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Ultrasonographic Evaluation of Common Findings in Acute Abdomen amongst Paediatric Age Group in Kano Metropolis, Nigeria

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Abstract

Acute abdomen is very common complaint for paediatric patients presenting to the paediatric emergency departments and outpatient clinics and its management is time consuming. Ultrasound is reliable for the diagnosis of acute abdomen. This study was aimed at evaluating the commonest ultrasonographic findings in paediatric age group presented with acute abdomen in Kano metropolis, Nigeria. This was prospective, cross sectional study conducted from September, 2020 to December, 2022. A convenience sampling method was employed and a sample size of 170 paediatric patients with ages ranging between 0 and 18 years. Paediatrics presenting with non-traumatic acute abdomen were included in the study, while those with traumatic acute abdomen were excluded. GE LOGIQ F6 US machine with transducer frequency of 3.5 MHz-8 MHz was used as an instrument for data collection. The selected patients were scanned in supine position. Data generated was analyzed using SPSS version 22.0. Results generated indicate that the commonest symptoms of acute abdomen among paediatric in Kano metropolis besides abdominal pain were vomiting (63.5%) and running fever (55.8%). The commonest ultrasonographic findings of acute abdomen were gastroenteritis (17.1%), acute appendicitis (12.9%), nonspecific abdominal pain (10.0%) mesenteric adenitis (7.6%) and acute cholecystitis (7.1%). Intussusception, intestinal obstruction and intestinal perforation accounted for 5.9% each. Pyelonephritis, and cystitis accounted for 4.1% and 4.7% respectively. There was 2.9% for each acute hepatitis, renal calculus and pelvic inflammatory disease (PID). Midgut malrotation and volvulus and acute peritonitis accounted for 1.8% each. The common findings in acute abdomen among paediatrics in Kano metropolis, Nigeria were gastroenteritis, acute appendicitis, nonspecific abdominal pain and mesenteric adenitis.

Keywords: Appendicitis, Chronic abdominal pain, Gastro-enteritis, Ultrasonography

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INTRODUCTION

Acute abdomen is the intra-abdominal process causing onset of severe pain induced by wide variety of pathological conditions that require emergency or more often surgical management (Aviral *et al.,* 2005). It includes surgical, medical and gynecological conditions (Nyaga *et al.,* 2010). There are different conditions which present as acute abdomen, from trivial to potentially life threatening ones that cause great diagnostic dilemma (Sinha *et al.,* 2015).

Paediatric age group ranges from newborn infants to adolescents (Sidi *et al.,* 2021; Lissauer *et al.,* 2012). According to Hijaz and Friesen (2017), due to its nonspecific nature of symptoms, difficulty in the assessment and physical examination in children, acute abdomen in paediatric age group has been a challenge to practitioners. The presentation of acute abdomen in paediatric age group is usually sudden onset of abdominal pain that associated nausea or vomiting (Patterson *et al.,* 2022). Paediatric acute abdomen varies with age, associated symptoms, and pain location (Kim, 2013). Most patients with acute abdomen in paediatric age group appear ill (Patterson *et al*., 2022). Main points regarding acute abdomen should include pain location, radiation, intensity and nature of pain, previous episodes of acute abdomen, and the intensity or progression of the pain, as well as associated symptoms (Hijaz and Friesen, 2017). Kumar *et al*. (2019) reported that the gaps between the acute abdominal pain and acute abdomen overlap and are used interchangeably in clinical practice.

The evaluation of acute abdomen in pediatric patients requires a thorough history and physical examination and laboratory tests and/or imaging studies to rule out urgent from non-urgent cases (Ali and Maddu, 2019). To identify the specific cause of acute abdomen and to partially exclude the possibility that the pain is not ongoing manifestation of chronic abdominal pain, the past medical history of the patient needs to be considered (Hijaz and Friesen, 2017). The evaluating provider needs to assess for an urgent condition even in a patient with chronic abdominal pain as chronic pain is not protective against acute conditions such as appendicitis (Hijaz and Friesen, 2017).It is vital to note that laboratory investigations can narrow a differential diagnosis, confirm clinical suspicion or exclude it but not enough to differentiate surgical from non-surgical cause of acute abdomen.

Radiological investigations play significant role in the diagnosis of acute abdomen because clinical evaluation results can be inaccurate (Shah *et al*., 2017; Hijaz and Friesen, 2017). The radiologic imaging has the ability to accurately determine and diagnose intra-abdominal pathology and in no other specialty has such dramatic transformation taken place in the past 10 years (Ali and Maddu, 2019). Computed tomography (CT) has been demonstrated to have a marked effect on the management of acute abdomen but exposes patients to high radiation dose and is not readily available (Shah *et al*., 2017). Ultrasonography (US) is an imaging modality for evaluating acute abdomen, as it is non-invasive, portable, readily obtainable, relatively inexpensive, and without the risks of ionizing radiation or iodinated intravenous contrast (Sidi *et al.,* 2022). Ultrasound has extremely high diagnostic accuracy in many clinical scenarios equivalent or even superior to CT (Hijaz and Friesen, 2017). Magnetic resonance imaging (MRI) has high sensitivity and specificity for the diagnosis of surgical acute abdomen (Hijaz and Friesen, 2017). However, it is considered expensive, not readily available and may require sedation in children (Sinha *et al*., 2016). To the best of our knowledge, there is no documented study conducted on the common ultrasonographic findings of acute abdomen in paediatric age group in Kano, Nigeria. The findings of this study would serve as a guide to sonographers, radiologists and paediatricians in the diagnosis and management of paediatric patients with acute abdomen. This study was aimed at evaluating the commonest

ultrasonographic findings among paediatric age group presented with acute abdomen in Kano Metropolis, Nigeria.

MATERIALS AND METHODS

Study Area

This study was conducted at some health facilities domiciled in Kano metropolis; Murtala Muhammad Specialist Hospital, Muhammad Abdullahi Wase Teaching Hospital, Imam Wali General Hospital, Khalifa Sheik Isyaka Rabiu Paediatric Hospital, Dazango Clinic and Diagnostic Centre, Waziri Shehu Gidado General Hospital and Muhammadu Buhari Specialist Hospital from September, 2020 to December, 2022.

Sampling and Sample Size

It was a prospective and cross sectional study conducted among paediatric age group ranging between 0 and 18 years presented with acute abdomen. A convenience sampling method was employed and a sample size of 170 paediatric patients were used. The sample size was determined using Cochran's formular (cited in Singh and Masuku, 2014) as shown below:

$$n = Z^2xPq/e^2$$

Where:
n is the sample size
Z is the standard normal deviation corresponding to 95% confidence level i.e.1.96
P is the prevalence of acute abdomen = 9% (Reust and Williams, 2016)
q is the complementary probability = 1-p
e is the desired level of precision (i.e margin of error)
Therefore, $n = 1.96^2X0.09X0.91/0.05^2$
$n = 3.8416X0.09X0.91/0.0025$
$n = 126$

Therefore, the minimum sample calculated for this study was126 paediatric patients. However, a sample size 170 paediatric patients was used.

Paediatrics presented with non-traumatic acute abdomen were included in the study, while those with traumatic acute abdomen were excluded. GE LOGIQ F6 US machine with transducer frequency of 3.5 MHz-8 MHz was used as an instrument for data collection. The procedure was explained to the patients and patients' relative. The patients were scanned in supine position, with scanning table tilted to support patient's head. For paediatric patients that did not cooperate, the mother (or relative) helped hold them for the procedures to be done. The operator of the machine stood or seated by the right side of the table. Adequate water-based gel was squeezed onto the patient body (epigastric, umbilical, suprapubic and lumbar regions). The abdominal structures were scanned in longitudinal, transverse, oblique and coronal planes. The probe pointer was pointed cephalic or toward the right side of the patient. The heart and right tip of the liver were viewed by placing the transducer at the sub-xyphoid region in longitudinal plane. The liver, gall bladder, Morrison's pouch and right kidney were viewed by sliding the probe below the right subcostal margin. Taking dealing with ribs into consideration, the probe was moved to right coronal plane to see the best view of the right kidney, liver and gall bladder, and to the opposite side to view the spleen and left kidney. The transducer was put in transverse plane in the suprapubic area to view the bladder (and uterus in older paediatric patients). Using vertically oriented overlapping lanes, peritoneal cavity was scanned. Moving the probe back and forth, each abdominal quadrant was scanned using gentle graded compression technique. For cooperative patients, further

attention was focused on localized area of pain or tenderness. However, patients might be turned to either side during the procedure to improve the quality of the images.

Data Analysis

The findings for each patient were documented in the data capture sheet. The obtained data was categorized based on the age and gender of the selected patients. The data was analyzed using IBM Statistical Software version 29.0.1.0. Statistical Significance was considered at $p<0.05$.

RESULTS AND DISCUSSION

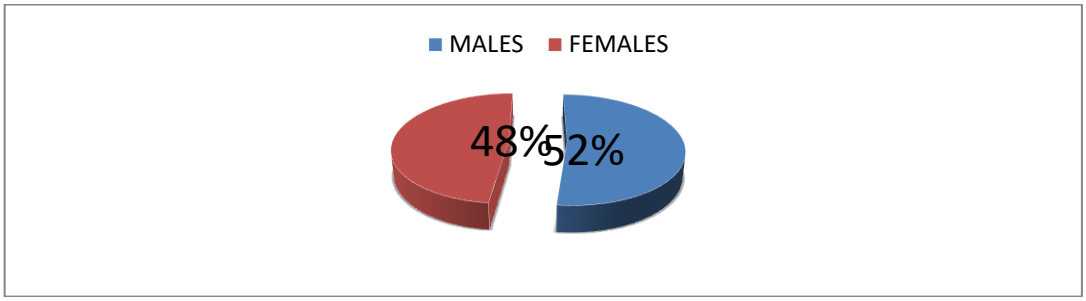

Figure 1: Gender distribution of the selected patients

Table 1: Age groups of the selected patients

Paediatric age group	Frequency (n)	Percentage
Neonate(birth-28days)	9	5.3
Infant(1month-12months)	11	6.5
Toddler(13month -2years)	18	10.6
Early childhood (3-5years)	26	15.3
Middle childhood(6-11years)	55	32.4
Early adolescent(12-18years)	51	30.0
Total	170	100

Figure 1 showed that the majority of the selected patients were males. This finding is similar to the findings of the studies conducted by Aviral *et al.* (2005); Khalid *et al.* (2012), Lin and Lin (2013) and Sibanda *et al.* (2020). However, the findings of the current study were contrary to the findings of Arrendodo (2018) that reported equal number of males and females in their study. The age range of this study as indicated in Table 1 is in agreement with the findings of the studies conducted by Lin and Lin 2013; Arredondo (2018) and Aviral *et al.* (2005). However, this was contrary to the study conducted by Kumar *et al.* (2019) that reported higher age range of the selected subjects. The most affected age group in this study was 6-11years. These findings were similar to the studies conducted by Sibanda *et al.* (2020) and Khalid *et al.* (2012). This might be due to high number of middle childhood patients admitted in the hospitals.

The findings of this study as indicated in Table 2 show that all the selected patients presented with symptom of acute abdominal pain. Besides abdominal pain, vomiting was the second most common symptom of acute abdomen. This was followed by fever and then constipation. These findings are similar to the studies conducted by Khalid *et al.* (2012) and (Sibanda *et al.*, 2020). However, the findings of the current study are contrary to Aviral *et al.* (2005) that reported fever as the second most common symptom followed by vomiting. The possible reason for the findings of this study and the previous published works might be attributed to social factors such as overpopulation, poor nutrition and sanitation.

Table 2: Symptoms of acute abdomen

Symptoms	Frequency (n)	Percentage
Abdominal pain, vomiting, fever	43	25.3
Abdominal pain, vomiting	65	38.2
Abdominal pain, fever	52	30.6
Abdominal pain and constipation	10	5.9
Total	170	100

The findings of the current study as indicated in Table 3 show that, the most common sign of acute abdomen was abdominal tenderness and distension, followed by abdominal tenderness, abdominal distension and then rigidity guarding. However, six of the selected patients presented with no sign of tenderness, abdominal distension or rigidity/guarding. These finding are similar to what was reported by Aviral *et al.* (2005). The similarities of the signs in this study and that of Aviral *et al.* (2005) might be due to closeness of the age range in studies and both studies were conducted in developing countries.

Table 3: Sign of acute abdomen

Symptoms	Frequency (n)	Percentage
Tenderness and distension	78	49.5
Tenderness only	45	26.5
Distension only	26	15.3
Rigidity/guarding	15	8.8
No tenderness, No abdominal distension, No ridity/guarding	6	3.5
Total	170	100

Table 4: Ultrasonographic findings

Ultrasonographic Findings	Age groups						Percentage(%)
	Neonates	Infants	Toddlers	Early Childhood	Middle childhood	Early adolescent	
Nonspecific abdominal pain	3	2	3	4	4	1	17(10.0%)
Gastroenteritis			3	4	13	9	29(17.1%)
Pyelonephritis				1	2	4	7(4.1%)
Cystitis	1		1	1	3	2	8(4.7%)
Acute appendicitis				1	7	14	22(12.9%)
Intussusception		6	4				10(5.9%)
Midgut malrotation and volvulus	2	1					3(1.8%)
Intestinal obstruction	1	1	3	2	2	1	10(5.9%)
Mesenteric adenitis			1	7	5		13(7.6%)
Ovarian cyst rupture						1	1(0.6%)
Ovarian torsion						1	1(0.6%)
Testicular torsion					1	1	2(1.2%)
Intestinal perforation		1	2	2	3	2	10(5.9%)
Acute cholecystitis					8	4	12(7.1%)
Acute hepatitis				2	2	1	5(2.9%)
Hernia				1			1(0.6%)
Renal calculus				1	2	2	5(2.9%)
Acute pancreatitis					1	3	4(2.4%)
Acute peritonitis			1		2		2(1.8%)
Pelvic inflammatory disease						5	5(2.9%)
Hirschsprung disease	2						2(1.2%)
Total	9	11	18	26	55	51	170(100%)

Furthermore, the findings of this study as shown in Table 4 indicate that, the four most common causes of acute abdomen among paediatric age group in this study are gastroenteritis, acute appendicitis, non-specific abdominal pain and then mesenteric adenitis. These findings are in accordance with the findings of the study conducted by Ibrahim *et al.* (2019). However, the findings of this study are contrary to Sibanda *et al.* (2020) that reported the three most frequent diagnoses of acute abdomen as mesenteric lymphadenitis, ascites and pneumoperitoneum. The single most common cause of acute abdominal pain was non-specific abdominal pain, followed by abdominal abscess, acute appendicitis and intussusceptions (Khalid *et al.,* 2012). These discrepancies could be attributed to geographical location.

In this study, non-specific abdominal pain, intussusceptions, mesenteric adenitis, gastroenteritis and acute appendicitis were the common causes of abdominal pain in neonate, infant, toddler, early childhood and middle childhood, and early adolescent respectively. These findings are supported by Sibanda *et al.* (2020) where intussusception was the common cause of abdominal pain in infants.

CONCLUSION

During the conduct of this study, the common ultrasonographic findings in acute abdomen in paediatric age group in Kano metropolis, Nigeria were gastroenteritis, acute appendicitis, nonspecific abdominal pain and mesenteric adenitis. Non-specific abdominal pain, intussusceptions, mesenteric adenitis, gastroenteritis and acute appendicitis were the common causes of abdominal pain in neonate, infant, toddler, early childhood, middle childhood and early adolescent in Kano metropolis respectively.

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