Annals of African Medicine Vol. 9, No. 4; 2010:213-7
DOI: 10.4103/1596-3519.70956

Original Article

Appendicitis: Trends in incidence, age, sex, and seasonal variations in South-Western Nigeria

A. S. Oguntola, M. L. Adeoti, T. A. Oyemolade

Department of Surgery, LAUTECH Teaching Hospital, Osogbo, Nigeria

Correspondence to: Dr. A. S. Oguntola, Department of Surgery, College of Health Sciences, LAUTECH, P.M.B 44OO, Osogbo, Nigeria. E-mail: asoguntola@yahoo.com

Abstract

Background: Appendicitis is a common clinical condition worldwide. Differences in incidences, sex, age, and seasonal variations have been reported widely, with paucity of information from Nigeria.
Aim: To assess the trends in incidence and pattern of variation with age, sex, and seasons of the year.
Materials and Methods: A review of the records of all patients with confirmed appendicitis treated in both the LAUTECH Teaching Hospital (LTH) and the Abake Medical Center (AMC), both situated in Osogbo, Nigeria, between January 2003 and December 2008, was done. LTH was a 320-bed University Hospital (with 100 surgical beds), while AMC was a 20-bed surgical center. The age, sex, and month of admission of all the histologically proven cases of appendicitis were retrieved and treated. Analysis was done using simple percentages, Student t or Chi-square tests, where applicable.
Results: A total of 299 out of 321 cases of appendicitis recorded during the observed period were confirmed histologically from both hospitals (69.56% from LTH). Fifty-two percent were males. It made up 0.94, 1.43, and 1.86% of the total hospital admissions in 2004, 2006, and 2008, respectively. There has been an increasing incidence in both sexes almost in a similar pattern. The overall mean age was 25.79 years (M 25.94 and F 25.43 years) with 6% below the age of ten and 1.3% above 60 years. The highest incidence in males and females occurred in the second and third decades, respectively. Incidences were higher during the rainy season (April to September) 68%, $P < 0.05$), with peaks from June to August, when 39.5% of all cases presented.
Conclusion: The increasing incidence of appendicitis in both sexes in this region may be due to the change to a Western lifestyle. The age distribution has a similar pattern in both sexes and 87% are 40 years or less, although the incidence is marginally higher in males. Higher prevalence of infections and allergens from pollens in the rainy season could contribute to a higher incidence of appendicitis.

Keywords: Age distribution, appendicitis, incidence, seasonal variation, sex distribution, trends

Résumé

Arrière-plan: Appendicite est une condition clinique commune dans le monde entier. Différences entre les incidences, sexe, âge et variations saisonnières ont été signalés largement, avec la rareté des informations du Nigeria.
Objectif: Pour évaluer les tendances dans l'incidence et la répétition des variations avec l'âge, le sexe et les saisons de l'année.
Matériel et méthodes: A l'examen des dossiers des patients avec appendicite confirmé traités à la fois l'hôpital d'enseignement LAUTECH (LTH) et le centre médical Abake (AMC), les deux situés dans Osogbo, au Nigéria, entre janvier 2003 et décembre 2008, a été fait. LTH était un centre hospitalier universitaire de 320-lit (avec 100 lits chirurgiens), tandis que l'AMC a été un centre chirurgical de 20 lits. L'âge, le sexe et le mois d'admission de tous les cas histologique éprouvées d'appendicite ont été récupérées et traitées. Analyse a été réalisée à l'aide de simples pourcentages, étudiant t ou essais Chi2, lecaséchéant.
Résultats: Un total de 299 de 321 cas d'appendicite enregistrés pendant la période observée ont été confirmés histologique de deux hôpitaux (69.56% de LTH). Cinquante-deux pour cent étaient les hommes. Il compose 0,94, 1.43 et 1,86% de l'hospitalisation de total en 2004, 2006 et 2008, respectivement. Il y a eu une incidence croissante dans les deux sexes presque dans un modèle similaire. L'âge moyen global a été 25.79 ans (25.94 M et F 25.43 ans) avec

6% inférieur à l'âge de dix ans et 1,3% au-dessus de 60 ans. L'incidence plus élevée dans les mâles et les femelles est survenue dans les décennies de deuxième et troisième, respectivement. Incidences étaient plus élevés pendant la saison des pluies (d'avril à septembre) 68%, $P < 0,05$), avec des pics de juin à août, lorsque 39,5% des cas présentés. **Conclusion:** L'incidence croissante de l'appendicite dans les deux sexes dans cette région peut être due à la modification apportée à un mode de vie occidental. La répartition par âge a une tendance semblable dans les deux sexes et 87% sont 40 ans ou moins, bien que l'incidence est légèrement plus élevé chez les hommes. Prévalence plus élevé d'infection et d'allergènes de pollens dans la saison des pluies pourrait contribuer à une fréquence plus élevée de l'appendicite.

Mots-clés: Répartition par âge appendicite, incidence, variations saisonnières, distribution de sexe

Introduction

Appendicitis is the most common surgical cause of abdominal pain worldwide.[1,2] Differences in incidences, sex, age, and seasonal variations have been reported widely, with paucity of information from Nigeria. The incidence is higher among the Caucasians and also in people living in the developed world, although this appears to be declining.[3-6]

Report of increasing incidence in African countries has been reported by some authors in the last few decades.[7-10] Changing to a Western lifestyle, including diets, have been held responsible for this.[11] It is generally reported to be more common in males[6,12-15] and usually occurs in the age range of 10 to 30 years,[6,10,12-15] although Mangete from Port-Harcourt in Nigeria, found a significantly higher incidence in females.[10] Higher incidences have been reported in the summer months by many authors.[3,14,16-17] Ashley has reported an excess during spring, implicating a high prevalence of viral infections among others during these months,[18] but Sanda *et al*,[19] have suggested intense challenge to the mucosa-associated lymphoid tissue from allergens in the dust, during the sandstorms of the Spring months, in the Arabian Peninsula. The aim of this retrospective study is to assess the trends in incidence and patterns of variation with age, sex, and seasons of the year, thus contributing to the world of literature on appendicitis, from this part of Nigeria.

Materials and Methods

A review of the records of all patients with confirmed appendicitis treated in both the LAUTECH Teaching Hospital (LTH) and the Abake Medical Center (AMC), both in situated in Osogbo, Nigeria, during the period January 2003 to December 2008, was done. Osogbo, a semi-urban town with a population of 465000 (an annual population growth rate of 2.8 by 1995, Estimate), with few other sub-urban towns nearby, within south-Western Nigeria, is served mainly by LTH and few secondary and private hospitals. The LTH University Hospital has 100 surgical beds, while the AMC is a 20-bed surgical center.

The age, sex, and month of admission for all the histologically proven cases of appendicitis were retrieved and treated. The total number of hospital admissions for each year was obtained from the Medical Records Department of the hospitals, and this was used to calculate the percentage of admissions made, of confirmed appendicitis cases. Tables and figures were drawn and an analysis was done, using simple percentages, student's t test, and the Chi square test, as found appropriate. The result here could not be absolute, as some cases were admitted to other hospitals within the vicinity especially during periods of industrial crisis; it nevertheless represented the pattern of the disease in this region.

Results

A combination of data from the two sources showed that a total of 299 out of 311 cases of appendicitis recorded during the observed period (January 2003 – December 2008) were confirmed histologically. There were 208 cases (69.56%) comprising of 109 males and 99 females from LTH, while (47 males and 44 females) were seen at AMC. Males constituted 52.17% (M: F 1.1:1). A continuous increase in incidence was noticed over the years; the incidence in 2008 almost doubled that of 2003 [Figure 1], while the values of appendicitis as a percentage of the total hospital admissions were 0.94, 1.43, and

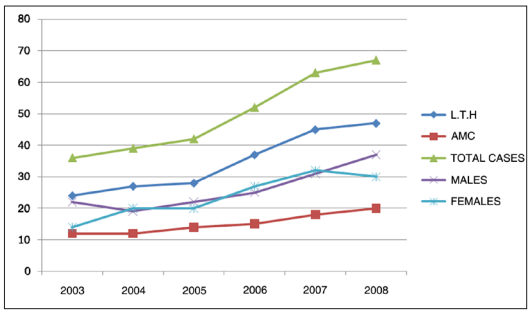

Figure 1: Line graphs showing incidence, sex, and distribution of 299 cases of appendicitis seen at LTH and AMC, OSOGBO, between January 2003 and December 2008, by year

1.86 for the years 2004, 2006, and 2008, respectively. It also constituted 5.85 and 10.87% of all surgical admissions in 2003 and 2008, respectively. [Table 1 and Figures 2a and b]

There is an increasing incidence in both sexes almost in a similar pattern [Figure 1]. The overall mean age was 25.79 years (M 25.94 and F 25.43 years). Only 6% of the cases were recorded for the first decade of life, while 65.9% occurred in the age group 11 – 30 years [Figure 3]. The highest incidence in males and females occurred in the second and third decades, respectively.

Incidences were higher in the period between April and September (68% of all, $P < 0.05$), with peaks in June, July, and August. This started declining from the month of October, with the lowest in December, followed by gradual minimal increment from the month of January. [Table 2, Figure 4]

Discussion

The incidence of appendicitis varies substantially by country, geographical region, race, sex, age, and seasons.[3,6,13,17] The finding of an increasing incidence in this study is in-keeping with the previous reports from Nigeria[8,10] and other authors,[7,9] generally from the developing world. This is in contrast to the common findings of reducing incidence in a larger part of the developed world.[3,4,6] Several reasons could be adduced to this, ranging from the very youthful African population and changing to the a Western lifestyle.[5,11]

The predisposing factors to appendicitis are thought to be multifactorial, ranging from dietary, age, genetic predisposition, viral and bacterial infections, and parallel changes in humidity.[12] Vascular disorders, stressful life,[5] smoking,[20] and inadequate childhood breast feeding,[21] are also being suggested by some authors.

The increasing number of 'fast food' restaurants where mainly high-carbohydrate, low-fiber diets, confectionaries, and sweets are served could have contributed to the increase in the incidence, as an increasing number of young men and women, at times the whole family patronize these facilities, thus consuming less of the traditional high-fiber, less sugary diet. Large consumption of sweets and sugary diets has been implicated by some authors.[22,23]

Most authors reported a higher incidence in males.[3,12,13,18] The finding of M:F 1.1: 1, suggests that the incidence is marginally higher in males, which is in-keeping with the finding of Ayoade *et al*, from Sagamu,[15] also in South-Western Nigeria. The young females here tend to have a preference for a highly-refined diet, including confectionaries, which prolong the colon transit time, with the aim of reducing bowel motion frequency and maintaining

Table 1: Distribution by year, 299 cases of appendicitis, total hospital and surgical admissions at L.T.H and A.M.C Osogbo between January 2003 and December 2008

Year	Total no. appendicitis cases	Total no. of hospital admissions	Percentage of total hospital admissions	Total surgical admission	Percentage of total surgical admissions
2003	36	3096	1.17	615	5.85
2004	39	4118	0.94	670	5.82
2005	42	3833	1.1	656	6.40
2006	52	3629	1.43	489	10.63
2007	63	4584	1.37	632	10.87
2008	67	3595	1.86	616	9.96
TOTAL	299	22855	1.31	3648	8.19

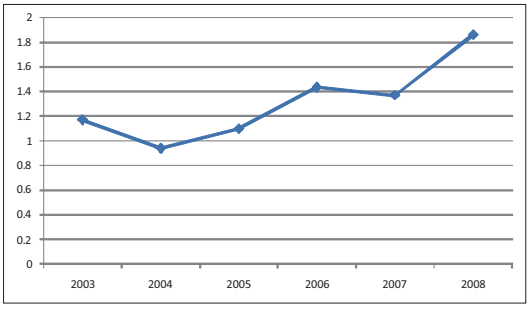

Figure 2a: Cases of appendicitis as a percentage of yearly total hospital admissions between 2003 and 2008

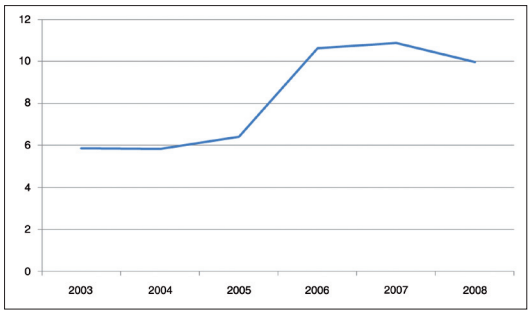

Figure 2b: Cases of appendicitis as a percentage of yearly total surgical admissions between 2003 and 2008

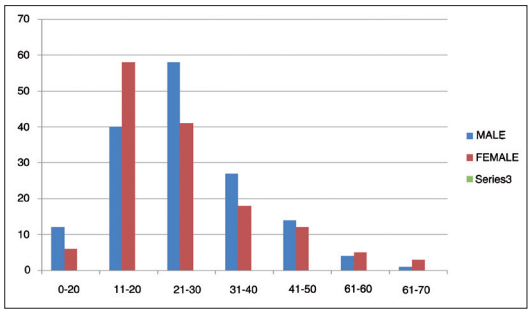

Figure 3: Bar chart showing sex and age distribution of 299 cases of appendicitis seen at LTH and AMC, OSOGBO, between January 2003 and December 2008

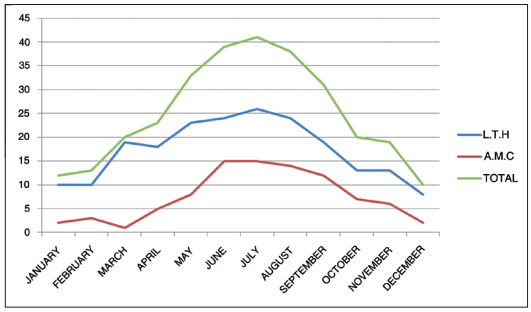

Figure 4: Line graph showing distribution by months: 299 cases of appendicitis at LTH and AMC, OSOGBO, between January 2003 and December 2008

a slim stature. This has been found to increase the possibility of developing appendicitis, diverticular diseases, and even colonic malignancies in South Africa.[23,24]

The high prevalence of intestinal parasites in the developing world could also account for some cases of appendicitis, as it has been noticed to be initiated by or associated with them. The commonly associated parasites are schistosoma mansoni, haematobium, Enterbious vermicularis, ascaris, Entamoeba histolytica, and pin worm, among others. Badmus *et al*,[25] and Adebamowo *et al*,[26] have reported some cases of schistosomal appendicitis from South western Nigeria.

Appendicitis is generally a disease of young age. The usual finding of the highest incidence was seen in the second and third decades of life. The mean average age of 25.7 years is in-keeping with that cited by Al Omran *et al*,[3] and others. The age distribution has a similar pattern in both sexes; this supports the non-influence of sex or the X chromosome as a predisposing factor to appendicitis.[18] With the relative rarity in the first decade and progressive decline after the third decade it may be inferred that the peak incidence seems to coincide with the age endowed with the most active lymphoreticular activity in the mucosa-associated lymphoid tissues, which make up most of the appendix.

Table 2: Quaterly distribution of presentation

Total	AMC	LTH	Months
45	6	39	March-Jan
95	29	66	June-April
110	41	69	Sept-July
49	15	34	Dec- Oct
299	91	208	

299 cases of appendicitis at L.T.H and A.M.C OSOGBO between January 2003 and December 2008

Cases of appendicitis present throughout the year, but some particular months are associated with higher incidences, although this varies from region to region. Higher incidences are noted to be associated with summer months by many authors.[3,14,27] The months of May to October present a high incidence (with peaks in June to August) in this study, this is in-keeping with the findings from California[13] and Italy.[16] The presence of seasonal variation shows the possibility of heterogenous extrinsic factors such as, humidity, allergens, sun radiation, and viral and bacterial infections in the etiogenesis of appendicitis. The steady increase in the number of cases from the month of April, corresponds with the onset of the rainy season, the intensity of which increases toward the months of July, August, and September. Higher humidity, which occurs during this period has been implicated by some authors.[12,28] Khaevel *et al*, also postulated the importance of the actual reduction of sun radiation and vast fluctuations in air temperature, in the incidence of appendicitis.[28] Increase in the incidence of bacterial and viral infections (causing lymphoid hyperplasia leading to appendix lumen obstruction)[29] and parasitic infestations during this period could also contribute to the higher incidence of appendicitis, in a region where the climate is characterized by high humidity and heavy rainfall, in an environment with poor sanitation. Allergic reaction to pollen from flowers and palm produce,[30] for example, maize, during the rainy period may also account for some of the cases, which appear as lymphoid hyperplasia; a form of immunological response.

Conclusion

There is an increasing incidence of appendicitis in south western Nigeria, which affects both sexes equally, though the incidence is marginally higher in males. The age distribution has a similar pattern in both sexes, rare in the first decade, but peaks in the second and third decades; the period of a highly responsive lymphoreticular system. Appendicitis is more common during the rainy season, a period known for humidity, high incidence of bacterial and viral infections, and high prevalence of intestinal parasites.

References

1. Ajao OG. Appendicitis in a tropical African population. J Natl Med Assoc 1979;71:997-9.
2. Mungadi IA, Jabo JA, Agwu NP. A review of appendicitis in Sokoto, Northwestern Nigeria. Niger J Med 2004;13:240-3.
3. Al Omran M, Mandani M, McLeod RS. Epidemiologic features of acute appendicitis in Ontario, Canada. Can J Surg 2003;46:263-8.
4. Blomqvist P, Ljung H, Nyren O, Ekbom A. Appendicectomy in Sweden 1989- 1993 assessed by the inpatient Registry. J Clin Epidemiol 1998;51:859-65.
5. Walker AR, Segal I. Appendicitis: an African perspective. J R Soc Med 1995;88:616-9.
6. Addis DG, Shaffer N, Fowler BS, Tauxe RV. The epidemiology of acute appendicitis and appendicectomy in the United States. Am J Epidemiol 1990;132:910-25.
7. Osman AA. Epidemiological study of appendicitis in Khartoum. Int Surg 1974;59;218-23.
8. Offili OP. Implications of the rising incidence of appendicitis in Africans. Cent Afr Med 1987;33:243-5.
9. Appendicitis. East Afr Med J 1990;67:597-8.
10. Mangete ED, Kombo BB. Acute appendicitis in PortHacourt, Nigeria. Orient J Med 2004;16:1-3.
11. Burkitt DP, Walker AR, Painter NS. Effect of dietary fibre on stools and transit-times, and its role in the causation of disease. Lancet 1972;30:1408-12.
12. Freud E, Pilpel D, Mares AJ. Acute appendicitis in childhood in the Negev region: Some epidemiological observations over an 11-year period (1973-1983). J Pediatr Gastroenterol Nutr 1988;7:680-4.
13. Luckmann R, Davis P. The epidemiology of acute appendicitis in California: Racial, gender, and seasonal variation. Epidemiology 1991;2:323-30.
14. Noudeh YJ, Sadigh N, Ahmadnia AY. Epidemiologic features, seasonal variations and false positive rate of acute appendicitis in Shahr-e-Rey, Tehran. Int J Surg 2007:5:95-8.
15. Ayoade BA, Olawoye OA, Salami BA, Banjo AA. Acute appendicitis in olabisi onabanjo university teaching hospital Sagamu, a 3-yer review. Niger J Clin Pract 2006;9:52-64.
16. Gallerani M, Boari B, Anania G, Cavallesco G, Manfredini R. Seasonal variation in onset of acute appendicitis. Clin Ter 2006;157:123-7.
17. Wolkomir A, Kornak P, Elsakr M, McGovern P. Seasonal variation of acute appendicitis: A 56-year study. South Med J 1987;80:958-60.
18. Ashley DJ. Observations on the epidemiology of appendicitis. Gut 1967;8:533-8.
19. Sanda RB, Zalloum M, El-Hossary M, Al-Rashid F, Ahmed O, Awad A, *et al*. Seasonal variation of appendicitis in northern Saudi Arabia. Ann Saudi Med 2008;28:140-1.
20. Oldmeadow C, Wood I, Mengerson K, Visscher PM, Martin NG, Duffy DL. Investigation of the relationship between smoking and appendicitis in Australian twins. Ann Epidemiol 2008;18:631-6.
21. Alves JG, Figueiroa JN, Barros I. Does breast feeding provide protection against acute appendicitis? A case control study. Trop Doct 2008;38:235-6.
22. Martin DL, Gustafson TL. A cluster of true appendicitis cases. Am J Surg 1985;150:554-7.
23. Burkitt DP. The aetiology of appendicitis. Br J Surg 1971;58:695.
24. Walker AR, Walker BF, Le lake A, Manetsi B, Tlotetsi GT, Verardi MM, *et al*. Dietary fibre intake and chronic bowel diseases: Transit time in black and white adolescents in South Africa. S Afr J Food Sci Nutr 1994;6:55-8.
25. Badmos KB, Komolafe AO, Rotimi O. Schistosomiasis presenting as acute appendicitis. East Afr Med J 2006;83:528-32.
26. Adebamowo CA, Akang EE, Ladipo JK, Ajao OG. Schistosomiasis of the appendix. Br J Surg 1991;78:1219-21.
27. Katzan M. Some observations in acute abdomen in children. S Afr Med J 1966;40:566-9.
28. Khaeval AA, Birkenfeldt RR. Nature of the relation of acute appendicitis morbidity to meterological and heliogeophysical factors. Vestn Khir Im I I Grek 1978;120:67-70.
29. Barker DJ, Morris J. Acute appendicitis, bathroom and diet in Britain and Iceland. BMJ 1988;296:953-5.
30. Kwaasi AA, Tipirnemi P, Harfi H, Parhar RS, Alsedairy ST. Date palm (Phoenixdactylifera L) is a potent allergen. Ann Allergy 1992;68:78.

Source of Support: Nil, **Conflict of Interest:** None declared.