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Research Paper

A retrospective descriptive study based on etiology of appendicitis among patients undergoing appendectomy☆

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ABSTRACT

Objectives: Appendicitis is one of the common abdominal injuries that requires surgical intervention, appendectomy. It is associated with a number of common and uncommon etiologies including gastrointestinal diseases and infection. The aim of this study is to evaluate the etiology of appendicitis among the patients who underwent appendectomy at our center.
Method: In this retrospective descriptive study, patients who were referred to (XXX) for appendectomy were included. The patients' data was accessed to extract demographic data and histopathological findings following appendectomy. The data was analyzed using SPSSv22.
Result: Out of 733 people included in the study, 437 were male (59.6%) and 296 were female (40.4%) with the overall average age of 28.1 years. 10.64% of patients reported underwent negative appendectomy negative, which was reported in 35.89% women and 64.1% men. Acute inflammation was the most common findings, seen in 152 patients (20.74), followed by gangrenous appendix in 98 patients (13.37%).
Conclusions: Unusual findings from appendectomy is uncommon for which all appendectomy should undergo histopathological analysis.

1. Introduction

Appendectomy is one of the most commonly performed surgical procedures for acute appendicitis [1]. Despite advancements and appendectomy being one of the common surgical procedures, etiology of appendicitis is poorly known, and severity of the disease cannot be distinguished based on paraclinical, clinical and imaging modalities [2]. Acute appendicitis is the most common type of appendicitis that can be due to environmental factors, hyperplasia and fecalith [3]. Additionally, infections are also known to cause/trigger appendicitis [4,5]. Generally, it is classified based on simple and complex (perforated and gangrenous) [6,7]. 2–7% of appendicitis are reported with complex findings such abscess [1,8].

Obstruction-associated appendicitis is also known to have uncommon etiology such as amebiasis, carcinoid tumor, tuberculosis, actinomycosis, enterobiasis and ascariasis, to name a few [9–12]. The aim of this study is to investigate the etiology of appendicitis among patients undergoing appendectomy at our center. (see Figs. 1 and 2).

2. Methods

This is a cross-sectional, retrospective study which investigates the causes of appendicitis in patients undergoing appendectomy at (XXX) from 2018 to 2019. This center was selected for the sampling center because it is one of the main centers for surgical procedures in the region. All the patient referred to the center during the study period, who underwent appendectomy (any age) were included in the study. Patients with incomplete files and without pathological findings were excluded from the study.

Patients, who underwent appendectomy, medical records were accessed from the hospital's data base. The researcher used complete files to examine the causes of appendicitis according to the inclusion criteria using a surgical description sheet, case summary, pathology description, laboratory tests, ultrasound report or other diagnostic tests. Information collected in the data sheet included demographic characteristics such as age and sex, clinical parameter like the type of surgery and the cause of appendicitis (torsion,

☆ The study was approved by the ethical committee of Lorestan University of Medical Sciences (IR.LUMS.REC.1399.032). https://ethics.research.ac.ir/ProposalCertificateEn.php?id=130567&Print=true&NoPrintHeader=true&NoPrintFooter=true&NoPrintPageBorder=true&LetterPrint=true.

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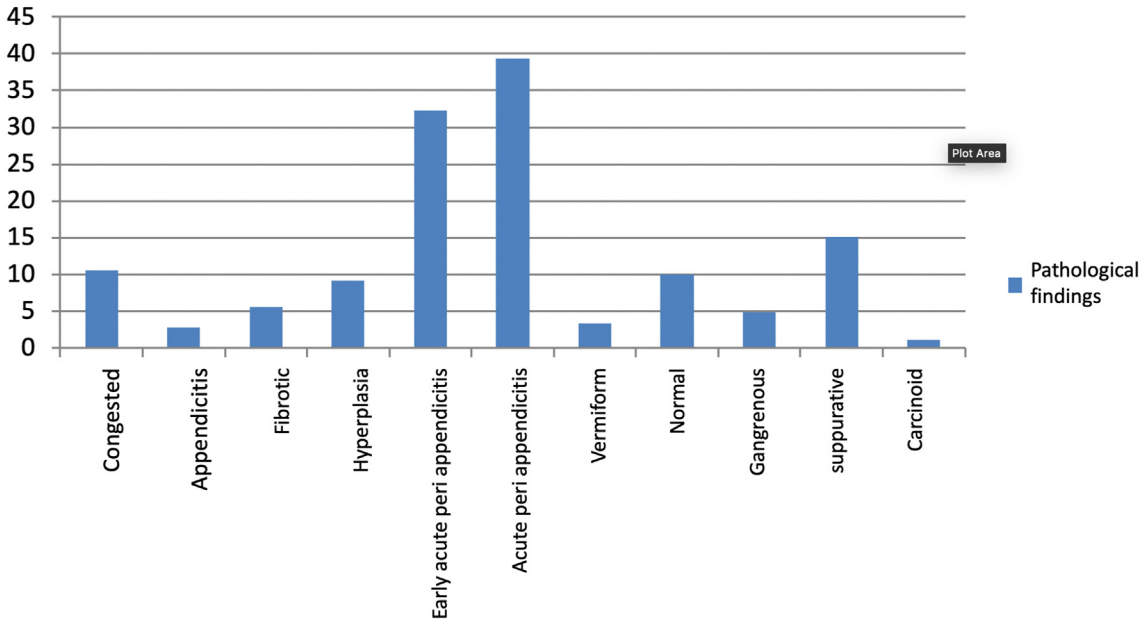

Fig. 1. Percentage of pathology findings of the studied data.

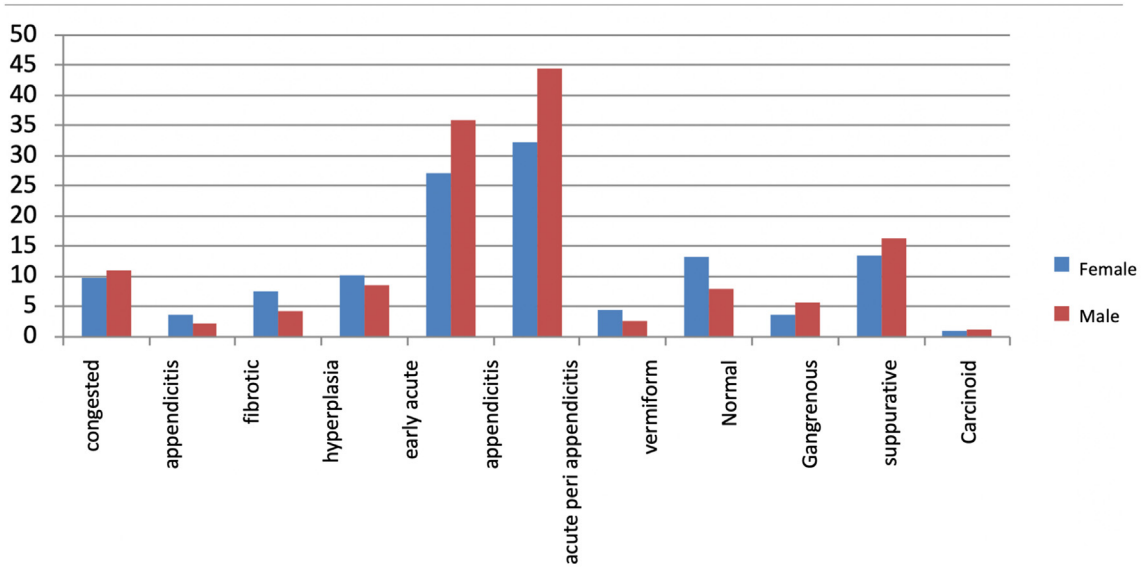

Fig. 2. Frequency of pathology findings, data examined by gender.

obstruction, parasitic infection, hypertrophy of the lymphoid tissue of the appendix wall, inflammatory diseases of the gastrointestinal tract, trauma to the abdomen.). If there was no pathology in the file from the pathology department, the file was followed up.

All the histological samples were fixed in 10% phosphate buffer formaldehyde and embedded in paraffin. For staining, hematoxylin and eosin was used and samples were observed under light microscope. For neuroendocrine tumors, immunohistochemical analysis was performed with *anti*-chromogranin A and synaptophysin antibodies using avidin-biotin complex method.

For statistical analysis, the data was entered in SPSSv22. It was presented in the form of mean, standard deviation and frequencies and the distribution of the proportionality of the results in the form of frequency tables and graphs. Significance level was considered to be $p < 0.05$.

The study was approved by the ethical committee of (XXX).

The work has been reported in line with the STROCSS criteria [13].

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3. Results

The statistical population included 733 patients whose appendicitis pathology information was obtained.

Out of 733 patients, 437 were men (59.6%) and 296 were women (40.4%) with an approximate ratio of 1.4 men per 1 woman. The mean age of the population was 28.1 years (7–89 years), Table 1.

The pathological findings showed that acute inflammation was reported in 152 patients (20.74%), gangrenous appendix in

Table 1
Frequency of sex, age and age of hospitalized data.

Variable		Number	%
Sex	Female	296	40.4
	Male	437	59.6
Age	10>	69	8.9
	10–20	183	24.9
	20–30	181	24.7
	30–40	155	21.1
	40–50	77	10.5
	50–60	26	3.5
	60<	42	5.4
Year of hospitalization	2018	406	53
	2019	327	47
Pathological findings	normal	78	10.64
	Carcinoid	95	12.96
	hyperplastic polyps	77	10.50
	mucinous cystadenomas	39	5.32
	Gangrenous	98	13.37
	Adenocarcinoma	12	1.64
	Neurofibroma	13	1.77
	eosinophilic appendicitis	10	1.36
	phlegmonous appendicitis	91	12.41
	adenocarcinoma	68	9.28
	Acute inflammation	152	20.74

98 patients (13.37%) and carcinoid tumor in 95 patients (12.96%). The gender distribution of pathological findings is reported in Table 2.

In 2018, acute appendicitis and phlegmonous appendicitis and carcinoid tumor were the most common findings among female whereas, acute inflammation and carcinoid tumor were most common males. In 2019, acute appendicitis and phlegmonous appendicitis in female and acute appendicitis and gangrenous appendix in male were the common findings.

4. Discussion

The diagnosis of appendicitis chiefly depends on patients' laboratory and radiological findings, signs and symptoms, patients' history and surgeons' experience regarding making the judgement [14]. The results of our study showed that, in both the gender acute appendicitis is the most common which was commonly reported due to obstruction, hyperplasia and fecaliths, respectively, seen from the histopathology of appendectomy patients. None of our patients were presented with microbial appendicitis or had gastrointestinal etiology like inflammatory bowel disease. Overall, approximately 60% of our patients were male and 40% were female.

Table 2
Pathological findings Data examined by gender and year.

Pathology findings	2018				2019			
	Female (162)		Male (244)		Female (134)		Male (193)	
	%	N	%	N	%	N	%	N
Nomral	9.26	15	11.89	29	9.70	13	10.88	21
Carcinoid	12.96	21	13.52	33	11.19	15	13.47	26
hyperplastic polyps	10.49	17	11.48	28	8.96	12	10.36	20
mucinous cystadenomas	4.94	8	6.56	16	4.48	6	4.66	9
Gangrenous	13.58	22	12.30	30	12.69	17	15.03	29
Adenocarcinoma	1.23	2	2.05	5	1.49	2	1.55	3
Neurofibroma	1.23	2	2.05	5	1.49	2	2.07	4
eosinophilic appendicitis	1.85	3	1.64	4	1.49	2	0.52	1
phlegmonous appendicitis	12.96	21	11.07	27	13.43	18	12.95	25
Adenocarcinoma	9.26	15	7.79	19	10.45	14	10.36	20
Acute inflammation	22.22	36	19.67	48	24.63	33	18.13	35

A number of studies have indicated that appendicitis is more common in men than women [15–17].

Limaiem, Arfa [18] conducted a study on histopathological findings of appendix samples obtained from appendectomy of 1627 patients. Most of the patients were presented with acute appendicitis (89.42%) and normal appendix (6.2%). In a retrospective study, Emre, Akbulut [14] also reported that among 1255 patients who underwent appendectomy, 94% were presented with positive appendicitis. Majority of the patients were seen with phlegmonous appendicitis, gangrenous appendicitis and perforation, respectively.

Among appendiceal carcinoma, carcinoid tumor accounts for 60% cases and is commonly presented with aggressive characteristics. In appendectomy patients its incidence is reported in 0.3–2.27% cases [19–22]. In our study, 12.96% of patients who underwent appendectomy, had carcinoid tumor.

Chandrasegaram, Rothwell [23] reported that fecaliths was the common cause of appendicitis in their study. Low fiber intake can increase fecaliths and associated risk of appendicitis [24]. Obstruction has been considered as main cause of appendicitis in several researches as a result of fecaliths [25]. Hyperplasia is a common cause of appendicitis in pediatric patients; however, our study does evaluate the data based on age groups.

Reporting rare etiologies of appendicitis in 1683 pediatric patients, Öztaş, Dursun [15] showed that acute appendicitis and phlegmonous appendicitis were the commonest findings whereas, the enterobius vermicularis, appendiceal neuroma and neuroendocrine tumor were the most common rare findings in these patients.

5. Conclusion

Our study provides a limited data, not including postoperative outcome and follow-up related data. Further studies are therefore required to evaluate postoperative and long-term outcomes associated with the pathology of appendicitis.

Appendectomy is generally effective for acute appendicitis presented with various etiologies. Appendectomy is also sufficient for benign tumor. We recommend that, despite normal appearance of appendix, the samples should undergo histochemical analysis following appendectomy in order to plan patients' management accordingly.

Provenance and peer review

Not commissioned, externally peer-reviewed.

Ethical approval

All procedures performed in this study involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

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Author contribution

Dr. Mohammad Kazem Shahmoradi: conceptualized and designed the study, drafted the initial manuscript, and reviewed and revised the manuscript.

Dr. Farshad Zarei: Designed the data collection instruments, collected data, carried out the initial analyses, and reviewed and revised the manuscript.

Dr. Mania Beiranvand and Zahra Hosseinnia: Coordinated and supervised data collection, and critically reviewed the manuscript for important intellectual content

Conflict of interest statement

The authors deny any conflict of interest in any terms or by any means during the study.

Guarantor

Mohammad Kazem Shahmoradi

Research Registration Number

Name of the registry: Lorestan University of Medical Sciences

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https://ethics.research.ac.ir/ProposalCertificateEn.php?id=130567&Print=true&NoPrintHeader=true&NoPrintFooter=true&NoPrintPageBorder=true&LetterPrint=true

Hyperlink to the registration (must be publicly accessible): N/A

Availability of data and material

Data sharing not applicable to this article as no datasets were generated or analyzed during the current study.

Consent for publication

Not applicable.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ijso.2021.100326.

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