EOSINOPHIL COUNT VARIATION AMONG HISTOPATHOLOGICAL FEATURES OF APPENDECTOMY SPECIMENS AT BIRAT MEDICAL COLLEGE TEACHING HOSPITAL

Kafle SU[1], Singh M[2], Kafle N[3], Sinha A[3]*

Affiliation

1. *Associate Professor, Department of Pathology, Birat Medical College and Teaching Hospital*
2. *Assistant Professor, Department of Pathology, Birat Medical College and Teaching Hospital*
3. *Lecturer, Department of Pathology, Birat Medical College and Teaching Hospital*

ARTICLE INFO

Received : 14 August, 2020
Accepted : 16 September, 2020
Published : 05 October, 2020

ORA 191

DOI: https://doi.org/10.3126/bjhs.v5i2.31414

**** Corresponding Author***
Dr. Santosh Upadhyaya Kafle
Associate Professor
Department of Pathology
Birat Medical College Teaching Hospital
Tankisinuwari-2, Morang
Email ID: drsantoshkafle@gmail.com
ORCID ID: https://orcid.org/0000-0002-7743-0485

Citation

Kafle SU, Singh M, Kafle N, Sinha A. Eosinophil Count Variation among Histopathological Features of Appendectomy Specimens at Birat Medical College Teaching Hospital. BJHS 2020;5(2)12: 1104-1109.

ABSTRACT

Introduction

The histopathological examination of appendectomy specimens is the gold standard method for diagnosis. The presence of eosinophil besides other inflammatory cells like neutrophils and mature lymphocytes within different histological layers of appendectomy specimens are common findings for labeling it under various groups. This finding supports the assumption that appendicitis is triggered by Type 1 hypersensitivity reaction.

Objective

To evaluate the eosinophil count variation in appendectomy specimens in patients with the clinical diagnosis of appendicitis.

Methodology

This is a cross sectional hospital based study of 144 appendectomy specimens obtained in Department of Pathology, Birat Medical College Teaching Hospital from January 2019 to December 2019. Socio-demographic data, association of histopathological patterns with age groups, gender and eosinophil count in various histopathological groups was compared and cross-tabulated using SPSS version 16.

Result

Among 144 appendectomy specimens, 73 (50.70%) were male. The predominant study population was within 15-24 years age group (36.80%). The commonest histopathological diagnosis was acute appendicitis (31.25%) with highest eosinophil count in all of its histological layers. The association of various histopathological patterns with age groups and gender were not statistically significant, whereas it revealed statistically significant correlation between eosinophil counts in all histological layers.

Conclusion

Findings suggest that the eosinophil count variation in the entire histological layers correlate well among different histopathological patterns of appendectomy specimens. This reflects the high diagnostic value of evaluating the eosinophil count in appendectomy specimens.

KEYWORDS

Appendectomy, acute appendicitis, histopathological groups, eosinophil

INTRODUCTION

The most common causes of abdominal pain along with surgical emergencies among the hospital admissions is appendicitis.[1-3] The duct obstruction which occurs either due to the feces impacted leading to blocked inside or by self-discharge may cause dilatation and inflammation of the appendix revealing acute appendicitis.[4] Most of them require emergency surgical removal followed by thorough histopathological examination and evaluation. The detail patient's history and physical examination play an important role to achieve the diagnosis.[5]

The detailed clinical evaluation and operative protocols for treating such patients is fixed and accepted widely. Whereas, the pathogenesis behind the appendicitis is still understood poorly. In this context, several blood markers including different types of inflammatory cells count within white blood cells (WBC) components may be increased in-patients with appendicitis.[6, 7] Despite all advancement in technology along with latest modalities and imaging techniques, there still exists a great dilemma in the clinical diagnosis of appendicitis.

Histopathological evaluation and examination of the appendectomy specimens thus remains the gold standard method for the diagnostic confirmation of appendicitis. However, this confirmation is gained only after the thorough histopathological evaluation of the appendectomy specimens is done. Several inflammatory cells involvement within the appendectomy specimens with the clinical diagnosis of appendicitis is proved. The mixed inflammatory cells like neutrophils, mature lymphocytes and eosinophils are observed within the different layers of the appendix confirming the final diagnosis as “appendicitis” with special entity as: acute appendicitis, acute appendicitis with periappendicitis, acute suppurative appendicitis with periappendicitis and receding appendicitis etc. With this, moreover, the different leukocytes testing revealing the elevated white blood (WBC) count may confirm the acute appendicitis before its surgical removal. Such inflammatory parameters evaluation in blood may further prevent the unnecessary cases of surgery with the reduction of negative appendectomy in number to some extent.[8] Right-sided abdominal pain proves as being the patient's key complaints for clinical diagnosis of acute appendicitis. However, the cause of acute abdominal pain in such patients remains unexplained. But, the surgical intervention undergoing for appendectomy procedure proves curative measure for it.[9] The obstruction and inflammation is implicated in the pathogenesis of acute appendicitis mostly.[10] While, fecolith and lymphoid hyperplasia is observed in only a small percentage of cases.

Microscopically, the presence of acute and chronic inflammatory cells like neutrophils and mature lymphocytes within different layers is common findings. In addition, eosinophil is also seen infiltrating different layers in appendicitis. Eosinophils are abundant in immune reactions mediated by IgE and in parasitic infections, so the eosinophilic infiltration in appendicitis supports the postulation that acute appendicitis is triggered by Type 1 hypersensitivity reaction.[11] But there exists very few such studies that might add information of eosinophil count in patients presenting as the clinical diagnosis of acute appendicitis.

This study thus aims at evaluating the spectrum of eosinophil count variation in appendectomy specimens with the clinical diagnosis of appendicitis.

METHODOLOGY

This is a hospital based cross-sectional study conducted for total of 144 appendectomy specimens that were all received for a period of one year from January 2019 to December 2019 at Department of Pathology, Birat Medical College Teaching Hospital (BMCTH), Morang, Nepal. The study permission was obtained from the institutional review committee. All consecutive appendectomy surgical specimens with the clinical diagnosis of acute appendicitis received in the department of pathology for histopathological examination within the said period were included in the study. Gangrenous, perforated appendices and appendix removed in other surgical procedures was excluded from the study due to necrosis of different layers including muscle fibers.

Hematoxylin and Eosin (H&E) stained study slides of all those specimens were taken out from the record box and archive of the department of pathology. The histopathological features of each study slide were reviewed and the microscopic findings were recorded in excel sheets. The details of the patient like age, sex and clinical diagnosis were noted as per the proforma. Based on the histopathological features: five histopathological groups were made and the eosinophil count was done in different layers as: mucosa, submucosa and muscularis propria of the appendix according to the groups made. The different histopathological groups made were as: acute appendicitis, acute appendicitis with periappendicitis, severe acute appendicitis with periappendicitis, acute suppurative appendicitis with periappendicitis and receding appendicitis. The counting of eosinophil in the mucosa, submucosa and muscularis propria was done under high power of the microscope (X40), commencing from the field in which the first eosinophil was sighted within all those layers. The average counts obtained in 10 non-overlapping high power fields were considered. The degree of eosinophil infiltration and their count in various histopathological groups were studied.The association between the different histopathological groups with the respective age groups and gender was evaluated using Pearson's chi-square test. The eosinophil cell count variation in all histological layers among various histopathological groups was compared and cross-tabulated using ANOVA Test, analyzed all by using SPSS version 16 with p-value <0.05 was considered significant.

RESULT

Out of the total 144-study sample, the male to female ratio was 1.02:1. Appendicitis was found most commonly in 15-24 years of age, shown in Table 1.

Table 1: Social demographics of the patients

Age group (years)	Frequency n (%)
0-14	28 (19.45%)
15-24	**53 (36.80%)**
25-39	40 (27.78%)
40-59	21 (14.58%)
60 and above	02 (1.39%)
Gender	**Frequency n(%)**
Male	**73 (50.70%)**
Female	71 (49.30%)

Among the different histopathological groups of appendectomy specimens studied, acute appendicitis was the most commonly detected entity with 45(31.25%) cases followed by acute appendicitis with periappendicitis of 30(20.84%) cases respectively as listed in table 2:

The increased incidence of acute appendicitis, severe acute appendicitis with periappendicitis and receding appendicitis was seen within the younger age group of 15-24 years, with more in female gender. Similarly, the maximum number of cases diagnosed as acute appendicitis with periappendicitis was observed within the age group ranging from 25-39 years with more among male gender. Acute suppurative appendicitis with periappendicitis was seen mostly within both age groups as 15-24 years and 25-39 years equally, with higher incidence among male gender. The cross tabulation between the different histopathological groups with age group and sex variation of the study population revealed the positive correlation, but was not statistically significant, as shown in table 3:

Table 2: Histopathological groups of appendectomy specimens

Histopathological groups	Frequency n (%)
Acute appendicitis	**45 (31.25%)**
Acute appendicitis with periappendicitis	30 (20.84%)
Severe acute appendicitis with periappendicitis	22 (15.28%)
Acute suppurative appendicitis with periappendicitis	29 (20.13%)
Receeding appendicitis	18 (12.5%)
Total	**144 (100%)**

Table 3: Cross tabulation between different histopathological groups with age group and sex (using Pearson's chi-square tests)

		Different histopathological groups						P-value
		Acute appendicitis	Acute appendicitis with periappendicitis	Severe acute appendicitis with periappendicitis	Acute suppurative appendicitis with periappendicitis	Receedingappendicitis	Total	
Age group (Years)	0-14	06(21.4%)	06(25.0%)	06(10.7%)	06(25.0%)	06(17.9%)	28 (100%)	0.804
	15-24	19(35.8%)	10(18.9%)	07(13.2%)	09(17.0%)	08(15.1%)	53(100%)	
	25-39	14(35.0%)	12(66.7%)	06(15.0%)	09(22.5%)	04(10.0%)	40(100%)	
	40-59	06 (28.6%)	06 (28.6%)	05(23.8%)	03(14.3%)	01(4.8%)	21(100%)	
	60 and above	0 (0%)	0(0%)	01(50.0%)	01(50.0%)	0(0%)	02(100%)	
	Total	45(31.3%)	30(20.8%)	22(15.3%)	29(20.1%)	18(12.5%)	144(100%)	
Sex	Male	19(26.0%)	18(24.7%)	11(15.1%)	17(23.3%)	8(11.0%)	73(100%)	0.502
	Female	26(36.6%)	12(16.9%)	11(15.5%)	12(16.9%)	10(14.1%)	71(100%)	
	Total	45(31.3%)	30(20.8%)	22(15.3%)	29(20.1%)	18(12.5%)	144(100%)	

The total highest mean eosinophil count was seen in acute appendicitis among all histopathological groups involving the mucosa, submucosa and muscularis propria layers (Table 4). The cross tabulation between the histopathological groups and mean eosinophil count within mucosa, submucosa and muscularispropria layers revealed statistically significant positive correlation, p-value <0.05 as in Table 5.

Table 4: The comparison of total eosinophil counts in the various layers of appendices among different histopathological groups

Histopathological groups	Number of cases	Total mean eosinophil count/sq mm		
		Mucosa	Submucosa	Muscularispropria
Acute appendicitis	45	87.46 ±26.53	42.54±14.76	20.82±6.34
Acute appendicitis with periappendicitis	30	83.79±23.59	36.13±12.99	18.91±6.31
Severe acute appendicitis with periappendicitis	22	81.63±21.40	38.18±14.79	17.98±5.80
Acute suppurative appendicitis with periappendicitis	29	81.43±20.35	34.29±9.41	18.62±5.29
Receding appendicitis	18	85.50±12.02	35.00±1.41	16.50±4.95
Gender				
Male	73	83.26±21.78	37.62±11.61	19.36±6.44
Female	71	83.92±24.14	37.70±15.26	18.52±5.60

Table 5: Cross tabulation between histopathological groups and total mean eosinophil's count (using ANOVA tests)

		Mean Square	F	p-value
Eosinophils in mucosa (Fig:1)	Between groups[+]	10802.43	47.26	**0.000***
	Within groups[++]	228.64		
Eosinophils in submucosa (Fig:2)	Between groups[+]	2706.48	24.74	**0.000***
	Within groups[++]	109.35		
Eosinophils in muscularis mucosa (Fig:3)	Between groups[+]	293.08	10.08	**0.000***
	Within groups[++]	29.05		

*the test result is significant at p<0.05, [+]between different histopathological groups, [++]between different histological layers within group

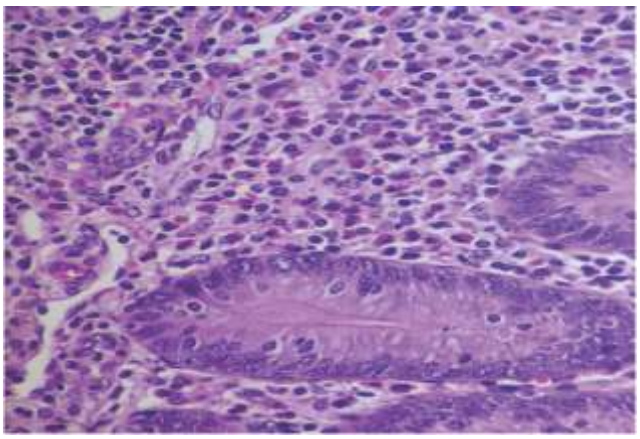

Figure 1: Microscopic features of appendicitis showing eosinophil in mucosa (40X, H&E stain)

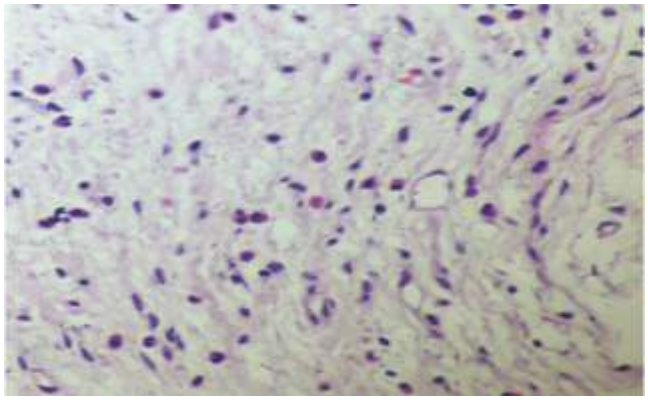

Figure 2: Microscopic features of appendicitis showing eosinophil in submucosa (40X, H&E stain)

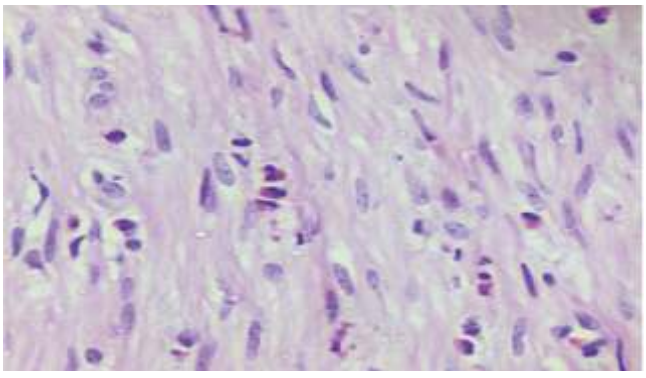

Figure 3: Microscopic features of appendicitis showing eosinophil in muscularispropria (40X, H&E stain)

DISCUSSION

Appendicitis is the most common cause of abdominal pain along with surgical emergencies among the hospital admissions.[1-3] Thus, the appendectomy becomes the most frequently performed intra-abdominal surgery. The diagnosis of appendicitis is done on the basis of clinical, radiological and pathological findings correlation. However, the histopathology examination of the appendectomy specimen remains as gold standard for diagnosis.[12] The different spectrum of the histopathological groups of appendicitis included in our study was acute appendicitis, acute appendicitis with periappendicitis, severe acute appendicitis with periappendicitis, acute suppurative appendicitis with periappendicitis and receding appendicitis. Among which, the total male to female ratio involvement was almost equal with slight increase in male cases. Male and female numbers were 73(50.70%) and 71(49.30%) respectively revealing the ratio of 1.02:1. Most of them were within the age group ranging from 15-24 years of 52(36.80%) cases, followed by 25-39 years of 40(27.78%) cases and 0-14 years of 28(19.45%) cases respectively. The highest incidence of acute appendicitis comprising 45(31.25%) cases was among the different histopathological groups of appendectomy specimens studied. Likewise, the second most common was acute appendicitis with periappendicitis of 30(20.84%) cases followed by acute suppurative appendicitis with periappendicitis and severe acute appendicitis with periappendicitis of 29(20.13%) cases and 22(15.28%) cases respectively. Whereas, the receding appendicitis comprising 18(12.5%) cases was in the least incidence among the histopathological groups of appendectomy specimens.

Study done by KolurA et al[13] revealed the recurrent appendicitis more commonly rather than acute appendicitis. But, in many other studies[14] the common histopathological groups among appendectomy specimens were acute appendicitis as in our study findings. The peak incidence of such findings was seen within the age group of first and second decade of life and the cases was declined after third decade of life. In the present study, the highest incidence of appendectomy was seen in male comprising 73(50.70%) cases. Unlike our findings, study done by KolurAet al[13]and Lee Ja[15] has such findings more in females comprising around 50.4% cases each. The different histopathological groups in our study were cross-tabulated between the age groups and sex of the patients involved in the study. The findings revealed the positive correlation between them, but were not statistically significant (Table 3).

Many studies[12] have postulated a significant rise in eosinophil's count in histopathological findings of acute appendicitis compared to normal appendices. They even have speculated that the rise in such eosinophil may be the cause of pain in histologically normal but clinically suspected acute appendicitis. In our study, the highest incidence of total mean eosinophil counted per square millimeter within mucosa, submucosa and muscularis propria was also

observed in acute appendicitis, as said earlier. Likewise, few other studies[11,12] explains that the mast cells holding a central role in Type I hypersensitivity leads in recruiting eosinophil and discharge of primary and secondary mediators of inflammation. Similarly, few study findings showed eosinophilic infiltration in muscularis propria layers of acute appendicitis and postulated that acute appendicitis is triggered by Type I hypersensitivity. Thus proving the important role of eosinophil in the pathogenesis of appendicitis.[11-13,16-19]

Our study findings showed the receding appendicitis as highest incidence after acute appendicitis of eosinophil infiltration within mucosal layers followed by acute appendicitis with periappendicitis, severe acute appendicitis with periappendicitis and acute suppurative appendicitis with periappendicitis respectively. Similarly, the mean eosinophil count in submucosa was seen mostly in severe acute appendicitis with periappendicitis after acute appendicitis followed by acute appendicitis with periappendicitis, receding appendicitis and acute suppurative appendicitis with periappendicitis respectively. The eosinophil count within the muscularis propria was mostly seen in acute appendicitis with periappendicitis after acute appendicitis followed by acute suppurative appendicitis with periappendicitis, severe acute appendicitis with periappendicitis and receding appendicitis respectively (Table 4). Likewise, a study done in Karnataka, India[22] revealed highest mean eosinophil count in the mucosal layer of acute suppurative appendicitis and lowest was seen in the muscularis propria of chronic appendicitis. The mean eosinophil count was observed mostly in the mucosal layer followed by muscularis propria and then submucosa in acute suppurative appendicitis and acute appendicitis respectively. In contrast to these findings, our study showed the transmural involvement of eosinophil as the highest number in acute appendicitis. KolurAet al[13] study showed more mean eosinophil count in acute suppurative appendicitis than acute appendicitis, which differs from ours study findings. Moreover, Aravindan KP[11] research findings were similar to our study outcomes revealing the eosinophil count more in all layers of acute appendicitis. They also suggested that the eosinophil infiltration in acute appendicitis could be an early or initial consequence of mediators released by mast cells in such inflammatory conditions. The chemotactic factors present in the mast cells granules or due to histamine released by them further enhance eosinophil to reach the site. Such postulations can be given over and matched within our study findings as well. The entire histopathological groups of appendectomy study specimen were infiltrated by eosinophil in all histological layers. Their role in pathogenesis of appendicitis can be speculated as Type I hypersensitivity reactions playing role in recruiting the eosinophil and causing mast cells degranulation resulting in discharge of primary and secondary mediators of inflammation that play important role in the pathogenesis of appendicitis.[13,21]

In a study conducted by Kolur et al[13], the highest mean eosinophil count seen in acute eosinophilic appendicitis was statistically significant, $p<0.001$. To know more about in our study, such eosinophil infiltration count over mucosa, submucosa and muscularis propria layers of all appendectomy specimens were cross tabulated individually with the different histopathological groups. The correlation thus obtained was strong and statistically significant, p-value <0.001 (Table 5). With this, our study observation seems quite close in supporting the allergic theory of appendicitis rather than the obstructive theory. However, such outcomes being alike in more other studies[21] still yields further demand on its wide and depth study.

CONCLUSION

Our findings reveal statistically significant positive correlation between the mean eosinophil count in all of the histological layers among different histopathological groups of appendectomy specimens. Eosinophil counts in all of the histological layers were high in acute appendicitis, being the highest incidence among all histopathological groups. This study thus contributes to conclude the role of eosinophil in pathogenesis of appendicitis, supporting the postulation of allergic theory.

RECOMMENDATIONS

Further study and research related to the association of eosinophil count with other allergic factors among different age groups and gender of appendectomy specimens.

LIMITATIONS OF THE STUDY

Our study would have covered and achieved more information if we had observed the total blood eosinophil count correlation as well.

ACKNOWLEDGEMENTS

We are thankful to Dr. Tara Kafle for her support in doing statistical analysis. We are also grateful to all the laboratory staff of the Department of Pathology at Birat Medical College Teaching Hospital especially Mr. Birendra Roy and Mrs Sudha Adhikari.

CONFLICT OF INTEREST

None

FINANCIAL DISCLOSURE

None

REFERENCES

1. Lau WY, Teoh-Chan CH, Fan ST et al: The bacteriology and septic complication of patients with appendicitis. Ann Surg 1984;200:576–581.DOI:10.1097/00000658-198411000-00003.
2. Bennion RS, Baron EJ, Thompson JE Jr et al: The bacteriology of gangrenous and perforated appendicitis. Ann Surg1990; 211:165–171.DOI: 10.1097/00000658-199002000-00008.
3. Chen C-Y, Chen Y-C,Pu H-N et al: Bacteriology of acute appendicitis and its implication for the use of prophylactic antibiotics. Surg Infect 2012;13(6):383–390.DOI: 10.1089/sur.2011.135.
4. Rosemart A, Kozar JI, Rosly N. Appendix. In: Schwarts SI. Principles of surgery. 10th ed. New York: McGraw-Hill. 2013;2004-93.http://72679586197292704471.
5. Rezaei E, Ghaemi M, MotamedolshareiatiM ,Rashed T. Diagnostic value of serum CRP and WBC count at diagnosis of patients with suspected acute appendicitis. J GorganUniv Med Sci. 2004;6(2):83-6.
6. Andersson RE: Meta-analysis of the clinical and laboratory diagnosis of appendicitis. Br J Surg 2004;91(1): 28–37.DOI: 10.1002/bjs.4464.
7. Lintula H, Kokki H, Pulkkinen J et al: Diagnostic score in acute appendicitis. Validation of a diagnostic score (Lintula score) for adults with suspected appendicitis. Langenbecks Arch Surg 2010;395:495–500.DOI:10.1007/s00423-010-0627-0.
8. Turner RJ. The Gastrointestinal Tract. In: Kumar V, Abbas KA, Aster CJ, editors. Robbins and Cotran Pathologic Basis of Disease. 9th edition. New Delhi: Elsevier; 2015.https://www. elsevier.com/ books/ robbins-and-cotran-pathologic-basis-of-disease/kumar/ 978-1-4557-2613-4.
9. Miettinen P, Pasanen P, Lahtinen J, Kosonen P, Alhava E (1995) The long-term outcome after negative appendix operation. Am ChirGynaecol 84:267–270.https://pubmed.ncbi.nlm.nih.gov/ 8702199/.
10. Liu C, Crawford JM (2004) The Gastrointestinal Tract, Appendix. In: Robbins and Cotran Pathologic basis of disease ED., Kumar V, Abbas K, Fausto N, editors. Saunders An imprint of Elsevier India, p 870. https://www.elsevier.com/books/robbins-and-cotran-pathologic-basis-of-disease-professional-edition/kumar/978-1-4377-0792-2.
11. Arvindan KP. Eosinophils in acute appendicitis: Possible significance. Indan J PatholMicrobiol. 1997; 40 (4):491-8.https://pubmed.ncbi.nlm.nih.gov/9444860/.
12. Singh UR, Malhotra A, Bhatia A. Eosinophils, mast cells, nerves and ganglion cells in appendicitis. Indian J Surg. 2008;70(5):231-234. DOI: 10.1007/s12262-008-0066-0.
13. Kolur A, Patil AM, Agarwal V, Yendigiri S, Sajjanar BB. The Significance of mast cells and eosinophils counts in surgically resected appendix. J InterdisciplinHistopathol. 2014;2(3):150-153.DOI: 10.5455/ jihp.20140512102819.
14. Crabbe MM, Norwood SH, Robertson HD, Silva JS.Recurrent and chronic appendicitis.SurgGynecolObstet1986; 163(1): 11-13.https://pubmed.ncbi.nlm.nih.gov/3726719/.
15. LEE JA. The influence of sex and age on appendicitis inchildren and young adults. Gut 1962; 3: 80-84.DOI: 10.1136/gut.3.1.80.
16. Nagaraj G, Das S, Venkatesha M, Lingiah HK. Acomparative study of mast cells in appendix.IntJ MedSci Pub Health. 2015;4(11):1611-1615. DOI:10.5455/ijmsph.2015.02032015330.
17. Sonti S. A study on the mast cells in appendix. J ClinDiagn Res. 2012; 6(7):1276-1279https://www.jcdr.net/ articles/pdf/2477/39%20.
18. Kothadia JP, Katz S, Ginzburg L. Chronicappendicitis: uncommon cause of chronic abdominal pain. TherapeutAdvanGastroenterol. 2015; 8 (3):160-162. DOI: 10.1177/1756283X15576438.
19. Leardi S, Delmonaco S, Minerva Chir, Ventura T,Chiominto A, DeRubeis G. Recurrent abdominal painand chronic appendicitis. Minerva Chir. 2000;55(1-2):39-44.https://pubmed.ncbi.nlm.nih.gov/10832282/.
20. Bhramaramba K, Srujana S, Ramadevi P, Kumar OS.Role of mast cells and neuronal hypertrophy in acuteappendicitis.Int Arch Integ Med. 2016;3(11): 94-102.https://iaimjournal.com/wp.
21. Mysorekar VV, Chanda S, Dandeka CP. Mast cellsin surgically resected appendices. Indian J PatholMicrobiol. 2006;49(2):229-233.https://pubmed.ncbi.nlm.nih.gov/16933721/.
22. Priya, GiriyanS.S.Study of mast cell and eosinophil count in surgically resected appendix.Trop J Path Micro 2019;5(9):728-734.DOI: https://doi.org/10.17511/jopm.2019.i09.18.