	31.67%
Education status of parents		
Elementary	14	11.67%
Secondary	8	6.67%
University/college	98	81.67%
Marital status of parents		
Married	108	90.0%
Divorced	8	6.67%
Widow	4	3.33%

Employment status of parents		
Employed	84	70.0%
Un-employed	36	30.0%
Income status of parents, \$		
< 900	72	60.0%
> 900	48	40.0%

Table 2: Determine preoperative histopathological related to appendicitis.		
Parameters	Number of patients [120]	Percentage [%]
Appendiceal diameter (mm)	10.21 ± 3.49	
Anatomical position		
Usual	114	95%
Unusual	6	5%
Appendiceal wall layers		
Yes	77	64.17%
No	43	35.83%
Free abdominal fluid		
Yes	89	74.17%
No	31	25.83%
Diffuse-free intraperitoneal fluid		
Yes	24	20%
No	96	80%
Free intraperitoneal fluid in the peri appendiceal region		
Yes	48	40%
No	72	60%
Table 3: Determine common causes associated with patients with appendicitis.		

Causes	Ultrasound method [N = 60]	Traditional method [N = 60]	P – value
Hardened stool	40 [66.67%]	47 [78.33%]	0.00210
Parasites	21 [35%]	24 [40%]	0.0435
Infection	33 [55%]	27 [45%]	0.0460
Genetic factor	26 [43.33%]	22 [36.67%]	0.0013

Table 4: Intra and post-operative outcomes.

Parameters	Ultrasound method [N = 60]	Traditional method [N = 60]	P-value
Laparoscopic appendectomy operative time (mean ± SD)	70.28 ± 9.01	80.67 ± 22.89	0.062
Bleeding rate, N [%]	2 [3.33%]	9 [15%]	< 0.001
General anesthesia,	60 [100%]	60 [100%]	0.05
Duration of starting general anesthesia (mean ± SD)	7.65 ± 0.75	9.82 ± 2.89	0.0291
Length of stay in hospital, days	4.64 ± 1.48	5.21 ± 1.90	0.0420
Recovery time [days]	9.82 ± 2.53	18.68 ± 4.86	0.00276
Follow-up time, week	Four weeks	Four weeks	0.05
Nausea and vomiting (NOV %)	2 [3.33%]	5 [8.33%]	0.0308
Mortality rate	0 [0%]	6 [10%]	< 0.001

Table 5: Assessment pain scores of patients by VAS scale.

Parameters	Ultrasound method [N = 60]	Traditional method [N = 60]	P-value
One week	4.87 ± 0.25	6.01 ± 0.85	0.0442

Two weeks	2.11 ± 0.05	4.68 ± 0.64	0.0307
Three weeks	1.10 ± 0.03	2.75 ± 0.41	0.0473
Four weeks	0	1.04 ± 0.006	0.0428

Table 6: Postoperative complications.

Parameters	Ultrasound method [N = 60]	Traditional method [N = 60]	P-value
Infection	1 [1.67%]	3 [5%]	0.0306
Bleeding	0 [0%]	1 [1.67%]	0.0470
Allergic dermatitis	1 [1.67%]	0 [0%]	0.0470
Postoperative mechanical bowel obstruction	0 [0%]	1 [1.67%]	0.0470
Intraabdominal abscess (IAA)	1 [1.67%]	2 [3.33%]	0.0452
Stercoral fistula	0 [0%]	2 [3.33%]	0.0213
Total	3 [5%]	9 [15%]	< 0.001

Table 7: Assessment of health quality of life for patients

Parameters	Ultrasound method [N = 60]	Traditional method [N = 60]	P-value
Physical function	80.92 ± 9.77	72.72 ± 5.93	> 0.001
Psychological Function	89.41 ± 8.54	60.59 ± 13.80	< 0.001
Social function	84.98 ± 6.83	71.18 ± 4.85	< 0.001
Daily activities	88.84 ± 6.77	68.64 ± 7.45	< 0.001

Discussion

The clinical and demographic data for patients with appendicitis were recorded as 65% for patients aged (8-11) years and 35% for patients (4-7.9) years; males had a higher rate of 75% than females, who had a rate of 25%. The most prominent diseases were recorded. Comorbidities were high blood pressure (60%), diabetes (25%), cerebrovascular disease (5%), and obesity (60%), most common and noticeable symptoms in pediatric patients were abdominal pain (28.33%), painful urination (20.83%), and fever (17.50%), duration of symptoms was the most prominent, and ranged between (24-48) hours, amounting to 50%.

This study determined the preoperative clinical findings related to the histopathology of patients with appendicitis, where the appendiceal diameter (mm) was 10.21 ± 3.49 , the anatomical position, which was mostly 95% normal and 5% abnormal, appendiceal wall layers were 64.17%, free abdominal fluid was 74.17%, diffuse free intraperitoneal fluid was 20%, and free intraperitoneal fluid in the area surrounding the appendix was 40%.

Regarding the results during and after surgery, the time for laparoscopic appendectomy was 70.28 ± 9.01 in the group that underwent ultrasound examination and 80.67 ± 22.89 in the group that underwent examination by the traditional method. Cases that experienced bleeding during surgery, included two cases in the group and 9 cases in the second group, duration of stay in the hospital was (4.64 ± 1.48) days in the first group and (5.21 ± 1.90) days in the second group. The duration of recovery was (9.82 ± 2.53) days in the first group and (18.68 ± 4.86) days in the second group; the follow-up period was four weeks (NOV%), included 2 cases in the first group and 5 cases in the second group, the mortality rate was 0 cases in the first group and 6 cases of death in the second group, the complication rate for patients was 3 cases in the first group and 15 cases in the second group, and the most prominent complications were infection, post-operative bleeding, intra-abdominal abscess, and ulcerative fistula.

Besides to that, the most common quality of life parameters for patients were the physical factor, which was recorded (at 80.92 ± 9.77) in the first group and (72.72 ± 5.93) in the second group, and the psychological aspect, which was recorded as 89.41 ± 8.54 in the first group and 60.59 ± 13.80 in the second group.

Previous studies have agreed that ultrasound technology has effectively contributed to the early detection of problems that the patient may suffer from, allowing it to play an effective role in evaluating the condition of the abdomen before and after surgery in terms of the presence of surgical complications and identifying abnormal fluid accumulations, which is attributed to the development of surgical interventions in appendectomy [21,22]. Moreover, other studies have shown that ultrasound is a high-quality and safe radiation-free imaging technique, which should be used more for postoperative patient monitoring [23]. An American study confirmed that ultrasound is efficient and effective in ensuring patient safety and excellent quality care, which contributes to improving the patient's clinical outcomes after surgery in the long term [24, 25, 26].

Conclusion

Our current study indicated the superiority of ultrasound as a non-invasive imaging technique compared to traditional methods because of the good advantages that ultrasound offers, as it plays a decisive role in the early detection of expected problems in the abdomen for patients with appendicitis, which improves the decrease in the rate of complications significantly, which is attributed to need for more accurate and effective surgical intervention, which results in faster patient recovery, better quality of life for patients, and a high reduction in the rate of pain for patients.

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