

## Pediatric gastrointestinal diseases in Nigeria: A histopathological analysis of 74 cases.

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### Abstract

**Background:** Children are vulnerable to a vast number of diseases including gastrointestinal disorders, which may be associated with life threatening complications that sometimes result in mortality especially if left untreated.

**Objective:** To establish the age and sex distribution of children in the study population as well as the histopathological characteristics of gastrointestinal diseases that occurred in those children who were aged 14 years and below in Sagamu, Southwestern Nigeria.

**Materials and Methods:** Demographic data such as age, sex, and clinical summary of children in the study population were extracted from the medical records of Olabisi Onabanjo University Teaching Hospital, Sagamu, Ogun State from January 2003 to December 2009. Based on this information, a review of paraffin embedded blocks and slides as well as histopathological reports of gastrointestinal diseases that occurred in those children aged 14 years and below was undertaken at the Morbid Anatomy Department of the hospital.

**Results:** Seventy-four cases of gastrointestinal diseases were seen in children aged 14 years and below. The majority (39.2%) of gastrointestinal diseases were accounted for by appendiceal lesions. Hirschsprung's disease, intussusceptions, enterocolitis and jejunal atresia accounted for 29.7%, 10.8%, 6.8% and 4.1% of cases respectively. Adenocarcinoma of the intestine was the predominant gastrointestinal tumor, occurring in 5 out of 7 children. Two cases of non-Hodgkin's lymphoma were also seen. The ages of the children ranged from 2 to 14 years, with a mean age of 8.6 years and a peak age incidence of gastrointestinal disease in the 10-14 year age group. Male children were more commonly affected with the exception of appendiceal lesions, which occurred more in females (M:F ratio= 1.6:1.0). Acute suppurative appendicitis was the most prevalent lesion of the appendix, occurring in 13 out of 29 appendiceal lesions. Moderately differentiated to poorly differentiated histological types were seen in the tumors, which were three adenocarcinomas and two mucinous carcinomas. Burkitt's and Mucosal-associated types of non-Hodgkin's lymphomas were the two histological types of lymphoma seen primarily in the stomach and small intestine respectively.

**Conclusion:** Appendiceal lesion was the predominant pediatric gastrointestinal disease found in the study population with preponderance for female children. Adenocarcinoma was the most common gastrointestinal tumor found, while, Hirschsprung's disease, intussusception, enterocolitis, jejunal atresia and non-Hodgkin's lymphoma contributed to only a minority of the gastrointestinal diseases found in the study population.

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### INTRODUCTION

Children are vulnerable to a vast number of diseases, including congenital anomalies, diarrheal diseases, acute respiratory infections, acute malaria, hepatitis B infection, poliomyelitis, measles, and neonatal tetanus [1]. Gastrointestinal diseases do occur in children, sometimes resulting in life threatening morbidities that may lead to mortality [1].

There is limited information on the epidemiology of

pediatric gastrointestinal diseases in developing countries like Nigeria due to the paucity of vital health statistics [2, 3].

The age and sex distribution of gastrointestinal diseases in children are influenced by many factors including geographical location, types of lesion and etiological factors [4-25]. There are a number of gastrointestinal diseases, some of which include: Appendiceal lesions, Hirschsprung's disease, intussusception, enterocolitis,

adenocarcinoma, jejunal atresia, and lymphoma [4, 5, 10, 11, 13, 14, 16, 26].

The interaction between genetic and environmental factors is known to play a crucial role in the etiopathogenesis of gastrointestinal diseases in children [9, 31, 32]. Malignant gastrointestinal tumors were initially thought to be uncommon in children; notwithstanding, recent findings have shown a gradual increase in the incidence of colorectal carcinoma in children [10, 12, 13]. The development of colorectal carcinoma in children is thought to be usually associated with an underlying predisposing disease or familial syndrome such as Turner's syndrome, Turcot syndrome, Gardner syndrome, adenomatous familial polyposis and hereditary non-polyposis colorectal syndrome. This proposition is further buttressed by the germline mutation theory, which explains what occurs in those children and how carcinogenesis may be triggered off in them. Besides genetic factors, diet also plays some roles in the etiopathogenesis of colorectal carcinoma. Low fiber diet, refined high-fat diet and high protein diet common with most fast-food outfits have all been incriminated [12, 13].

Malignant lymphoma in children, especially, the non-Hodgkin type has also been found to be commoner in the gastrointestinal tract for a reason that is not clear at the moment [27].

The objective of this study was to establish the age and sex distribution of children in the study population as well as the histopathological characteristics of gastrointestinal diseases that occurred in children aged 14 years and below in the Nigerian centre studied.

## MATERIALS AND METHODS

This was a retrospective study, which was undertaken to review histopathological reports of all gastrointestinal specimens submitted to the department of Morbid Anatomy and Histopathology of Olabisi Onabanjo University Teaching Hospital, Sagamu, South Western Nigeria over a seven-year period, from January 2003 to December 2009. Olabisi Onabanjo University Teaching Hospital, Sagamu is a referral hospital with specialist care for a population size of 253,421 people resident in Sagamu and its environ. The study population comprised of children aged 14 years and below. Information obtained from the patient's folders included: age and sex of the children, as well as the histological characteristics of their pathological specimens. Routine haematoxylin and eosin (H&E) staining was done and where necessary, histochemical studies were carried out. The data were analyzed using Microsoft Excel software and the Statistical Package for the Social Sciences (SPSS) software version 17. The data were analyzed as numerical, percentages and

simple proportion. Some data were presented in tabular and photomicrographic forms for ease of perusal.

## RESULTS

### Frequency of Gastrointestinal lesions

A total number of 74 cases of gastrointestinal lesions in patients aged 14 years and below were diagnosed giving a yearly biopsy occurrence of 10.6 in that age group. This accounted for 21.2% of the total (349) cases of gastrointestinal lesions seen during a seven-year period. Gastrointestinal biopsies constituted 12.3% of the total (2850) biopsies, of which only 2.6% were seen in patients aged 14 years and below.

The majority (93.2%) of the gastrointestinal diseases were surgical, as against medical cases, which accounted for only 6.8%. Appendiceal lesion was the predominant (39.2%) gastrointestinal disease. Hirschsprung's disease and intussusceptions accounted for 29.7% and 10.8% of cases respectively. Other gastrointestinal diseases encountered were enterocolitis, adenocarcinoma, jejunal atresia, and lymphoma (Table 1).

Adenocarcinoma was the most common gastrointestinal tumor accounting for 5 out of 7 cases. Another malignant tumor found in this series was lymphoma, which occurred in two patients and both were non-Hodgkin's lymphomas.

### Age and Sex Distribution

The ages of the children ranged from 2 days old to 14 years of age with a mean of  $8.6 \pm 0.9$  years and a peak incidence in the 10-14 years age group. A male to female ratio of 1.6:1.0 was also noted (Table 2). Female preponderance was observed in appendiceal lesions among children belonging to the 10 – 14 years age-group being the most susceptible (M: F = 1.4:1.0). The mean age of children with appendiceal lesion was  $10.4 \pm 1.60$  years. Male children were more commonly affected by Hirschsprung's disease (M:F=3.8:1.0, Mean age =  $7.03 \pm 0.71$  months).

A slight male preponderance was seen in intussusception (M:F=1.3:1.0 and Mean age =  $15.43 \pm 1.22$  months) and enterocolitis (M:F=1.5:1.0 and Mean age =  $11.86 \pm 1.32$  months). The mean ages for malignant tumors were  $12.3 \pm 1.02$  years for lymphoma and  $13.6 \pm 0.76$  years for adenocarcinoma respectively. All cases of adenocarcinoma and lymphoma were predominantly seen in males.

### Distribution of Anatomic sites

The rectum was the most common site for Hirschsprung's disease and this occurred in 17 out of 22 cases, while the remaining 5 cases were localized in

the sigmoid colon. All cases of intestinal atresia were found in the jejunum.

The ileo-caecum was the commonest site for occurrence of intussusceptions as 6 out of the 8 cases were localized there and the ileum and transverse colon were the other sites where intussusception occurred (Figure 1).



**Figure 1.** The gross appearance of intussusception with distal portion (transverse colon) telescoping into the distended proximal portion (terminal ileum and caecum).

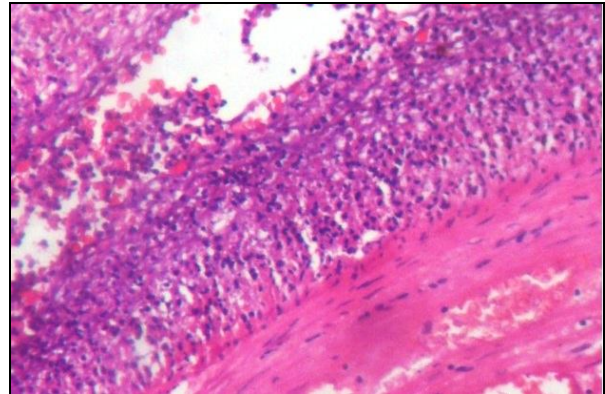
The right colon was the commonest site for enterocolitis, 3 out of 5 cases, while the left colon was commonly affected by adenocarcinoma (Figure 2), 2 out of 3 cases. Two cases of non-Hodgkin's lymphoma were found in the stomach extending to the duodenum and small intestine respectively.



**Figure 2.** The gross appearance of the colorectal carcinoma showing a fungating exophytic tumour mass of 4.0 x 3.5cm with a crater within the caecum.

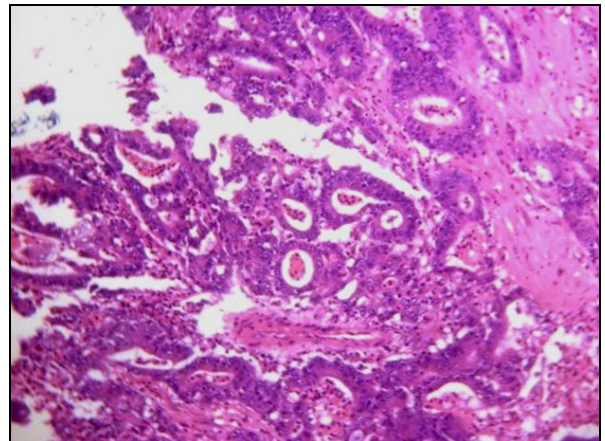
### Histological Types

Acute suppurative appendicitis was the most prevalent lesion of the appendix, accounting for 13 out of 29 appendiceal lesions. Early acute appendicitis and reactive lymphoid hyperplasia contributed 6 and 4 out of 29 appendiceal lesions respectively. Other histological lesions were acute necrotizing appendicitis (Figure 3), tuberculous appendicitis, extra appendiceal peritonitis, and submucosal fibrosis (Table 3).



**Figure 3.** The histological appearance of the acute appendicitis showing intense polymorphonuclear neutrophilic intramural infiltration (H&E, x200).

The histological types of colorectal carcinoma were moderately differentiated to poorly differentiated adenocarcinoma, which occurred in 3 cases, while mucinous carcinoma was the other subtype seen in 2 other cases (Figures 2 and 4).



**Figure 4.** The histological appearance of the colorectal carcinoma showing well to moderately differentiated malignant glands infiltrating the wall of the colon (H&E, x200).

Two cases of non-Hodgkin's lymphoma were Burkitt's type, primarily located in the stomach and Mucosal-associated type, primarily located in the small intestine.

### Clinical Characteristics

Abdominal pain was the most common symptom of appendiceal lesions especially with appendicitis (89.7%), with its anatomic location extending from the umbilicus (51.7%) through the right iliac fossa (41.4%) to become generalized (34.5%). Vomiting, fever and anorexia were observed in 82.8%, 86.2% and 55.2% of patients respectively. The mean duration of symptoms was 4.1 days. Right iliac fossa tenderness was present in 14 patients (48.3%). Peritonitis was associated with enterocolitis in 3 out of 5 cases. Peritonitis and perforation were seen accompanying acute appendicitis in 12 and 7 out of 29 cases respectively.

Most children with Hirschsprung's disease presented with features of intestinal obstruction and necrotizing enterocolitis in 86.4% and 13.6% of cases respectively. In addition, intussusception and jejunal atresia presented with features of intestinal obstruction ranging from protracted vomiting, constipation, abdominal distension and abdominal pain of varying degrees. Features of intestinal obstruction were the most common presenting symptom in children with colorectal carcinoma (3 out of 5 cases) and both patients with non-Hodgkin's lymphoma. Rectal bleeding and alteration in bowel habit were the other symptoms seen in colorectal carcinoma. In most (4 out of 5) of the children with colorectal carcinoma, symptoms were presented late in the course of the disease.

### DISCUSSION

Children can be affected by a vast number of diseases including congenital anomalies, diarrheal diseases, acute respiratory infections, acute malaria, hepatitis B infection, poliomyelitis, measles, and neonatal tetanus<sup>1</sup>. Some of these diseases may be associated with life threatening complications, some of which result in mortality [1]. This study revealed that 21.2% of gastrointestinal diseases were seen in children aged 14 years and below with a mean age of 8.6 years and a male to female ratio of 1.5:1.0. There is paucity of information on the epidemiology of pediatric gastrointestinal diseases in most developing countries like Nigeria. Nonetheless, a few studies in Southern Nigeria recorded relatively low incidences of gastrointestinal diseases that ranged from 14.0% to 19.0% of all pediatric admissions [2, 3].

In this study, appendiceal lesion was the predominant (39.2%) gastrointestinal disease, followed closely by Hirschsprung's disease (29.7%). Other gastrointestinal diseases encountered were intussusception, enterocolitis, adenocarcinoma, jejunal atresia, and lymphoma. Adejuyigbe et al in Ile-Ife, South-western Nigeria reported 5 cases of gastrointestinal duplication,

which was less than 7 cases reported in Ilorin, North-central Nigeria [4, 26]. In contrast to our study, intussusception complicated by intestinal obstruction was the most common gastrointestinal disease in children below 14 years in Ibadan, South-western Nigeria (29.23%) [5]. Other studies in Nigeria and outside Nigeria have recorded varying proportions of gastrointestinal diseases with appendiceal lesion being the most common in Benin, Nigeria; Hirschsprung's disease: in Israel, Italy and Germany; intussusceptions: in Uzbekistan; and colorectal carcinoma: in Turkey [6, 10, 11, 13, 14, 16]. These observations have shown that different types of gastrointestinal diseases are prevalent in different geographical regions of the world. This variation may be related to environmental factors such as the association between Rota virus infection and intussusceptions; the association between ingestion of low-fiber diet, fat-rich-diet and colorectal carcinoma; and the association between lymphoid hyperplasia and acute appendicitis.

The mean age of the children in this study was 8.6 years with a male to female ratio of 1.5:1.0. Males were predominantly affected in pediatric gastrointestinal diseases with the exception of appendiceal lesions, where a female preponderance was noted. Infants were most vulnerable to Hirschsprung's disease, whereas neonates and children below 2 years were commonly susceptible to intestinal atresia and intussusception respectively. Mean ages of 10.43 years, 12.0 years, 12.3 years and 13.6 years were reported for appendiceal lesions, enterocolitis, lymphoma and adenocarcinoma respectively. Studies in Ibadan, Nigeria and Uzbekistan, Asia fared favourably with our study where boys below 1 year of age were found to be vulnerable to intussusception [5, 11]. This association was further supported by findings of predominantly male neonates having Hirschsprung's disease in Negev, Israel, Genoa, Italy, Kuwait, and Nottingham, UK [6, 14, 23, 24]. Colorectal carcinoma was reported frequently in male children in Costa Rica and Turkey which compares favorably with results of our study [12, 13]. The finding of appendiceal lesions especially acute appendicitis in male children from Benin, Nigeria contrasted with the result of our study where more cases of appendiceal lesions were seen in female children [10]. Acute appendicitis was the most prevalent (72.4%) lesion of the appendix, with acute suppurative appendicitis being more common, 13 out of 29 cases. Reactive lymphoid hyperplasia was the second leading (13.8%) appendiceal lesion. Tuberculous appendicitis, extra-appendiceal peritonitis, and submucosal fibrosis were the other types seen. Osarumwense and Ogiemwonyi in Benin, Nigeria and Grüssner et al in Germany however reported a lower proportion of complicated appendicitis, 57.2% and 58.3% respectively, including appendix abscess,

appendix mass, perforated appendix, gangrenous appendix and peritonitis, when compared to 65.5% recorded in this study [10, 28].

Although the reason for this variation has not been adduced by this study, illiteracy, poverty and ignorance prevalent in Nigeria, a developing country may be responsible for why parents and guardian of children may seek medical intervention late in the course of the illness. Other parents may resort to native doctors and herbalists where service charge may be lower than in orthodox health facilities.

All cases of Hirschsprung's disease were located in the rectosigmoid region with three-quarters localized in the rectum. Out of which 86.4% and 13.6% of cases presented with features of intestinal obstruction and necrotizing enterocolitis respectively. These findings were similar to the outcome of studies in Harefuah, Israel, Safat, Kuwait and Nottingham, UK [6, 23, 24].

In this study, the ileocaecal region was the commonest site for intussusceptions, which is similar to reports of a study in Dublin, Ireland [31]. Many studies have also reaffirmed the role of Rota virus and pre-intussusception inflammatory reactions in association with overproduction of nitric oxide (NO) in facilitation of the development of ileocaecal intussusceptions in children [21, 31]. Unlike in adults where malignancy may be a predisposing factor to the development of intussusception, gastroenteritis, especially, that caused by Rota virus through the release of nitric oxide should be considered in the etiopathogenesis of childhood intussusception [21].

All cases of intestinal atresia were found in the jejunum. The right colon was the predominant site for enterocolitis, occurring in 3 out of 5 cases. Colorectal carcinoma was the predominant gastrointestinal tumor, 5 out 7 children, while two children had non-Hodgkin's lymphoma. In contrast, a study in Indianapolis, USA recorded non-Hodgkin's lymphoma as the predominant gastrointestinal malignancy in children, while colorectal carcinoma and gastric leiomyosarcoma were occasionally seen [22]. In variance to our result, two studies in Costa Rica and Turkey reported mucinous carcinoma as the most common pediatric gastrointestinal malignancy in their series [12, 13].

Features of intestinal obstruction were the predominant symptoms in colorectal carcinomas and non-Hodgkin lymphomas as well as rectal bleeding and change in bowel habit, similar to findings from Costa Rica and Turkey [12, 13]. The occurrence of a predominantly right loin pain in children suffering from colorectal carcinoma in UK however contrasted with our result [329].

This study revealed that Burkitt's type non-Hodgkin's

lymphoma was located in the stomach extending to duodenum while Mucosal-associated type of non-Hodgkin's lymphoma was situated in the small intestine. This was similar to what was obtained in Iraq, where Burkitt's lymphoma and non-Burkitt's lymphoma were the two leading gastrointestinal lymphomas in children, 13 cases each, closely followed by Mediterranean lymphoma all located in the small intestine as reported in our study [33].

Most (4 out of 5) of the children with colorectal carcinoma in this study population presented late in the course of the disease, which is similar to findings from other studies [12,13,32]. Although colorectal carcinoma is rare in children, it is usually very aggressive when it occurs, because it is poorly differentiated. Most studies reported a preponderance of mucinous carcinoma in children and adolescents in contrast to results from our study [12, 13]. This discrepancy may be due to underreporting of colorectal carcinoma in our environment, because some patients may present to the native doctors or herbalists, where less user fees are charged.

Appendiceal lesion was the predominant pediatric gastrointestinal disease with preponderance for female children. Adenocarcinoma was the most common gastrointestinal tumor. Hirschsprung's disease, intussusception, enterocolitis, jejunal atresia and non-Hodgkin's lymphoma accounted for a minority of cases.

## REFERENCES

1. WHO Information Fact Sheet N 109: Childhood Diseases in Africa. WHO, 1996.
2. Osifo OD, Aduwa IP. Pattern and Outcome of Pediatric Surgical Admissions to a Nigerian Tertiary Hospital. *Annals of Pediatric Surgery* 2010; 6(3):161-166.
3. Chapp-Jumbo, AU, Onyire NB, Adisa AC. Paediatric Surgical Admissions in the Abia State University Teaching Hospital- A 5 Year Study. *European Journal of Scientific Research* 2009; 29(4):540-542.
4. Adejuyigbe O, Olayinka OS, Sowande OA, Abubakar AM. Gastrointestinal duplications in Ile-Ife, Nigeria. *East Afr Med J* 2002; 79(3):134-6.
5. Ogundoyin OO, Afolabi AO, Ogunlana DI, Lawal TA, Yifeyeh AC. Pattern and outcome of childhood intestinal obstruction at a Tertiary Hospital in Nigeria. *African Health Sciences* 2009; 9(3):170-173.
6. Halevy H, Mares A, Cohen Z, Finaly R, Freud E, Pilpel D. Hirschsprung's disease in the Negev. *Harefuah* 1994; 127(5-6):148-54.
7. Bingué Espuny X, Ibars Valverde Z, Martínez Alonso M, Morales Bara I, Solé Mir E. [Intestinal invagination: change in its incidents from 1987 to 2008]. *Cir Pediatr* 2010; 23(4):206-210.

8. Tzankov A, Adams H, Sterlacci W. Rupture of the spleen. [Clinicopathological correlations and diagnostic procedures]. *Pathologie*. 2008; 29(2):148-57.
9. Moore SW, Zaahl MG. A review of genetic mutation in familial Hirschsprung's disease in South Africa: towards genetic counseling. *Journal of Pediatric Surgery* 2008; 43(2): 325-329. Osifo OD, Ogiemwonyi SO. Appendicitis in children: An increasing health scourge in a developing country. *Par J Med Sci* 2009; 25(3):490-495.
11. Latipov R, Khudoyorov R, Flem E. Childhood intussusception in Uzbekistan: Analysis of retrospective surveillance data. *BMC Pediatr* 2011; 11:22.
12. Salas-Valverde S, Lizano A, Gamboa Y, Vega S, Barrantes M, Santamaría S, Zamora JB. Colon carcinoma in children and adolescents: prognostic factors and outcome-a review of 11 cases. *Pediatr Surg Int* 2009; 25(12):1073-1076.
13. Karnak I, Ciftci AO, Senocak ME, Büyükpamukçu N. Colorectal carcinoma in children. *J Pediatr Surg* 1999; 34(10):1499-1504.
14. Pini Prato A, Rossi V, Avanzini S, Mattioli G, Disma N, Jasonni V. Hirschsprung's disease: what about mortality? *Pediatr Surg Int* 2011; 27(5):473-478.
15. Mgaya EM, Kitinya JN. Histopathology of malignant tumours of childhood in Tanzania. *East Afr Med J* 2000; 77(8):435-439.
16. Huppertz HI, Soriano-Gabarró M, Grimpel E, Franco E, Mezner Z, Desselberger U, Smit Y, Wolleswinkel-van den Bosch J, De Vos B, Giaquinto C. Intussusception among young children in Europe. *Pediatr Infect Dis J* 2006; 25(1):22-29.
17. al Lamki Z, Elbanna N, Unnikrishnan M, Saha A, Elbualy MS. Malignant tumours in Omani children. *Ann Trop Paediatr* 1994; 14(4):315-320.
18. Takano H, Smith WL. Gastrointestinal tumors of childhood. *Radiol Clin North Am* 1997; 35(6):1367-1389.
19. Samuelsson BO, Ridell B, Röckert L, Gustafsson G, Márky I. Non-Hodgkin lymphoma in children: a 20-year population-based epidemiologic study in western Sweden. *J Pediatr Hematol Oncol* 1999; 21(2):103-110.
20. Morgan JA, Young L, McGuire W. Pathogenesis and prevention of necrotizing enterocolitis. *Curr Opin Infect Dis* 2011; 24(3):183-189.
21. Buettcher M, Baer G, Bonhoeffer J, Schaad UB, Heininger U. Three-year surveillance of intussusception in children in Switzerland. *Pediatrics* 2007; 120(3):473-480.
22. Skinner MA, Plumley DA, Grosfeld JL, Rescorla FJ, West KW, Scherer LR. Gastrointestinal tumors in children: an analysis of 39 cases. *Ann Surg Oncol* 1994; 1(4):283-289.
23. Ziad F, Katchy KC, Al Ramadan S, Alexander S, Kumar S. Clinicopathological features in 102 cases of Hirschsprung disease. *Annals of Saudi Medicine* 2006; 26(3):200-204.
24. Singh SJ, Croaker GD, Manglick P, Wong CL, Athanasakos H, Elliott E, Cass D. Hirschsprung's disease: the Australian Paediatric Surveillance Unit's experience. *Pediatr Surg Int* 2003; 19(4):247-250.
25. Ongeti K, Saidi H, Ogeng'o J, Tharao M. Experience with Hirschsprung' Disease at a Tertiary Hospital in Kenya. *Annals of African Surgery* 2009; 4:8-12.
26. Olajide AR, Yisau AA, Abdulraseed NA, Kashim IO, Olaniyi AJ, Morohunfade AO. Gastrointestinal duplications: Experience in seven children and a review of the literature. *The Saudi Journal of Gastroenterology* 2010; 16(2): 105-109.
27. Foss HD, Stein H. Pathology of intestinal lymphomas: Recent Results *Cancer Res* 2000; 156:33-41.
28. Grüssner R, Pistor G, Engelskirchen R, Hofmann-von Kap-herr S. Appendicitis in childhood. *Monatsschr Kinderheilkd* 1985; 133(3):158-166.
29. Graffeo CS, Counselman FL. Appendicitis. *Emergency Medicine Clinics of North America*; 1996; 14(4):653-671.
30. Brender JD, Marcuse EK, Koepsell TD, Hatch EI. Childhood appendicitis: factors associated with perforation. *Pediatrics* 1985; 76(2):301-306.
31. Cserni T, Paran S, Puri P. New hypothesis on the pathogenesis of ileocecal intussusception. *J Pediatr Surg* 2007; 42(9):1515-1519.
32. Radhakrishnan CN, Bruce J. Colorectal cancers in children without any predisposing factors. A report of eight cases and review of the literature. *Eur J Pediatr Surg* 2003; 13(1):66-68.
33. Al-Bahrani Z, Al-Mondhiry H, Al-Saleem T, Zaini S. Primary intestinal lymphoma in Iraqi children. *Oncology* 1986; 43(4):243-250.

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