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ORIGINAL ARTICLE

Incidental Findings in Routine Histopathological Examination of Appendectomy Specimens; Retrospective Analysis of 1970 Patients

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Abstract Diseases and tumors of the appendix vermiformis are very rare, except for acute appendicitis. This study aimed to examine rare findings in the histopathologic examinations of specimens of patients undergoing appendectomy due to the diagnosis of acute appendicitis. The files of 1970 patients undergoing appendectomy due to the diagnosis of acute appendicitis between March 2012 and March 2016 were retrospectively investigated. Rare findings were found in 59 (3 %) patients, and these were evaluated in detail. Patients' age, gender, pathology reports, and postoperation follow-ups were recorded. The rare histopathological findings of 59 patients were examined. Of these, 31 were female (52.5 %) and 28 were male (47.5 %). The average age was 33.1 ± 18.2 years. The unusual findings were as follows: 16 fibrous obliteration, 11 *Enterobius vermicularis*, 2 schistosomiasis, 3 appendiceal neuroma, 2 granulomatous appendicitis, 1 Crohn's disease, 3 chronic appendicitis, 1 endometriosis, 2 hyperplastic polyps, 9 mucinous cystadenoma (+mucocele), 8 carcinoid tumors, and 1 lymphoma. All of the malignant tumors were localized in the distal end of the appendix, and all of the patients were treated with appendectomy. Patients with parasitic diseases also underwent anthelmintic treatment, while chemotherapy was administered to the patient with lymphoma. All of the patients diagnosed with malignancy were alive reported no problems at their follow-ups. Although all of the appendectomy samples were normal macroscopically, data from this study suggest that all specimens should be sent for routine investigation.

Keywords Appendicitis · Appendectomy · Carcinoid · Mucocele · Endometriosis

Introduction

Acute appendicitis (AA) is one of the most common causes of acute abdomen surgery, and appendectomy is the most commonly performed surgical procedure worldwide. The lifetime frequency of AA is 8.6 % in males and 6.7 % in females [1].

The increased incidence of AA, which peaks in young adults in their twenties, is associated with lymphoid development. Lumens obstruction is an effective factor in the formation of AA. However, fecaloid and lymphoid hyperplasia are the most common causes and can cause obstruction in some rare cases [2, 3]. These hyperplasias include enterobiasis, ascariasis, balantidiasis, taeniasis, actinomycosis, schistosomiasis, amebiasis, trichuriasis, blastocystis hominis, tuberculosis, adenovirus, neurofibroma, carcinoid tumor, goblet-cell carcinoid, primary or secondary adenocarcinoma, cystadenocarcinoma, lymphoma, leukemia, dysplastic changes, endometriosis, granulomatous diseases, gastrointestinal stromal tumor, mucocele, villous adenoma, tubulevillous adenoma, tubular adenoma, leiomyoma, diverticulitis, eosinophilic granuloma, and neurogenic appendicopathy [2, 3].

The literature describes different protocols for sending appendectomy specimens for pathological examination. Matthyssens et al. suggested that it is not necessary to routinely send appendectomy specimens unless they raise doubts macroscopically; however, there has not been a consensus regarding whether all specimens should be routinely sent for

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analysis [4, 5]. On the other hand, some studies have reported that unusual results are becoming more common. Consequently, important pathological findings may be overlooked, which might affect the treatment of some patients [6]. More than half of appendiceal tumors are diagnosed in pathological examination. Moreover, diagnoses such as parasitic infections, endometriosis and inflammatory bowel diseases can be also made with the evaluation of appendectomy specimens [7, 8].

In this study, we investigated the frequency of unexpected rare pathologies seen in appendectomy specimens in University Medical Faculty Hospital and compared our results with those reported in the literature.

Methods

This study was approved by the local ethics committee. The files of 1970 patients who underwent appendectomy with the diagnosis of AA between March 2012 and March 2016 in University Medical Faculty Hospital were retrospectively examined. The patients' age, gender, operative findings, diagnosis of pathology, postoperative results, and follow-ups were recorded. Information on postoperative conditions was recorded through May 2016.

There were 1188 (60 %) male patients and 788 (40 %) female patients. All of the appendectomy specimens were obtained from appendectomies conducted in our hospital. Histopathological examinations were performed in the hospital's pathology unit. Unusual pathology results after appendectomy were recorded. Appendectomy specimens with unusual findings (n = 59, 3 %) were re-evaluated by experienced pathologists.

Results

A total of 1970 patients with the diagnosis of acute appendicitis underwent appendectomy between March 2012 and March 2016 in Adıyaman University Medical Faculty Hospital. The diagnoses of all patients were confirmed via physical examination and laboratory findings. Unusual findings were observed in 59 (3 %, 28 male and 31 female) of the patients who underwent appendectomy. The range of age was 3–72 years and the mean age was 33.1 ± 18.2 years.

The unusual findings (n = 59) were as follows: 16 (27.1 %) fibrous obliteration, 11 (18.6 %) *Enterobius vermicularis*, 2 (3.3 %) schistosomiasis, 3 (5 %) appendiceal neuroma, 2 (3.3 %) granulomatous appendicitis, 1 (1.7 %) Crohn's disease, 3 (5 %) chronic appendicitis, 1 (1.7 %) endometriosis, 2 (3.3 %) hyperplastic polyps, 9 (15.2 %) mucinous cystadenoma (+mucocele), 8 (13.5 %) carcinoid tumors, and 1 (1.7 %) lymphoma (Fig. 1). The numbers of patients based on etiologic causes are summarized in Table 1.

All patients with malignancy had a clinical prediagnosis of acute appendicitis. There were no symptoms of carcinoid syndrome in any of the patients, and there was no suspicion of appendiceal tumor in any of the patients preoperatively. The malignant patients were diagnosed by histopathological examination and were sent to undergo treatment and follow-up with an oncologist. Appendectomy was sufficient for all patients. Chemotherapy was additionally administered to the patient with lymphoma. At the time of this manuscript, all patients with tumor are still alive. The mean disease-free follow-up duration was 25.8 months. The clinicopathological features of the tumor cases are summarized in Table 2. After establishing diagnosis by histopathologic examination, patients were followed-up with via abdominal ultrasonography, computed tomography, colonoscopy, and hydroxy indoleacetic acid measurements in 24-h urine samples. All patients were followed up with once every 3–6 months during the first year. In addition, the patients diagnosed with parasitic infections underwent oral medical treatment.

Discussion

Appendectomy is one of the most commonly performed surgical procedures [2]. Its incidence is quite proportional with lymphoid development and reaches its maximum level between the end of puberty and the mid-thirties.

The incidence of acute appendicitis is approximately the same in males and females before puberty; however, its incidence in females is twice that in males after puberty [9].

Obstructions in the lumen are the most important factors causing acute appendicitis. Intraluminal obstruction causes continuous mucus secretion, which leads to increases in pressure. This obstructs the lymphatic drainage, causing the development of edema and mucosal ulceration. The distension of the appendix increases, which results in venous obstruction. Following these events, ischemia and necrosis develop on the appendage wall [10].

Although fecalith and lymphoid hyperplasia are the most common factors causing intraluminal obstruction, some other rare factors have also been identified [11–13]. Intestinal parasitic diseases and malignant or benign tumors are the most common unusual pathological findings observed in specimens after appendectomy due to any cause [9].

E. vermicularis (pinworms, oxyuris) is a parasitic infection that affects nearly 200 million people worldwide. At the end of the nineteenth century, it was first shown that the localization of *E. vermicularis* on the appendiceal lumen causes appendicitis. Previous studies have shown that the incidence of *E. vermicularis* is between 0.6 and 3.8 % in surgical specimens of patients suspected to have appendicitis

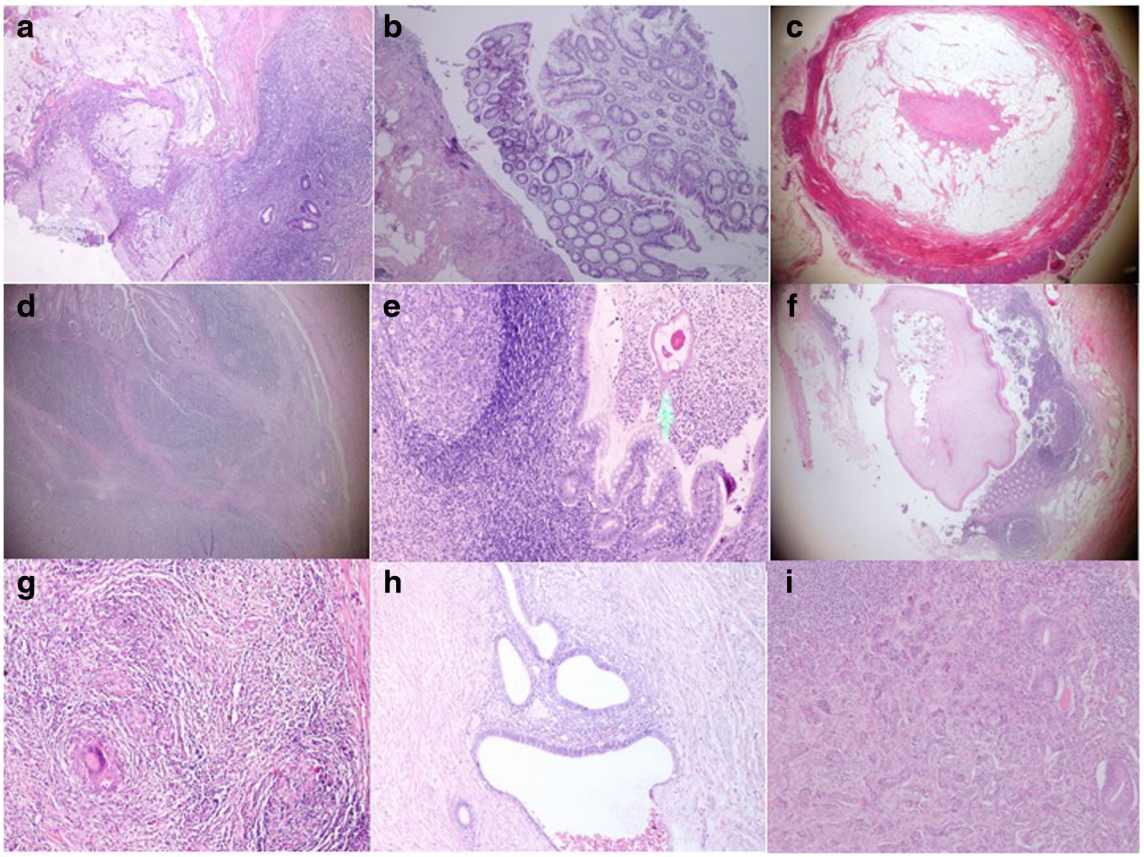

Fig. 1 **a** Mucocele, mucin secretion filling the appendiceal lumen (HE ×40). **b** Hyperplastic polyps with serration on the surface developing towards the appendiceal lumen (HE ×40). **c** Neuroma/spindle cells and nerve cells on fibromyxoid surface consisting of fibrous obliteration lumen, lymphoid tissue loss (HE ×40). **d** B cell lymphoma (HE ×20). **e** *Enterobius vermicularis* in the appendiceal lumen (HE ×200). **f** Schistosoma haematobium in the appendiceal lumen (HE ×40). **g** Granuloma structures consisting of multinucleated giant cells on the appendiceal wall (HE ×200). **h** Endometriosis, endometrial stroma in the appendix wall, glandular structures with blood components (HE ×100). **i** Carcinoid tumor characterized by uniform cells forming scattered solid islands in the lamina propria and muscularis propria (HE ×40)

[14]. These patients should also undergo anthelmintic treatment, as appendectomy only treats the consequences, but not the cause, of disease. *E. vermicularis* infestation is treated with oral mebendazole, which is repeated in 2 weeks [2]. Similar to the literature, in our current study, 11 (0.6 %) patients had oxyuris infestation and were given anthelmintic treatment.

Table 1 Distribution of the 59 cases identified as having unusual findings according to etiological causes

Total patients	*n* = 59
Carcinoid tumor	8
Mucinous cystadenoma (+mucocele)	9
Lymphoma	1
Hyperplastic polyps	2
Granulomatous appendicitis	2
Chronic appendicitis	3
Appendiceal neuroma	3
Fibrous obliteration	16
Schistosomiasis	2
Enterobius vermicularis	11
Endometriosis	1
Crohn's disease	1

The relationship between AA and schistosomiasis, another parasitic infection, was first identified by Burfield in 1906 [15]. Schistosomiasis, also known also as bilharziasis, is a rare cause of appendicitis that is seen only in endemic areas. Its prevalence depends on the presence of fecal contamination and snails in the source of drinking water [16]. In a study conducted in Nigeria by Gali et al., 2.3 % of appendectomy specimens had eggs of this parasite (as determined by histopathological examination) [17]. The development of a periappendiceal reaction against the parasite causes its pathophysiology. Inflammation causes structural deformation on the appendage wall, leading to intraluminal obstruction and appendicitis. Schistosomal appendicitis is treated with appendectomy and praziquantel [2]. In our current study, this parasite presented in only 2 (0.1 %) appendectomy specimens.

Table 2 Clinicopathological characteristics of 9 patients with primary appendicular tumors

Age	Gender	Diagnosis	Diameter (cm)	Localization	Therapy	Involvement	Follow-up (months)
60	M	Carcinoid tm	0.6	Tip	Appendectomy	Mucosa	40
18	M	Carcinoid tm	0.4	Tip	Appendectomy	Mucosa	44
34	F	Carcinoid tm	0.5	Tip	Appendectomy	Mucosa	25
16	F	Carcinoid tm	0.5	Tip	Appendectomy	Mucosa	35
8	M	Carcinoid tm	0.7	Tip	Appendectomy	Mucosa	13
25	M	Carcinoid tm	0.3	Tip	Appendectomy	Serosa	20
13	F	Carcinoid tm	0.5	Tip	Appendectomy	Mucosa	21
35	F	Carcinoid tm	0.8	Tip	Appendectomy	M. propria	34
45	M	B lymphoma	2	Tip	Appendectomy chemotherapy	M. propria	26

Histopathological examinations of appendectomy specimens have revealed that fibrous obliteration occurs at a rate of nearly 30 %. Despite this identification, the majority of the specimens are positive for neurogenic proliferation. Therefore, various definitions, including neurogenic appendicopathy and appendiceal neuroma, have recently been used. Although the mechanism of this pathological formation is not fully known, it is thought to develop secondary to hyperplasia of the neuroendocrine cells. The appendiceal lumen is full of inflammatory cells and fibrous tissue, and therefore, it is frequently accompanied by proliferating neuroendocrine and nerve cells. The differential diagnosis between acute appendicitis and appendiceal neuroma is difficult, and it should be established according to the patients' anamnesis, symptoms, and laboratory and physical examination findings. Most of these cases become incidentally evident with pathological examination in asymptomatic patients [18, 19]. One study reported that fibrous obliteration was found in 57 (65 %) of 88 appendectomy specimens with unusual findings [3]. In our current study, of the appendectomy specimens with unusual findings, there were 16 (27.1 %) with fibrous obliteration and 3 (5 %) with appendiceal neuroma.

Granulomatous appendicitis can be incidentally found in patients with acute appendicitis. Its incidence is rare, and is reported to be between 0.14 and 0.3 % in western societies and between 1.3 and 2.3 % in less developed countries [20, 21]. Diagnostic criteria for granulomatous appendicitis are similar to those of the intestinal tract, and include granulomatous inflammation, transmural lymphoid accumulation, and fissure type ulcers. Several infectious and non-infectious factors may cause granulomatous appendicitis.

Granulomatous inflammation of the appendix may also be associated with Crohn's disease and some other conditions, such as systemic sarcoidosis. However, in most cases, it has been incorrectly reported that granulomatous appendicitis is an indicator of Crohn's disease. In fact, only 5 to 10 % of patients with granulomatous appendicitis have conditions associated with Crohn's disease developing in other parts of the gastrointestinal system. Idiopathic granulomatous appendicitis is difficult to distinguish from early stage Crohn's disease, which only affects the appendix. The definitive diagnosis of granulomatous appendicitis requires long-term monitoring and detailed research. It has been reported that infectious agents such as Yersinia, Mycobacterium, Blastomycosis, Schistosoma, Actinomyces, Campylobacter, and Histoplasma are responsible for causing granulomatous inflammation of the appendix. The clinical course of these diseases is always changing, and patients often have symptoms of acute appendicitis, such as right lower quadrant pain, fever, nausea, and loss of appetite [2, 20–22]. One of the patients in our current study had granulomatous appendicitis; in this patient, a detailed investigation was performed due to the development of postoperative enterocutaneous fistula and Crohn's disease.

Endometriosis is identified as the presence of endometrial tissue ectopically outside the uterine cavity. Although endometriosis is common in most females of reproductive age, its gastrointestinal localization is rare. Approximately 10 % of females with endometriosis have pathologies of the intestinal region classified as external endometriosis. Intestinal endometriosis is mostly observed in the rectum and in the sigmoid colon and is rarely seen in the appendix. Although appendiceal endometriosis is usually asymptomatic, it sometimes causes appendicitis, perforation, and invagination. The histopathological diagnosis of appendiceal endometriosis is based on the demonstration of endometrial tissue in the specimen. This condition is often treated with surgery and hormone therapy [2, 3, 14]. In our current study, appendiceal endometriosis was detected in one patient. The patient began medical treatment after consultation with gynecology.

Carcinoid tumor is the most common type of malignant tumor of the appendix, and its incidence is reported to be approximately 60 %. In patients undergoing appendectomy, the incidence was found to be between 0.3 and 2.3 %. Its incidence in females is 2–3 times that in males. The

preoperative diagnosis of carcinoids is quite rare, as they are usually detected incidentally after an appendectomy [2, 13, 23, 24]. Approximately 70–95 % of carcinoid tumors are <1 cm and are localized at the tip of the appendix. Most of the appendix carcinoids are benign, and metastases of malignant carcinoids are rare. Appendectomy is adequate treatment for malignant tumors with a diameter of <1 cm, since their risk of metastasis is almost zero. The risk of metastasis increases up to 85 % in tumors with a diameter of >2 cm. Therefore, right hemicolectomy should be performed in those with carcinoid tumors of the appendix with a diameter of 2 cm or greater [2, 11, 23, 24].

Consistent with the literature, in our current study, appendix carcinoid tumor was detected in eight patients (0.4 %), and the female/male ratio (4:4) was 1. All of the affected patients presented with signs and symptoms of acute appendicitis. None of these patients showed findings of carcinoid syndrome, and none of these patients needed hemicolectomy.

Extranodal lymphomas are typically observed in the gastrointestinal tract of 35–40 % of all extranodal patients. The most frequently affected organs include the stomach, intestine, colon, and esophagus, respectively. The incidence of primary appendix lymphoma is estimated to be between 0.015 and 0.022 % of all appendix specimens. Appendix lymphoma is usually seen in those in their twenties and thirties. It clinically behaves like acute appendicitis and is often diagnosed via histopathological examination following surgery. The most common histopathological type is B cell lymphoma. Since extranodal lymphomas are rare, there are no defined treatments. In our current study, B cell lymphoma was detected in just one (0.05 %) case. The patient underwent chemotherapy and is in remission; there was no recurrence at follow-up [2].

Appendix mucocele was identified for the first time in 1842. It is an obstructive dilatation of the appendix caused by the accumulation of mucoid material into the appendiceal lumen. The incidence of this lesion is reported to be between 0.2 and 0.7 %. Appendix mucocele has been described as four histopathological types: retention cyst, mucosal hyperplasia, mucinous cyst adenoma, and mucinous cyst adenocarcinoma. Mucoceles are often asymptomatic, and therefore, they are usually identified during appendectomy, laparotomy performed for another reason, or during examination of the surgical specimen. The standard treatment of appendix mucocele is appendectomy, but right hemicolectomy is necessary in mucinous cyst adenocarcinomas [2, 25]. In our current study, nine appendectomy specimens were reported as mucinous cystadenoma (+mucocele). Appendectomy was sufficient in all of these cases. Since mucinous cyst adenomas are highly associated with colon and ovarian malignancies, postoperative follow-ups of our cases were conducted using computed tomography, ultrasonography, and colonoscopy [14].

Appendix hyperplastic polyps (AHP) are rare, and their actual incidence is unknown. These polyps are typically small and have similarities with hyperplastic polyps, which can be seen anywhere in colon. Although AHP can present with symptoms of acute appendicitis, it is usually detected incidentally. Such polyps are significantly associated with adenocarcinoma in any part of the colon. Therefore, the presence of mucosal hyperplasia findings in appendectomy material is an indication that further detailed research should be conducted to eliminate colorectal cancer [26]. In our current study, hyperplastic polyps were found in the appendectomy specimens of two patients with acute appendicitis. There were no symptoms of malignancy in these cases.

Although AA is the most common pathology affecting the appendix, chronic or recurrent appendicitis can also be seen. Chronic inflammatory changes up to 5 %, infiltrated by both lymphocytes and plasma cells on serous and muscular layers, and can be seen in the specimens of patients who underwent appendectomy. Chronic inflammation of the appendix is determined based on the presence of lymphocytic and eosinophilic infiltration, fibrosis, and granulomatous and foreign body reaction. Since this rare pathology creates a dilemma for clinicians in its diagnosis and treatment, there are often delays in its diagnosis. Chronic appendicitis does not display the classic signs of acute appendicitis, and therefore, its diagnosis should be established with histopathological examination. Chronic appendicitis should also be considered in the differential diagnosis of patients with recurrent or chronic right lower quadrant pain. Computed tomography is the best test for its diagnosis, and appendectomy can be an effective treatment for these patients [27]. In our current study, of the three patients reported as having chronic appendicitis, two had a history of recurrent abdominal pain and one had chronic abdominal pain.

Conclusion

Although lymphoid and fecaloid hyperplasia are the most common causes of acute appendicitis, other unusual causes should also be considered. These unusual causes may be overlooked if specimens do not undergo histopathological evaluation. These overlooked causes may prevent full therapy of the disease, and therefore, we suggest that all appendectomy specimens undergo histopathological evaluation.

The most common unusual findings in appendectomy specimens are parasites and benign or malignant tumors. Appendectomy is not sufficient therapy in parasitic diseases; in these cases, anti-parasitic treatment should be performed. While appendectomy is curative in cases with benign tumors, additional surgery may be necessary in those with malignant tumors, based on the characteristics of the mass. Therefore,

overlooked malignant lesions may cause further medical, social, and legal problems.

In conclusion, all appendectomy materials should undergo routine histopathological investigation due to unexpected and unusual findings, even in cases where the appendectomy materials are macroscopically normal.

Compliance with Ethical Standards This study was approved by the local ethics committee.

Conflict of Interest The authors declare that they have no conflict of interest.

Informed Consent Written informed consent was obtained from the patient.

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References

1. Flum DR, Koepsell T (2002) The clinical and economic correlates of misdiagnosed appendicitis: nationwide analysis. Arch Surg 137(7):799–804
2. Akbulut S, Tas M, Sogutcu N, Arikanoglu Z, Basbug M, Ulku A, Semur H, Yagmur Y (2011) Unusual histopathological findings in appendectomy specimens: a retrospective analysis and literature review. World J Gastroenterol 17(15):1961–1970
3. Emre A, Akbulut S, Bozdag Z, Yilmaz M, Kanlioz M, Emre R et al (2013) Routine histopathologic examination of appendectomy specimens: retrospective analysis of 1255 patients. Int Surg 98(4): 354–362
4. Matthyssens LE, Ziol M, Barrat C, Champault GG (2006) Routine surgical pathology in general surgery. Br J Surg 93(3):362–368
5. The Royal College of Pathologists 2005 Histopathology and Cytopathology of limited or no clinical value 2nd edition. London. [http://www.rcpath.org/publications]
6. Chan W, Fu KH (1987) Value of routine histopathological examination of appendices in Hong Kong. J Clin Pathol 40(4):429–433
7. Nemeth L, Reen DJ, O'Briain D, McDermott M, Pui P (2001) Evidence of an inflammatory pathologic condition in "normal" appendices following emergency appendectomy. Arch Path Lab Med 125(6):759–764
8. Connor SJ, Hanna GB, Frizell FA (1998) Appendiceal tumors. Dis *Colon rectum* 41(1):75–80
9. Kozar RA, Roslyn JJ (1999) The appendix. In: Schwartz SI (ed) Principles of surgery. McGraw-Hill, New York
10. Russell RC, Williams NS, Bulstrode CJ (2000) The vermiform appendix. In: Russell RC, Williams NS, Bulstrode CJ (eds) Bailey and Love's short practice of surgery, 23 th edn. Arnold Publishers, London, pp. 1076–1092
11. Duzgun AP, Moran M, Uzun S, Ozmen MM, Ozer VM, Seckin S, Coskun F (2004) Unusual findings in appendicectomy specimens: evaluation of 2458 cases and review of the literature. Indian J Surg 66(4):221–226
12. Jones AE, Phillips AW, Jarvis JR, Sargen K (2007) The value of routine histopathological examination of appendicectomy specimens. BMC Surg 7:17
13. Chamisa I (2009) A clinicopathological review of 324 appendices removed for acute appendicitis in Durban, South Africa: a retrospective analysis. Ann R Coll Surg Engl 91(8):688–692
14. Yabanoglu H, Caliskan K, Ozgur Aytac H, Turk E, Karagulle E, Kayaselcuk F et al (2014) Unusual findings in appendectomy specimens of adults: retrospective analyses of 1466 patients and a review of literature. Iran Red Crescent Med J 16(2):1–6
15. Ladu R (2014) Schistosomiasis as a rare cause of recurrent acute appendicitis: a case report. Int J Surg Case Report 5(3):159–160
16. Steinmann P, Keiser J, Boss R, Tanner M, Utzinger J (2006) Schistosomiasis and water resources development: systemic review, meta-analysis and estimates of people at risk. Lancet Infect Dis 6(7):411–425
17. Gali BM, Nggada HA (2006) Schistosomiasis of the appendix in Maiduguri. Trop Doctor 36(3):162–163
18. Gupta K, Solanki A, Vasishta RK (2011) Appendiceal neuroma: report of an elusive neuroma. Trop Gastroenterol 32(4):332–333
19. Patel AV, Friedman M, MacDermott RP (2010) Crohn's disease patient with right lower quadrant abdominal pain for 20 years due to an appendiceal neuroma (fibrous obliteration of the appendix). Inflamm Bowel Dis 16(7):1093–1094
20. AbdullGaffar B (2010) Granulomatous diseases and granulomas of the appendix. Int J Surg Pathol 18(1):14–20
21. Tucker ON, Healy V, Jeffers M, Keane FB (2003) Granulomatous appendicitis. Surgeon 1(5):286–289
22. Shivakumar P, Shanmugam RP, Mani CS (2010) Idiopathic granulomatous appendicitis: a rare appendicular pseudo tumor. Trop Gastroenterol 31(2):130–131
23. Shapiro R, Eldar S, Sadot E, Papa MZ, Zippel DB (2011) Appendiceal carcinoid at a large tertiary center: pathologic findings and long-term follow-up evaluation. Am J Surg 201(6):805–808
24. In't Hof KH, van der Wal HC, Kazemier G, Lange JF (2008) Carcinoid tumour of the appendix: an analysis of 1,485 consecutive emergency appendectomies. J Gastrointest Surg 12(8):1436–1438
25. Demetrashvili Z, Chkhaidze M, Khutsishvili K, Topchishvili G, Javakhishvili T, Pipia I (2012) Mucocele of the appendix: case report and review of literature. Int Surg 97(3):266–269
26. Limaiem F, Bouraoui S, Bouahmed S, Sahraoui G, Lahmar A, Mzabi-Regaya S (2015) Appendiceal hyperplastic polyp: case report. J Interdiscipl Histopathol 3(1):36–38
27. Kothadia JP, Katz S, Ginzburg L (2015) Chronic appendicitis: uncommon cause of chronic abdominal pain. Therap Adv Gastroenterol 8(3):160–162