Predictors of Complicated Appendicitis in a Tertiary Hospital in Southern Nigeria.

[1]Oyintonbra F. Koroye, [1]Riemann Biowe, [1]Beleudanyo G. Fente

[1]Department of Surgery, Niger Delta University
Teaching Hospital, Okolobiri, Bayelsa State

Corresponding author:
Dr. Oyintonbra F. Koroye
Department of Surgery
Niger Delta University Teaching Hospital, Okolobiri, Bayelsa State
+2348037087725, oyintonbrak@yahoo,com
ORCID ID 0000 0002 0928 1748

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ABSTRACT

Background: *Acute Appendicitis (AA) is the commonest abdominal surgical emergency making appendicectomy the commonest abdominal surgical operation performed worldwide. This is to prevent the progression of uncomplicated acute appendicitis (UAA) to complicated acute appendicitis (CAA) characterised by perforation, gangrene, abscess formation and generalised peritonitis. Complicated acute appendicitis comes with a higher rate of complications, longer hospital stay and increased hospital costs. Identification of the predictors of CAA will help with prioritisation of resources and a reduction in morbidity, mortality and health care costs. The aim of this study was to identify the predictors of CAA in our setting.*

Methods: *This is a retrospective study conducted at the Niger Delta University Teaching Hospital, Okolobiri, Bayelsa State, Nigeria. It involved all patients with histologically confirmed acute appendicitis from January 2021 to December 2022. Data was extracted from patient folders, theatre and ward records. Descriptive statistics were used to analyse patient demographics. Bivariate analysis was performed to assess associations between independent variables and adverse outcomes using appropriate statistical tests. Variables with $p<0.1$ were entered into multivariate logistic regression analysis to identify independent predictors. A P-value <0.05 was considered to be significant.*

Results: *There were 145 cases of confirmed AA with a female to male ratio of 1.3:1. The incidence of CAA was 19.3%. Male gender, Alvarado score of 7-10 and the duration of symptoms before presentation greater than 24 hours were found to be significant factors in the prediction of CAA with O.R. of 2.66, 6.67 and 11.14 respectively, CI 95%.*

Conclusion: *There is a high incidence of CAA in our study. A high index of suspicion in the male gender, use of the Alvarado score as a clinical tool and taking the duration of symptoms into cognisance will help identify patients with complicated appendicitis. A lower threshold for, and shorter time to surgery may help prevent the complications associated with CAA.*

KEY WORDS: complicated appendicitis, perforation, gangrene, delayed presentation

INTRODUCTION

Acute appendicitis (AA) is the commonest general surgical emergency accounting for up to two-thirds of the emergency surgical workload. Appendicectomy is thus the commonest emergency abdominal surgery performed worldwide.[1] The aim of an appendicectomy is to prevent progression of Uncomplicated Acute Appendicitis (UAA) to Complicated Acute Appendicitis (CAA). Considering the natural history of appendicitis, the catarrhal type of UAA usually resolves while the obstructive variant progresses to CAA which is characterized by perforation, gangrene, abscess formation, appendix mass and generalized peritonitis. These complications significantly increase morbidity and mortality. There is no practical way of distinguishing catarrhal and obstructive types of appendicitis. There are a number of studies that have identified predictors and outcomes of complicated appendicitis.″″ This has applications in risk stratification, perioperative optimization and patient counselling. There is a paucity of research on these predictors from our region. The aim of this study is to determine the factors associated with the development of CAA.

METHODS

This was a retrospective, observational study conducted at the Niger Delta University Teaching Hospital, Bayelsa State, Nigeria. Ethical approval was duly obtained from the Hospital ethics committee (approval number - NDUTH/REC/0053/2022). The study period was from January 2021 to December 2022.

All patients with histologically confirmed AA were included in the study. Excluded were interval and negative appendicectomy patients and paediatric patients. Complicated Acute Appendicitis (CAA) was defined as any case in which there was gangrene, perforation, abscess and generalized peritonitis.

A proforma tool was used to extract data from the patients' folders, theatre and ward records.Data collected included patient demographics, clinical features, duration of symptoms, Alvarado score, post op complications and length of hospital stay. These were analysed using the SPSS software version 22.0. Descriptive statistics were used to analyse patient demographics. Bivariate analysis was performed to assess associations between independent variables and adverse outcomes using appropriate statistical tests. Variables with $p<0.1$ were entered into multivariate logistic regression analysis to identify independent predictors. A -value of <0.05 was considered to be significant.

RESULTS

During the study period, 145 patients were found to have histologically confirmed AA from a total number of 156 appendicectomies. Females constituted 56.6% of the cohort with a male to female ratio of 1:1.3. The highest incidence occurred in the 21 to 30 age group with 39.3% of the cases. Over half of the patients were single (52.4%), and 57.2% had secondary level of education as their highest educational attainment.

Table 1. Sociodemographic characteristics. (N=145)

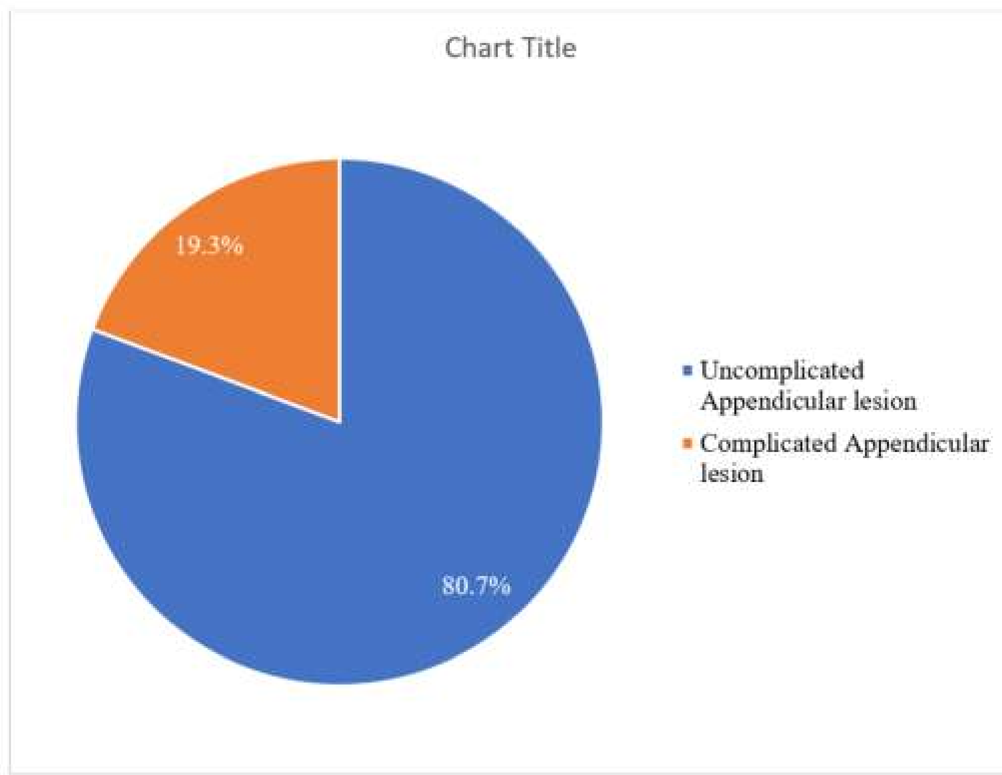
Characteristics	Frequency (N = 145)	Percent (%)
Gender		
Male	63	43.4
Female	82	56.6
Age Group		
20 years	27	18.6
21 – 30 years	57	39.3
31 – 40 years	37	25.5
41 – 50 years	16	11.0
>50 years	8	5.5
Marital Status		
Single/Separated/Divorced	76	52.4
Married	69	47.6
Highest Educational Attainment		
Primary	14	9.7
Secondary	83	57.2
Tertiary	48	33.1

Table 2. Clinical features.

Characteristics	Frequency (N = 145)	Percent (%)
Presenting Complaints (more than one option possible)		
Right lower abdominal pain	144	99.3
Vomiting	72	49.7
Fever	47	32.4
Anorexia	30	20.7
Nausea	30	20.7
Diarrhoea with blood	7	4.8
Duration of Symptoms		
≤ 12 hours	11	7.6
12 – 24 hours	7	4.8
25 – 72 hours	47	32.4
73 – 120 hours	30	20.7
>120 hours	50	34.5
Presence of Other Medical Conditions	27	18.6
Sepsis	3	11.1
Peptic Ulcer Disease	9	33.3
Hypertension	12	44.5
Bronchial asthma	3	11.1
Elicited Signs on Examination (more than one option possible)		
Right-sided lower abdominal tenderness	145	100.0
Rebound tenderness	110	75.9
Psoas sign	27	18.6
Roving's sign	52	35.9
Obturator sign	7	4.8
Pointing sign	54	37.2
Rigidity	2	1.4
Alvarado Score Grading		
1 – 4 (Appendicitis unlikely)	47	32.5
5 – 6 (Appendicitis possible)	54	37.2
7 – 10 (Appendicitis definitive)	44	30.3

Table 2 shows that the three commonest presenting complaints were right lower abdominal pain (99.3%), vomiting (49.7%) and fever (32.4%). Slightly above a tenth of the patients presented within the first 24 hours of onset of symptoms (12.4%), while about a third (34.5%) presented after 5 days of symptoms (Table 2). Table 2 further shows that at presentation, 30.3% had an estimated Alvarado score of between 7 and 10 and approximately, a fifth of the patients reported comorbidity (18.6%).

The incidence of complicated acute appendicitis was 19.3%, (28/145).



Pie Chart showing the incidence of Complicated Acute Appendicitis (CAA) in our study.

Table 3; Logistic regression analysis showing the predictors of complicated acute appendicitis.

Characteristics (Reference Group)	B coefficient	OR	(95%CI)		p-Value
			Min	Max	
Age	0.03	1.03	0.99	1.06	0.137
Gender (Female)					
Male	0.98	2.66	1.12	6.32	0.026*
Marital Status (Married)					
Single	-0.77	0.46	0.19	1.09	0.080
Highest Educational Attainment (Primary)					
Secondary	0.89	2.44	0.29	20.27	0.411
Tertiary	1.49	4.46	0.53	37.77	0.170
Duration of Symptoms (< 12 hrs)					
12 – 23 hours	1.36	3.90	0.22	67.93	0.351
24 – 71 hours	2.41	11.14	1.26	98.82	0.030*
72 – 119 hours	2.73	15.26	1.82	128.33	0.012*
≥ 120 hours	3.08	21.67	2.39	208.89	0.008*
Vomiting (No)					
Yes	1.16	3.19	1.29	7.82	0.011*
Fever (No)					
Yes	0.92	2.52	1.08	5.85	0.032*
Anorexia (No)					
Yes	0.76	2.14	0.85	5.39	0.106
Diarrhoea (No)					
Yes	0.54	1.35	0.59	3.18	0.586
Co-Morbidity (No co-morbidity)					
Co-Morbidity present	-0.76	0.47	0.13	1.72	0.252
Alvarado Scores (1 – 4)					
5 – 6 Appendicitis possible	1.42	4.14	1.03	16.64	0.065
7 – 10 Appendicitis definitive	1.89	6.67	1.68	24.46	0.007*
Presentation – Intervention (< 12hrs)					
12 - 24 hours	0.25	1.28	0.43	3.82	0.661
25 - 48 hours	-0.53	0.59	0.10	3.37	0.552
> 48 hours	0.69	2.00	0.24	16.68	0.227

*Statistically significant at $p < 0.05$

Table 4 presents the results of binary logistic regression that explores the characteristics associated with the occurrence of CAA. Of the sociodemographic features only male gender, (OR – 2.66; p= 0.026) was significantly associated with occurrence of CAA compared to females. Age, marital status and educational attainment had no significant relationship ($p > 0.05$). Duration of symptoms showed significantly increased odds of developing CAA as duration of symptoms before presentation increases. Patients who presented after 5 days of symptoms were 20 times more likely to have ruptured/perforated appendix compared to those presenting within 12 hours of symptoms (OR – 21.67 C.I. 95%; p = 0.008)

DISCUSSION

Uncomplicated Acute Appendicitis if left untreated may progress to CAA characterized by any of the following; perforation, gangrene, abscess formation or generalized peritonitis. This comes at an increased cost and a strain on the already thin resources in low and middle income countries (LMCIs) like ours. The incidence of CAA in our study was 19.3%. The incidence in the literature ranges from as low as 4% up to 48%.[5,6,7,8]

There was a slight female preponderance in our study with a male to female ratio of 1: 1.3. This is similar to findings in some other studies.[′′] Other studies are at variance with our findings, showing a male preponderance instead.[2,′′]

We found the 21-30-year age group to have the highest incidence of AA. This buttresses the fact that AA is a disease of the young. Other studies show similar results.[2,7,8,9,10,11]
Right sided lower abdominal pain is a constant symptom in almost all our patients, 99.3%. This is followed by anorexia, fever, nausea and vomiting in that order. Several other studies support this symptomatology.[5, 7, 9, 10, 12] Li et al in their study found fever to be a significant predictor of CAA.[6] This was the case in our study. Vomiting was also a significant factor in the prediction of CAA in this study.

In our study, the male gender was a significant factor in the development of CAA. While AA is slightly commoner in females as in our study, the role of sex as a predictor of CAA is debatable. In a systematic review involving a large number of patients, males had a significantly higher risk of perforation compared to females. Mekakas et al, and Augustin et al in their separate studies, arrived at similar conclusions.[′] Some other studies have shown no significant difference between the sexes, while the female sex was a significant predictor for CAA in paediatric patients. Males being a significant predictor in this study may be due to the increased pain threshold and poor health seeking behaviour in men leading to a delayed presentation. This in turn leads to CAA as demonstrated in this study.
This study showed that a delay in presentation of more than 24 hours was associated with a significantly increased risk of developing CAA. This risk more than doubles as the duration of symptoms approach 120 hours (5 days). Some other studies demonstrated statistical significance at duration of symptoms before presentation of greater than 24 hours.[2,5,6,7,11,12]

Our study demonstrated that patients who had Alvarado scores from 7 to 10 were seven times more likely to have CAA compared to UAA, (OR-6.67, C.I. of 95%; p=0.007). The Alvarado scoring system was originally designed to aid the diagnosis of AA. Several studies have shown it to be a moderate predictor of CAA.[′] Al Awayshih et al in their study, found this scoring system to have a positive predictive value, sensitivity and specificity of 89%, 54% and 75% respectively. They concluded it was unreliable in the diagnosis of AA.[20] A similar study on paediatric patients showed comparable Alvarado scores between those with CAA and UAA.[17] This scoring system was however a significant predictor of post-operative complications.[17]
The addition of imaging to the scoring system did not add any significant difference in the prediction of CAA.[19] Some other authors demonstrated an increased yield in the predictive accuracy of this scoring system by adding other variables like female sex, serum bilirubin, appendiceal wall thickness and the presence of a fecolith on imaging.[4]

The overall complication rate in our study was 10% with superficial surgical site infection being the commonest complication (7.7%). Complication rates in other studies range from 10% to 45%.[5,7,10,11,12] Zewdu et al in their study showed that CAA is more likely to lead to post-operative complications compared to UAA.[5]

The total length of stay in hospital for patients with CAA was significantly higher than those with UAA in some studies.[2] Other significant factors for the development of CAA are referral patients, white blood cell count and neutrophil count.[5,6] These white cell and neutrophil counts are components of the Alvarado score which were found to be a significant predictors of CAA in our study.

Rui Li et al in their study identified some sonographic features of the appendix as significant predictors of CAA.[6] These include the presence of a faecolith, periappendicular fluid and an increased appendiceal diameter.[4,6] The presence of a faecolith would most likely cause the obstructive type of acute appendicitis as against the catarrhal type. This is likely to cause increased intraluminal pressure with increased diameter, gangrene and perforation.

The strengths of this study is that it is data with relevance to practice in LMICs. The limitations include; it is a retrospective single center study. Also we did not study some inflammatory markers, white cell parameters, C-Reactive Protein and imaging which come at a reasonable cost but are sometimes unavailable in our climes. These may have helped us detect other possible predictors in our patients.

CONCLUSION

There is a high incidence of CAA in our study. Male sex, the Alvarado score and the duration of symptoms are significant predictors of CAA. A high index of suspicion in the male gender, use of the Alvarado score as a clinical tool and taking the duration of symptoms into cognizance will help identify high risk patients for complicated appendicitis. A lower threshold for and shorter time to surgery in these patients may help prevent the complications and costs associated with CAA.

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