

Acute Appendicitis: Risk Factor for Perforated Appendices

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ABSTRACT

Background: Acute appendicitis and its complications are the leading causes of acute abdomen and among the indications for emergency surgical intervention in clinical practice. Though appendicitis is common, yet it is commonly missed. Those late to be diagnosed cases of acute appendicitis, usually come with perforation.

Objective: The current study aims to identify risk factors associated with perforated appendix.

Patients and Methods: An observational prospective study conducted at the surgical department of Al Yarmook Teaching Hospital in Al Karkh- Baghdad, Iraq from the first of January till the end of April 2021. A convenient sample of 124 patients admitted to surgical and emergency wards for acute appendicitis at the study period, were selected. Patients were interviewed and their corresponding files were checked thoroughly. Studying the association between risk factors and perforation was done.

Results: The mean age of presentation with Acute Appendicitis was 26.7 ± 10.3 years. Prevalence of appendice perforation was 25.8%. Delay time was 1.20 days. The study showed a significant association between perforation of appendix and gender, Body Mass Index, having previous surgeries or chronic diseases, delay time, and appendix position. No significant association was recorded between age or marital status and perforation of appendix.

Conclusions: peak age of presentation with Acute Appendicitis was twenties. The average time of presentation till surgical intervention of Acute Appendicitis was from (1-4 Days), and the study show significant association between appendicular perforation and male gender, anatomical site, history of comorbidities and previous surgeries, increased Body mass Index and delay time of presentation.

Keywords: Appendicitis, Perforated Appendix, predisposing Factor, perforation

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1. INTRODUCTION

Acute appendicitis (A.A) and its complications are the leading causes of acute abdomen and among the indications for emergency surgical intervention in clinical practice (1). It is the most common diagnosis made in young patients admitted to emergency wards. (2) Acute appendicitis can be described as either simple or complicated. Complicated appendicitis includes appendicular mass, appendicular abscess, and perforated appendix (2). Most complicated appendicitis started de novo as simple appendicitis raising the notion that it is a disease in evolution that has become of clinical importance due to delayed or missed diagnosis. Grossly, simple appendicitis is of two major forms: obstructive and catarrhal appendicitis. AA in adults is often obstructive in type and sequel to some form of luminal obstruction by fecaliths, lymphoid tissues, or rarely foreign bodies (3).

Incidence:

With an incidence of about 100 per 100,000 population. The life-time risk of developing appendicitis is 8.6% for males and 6.7% for females (4). It is the most common non obstetric surgical emergency during pregnancy (5). about 90% of AA found in children and young adults and 10% in patients over 60 years old (6). The incidence of AA started to decline steadily since late 1940s. In developed countries, Acute appendicitis occurs at a rate of 5.7–50 patients per 100,000 inhabitants per year, with a peak between the ages of 10 and 30 years (7,8) Geographical differences are reported, though Iraqi data is limited but it had been reported that lifetime risk for AA of 9% in the USA, 8% in Europe, 2% in Africa, Middle east, and Iraq (9). Moreover, there is great variation in the presentation, severity of the disease, radiological workup, and surgical management of patients having AA that is related to country income (10). The rate of perforation varies from 16% to 40%, with a higher frequency.

2. METHODOLOGY

Study design and study period:

The current study was an observational prospective study conducted at the surgical department of Al Yarmook Teaching Hospital in Al Karkh- Baghdad, Iraq. The period of study extended from the first of January till the end of April 2021.

Study Sample:

A convenient sample was selected, the total sample size was 124 patients admitted to surgical and emergency wards with AA at the study period.

Inclusion criteria: All patients 14 years and older with suspected clinical diagnosis of AA confirmed by imaging and seen by a surgeon were included in the study.

Exclusion criteria: patients 13 years of age or younger

Tools of the study:

Patients were interviewed and their corresponding files were checked thoroughly. Pre-operative notes were reviewed. Data collected included age (in years), gender (male/female), weight (in Kilograms) and height (in meters) were measured and BMI (Kg/m²) for each patient was calculated immediately using Center of communicable disease control (CDC) formula (11). In addition to that, patients were asked in detail about the time when the symptoms appeared till the time of surgical intervention, time was calculated and summarized. If the patient had previous abdominal surgeries (Yes/No), if had chronic illnesses (hypertension, diabetes mellites ..etc.) (Yes/No). post-operative notes were also reviewed, position of appendix was recorded, state of appendicular perforation was written also.

Statistical Analysis:

Data were cleared and entered into Statistical Package of Social Sciences (SPSS) version 18.0.0 (Chicago, IL) Software to compute the statistical analysis. Variables were categorized for the sake of summarization and presentation; Univariate analyses were performed to study the association between risk factors and appendiceal perforation using a chi-square test, or a Fisher's exact test, if the expected value of a cell was less than five. P value equal to or less than 0.050 were considered statistically significant.

Operational definitions

Delay time: in the current study we calculated time period from the beginning of symptoms appearance to the day of surgical intervention, the time was approximated and presented in days for easier calculation and presentation.

Body Mass Index (BMI) is a person's weight in kilograms divided by the square of height in meters. A high BMI can be an indicator of high body fatness (31). BMI categorized into four

categories; underweight : BMI <18.5, healthy weight: 18.5 to <25, overweight 25-<30 and obese when BMI ≥ 30 kg/ m²

3. RESULTS

There were a total of 124 patients enrolled in this study. The mean age and standard deviation of participants was 26.7 ± 10.3 years within a range of (14-65) years of age. demonstrates the demographic, males were (48.4%) . Among the studied group, 17 (13.7%) were underweight, 37.1% had healthy weight, overweight (28.2%) and 21% were obese. History of chronic diseases and previous surgeries reported in 8.1% and 9.7% of the cases, respectively, (Table 1)

Perforated appendix was found in 32 cases contributed for 25.8%, (Figure 1). Regarding the position of appendix, in majority (72%) of cases it was retrocecal, pelvic in (16.9%) , Post iliac in (5.6%), Peri-ilial in (3.2%) and 0.8% for each of sub-cecal and subhepatic . From other point of view, the mean time between appearance of symptoms and surgical intervention was 1.20 days ranging from less than 24 hours up to 4 days since symptoms started to appear. Majority of patients, 87/124 (70.2%) had symptoms for one day or less (Table 2). The percent of perforation increased from 12.5%; if delay time was one day or less; up to 46.9% when delay time reached to three days or more (Table 3).

Applying Chi square and Fischer tests to illustrates the association between various variables and appendiceal perforation; as seen in (Table 4), The current study showed no significant association between age and developing perforated appendix; (p value = 0.221). Gender was significantly associated with perforation of appendix, males showed higher percent (35%) than females (17.2%); (p value= 0.023) BMI showed a significant association with perforated appendix, the percent escalated to 73.1% among obese patients.; (P-value< 0.001). There was a significant association between perforation and time delay from appearance of symptoms till the surgical intervention, the percent of perforation increase to 76.5% and 75% in 2 and 3 days or more delay time. (p value< 0.001). Having previous surgeries or chronic diseases showed higher percent of perforation (p value=0.002) and (p value<0.001) respectively. The current study showed a significant association between perforation and

apppendicular position, higher percent of perforation was reported with appendices positions other than retrocecal, (p- value< 0.001).

Table 1. Demographical features of the studied sample.

Variables		Frequency	Percent
Age (year)	< 40	110	88.7
	≥ 40	14	11.3
	Mean (SD) : 26.7 (10.3)	-	-
	Range : 14 – 65)	*	*
Gender	Male	60	48.4
	Female	64	51.6
BMI	underweight (<18.5)	17	13.7
	Healthy weight (18.5-24)	46	37.1
	Overweight (25-29)	35	28.2
	Obese (≥30)	26	21.0
History of chronic diseases		10	8.1
History of previous surgeries		12	9.7

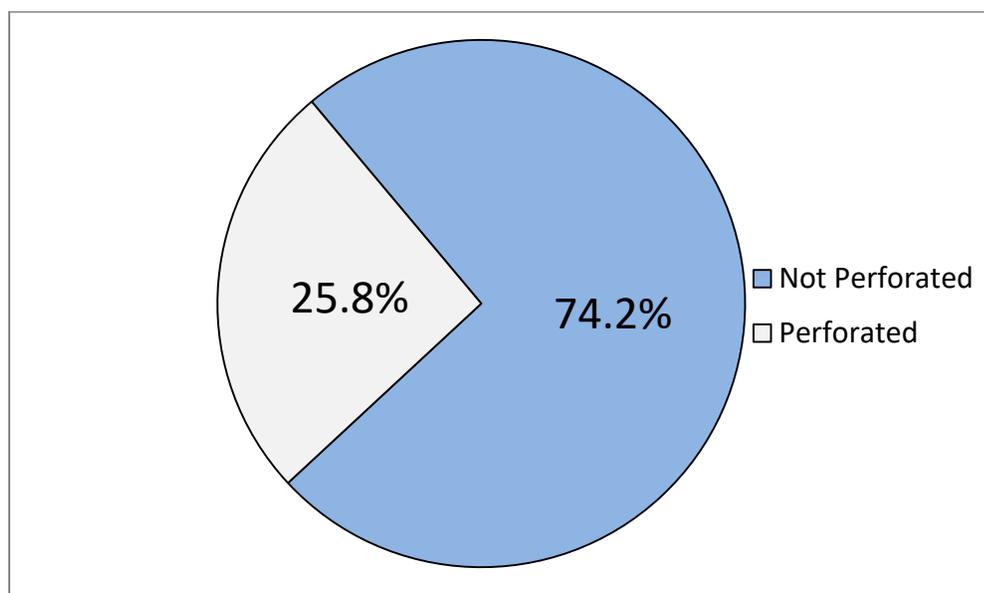


Figure 1. Distribution of patients according to state of appendix perforation.

Table 2. Distribution of the studied group according to the position of appendices and delay time before intervention (N=124)

Variable		Number of cases	%
Position of appendices	Rectocecal	90	72.6
	Pelvic	21	16.9
	Post iliac	7	5.6
	Peri-iliac	4	3.2
	Sub-cecal	1	0.8
	Subhepatic	1	0.8
Delay time before intervention	One day or less	87	70.2
	Two days	17	13.7
	Three days	14	11.3
	Four days	6	4.8

Table 3. The percentage of perforation according to delay time

Delay time before intervention	Appendix perforation			
	Yes		No	
	No.	%	No.	%
One day or less	4	12.5	83	90.2
Two days	13	40.6	4	4.3
Three days or more	15	46.9	5	5.4
Total	32	100.0	92	100.0

Table 4. The distribution of demographic variables according to perforation status of the appendix

Variables		Perforated appendix				Total	P. value*
		Yes (n=32)		No (n=92)			
		No.	%	No.	%		
Age (year)	< 40	26	23.6	84	76.4	110	0.221 ns
	≥ 40	6	42.9	8	57.1	14	
Gender	Male	21	35.0	39	65.0	60	0.023
	Female	11	17.2	53	82.8	64	
BMI (kg/m ²)	< 25	3	4.8	60	95.2	63	<0.001
	25 – 29.9	10	28.6	25	71.4	35	
	≥ 30	19	73.1	7	26.9	26	
Delay time before intervention (day)	< 24	4	4.6	83	95.4	87	<0.001
	25 -71	13	76.5	4	23.5	17	
	72 - 96	15	75.0	5	25.0	20	
Previous surgeries	Yes	8	66.7	4	33.3	12	0.002
	No	24	21.4	88	78.6	112	
Chronic diseases	Yes	10	100.0	0	0.0	10	<0.001
	No	22	19.3	92	80.7	114	
Position of appendix	Retrocecal	15	16.7	75	83.3	90	<0.001
	Others	17	50.0	17	50.0	34	

*Chi square and Fischer's exact tests used accordingly
ns: not significant, all other P. values were significant

4. DISCUSSION

Perforated appendicitis is not uncommon and it can be avoided once proper attention and suspicion is effectively raised, thus studying the various risk factors contributing in perforation of appendix would help improve our management of patients.

Peak age of presentation with AA was 26.7 years ranged between 21-30 years old agreeing with results from Basra- Iraq (12), south Africa (26 years) (13), India (26.4 years) (14) and also in alignment with findings from previous literatures where the peak incidence of acute appendicitis worldwide ranges between 10 and 30 years of age (12). Yet our result was slightly lower than that reported in Mexico (27.5 years) (16), Nigeria (28.5 years) (1), Turkey (32 years) (17), Palestine (32.9 years) (18) and Ghana (32.4 years) (19). A probable explanation might be related to the differences in referral patterns to the hospitals.

The incidence of appendiceal perforation in acute appendicitis is estimated to be in the range of 20-30%. (20-22) Nearly one quarter (25.8%) of the studied sample had perforated appendix. This percent is lower than that reported in Iraq (29.6%) (43), Nigeria (28.5%) (1), Ghana (39%) (19), Jordan (41%) (20) , Thailand (35%) (24) and Bangladesh (44%) patients had perforated appendicitis (25), These higher percentages might reflect sampling differences from different centers and hospitals. The current percentage was higher than that reported in Al Basrah (19%) (12) and Al Diwaniya (20%) (26) which is probably related to lower sample sizes and low capacities of these hospitals. Our current result is also higher than that reported in Jordan (The perforation rate was 14.5%) (27), Turkey (15.3%) (17), USA (15.8% perforated) (28) and India (22%). (29) This difference may reflect the availability of rapid imaging techniques in those centers that aided in early diagnosis.

Although age is usually on the top of the risk factors for appendiceal perforation, yet our current study showed no significant association between age and perforation which disagrees with results from Baghdad- Al Kindy hospital where young age group were the most affected by perforation, (23) a difference that might be related to sample size and inclusion criteria. However, studies from Al Basrah- Iraq (12) and USA (28) showed the opposite, they illustrated an increased risk of perforation with increased age. It had been reported that appendicitis in late adulthood characterized by a delay in treatment; mainly due to low suspicion, also it is associated with high perforation rates, and unfavorable outcome parameters, all mutually correlating. Older patients with acute abdominal pain are high-risk patients, unlike their younger counterparts. They have to be clinically evaluated by experienced surgeons within a narrow time margin (30). Another study from Jordan and Diwanyah -Iraq showed that AA perforation rate was high in elderly patients (38.2%) and children below 11 years (21.7%) (26, 27) So it seems age is a factor that need to be considered but not used to rule out acute appendicitis. Acute appendicitis must be suspected regardless of age. In regard to gender, the current study showed a significant association between perforated appendix and male gender, agreeing with results from Baghdad (23), Al Diwaniya- Iraq (26), Jordan (47) , India (29) and USA (28, 31,32) It had been reported that there is a slight male preponderance of 3:2 in teenagers and young adults; in

adults, the incidence of appendicitis is approximately 1.4 times greater in men than in women. The incidence of primary appendectomy is approximately equal in both sexes (33). The diagnosis of acute appendicitis in overweight patients is challenging due to the limited value of the clinical examination. It had been reported that the role of ultrasonography in patients with BMI ≥ 25 kg/m² with suspected acute appendicitis is questionable due to its high rate of non-conclusive findings. Therefore, abdominal CT scans should be preferred to investigate suspected appendicitis in overweight patient if clinical findings are not conclusive (34). Agreeing with a study by Wang H. illustrated that patients who presented with a complicated appendicitis had a higher average BMI and higher average hours of symptoms prior to triage than patients who presented with a non-complicated appendicitis (35). Acute appendicitis is typically done within hours of diagnosis to prevent the complications of gangrene and perforation. In adult patients with acute appendicitis, the risk of developing advanced pathology and postoperative complications increases with time; therefore, delayed appendectomy is unsafe. In uncertain cases, delay of surgery and repeated assessment are commonly practiced to achieve a more precise diagnosis. All these factors may contribute to diagnostic or therapeutic delays in the management of acute appendicitis. Delay in treatment is regarded as the main cause of perforation and complications (17, 36) The average time between symptoms appearance and surgical intervention was 1.20 ± 1.1 days ranging from less than 24 hours up to 4 days (96 hours) since symptoms started to appear. a comparable finding was reported from a study by Abu Foul S et al showed a delay time ranging from 42 -63 hours (average reaches to 2.1 days) (18). The current study illustrated that as the delay time between the appearance of symptoms up to surgical intervention increase the percent of having perforated appendix increased significantly, agreeing with results from Iraq (23, 26), Nigeria(1), India (29), Turkey (17), Jordan (20), Thailand (24), USA(36) and others (18) The current study showed that anatomical sites other than retrocecal is significantly associated with perforation, though multivariate analysis failed to illustrate a significant association, but in previous Iraqi studies by Hindosh L et al and Sagir I. it was reported that the most common appendix anatomical location for complicated appendicitis was pelvic appendix (23,26). Most studies on acute uncomplicated appendicitis suggest that surgical management is superior to medical management (37-39).

Nevertheless, patients with multiple comorbidities, especially those with systemic illness like hypertension, diabetes mellitus or steroid usage have been omitted from these study trials (40,41). There is also substantial evidence that comorbid patients receiving appendectomy suffer worse outcomes (42). the presence of serious comorbidities is associated with significantly worse prognosis for such a benign disease, even in absence of complications (43). This might shed the light on the probable cause of such significant association between perforation and having comorbidities Our result is in agreement with that from Iraq (26) and USA (28).

5. CONCLUSIONS

Peak age of presentation with Acute Appendicitis was twenties. The average time of presentation till surgical intervention of Acute Appendicitis was from (1-4 Days).

Our study shows significant association between appendicular perforation and male gender, anatomical site, history of comorbidities and previous surgeries, increased Body Mass Index and delay time of presentation. Nearly one quarter of studied sample had perforated appendix

Ethical Approval:

All ethical issues were approved by the author. Data collection and patients enrollment were in accordance with Declaration of Helsinki of World Medical Association , 2013 for the ethical principles of researches involving human. Signed informed consent was obtained from each participant and data were kept confidentially. Administrative approvals were granted from the The Council of the Arabic Board of Medical Specialization, approval of administration of Baghdad Al Karkh Health directorate and Al Yarmouk teaching hospital, a verbal and signed consent were obtained from all participants of the parents (in pediatric cases) after explaining the study objectives. All personal information and data were kept confidentially and exclusively used for the purpose of this study.

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