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RESEARCH ARTICLE

HISTOMORPHOLOGICAL SPECTRUM OF APPENDECTOMY SPECIMENS IN KOTA MEDICAL COLLEGE OF RAJASTHAN: A CASE SERIES OF 761 SPECIMENS

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ABSTRACT

Introduction: Appendicitis is one of the commonest surgical emergency and appendectomy is the most common surgery. Histopathological examination of appendectomy specimens is must to confirm the diagnosis and also to report unusual findings and to detect incidental neoplasms at the earliest possible

Aims and Objectives: To study the proportion of various lesions in resected specimens of appendix and to emphasize the need of histopathological examination.

Material and Methods: A retrospective study including 761 appendectomy specimens over a time period of 2 yrs from October 2014 to September 2016 was conducted.

Result: In our study, males are more as compared to females with sex ratio of 2.23:1. Maximum number of cases belong to age group 20-30 followed by 10-20 years. Most common finding is the inflammatory lesions accounting to 91.06%. Negative appendicectomy and incidental appendicectomy rates are 4.73% and 3.67% respectively. 10 cases (1.31%) showed benign and malignant neoplasm. Carcinoid is the most common malignancy (0.52%).

Conclusion: This study showed a marked variations in morphological spectrum and also some incidental neoplastic and rare lesions hence emphasizing the need of histopathological examination.

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INTRODUCTION

Acute appendicitis is the most common general surgical emergency (Marudanayagam *et al*., 2006). Incidence in UK is over 40,000 cases every year. An estimated life time risk of appendicitis is 7% (Turner, 2010). Inspite of high prevalence, acute appendicitis is at times difficult to differentiate from other intra-abdominal emergency conditions especially in females in reproductive age group causing difficulties in clinical diagnosis and often lead to negative appendicitis. A lot of advanced tests in laboratory and radiology has been introduced which claim higher accuracy rate in diagnosis, an increase in diagnostic error rates has been observed. Around 20% of patients are negative on histopathological analysis (Rothrock *et al*., 1995). Misdiagnosis of appendicitis in non pregnant females of reproductive age is so common that appendectomy is the most frequent performed urgent abdominal operation (O'Connell, 2010). The delay in diagnosis could lead to complications like perforation, peritonitis, sepsis, increased morbidity and mortality (Zoarets *et al*., 2014). Appendicitis is rare in infants and has its peak in teens and twenties. Incidence is equal in both sexes before puberty and in elderly but it is more in young males as compared to females, in 3:2 ratio. Obstruction of lumen is the causative factor produced either by a usual or unusual reasons (O'Connell, 2010). This retrospective study was carried out to know the incidence of various lesions in appendectomy specimens. Appendix tumours are rare accounting to only 0.4% of Gastro-intestinal Tract malignancies and 1% of appendiceal specimens. Carcinoid is the most common tumor of appendix followed by Mucinous cystadenocarcinoma. There is difference of opinion regarding the practice of routine histopathological examination of appendix specimens in different institutions. Matthyseens *et al* suggest that only those appendix having gross abnormality during operation should be submitted for histopathological examination (Matthyssens *et al*., 2006). Not only Histopathological analysis remains the gold standard for confirmation of appendicitis, at times sinister findings such as worms, tuberculosis and other lesions of clinical importance are also confirmed. Thus proving the importance of meticulous examination of each and every single resected appendix. Histopathological examination is routinely done at our institute hence this study was planned to document incidence of histopathological spectrum in the resected appendices.

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MATERIALS AND METHODS

This retrospective study is conducted in the histopathology department of government medical college kota. Histopathological records of 761 patients of resected appendectomy specimens were retrieved over a period of 2 years from October 2014 and September 2016. Clinical history, physical Examination along with available relevant investigations and operative findings were recorded from requisition forms. Operative records were analysed to find out primary or co-existing operative findings. The specimens were fixed in 10% buffered formalin. Detailed gross examination of each specimen was done taking into account length, width, perforation, gangrenous change, any growth or mucinous change. On cutting lumen patency, wall thickness, fecolith or any other abnormality were recorded. 3 pieces each from each appendix, two transverse sections from body and one longitudinal section from tip were given into routine. If any abnormality was found extra sections were given. Following the gross, routine tissue processing was done by automatic tissue processor. Haematoxylin & Eosin staining was performed. Special stains like Periodic acid Schiff's, Mucicarmine and Acid fast bacilli stain were performed whenever required. Detailed histopathological examinations were done.

Statistical analysis

A master reference sheet is prepared by retrieving all the clinical details along the gross, microscopic, interesting and associated rare findings. Amassed data is processed and evaluated in percentage by comparing with total number of appendectomies using MS Excel 2010.

RESULTS

Out of 12,706 total surgical specimens received in 2 years duration in kota medical college, 761 were appendectomy specimens (5.98%) with M:F sex ratio of 2.23 :1. Maximum cases 255(33.50%) belong to 21-30 years age range followed by 236 cases (31.01%) in 11-20 years interval. Even 4 (0.5%) cases of 80-90 years age interval were there. Males outnumber females in all age groups except in 80-90year age group in which females exceed. (Table-1, Graph-1) Non-neoplastic lesions of appendix came out as the major diagnostic group with a total of 751 cases (98.65 %) having males (69.37%) and female (30.62%). Out of which, maximum cases showed acute appendicitis (26.23%) followed by healing appendicitis (21.83%). 143cases (19.04%) were diagnosed as chronic appendicitis. Mucocele represented only 0.2% (2 cases) that too only in females. 23 cases (3.06%) showed only lymphoid follicular hyperplasia while 22 cases (2.92%) showed completely obliterated lumen. 64 cases (8.40%) out of non-neoplastic pathology were unremarkable. (Table-2) Out of these 64 cases, 28(3.67%) appendectomies were incidental and innocent which were removed with other surgeries. Innocent appendectomy rate is higher in females 21 cases and is 3 times as compared to males. Most of the appendices were taken out in surgeries pertaining to ovary and hysterectomy in females, while in males they are removed with resection of gut and Meckel's Diverticulum. (Table-3) 36cases(4.73%) were negative for appendicitis. These were appendectomies which did not show any changes of inflammation and resected in impression of appendicitis.

A total of 210 cases (27.59%) (Table-4) showed unusual findings which were associated with appendicitis either in form of etiology or complication. Maximum cases 168 (80%) were seen in males while only 42 cases (20%) were seen in females. Most common complication is periappendicitis in 124 cases (16.29%). Out of which 7 cases were of granulomatous periappendicitis. Fecolith is seen in 57 (7.49%) cases and perforation was seen only in 10 cases (1.31%) and maximum are males. A single case of botryomycosis and 8 cases (1.05%) showed enterobius vermicularis and majority were in males.

Table 1. Distribution of Age and Sex in Appendectomy specimen

Age range	Female	Male	Grand Total (n=761)	Percentage
0-10	11	25	36	4.73%
11-20	80	156	236	31.01%
21-30	67	188	255	33.50%
31-40	34	83	117	15.37%
41-50	19	43	62	8.14%
51-60	10	15	25	3.28%
61-70	7	10	17	2.23%
71-80	4	5	9	1.18%
81-90	3	1	4	0.52%
Grand Total	235	526	761	100%

Table 2. Distribution of Non-neoplastic lesions in Appendectomy specimens

S.No.	Lesion	Female	Male	Total (n= 761)	Percentage
1.	AA	48	149	197	26.23%
2.	AG	2	14	16	2.13%
3.	AS	23	97	120	15.97%
4.	CA	75	68	143	19.04%
5.	HA	38	126	164	21.83%
6.	LH	14	9	23	3.06%
7.	Mucocele	2	0	2	0.26%
8.	OA	7	15	22	2.92%
9.	UR	21	43	64	8.52%
	Grand Total	230	521	751	98.65%

Table 3. Distribution of co-existing surgeries in incidental Appendicectomy specimens

S. No.	Lesion	Female	Male
1.	Cholecystectomy	3	1
2.	Exploretory laprotomy	1	0
3.	Hysterectomies	6	0
4.	Meckel's diverticulum	2	3
5.	Ovary operation	6	0
6.	Resected gut	3	3
	Grand Total	21	7

Table 4. Distribution of Unusual findings in Appendectomy specimens

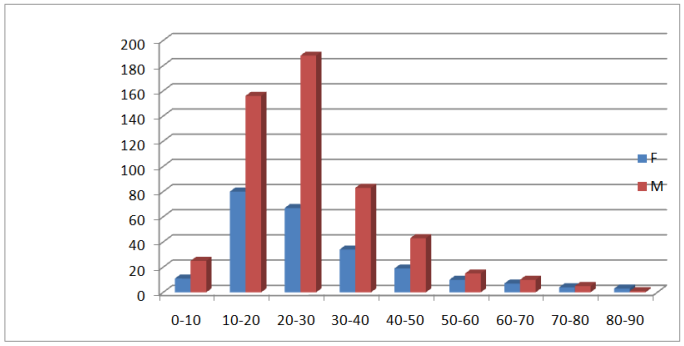
S. No.	Lesion	Female	Male	Grand total (n=761)	Percentage
Associated to etiology					
1.	E. Vermicularis	2	6	8	1.05%
2.	Fecolith	11	46	57	7.49%
3.	Botryomycosis	0	1	1	0.13%
Associated to complications					
4.	Perforation	1	9	10	1.31%
5.	Abscess	3	4	7	0.91%
6.	Periappendicitis	23	101	124	16.29%
7.	Giant cell reaction	2	1	3	0.39%
	Grand Total	42	168	210	27.59%

Table 5. Distribution of Incidental non-neoplastic findings in Appendectomy specimens

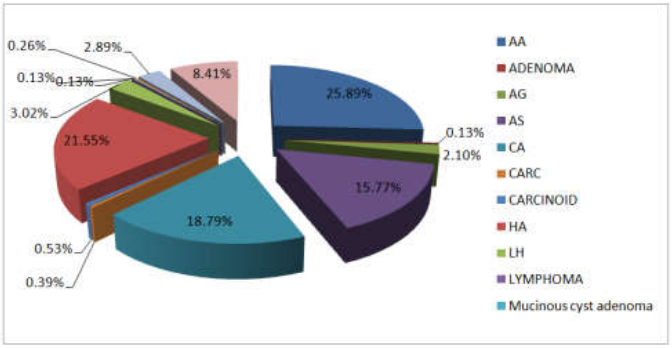
S. No.	Lesion	Female	Male	Total (n=761)	Percentage
1.	Hirshprung disease	0	1	1	0.13%
2.	Hyperplasia	0	1	1	0.13%
3.	Pseudomyxoma peritonei	0	1	1	0.13%
4.	RLH	16	25	41	5.38%
5.	Xanthogranulomatous reaction	2	0	2	0.26%
	Grand Total	18	28	46	6.04%

Table 6. Distribution of Incidental Neoplastic lesions in Appendectomy specimens

S. No.	Lesion	Female	Male	Total (n=761)	Percentage
1.	Adenoma	0	1	1	0.13%
2	Mucinouscystadenoma	0	1	1	0.13%
3.	Carcinoma	2	1	3	0.39%
4.	Carcinoid	3	1	4	0.52%
5.	Lymphoma	0	1	1	0.13%
	Total	5	5	10	0.13%



Graph 1. Decade wise distribution of Age and Sex in Appendectomy specimens



Graph 2. Distribution of various types of lesions in appendectomy specimens

In our study, 56cases of incidental (7.34%) findings were detected. 46 cases (6.04%) showed non-neoplastic unusual interesting findings. (Table-5) Maximum 41 cases (5.38%) showed reactive lymphoid hyperplasia of draining lymph node and a case each of Hirshsprung disease, hyperplasia of lining epithelium and pseudomyxoma peritonei also seen. Only 10 cases (1.314%) showed incidental neoplastic lesions(Table-6). Out of these 2 cases were benign. These were adenoma (0.13%) and mucinous cyst adenoma (0.13%) and 8 cases were malignant. Maximum 4 cases (0.52%) were of carcinoid tumour, followed by carcinoma, 2(0.26%) were adenocarcinoma and 1(0.13%) was mucinous cyst adenocarcinoma. Single case (0.13%) of MALT lymphoma was also diagnosed.

DISCUSSION

Acute appendicitis as a clinical entity was first attributed by Reginald Fitz. Afterwards Mc Burney Charles described clinical manifestations of acute appendicitis including Mc Burney's point (O'Connell, 2010). The first recorded successful appendectomy was on December 6, 1735 at St.

Figure 1. Gross pictures showing 1A-innocent appendix. 1B-mucinouscystadenoma at the tip of appendix. 1C-acute appendicitis showing marked edema and congestion. 1D-carcinoma appendix showing greyish white irregular growth. 1E-mucocele of appendix showing thinned out wall.1F-mucinous adenocarcinoma showing growth and mucin

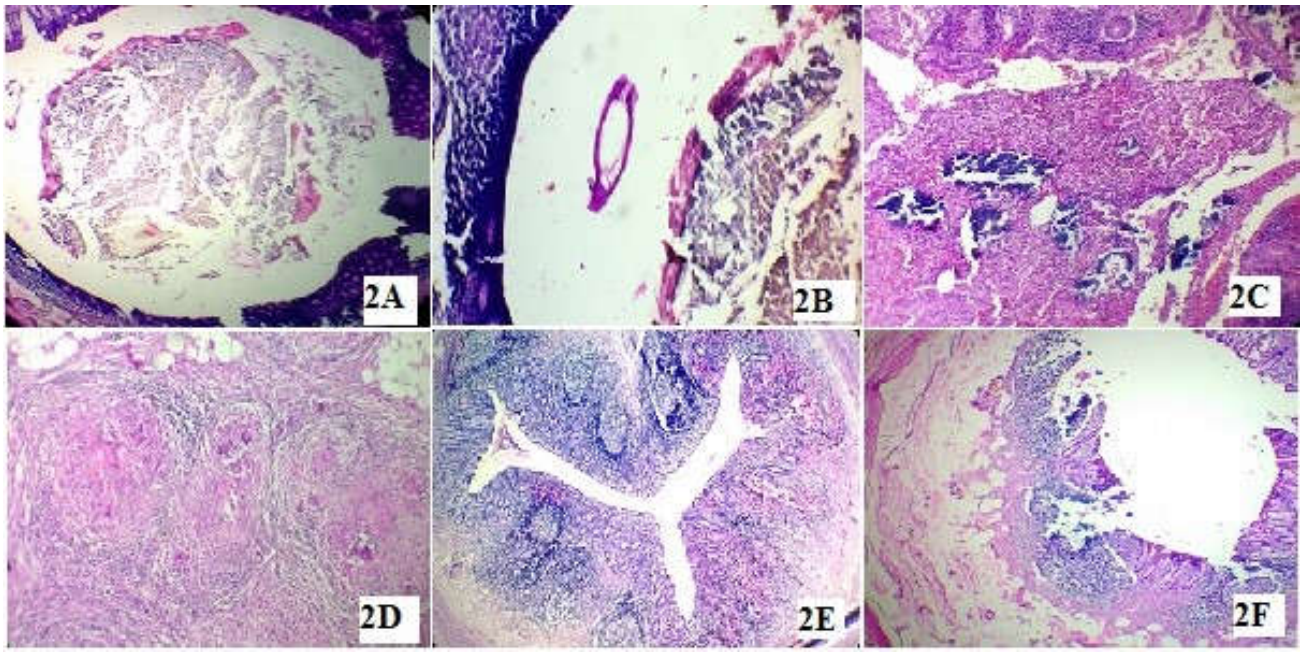


Figure 2. Microscopic Pictures of 2A-fecolith in appendix lumen. 2B-enterobius vermiformis in lumen. 2C-botryomycosis. 2D-granulomatous periappendicitis. 2E-lymphiod hyperplasia 2F-chronic appendicitis showing fat infiltration into submucosa

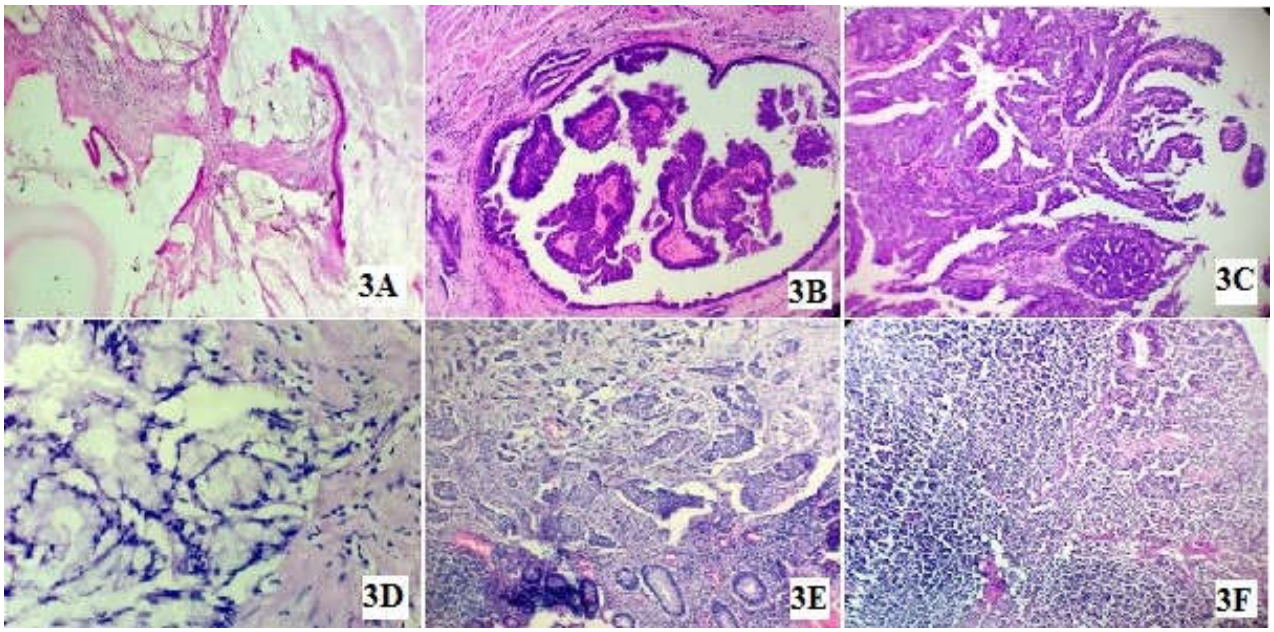


Figure 3. Microscopic pictures of 3A-pseudomyxoma peritonei showing well differentiated lining epithelium in mucin pools. 3B-adenoma of appendix showing stratified lining epithelium and acini formation without invasion. 3C-adenocarcinoma infiltrating into stroma. 3D-malignant cells in mucin pools invading into wall. 3E-carcinoid appendix showing clusters of small cells throughout the wall. 3F-lymphoma of appendix showing lymphoepithelial lesion and lymphoid infiltration in wall

George's Hospital in London. Kurt Semm, a German gynaecologist, radically changed McBurney's procedure when he performed the first laparoscopic appendectomy on May 30, 1980. Acute appendicitis has been a prevalent general surgical emergency for decades and appendectomy is amongst most frequent surgical operations, accounts for about 40% of all surgical emergencies. The incidence of appendectomy has evidently hiked nowadays because of sedentary life style and food habits (Oguntola *et al*., 2010). Incidence varies with country, race, socio-economic status, dietary habits, geographic regions, hygiene, age and season (Oguntola *et al*., 2010). Incidence of appendectomy is low 5.98% in my study as also seen by Shrestha *et al*. (2012). Approximately 7% of population will have appendicitis in their life time with peak incidence occurring between 10 to 30 years (Turner, 2010). This study showed the peak incidence in 20-30 years (33.50%) followed by 10-20 years (31.01%) Similar findings were observed by Shrestha *et al*. (2012). Males are affected more than females in ratio of 2.23:1 and Non-neoplastic lesions account for 98.6%. Similar to the study conducted by Sharma *et al*. (2014). Inflammatory lesions are the most common finding (91.064%) seen in the appendictomy patients presented with acute abdomen (Harnish K Chawda *et al*., 2015). Acute appendicitis is the most common finding accounting for

26.23% cases, followed by healing appendicitis 21.83% cases, suppuration in 15.97% cases, same as the result of Sinha *et al*. (2016). Acute suppurative appendicitis have a high propensity to rupture, hence timely diagnosis is mandatory. In this study, Lymphoid hyperplasia is seen in 23 cases (3.06%) and seen more in females as compared to males similar to the study Sinha *et al*. (2016). These cases showed a lots of reactive lymphoid follicles in whole circumference of appendix with mild sclerosis of connective tissue in submucosa causing compression of lumen, however, inflammation is absent suggesting that lymphoid hyperplasia is associated with obstructive changes, hence acute appendicitis. There are 2 (0.26%) cases of Mucocele. The overall incidence of Mucocele in the literature ranges from 0.2% to 0.7%. Most of mucoceles are asymptomatic and diagnosed incidently. 64 cases (8.521%) were unremarkable showing incidental appendectomy rate of 3.67%. Negative appendectomy rate is a well known consequence of appendicitis and rates are taken as quality marker in the appendicitis management. These patients have a longer length of stay in hospital, infection, complication and fatality rates when compared with appendicitis patients. In the current study, 36 cases (4.73%) were negative for appendicitis. These are in aggrement with the acceptable negative appendicectomy rate in single institutes of 1.7 to 7% (Webb *et al*., 2011). These were appendectomies which did not show any changes of inflammation and resected in impression of appendicitis. It can be further lowered with the use of CT Scan imaging and exploratory laparoscopy as diagnostic tool (Raja *et al*., 2010). In literature, Negative appendectomy rate is higher in females as compared to males that too in reproductive age group because of increased incidence of pelvic inflammatory diseases, ectopic pregnancy, ovarian cysts, endometriosis etc but in our study, males are more as compared to females. Negative patients should be searched and followed up to find out the real cause.

Obstruction of lumen is the culprit leading to obstruction of vascular and lymphatic drainage due to increased intraluminal pressure. Inflammatory exudation and bacterial proliferation leading to gangrene, periappendicular abscess formation and perforation in peritoneal space leads to diffuse peritonitis, a life threatening condition. Obstruction can be due to fecolith, fibrosis, worms, lymphoid hyperplasia, benign and malignant lesions etc. Our study showed fecolith in 57(7.49%) cases. Abscess formation was seen in 7(0.91%) cases reflecting delayed medical attention. Periappendicitis was seen in 124 (16.29%) cases higher as compared to the study done by sweta Sharma, *et al*. (2014) who had 7.8%. Perforation rate in our study is 1.31% comparable with other studies (Sinha and Dey, 2016). The association of pinworm infection and appendicitis was first made in the late 19 century. While the reported incidence of pinworm infections in appendectomy specimens from patients with presumed appendicitis has ranged from0.2%to 41.8%. The presence of Enterobius Vermicularis in the appendix usually produces symptoms resembling acute appendicites. In our study, EnterobiusVermicularis are seen in 8 (1.05%) cases and Botryomycosis in 1(0.13%) (Sinha and Dey, 2016). In this series, the incidence of pinworms in the appendectomy specimens was 1.05%, which is similar to the overall literature. Its a very important finding because by appendectomy only patient is not cured and anti-helmenthic treatment is required.

In our study, 56 cases of incidental (7.34%) findings were detected. These cases would have been missed if Histopathological examination was not done and patient management and outcome could have suffered. Very interesting cases of hirshsprung disease, pseudomyxoma pertoni and xanthogranulomatous reaction have been detected. Appendiceal tumors are rarely associated with manifestation of clinical symptomatology and most often recognized incidentally, either during an abdominal operation or general pathological examination of a resected appendix specimen (Hakan Yabanoglu *et al*., 2014). Carcinoid tumor is most frequently diagnosed primary malignant lesion. Although it accounts for about 60% of all appendiceal tumors, its incidence in patients undergoing appendectomy is only 0.30% to 2.27%. Most of the carcinoid tumors are located at the tip of the appendix and are < 1 cm in diameter. Carcinoids only metastasize when they exceed 1 cm. Therefore, simple appendectomy is considered sufficient management for these tumors. In our study, the incidence of appendiceal carcinoid (0.52%) was similar to that in the overall literature. Primary adenocarcinoma of the appendix is a rare tumor, with overall incidence in the literature between 0.01% and 0.20%. Adenocarcinomas generally show aggressive behavior. Another rare condition of the appendix is mucinous cystadenocarcinoma. This tumor type is usually associated with a second malignancy of the gastrointestinal tract and acute appendicitis is the most common symptom. Like the other appendix related cancers, subsequent pathological evaluation of a resected appendiceal specimen is the only way for the diagnosis of mucinous adenocarcinoma. In our series, one case each of these tumor types were diagnosed, giving an incidence of 0.13% each that is similar to that in the overall literature. Adenocarcinomas are often treated by oncologic resection with right hemicolectomy.

Conclusion

Detailed study of amassed data has yielded enlightening results about the Histopathological variety of appendectomy lesions and several rare interesting findings. As a lot of benign and malignant lesions were diagnosed in appendectomy specimens and all were incidental, it emphasises the need to examine each appendectomy specimen thoroughly so that these lesions should be diagnosed at an early stage for better outcome and patient management. To find out and correlate negative appendectomy rate which is a quality marker for an institute for accuracy of clinician's diagnostic skills in collaboration with radiological findings. Our institute has a acceptable value of negative appendectomy rate however it can be reduced further by training our skills because failure to do so not only can produce a malpractice lawsuit against the examining doctor but also markedly increases morbidity, mortality and even infertility in females in cases of perforation.

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