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APPENDICULAR DISEASES;
SPECTRUM IN SURGICAL PATHOLOGY

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ABSTRACT: Acute appendicitis is a common cause of acute surgical abdomen and many appendectomies are performed daily. All disease processes involving appendix will present as acute appendicitis. Clinically diagnosed acute appendicitis is treated by urgent appendectomy. As most of the removed appendices will reveal acute suppurative inflammation, therefore, appendectomy specimens are not usually submitted for histopathological examination unless the surgeon notices advanced disease or grossly recognizable abnormalities. **Objectives:** The purpose of this study is; 1, to explore the spectrum of diseases affecting the appendix in the community; 2, to find the age and gender association of appendicular diseases; and 3, to see if all the surgically removed appendices should be submitted for histopathological examination as a routine procedure. **Study Design:** Retrospective study. **Setting:** Charsada Teaching Hospital affiliated with Jinnah Medical College Peshawar. **Period:** January 2013 to January 2016. **Methods:** The histology slides and diagnoses of all the retrieved cases were reviewed with regards to morphology, patient's age, gender and presence or absence of any associated disease. **Results:** Nine disease entities were identified affecting the appendix, which from most to least common were acute suppurative appendicitis, lymphoid hyperplasia, fecalith, fibrous luminal obliteration, oxyuriasis, carcinoid tumor, submucosal fibrosis, acquired diverticulosis, and inflammatory mucocele. The first three commonest diseases were most frequent in the second decade of life; fibrous luminal obliteration in the fourth decade, carcinoid tumors in the third decade, and oxyuriasis in the first decade. Moreover, acute suppurative appendicitis, fecalith, oxyuriasis, and submucosal fibrosis were more frequent in males; whereas, lymphoid hyperplasia and fibrous luminal obliteration were more common in females. **Conclusions:** Acute suppurative appendicitis was the most common histological diagnosis. Acute suppurative appendicitis, fecalith, oxyuriasis, and submucosal fibrosis were more common in males; whereas, lymphoid hyperplasia and fibrous luminal atresia were more common in females. Acute suppurative appendicitis, lymphoid hyperplasia, and fecalith were most common in the second decade of life. In view of the nine different histological disease entities identified in this study under one clinical diagnosis of acute appendicitis, it is highly recommended to submit all appendectomy specimens for histopathological examination.

Key words: Acute suppurative appendicitis, appendicular diverticulosis, inflammatory/retention mucocele, fecalith, fibrous luminal obliteration.

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STATEMENT OF NOVELTY OF THE STUDY

The work described has not been published before; that it is not under consideration for publication anywhere else; that its publication has been approved by all coauthors and the institute where the work has been carried out. The publisher will not be held legally responsible should there be any claims for compensation.

INTRODUCTION

Acute appendicitis is a common surgical emergency and many appendectomies are performed daily.[1] It is seen more commonly in Europe and North America due to low fiber and high protein diet.[2] In North America, its estimated incidence is 11 cases/10,000 of population and lifetime risk of developing acute appendicitis is 9% for males and 7% for females.[3,4,5] Any disease process of the appendix can present

clinically as acute appendicitis, characterized by periumbilical pain that shifts in the right iliac fossa and is marked by tenderness and rebound tenderness. Clinical acute appendicitis is treated by urgent appendectomy and as most of the appendices removed will reveal acute suppurative inflammation; therefore, appendices removed during surgery are not always submitted for histopathological examination.

Usually, it is the surgeon who examines the specimens grossly and decides which specimen to be sent for histopathological examination and which one to be discarded. Very occasional appendectomy specimens with advanced disease or grossly recognizable abnormalities will ultimately be sent for histopathological examination. Therefore, many disease processes other than acute suppurative appendicitis, like early stage tumors, will be missed. Also, in the absence of routine appendix specimen submission for histopathological examination, the spectrum/pattern of disease, age, and gender predilection of the disease cannot be determined.

The purpose of this study is; firstly, to explore the spectrum of diseases affecting the appendix in the community; secondly, to find the age and gender association of those diseases; and thirdly, to see if the surgically removed appendices should always be submitted for histopathological examination as a routine procedure.

METHODS

In this retrospective pathology laboratory-based study spanning over a period of three years (from January 2013 to January 2016), a total of 225 cases with clinical diagnosis of acute appendicitis were retrieved from the archives of Charsada Teaching Hospital affiliated with Jinnah Medical College Peshawar. The slides and diagnoses of all the retrieved cases were reviewed with regards to morphology, patient's age, gender, and presence or absence of any associated disease. Acute appendicitis was histologically defined as variable infiltration of the muscularis propria by neutrophils outside the capillaries, thereby including sub-categories like acute suppurative appendicitis, acute suppurative appendicitis with peri-appendicitis, gangrenous appendicitis, and acute suppurative appendicitis with perforation. Fecalith was defined as a compact, dry, and hard mass found in the lumen of appendix. Inflammatory/retention mucocele was defined as distention of the appendix lumen by mucus resulting from proximal inflammation.

RESULTS

On analyzing all the 225 cases of clinical acute appendicitis from the year 2013-2016, it was found that (Table I) acute suppurative appendicitis (n=121) was the most common pathology of appendix, followed by lymphoid hyperplasia (n=61), fecalith (n=13), fibrous luminal obliteration (n=11), oxyuriasis (n=9), carcinoid tumor (n=4), submucosal fibrosis (n=3), acquired diverticulosis (n=2), and inflammatory/retention mucocele (n=1). Acute suppurative appendicitis (n=47), lymphoid hyperplasia (n=27), and fecalith (n=7) were most common in the second decade of life (Table II). Fibrous luminal obliteration/luminal atresia (n=7) was common in the fourth decade of life. Carcinoid tumors were most common in the third decade. Oxyuriasis was most common in the first decade of life. Submucosal fibrosis was equally distributed among the third, fifth, and eighth decades. Diverticulosis was equally distributed between third and fifth decades. Inflammatory/retention mucocele was seen in the third decade of life. Acute suppurative appendicitis, fecalith, oxyuriasis, and submucosal fibrosis were more common in males; (Table III) whereas, lymphoid hyperplasia and fibrous luminal obliteration were more common in females. Carcinoid tumors and acquired diverticulosis had equal gender distribution.

DISCUSSION

Acute appendicitis is a common surgical emergency and appendectomy is one of the commonest emergency abdominal operations performed worldwide.[1] Vermiform appendix is a tubular structure arising from the medial side of cecum near the junction of cecum and terminal ileum. Its mucosa resembles that of cecum but, contains abundant lymphoid tissue in the submucosa.[2,3,6]

SN	Disease	Number (n)	Percent (%)
1	Acute appendicitis	121	53.8
2	Lymphoid hyperplasia	61	27.1
3	Fecalith	13	5.8
4	Luminal atresia	11	4.9
5	Parasites	9	4
6	Carcinoid	4	1.8
7	Submucosal fibrosis	3	1.3
8	Diverticulosis	2	0.9
9	Inflammatory mucocele	1	0.4
	Total	225	100

Table-I. Distribution of cases according to disease.

Disease	1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	Total
Acute appendicitis	14	47	36	14	10	-	-	-	**121**
Lymphoid hyperplasia	1	27	21	8	3	1	-	-	**61**
Fecalith	-	7	3	1	1	-	-	1	**13**
Luminal atresia	-	1	1	7	-	2	-	-	**11**
Parasites	5	3	1	-	-	-	-	-	**9**
Carcinoid	-	1	2	1	-	-	-	-	**4**
Submucosal fibrosis	-	-	1	-	1	-	-	1	**3**
Diverticulosis	-	-	1	-	1	-	-	-	**2**
Inflammatory mucocele	-	-	1	-	-	-	-	-	**1**

Table-II. Distribution of cases according to age.

SN	Disease	Male	Female	Total
1	Acute appendicitis	79	42	121
2	Lymphoid hyperplasia	21	40	61
3	Fecalith	9	4	13
4	Luminal atresia	3	8	11
5	Parasites	5	4	9
6	Carcinoid	2	2	4
7	Submucosal fibrosis	3	-	3
8	Diverticulosis	1	1	2
9	Inflammatory mucocele	1	-	1

Table-III. Distribution of cases according to gender.

There is no single known etiology for acute appendicitis and it is considered to be a multifactorial disease. The disease is precipitated by the obstruction to the flow of luminal contents usually by fecalith, lymphoid hyperplasia, parasites, food matter, tumors, etc. which is followed by stasis, increased intraluminal pressure, reduced perfusion, ischemia, and mucosal damage.[3,4] The mucosal damage leads to invasion by bacteria with invasion of muscularis propria by acute inflammatory cells. Acute appendicitis is diagnosed on clinical grounds and is usually characterized by neutrophilia and thickened appendix wall on ultrasonography/CT scan.

In our study of 225 cases with clinical diagnosis of acute appendicitis, we came across a total of 9 disease entities on histological examination affecting the appendix. The most common disease was acute suppurative appendicitis followed by lymphoid hyperplasia, fecalith, luminal obliteration, parasitic infestation, carcinoid tumor, submucosal fibrosis, diverticulosis, and mucocele (Table I).

Acute suppurative appendicitis was the most

common disease in our study (n=121, 53.8%). It was characterized by transmural acute inflammatory infiltration by neutrophils involving the muscularis propria in addition to mucosa, submucosa, and at times serosa with luminal acute inflammatory exudates. It was most common in the 2nd decade (11-20 years) of life followed by the 3rd decade (21-30 years) (Table II). It was almost twice as common in males as in females with male to female ratio of 1.9:1 (Table III). These findings are similar to those of Gilani et al who in their study of 1016 appendectomies conducted at Holy Family Hospital Rawalpindi found acute suppurative appendicitis in 56% of cases.[7]

Lymphoid hyperplasia in the submucosa of variable degree causing narrowing of the lumen was the second commonest finding (n=61, 27.1%) (Table I). It was characterized by large lymphoid follicles with expanded germinal centers. Most of these cases were not associated with acute inflammation in the appendix. It was also common in the 2nd decade (11-20 years) of life followed by the 3rd decade (21-30 years) (Table II). It was almost twice as commonly seen in females than in males with male to female ratio of 1:1.9 (Table III). This correlates with the study conducted by Babekir and Devi at Al Fujairah Hospital UAE on 405 appendectomies and their reported prevalence of lymphoid hyperplasia was 25%.[8]

Fecalith was found in the lumen of appendices in 5.8% of cases (n=13) (Table I). They were characterized by lumen obstructing, compact amorphous material containing vegetable material with or without focal calcification. Fecaliths could be formed as a result of low fiber diet that could further predispose to acute suppurative appendicitis.[9] All the cases were associated with acute inflammation in the appendix. It was also common in the 2nd decade (11-20 years) of life followed by the 3rd decade (21-30 years) (Table II). It was twice as common in males as in females with male to female ratio of 2.3:1 (Table III). Gilani et al have reported a similar prevalence of 5.7% in their study of 1016 appendectomies.[7]

Luminal fibrous obliteration/luminal atresia was seen in 4.9% of cases (n=11) (Table I). It was characterized by fibrocollagenous- to fibromyxoid proliferation in the lamina propria with resulting loss of central lumen and lining epithelium without inflammatory infiltration of muscularis propria. It has also been called neuronal hyperplasia or neuroma of the appendix.[3] It was most common in the 4th decade (31-40 years) of life (Table II). It was more than twice as common in females as in males with male to female ratio of 1:2.7 (Table III). In a study conducted on 190 appendectomies, the prevalence for luminal fibrous obliteration was reported to be 5.3% and the predominant age group affected was fourth decade, which are almost the same as in our study.[10]

Parasitic infestations in our study were entirely represented by oxyuriasis and this constituted the next most common disease (n=9, 4%) (Table I). They were recognized as sectioned adult worms and/or gravid females containing multiple ova and their characteristic gut lumen. It was always associated with acute appendicitis. It was most commonly seen in the 1st decade (1-10 years) of life followed by the 2nd decade (11-20 years) (Table II). It was slightly more common in males with male to female ratio of 1.25:1 (Table III). Gilani et al reported a similar prevalence of 4% in their study.[7] Similar age prevalence is reported by other authors.[11] Irum et al, however, reported a slightly higher prevalence of 10.45% in their study of 593 appendectomies; however, the gender and age predilection was the same.[12] These worms live and reproduce in the cecum, terminal ileum, proximal colon, and appendix.[11]

Carcinoid tumors (n=4, 1.8%) was the next commonest diagnosis (Table I). The tumor size ranged from 0.4 cm- to 1.5 cm with average size of 0.7 cm, 75% of the cases (n=3) had tumor size of <1 cm, whereas 25% of the cases (n=1) had size >1 cm. All the cases involved the distal half of the appendix. They were characterized by insular and trabecular arrangement of well-differentiated neuroendocrine cells involving the mucosa, submucosa, muscularis propria, and in one case, extending into the subserosa. The

muscularis propria was mostly hypertrophic. None of the cases had a recurrence or metastasis after a follow-up period of one year. It was most commonly seen in the 3rd decade (21-30 years) of life (Table II) with equal male to female ratio of 1:1 (Table III). Carcinoid tumors were diagnosed in 0.6% of cases, with male predominance and tumor size of up to 1 cm in 77% of cases in a study conducted at Ziauddin University over a seven year period.[13] The findings of our study are in accordance with this stated study except for equal gender distribution in our study in contrast to male predominance; this difference may be due to the size of the studied cases, 225 cases in our study versus 2157 cases in the mentioned study.

Submucosal fibrosis (n=3, 1.3%) was the next common diagnosis (Table I), it was characterized by replacement of loose fibroadipose- to fibrovascular tissue in the submucosa by dense fibrocollagenous tissue infiltrated by lymphocytes, plasma cells, and macrophages, with no infiltration of muscularis propria. It was seen equally in the 3rd, 5th, and 8th decades of life (Table II) with all the cases being male (Table III). This prevalence of 1.3% is less than that reported by Duduyemi who reported prevalence of 5.1% for submucosal fibrosis in his study of 293 appendectomies in Nigeria.[5]

Diverticulosis (n=2, 0.9%) was seen in association with acute suppurative appendicitis in both the cases (Table I). Acquired diverticulosis occurs when due to proximal luminal obstruction, there is increased intraluminal pressure causing the mucosa to herniate through the weak points in the muscularis propria at the entrances of arterial branches. One case was seen in the 3rd and the other in the 5th decades of life (Table II) with equal male to female ratio (Table III). This prevalence of 0.9% is less than that reported by Martinez et al who reported prevalence rate of 2.49% for appendiceal diverticulosis in a study of 2058 appendectomies.[14] This slightly higher reported prevalence may be due to the huge number of 2058 appendectomies in their study.

Inflammatory mucocele (n=1, 0.4%) was the least common diagnosis (Table I) resulting from proximal obstruction with inflammatory infiltration of the muscularis propria resulting in distension of the lumen by accumulated mucus. The epithelium was atrophic without dysplasia, malignant change, papillae formation, or adenocarcinoma.

Such mucoceles are also referred to as simple/retention/obstructive mucoceles and should be differentiated from mucosal hyperplasia, benign, or malignant changes.[15,16] It was seen in only one case in the 3rd decade of life (Table II) in a male patient (Table III). This prevalence of 0.4% is almost the same as that reported by Duduyemi who reported prevalence of 0.3% for mucoceles in his study of 293 appendectomies.[5]

In conclusion, acute suppurative appendicitis was the most common histological diagnosis followed by lymphoid hyperplasia with representation of rare entities like carcinoid tumor, diverticulosis, and mucocele in addition to others. Acute suppurative appendicitis, fecalith, oxyuriasis, and submucosal fibrosis were more common in males; whereas, lymphoid hyperplasia and fibrous luminal atresia were more common in females. Acute suppurative appendicitis, lymphoid hyperplasia, and fecalith were most common in the second decade of life. In view of the nine disease entities encountered in this study, it is highly recommended to submit all the appendectomy specimens for histopathological examination.

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REFERENCES

1. Mufti Js, Akhtar, Khan K, Raziq F, Rehman Z, Ahmed J. **Diagnostic Accuracy in Acute Appendicitis: Comparison between Clinical Impression and Ultrasound Findings.** JAMC. 1996; 8(1):13–15.

2. Rosai J. Appendix. In Rosai J, editor. **Surgical Pathology.** 10th ed. Elsevier; 2001.p.714-724.

3. Daniels J, Montgomery E. **Inflammatory Disorders of the Appendix. In: Odze RD, Goldblum JR, editors. Surgical Pathology of the Gastrointestinal Tract, Liver, Biliary Tract and Pancreas.** 2nd ed. Saunders;

2009.p.395-404.

4. Morson & Dowson. **Inflammatory Disorders of the Appendix. In: Morson & Dowson, editors. Gastrointestinal Pathology.** 4th ed. Blackwell Science; 2003.p412—417.

5. Duduyemi BM. Clinicopathological Review of Surgically Removed Appendix in Central Nigeria. Alexandria Journal of Medicine. Volume 51, Issue 3, September 2015, Pages 207–211.

6. Greenson JK. Appendix. **In: Greenson JK, editor. Diagnostic Pathology: Gastrointestinal.** 2nd ed. Elsevier; 2016.p.302-324.

7. Gilani S I, Ali S, Hyder O, Iqbal A, Mazher T, Mir ST, et al. **Clinicopathological Correlation in 1016 Appendicectomies Performed at Two Tertiary Care Hospitals.** Rawal Medical Journal. 2009; 34;ll-3.

8. Babekir AR, Devi N. Analysis of the Pathology of 405 Appendices. East African Medical Journal. 1990; 67:599–602.

9. Ramdass MJ, Young SQ, Milne D, Mooteeram J, Barrow S. **Association Between the Appendix and the Fecalith in Adults.** Canadian Journal of Surgery. 2015; 58(1):10–14.

10. Singhal V, Jadha V. **Acute Appendicitis: Are We Over Diagnosing It? Annals Royal College Surgeon England.** 2007; 89: 766–769.

11. Lamps LW. Entrobius vermicularis. **In: Lamps LW, editor. Surgical Pathology of Gastrointestinal System: Bacterial, Fungal, Viral and Parasitic Infections.** 1st ed. Springer; 2009.p.201—203.

12. Irum A, Sheryar H, Ahmareen K. **Parasitic Infestation of the Appendix, Masquerading as Acute Appendicitis.** International Journal of Pathology; 2016; 14(2).p.74-78.

13. Memon I, Moorpani K, Rehman S. **Carcinoid Tumors: A Usually Ignored Cause of Appendicitis.** Pak J Med Dent 2014; 3(3):4-7.

14. Martínez JT, Deniz JR, Blanc IL, Olivares EC, Alsina XR, et al. **(2016) Appendiceal Diverticulosis in Acute Appendicitis: Our Experience and Literature Review.** Journal General Practice (Los Angel) 4:279.

15. Carr NJ, Sobin LH. Appendix. **In: Weidner N, Cote RJ, Suster S, Weis LM.** Modern Surgical Pathology; Saunders; (2nd edition) 2009.p.837-852.

16. Tipu SA, Ahmed I, Ishtiaq S. Mucocele Appendix: A Literature Review. Khyber Medical University Journal 2014; 6(1):p.31-34.

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