



Correlation Among Pre-Operative Diagnosis, Intra-Operative Findings and Histopathological Analysis of Acute Appendicitis

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Received: August 07, 2023

Published: August 30, 2022

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Abstract

Background: Acute appendicitis is a sudden and severe inflammation of the appendix. It can cause pain in the abdomen and this pain may occur quickly and worsen within hours. The symptoms of acute appendicitis occur suddenly and are usually severe. Those may worsen over the course of a few hours. Acute appendicitis could be due to a bacterial, viral or parasitic infection in the digestive tract, which can enlarge the tissue of the appendix wall, stools causing a blockage in the tube between the large intestine and the appendix tumors, inflammatory bowel disease, injury or trauma to the abdomen.

Aim of the Study: The aim of this study was to assess the correlation among pre-operative diagnosis, intra-operative findings and histopathological analysis of acute appendicitis.

Methods: This cross-sectional study was conducted in the department of Surgery, North East Medical College Hospital, Sylhet, Bangladesh during the period from July 2008 to June 2009. In total 100 clinically diagnosed cases of acute appendicitis were enrolled in this study as study subjects. Proper written consents were taken from all the participants before data collection. All data were processed, analyzed and disseminated by using SPSS version 16.0 program as per necessity.

Results: In this study we found statistically significant associations of sex and operative time histopathological diagnosis of acute appendicitis where the P values were 0.019 and 0.015 respectively. Besides these, there was a significant correlation of pre-operative diagnosis with luminal contents ($P < 0.0001$). The findings of this study indicated that, the pre-operative clinical diagnosis was concordance with histopathological diagnosis in 89% of cases and discordant in 11% of cases. On the other hand, the findings of this study indicated that, the clinical diagnosis was concordance with intra-diagnosis in 84% of cases and discordant in 16% of cases.

Conclusion: More than 50% male patients and one third of female patients were proved with acute appendicitis on histopathological examination which indicated statistically significant association between the sex of the patients and histopathological diagnosis. Clinical diagnosis was concordance with intra-operative diagnosis in majority of the cases, whereas clinical diagnosis was concordance with histopathological diagnosis in 89% also. We can conclude that, the surgeon should be careful about the pre-operative assessment of the cases in diagnosis of acute appendicitis and thereby minimize the number of unnecessary appendicectomy.

Keywords: Appendix; Acute Appendicitis; Appendicectomy; Abdominal Pain; Intestine

Introduction

Acute appendicitis is the most common acute abdominal condition the surgeon is called on to operate or requiring emergency surgery [1], and appendicectomy is often the first major procedure performed by a surgeon in training [2]. The incidence of appendicitis seems to have risen gradually in the first half of the century particularly in Europe, America and Australasia with 16% of the populations undergoing appendicectomy. In the recent years, the incidence has fallen dramatically such that the individual lifetime risk of appendicectomy was 8.6% and 6.7% among males and females respectively [3]. In USA about 200 thousands appendicectomy were performed annually [4]. In England 42,526 patients underwent appendicectomies in the year 2004-5 [5]. This disease is common in the young males and the majority of patients are below 30 years of age [6]. The diagnosis of appendicitis is mostly clinical and straight forward, sometimes supported by laboratory test and ultra-sonogram [6]. Despite its known clinical presentation [7], the diagnosis of acute appendicitis is quite often a diagnostic dilemma. There is great difference in presentation due to variable position and length of appendix. The rate of unnecessary appendicectomy was found 25% in our country [4]. Several attempts have been taken in multiple centers around the world to develop a diagnostic scoring system for early diagnosis and to reduce the rate of negative appendicectomy. Delay in diagnosis and surgical intervention carries a higher complication rate [6]. Appendicectomy specimens removed from the patients with suspected acute appendicitis often appears macroscopically normal but histopathological analysis of these cases may reveal a more sinister underlying pathology. The histopathological examination of the appendix served two purposes. First, it allows the diagnosis of acute appendicitis to be confirmed, especially where this is not evident intra-operatively. Second, histopathological examination may disclose additional pathologies that may not be evident on gross examination intra-operatively but may affect subsequent management of the patients [5]. In order to reduce the incidence of negative appendicectomy appropriate measures should be taken in every step in the management of appendicitis patients [8]. The present study was designed to evaluate acute appendicitis to correlate between pre-operative diagnosis, intra-operative findings and histopathological analysis of appendicectomy specimen and to find out the disparity between the pre-operative, intra-operative and histo-pathological diagnosis of acute appendicitis as well as to reduce the incidence of negative appendicectomy.

Methodology

This cross-sectional study was conducted in the department of Surgery, North East Medical College Hospital, Sylhet, Bangladesh during the period from July 2008 to June 2009. In total 100 clinically diagnosed cases of acute appendicitis were enrolled in this study as study subjects. The study was approved by the ethical committee of the mentioned hospital. Proper written consents were taken from all the participants before data collection. The whole intervention was conducted in accordance with the principles of human research specified in the Helsinki Declaration [9] and executed in compliance with currently applicable regulations and the provisions of the General Data Protection Regulation (GDPR) [10]. As per the inclusion criteria of this study, only clinically diagnosed cases of acute appendicitis of both sexes from several age groups were included. On the other hand, according to the exclusion criteria of this study, patients with recurrent appendicitis, appendicular lump and those who refused consent for operation were excluded. All the demographic and clinical data of the participants were recorded. Routine investigations like haemoglobin, total count of WBC, differential count of WBC, urine R/M/E were done in all cases. X-Ray KUB and USG of KUB and pelvic organ were done. Emergency appendicectomy were performed in all cases by maintaining a standard operating procedure. Condition of the peritoneal cavity and appendix was recorded after opening the abdomen. Position of the appendix was noted. All operated specimens were examined macroscopically, split longitudinally; content of the lumen was noted and fixing immediately in formalin prior transport to the pathology laboratory for histopathological examination. Post-operative period was followed to note any complication and mortality. In this study, the primary variables were clinical diagnosis, pre-operative diagnosis and histopathological diagnosis. On the other hand, secondary variables were age, sex, marital status, socioeconomic condition, clinical presentations, clinical findings, laboratory findings WBC count and neutrophil count. After collecting data, editing was done manually and was analyzed with the help of computer software program such as SPSS version 16.0. Mean and standard deviation were calculated for continuous data and percentage for categorical data. To test the significance, Chi-square (χ^2) test and Fisher's Exact test were applied where necessary. For all analytical tests the level of significance was $p = 0.05$ or $p < 0.05$ was considered significant.

Results

In this study, age of the patients was ranging from 15 to 59 years with the mean age of 29.06 ± 12.02 years. Thirty-four percent of the patients were from the age group of 10 - 19 years, 32% of the patients were from the age group of 20 - 29 years, 17% of the patients were from the age group of 30 - 39 years, 10% of the patients were from the age group of 40 - 49 years and the rest 7% of the patients were between the age group of 50 - 59 years. In this study, pulse rates were found as ≤ 100/min in 79% and > 100/min were found in 21% of patients. Temperature was found normal in 15% and 98.6 to 101°F in 15% of cases. Tenderness was found localized in 72% and diffused in 28 of patients. Other positive signs were muscle guard (63%), pointing sign (81%), rebound tenderness (74%), Rovsing’s sign (70%), Psoas test (65%) and Obturator test (43%). In three quarter (75%) of the patients, WBC count was more than 11,000/- mm³ of blood and in one quarter of the patients (25%) WBC count was less or equal to 11,000/mm³ of blood. Neutrophil count was more than 70% was found in 79% of the patients and in 21% cases the neutrophil count was below 70%. Clinically acute appendicitis was found in 78% and burst appendix was found in 22% of cases. In this study, in analyzing the position of appendix among participants we observed that, in two third of the patients (67%), appendix was found as retrocaecal. Besides this, pelvic was found in 30% and pracaecal, subcaecal and postileal each comprises 1% of the patients separately. As per laparotomy findings, acute inflamed appendix was found in 62% of patients, inflamed and perforated appendix in 15%, gangrenous appendix in 7% and normal looking appendix in 16% of patients. As the distribution of patient on the basis of luminal contents of appendix, fecolith was found in 33%, purulent materials in 27%, faecal material in 13%, worm in 8% and empty in 19% of patients. Histopathologically acute appendicitis was found in 89% of patients and rest 11% were with unremarkable appendix. In this study we found statistically significant association between the sex of the patients and histopathological diagnosis of acute appendicitis where the P value was 0.019. 52% married patients was diagnosed acute appendicitis histo-pathologically and 5 (5%) was diagnosed as unremarkable appendix; and 37 (37%) unmarried patients were diagnosed as acute appendicitis histo-pathologically and 6 (6%) was diagnosed as unremarkable appendix. The difference between the two groups did not reach I the level of significance (p = 0.523). In assessing the

relationship between clinical findings and histological diagnosis we observed that, there was no statistically significant association was found between the tenderness and histopathological diagnosis (p = 0.496); pointing sign and histo-pathological diagnosis (p = 0.403); muscle guard and histo-pathological diagnosis (p = 0.319); rebound tenderness, and histopathological diagnosis (p = 0.289); Rovsing sign and histo-pathological diagnosis (p = 0.082); Psoas test and histopathological diagnosis (p = 0.743); and Obturator test and histopathological diagnosis (P = 0.529). Eighty-nine (89%) patients with histopathological diagnosis of acute appendicitis 57 (57%) were operated between 8 pm to 8 am and 32 (32%) were operated between 8 am to 8 pm. The association between the time of operation of the patients and histopathological diagnosis was statistically significant (p = 0.015). In this study, fecolith was in found acute inflamed appendix in 33%, inflamed perforated appendix in 6%, gangrenous appendix in 2% and normal looking appendix in 8% of cases. Pain in the right iliac fossa in acute inflamed appendix was in 18%, inflamed perforated appendix in 3%, gangrenous appendix in 4% and normal looking appendix in 4% of cases. Epigastric pain shifted to the right iliac fossa was in acute inflamed appendix in 7%, inflamed perforated appendix in 4%, gangrenous appendix in 1% and normal looking appendix in 2% of cases. Pain in the whole abdomen was in acute inflamed appendix in 4%, inflamed perforated appendix in 2% and normal looking appendix in 2% of cases. The difference between the luminal contents and per-operative diagnosis was statistically significant (p < 0.0001). The findings of this study indicated that, the pre-operative clinical diagnosis was concordance with histopathological diagnosis in 89% of cases and discordant in 11% of cases. Moreover, the findings of this study indicated that, the clinical diagnosis was concordance with intra-diagnosis in 84% of cases and discordant in 16% of cases.

Age (In Year)	Frequency (n)	Percentage (%)
10 - 19 yrs.	34	34.0
20 - 29 yrs.	32	32.0
30 - 39 yrs.	17	17.0
40 - 49 yrs.	10	10.0
50 - 59 yrs.	7	7.0

Table 1: Age distribution of the patients (N = 100).

Variables		%
Pulse	< 100/min	79.0
	> 100/min	21.0
Temperature	< 98.6° F	15.0
	98 - 101° F	63.0
	> 101°F	22.0
Tenderness	Localized	72.0
	Diffused	28.0
Muscle guard	Present	63.0
	Absent	37.0
Pointing sign	Present	81.0
	Absent	19.0
Rebound tenderness	Positive	74.0
	Negative	26.0
Rovsing's sign	Positive	70.0
	Negative	30.0
Psoas test	Positive	65.0
	Negative	35.0
Obturator test	Positive	43.0
	Negative	57.0

Table 2: Distribution of patients according to clinical findings (N = 100).

WBC	Frequency (n)	Percentage (%)
11,000/mm ³	75	75.0
< 11,000/mm ³	25	25.0

Table 3: Distribution of patients on the basis of WBC count (N = 100).

Neutrophil count	Frequency (n)	Percentage (%)
> 70%	79	79.0
< 70%	21	21.0

Table 4: Distribution of patient on the basis of neutrophil count (N = 100).

Diagnosis	Frequency (n)	Percentage (%)
Without burst appendicitis	78	78.0
Burst appendicitis	22	22.0

Table 5: Types of appendicitis among participants (N = 100).

Position of appendix	Frequency (n)	Percentage (%)
Retrocaecal	67	67.0
Pelvic	30	30.0
Paracaecal	1	1.0
Subcaecal	1	1.0
Postileal	1	1.0

Table 6: Distribution of patients on the basis of position of appendix (N = 100).

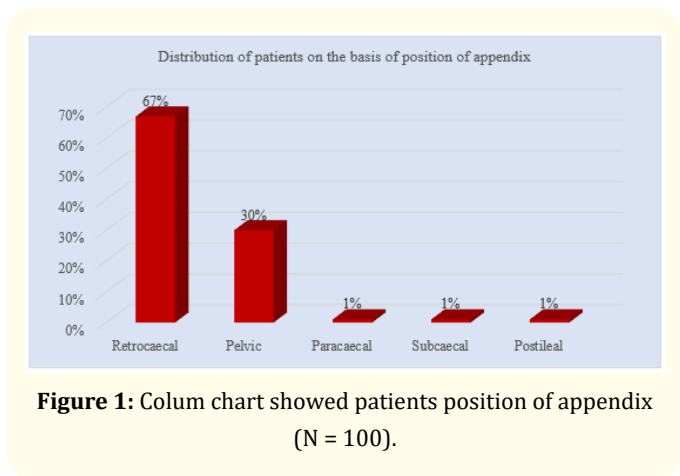


Figure 1: Column chart showed patients position of appendix (N = 100).

According to laparotomy	Frequency (n)	Percentage (%)
Acute inflamed appendix	62	62.0
Inflamed perforated appendix	15	15.0
Gangrenous	7	7.0
Normal looking	10	10.0

Table 7: Distribution of patients according to laparotomy findings (N = 100).

Luminal content	Frequency (n)	Percentage (%)
Fecolith	33	33.0
Purulent material	27	27.0
Faecal material	13	13.0
Worm	8	8.0
Empty	19	19.0

Table 8: Distribution of patient on the basis of luminal contents of appendix (N = 100).

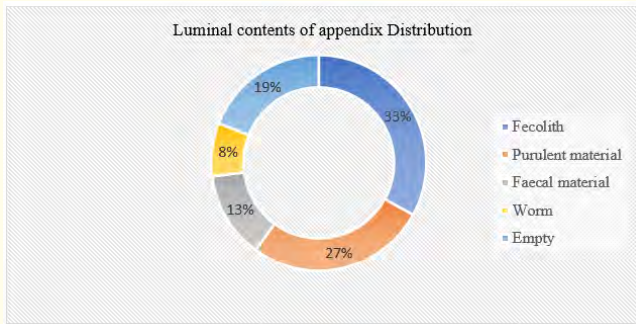


Figure 2: Ring chart showed luminal content wise patients appendix distribution (N = 100).

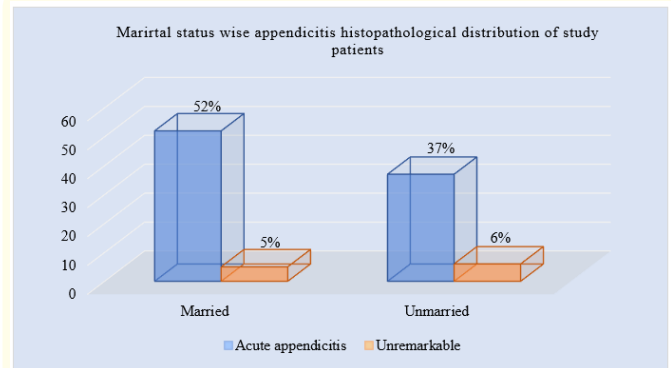


Figure 4: Bar chart showed group wise patients marital status (N = 100).

Sex	Histopathological diagnosis		Frequency (n)	P value
	Appendicitis	Unremarkable Appendix		
Male	59 (59.0)	3 (3.0)	62	0.019
Female	30 (30.0)	8 (8.0)	38	

Table 9: Association between the Sex of the patients and histopathological diagnosis (N = 100).

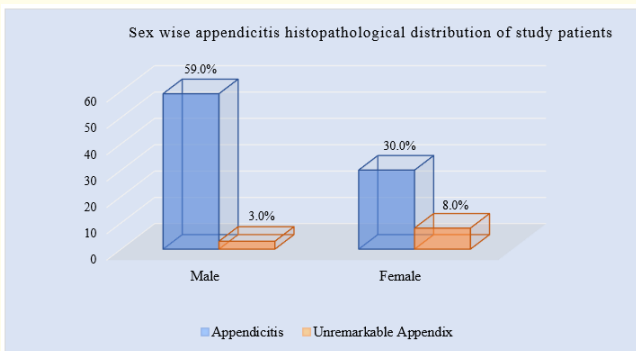


Figure 3: Column chart showed group wise patients sex distribution (N = 100).

Variables		Histopathological diagnosis		P value
		Acute appendicitis	Unremarkable appendix	
Tenderness	Localized	65 (65.0)	7 (7.0)	0.496
	Diffused	24 (24.0)	4 (4.0)	
Pointing sign	Present	74 (74.0)	7 (7.0)	0.403
	Absent	15 (15.0)	4 (4.0)	
Muscle Guard	Present	55 (55.0)	9 (9.0)	0.319
	Absent	34 (34.0)	2 (2.0)	
Rebound tenderness	Present	66 (66.0)	10 (10.0)	0.289
	Absent	23 (23.0)	1 (1.0)	
Rovsing sign	Present	65 (65.0)	5 (5.0)	0.082
	Absent	24 (24.0)	6 (6.0)	
Psoas test	Positive	57 (57.0)	8 (8.0)	0.743
	Negative	32 (32.0)	3 (3.0)	
Obturator test	Positive	38 (38.0)	6 (6.0)	0.529
	Negative	51 (51.0)	5 (5.0)	

Table 11: Relationship between clinical findings and histological diagnosis (N = 100).

Marital status	Acute appendicitis		Unremarkable		P value
	(n = 89)	%	(n = 11)	%	
Married	52	52.0	5	5.0	0.523
Unmarried	37	37.0	6	6.0	

Table 10: Association between marital status and histopathological diagnosis (N = 100).

Time of operation	Histopathological diagnosis		Total	P value
	Appendicitis	Unremarkable Appendix		
8 pm to 8 am	57 (57.0)	11 (11.0)	68 (68.0)	0.015
8 am to 8 pm	32 (32.0)	0 (0.0)	32 (32.0)	

Table 12: Association, between the time of operation and histopathological diagnosis (N = 100).

Luminal contents	Per-operative diagnosis (Appendix)				P value
	Acute	Perforated	Gangrenous	Normal	
Fecolith	18 (18.0)	8 (8.0)	7 (7.0)	0 (0.0)	< 0.0001
Purulent material	20 (20.0)	7 (7.0)	0 (0.0)	0 (0.0)	
Fecal matter	13 (13.0)	0 (0.0)	0 (0.0)	0 (0.0)	
Worm	5 (5.0)	0 (0.0)	0 (0.0)	3 (3.0)	
Empty	6 (6.0)	0 (0.0)	0 (0.0)	13 (13.0)	

Table 13: Association between Luminal contents and laparotomy diagnosis (N = 100).

Variables Acute Appendicitis		Histopathological diagnosis		Total
		Unremarkable Appendix		
Clinical diagnosis	Acute Appendicitis	.67 (67.0)	11 (11.0)	78 (78.0)
	Burst appendix	22 (22.0)	0 (0.0)	22 (22.0)
	Total	89 (89.0)	11 (11.0)	100 (100.0)

Table 14: Concordance of pre-operative clinical diagnosis and histopathological diagnosis (N = 100).

Variables Acute Appendicitis		Intra-operative diagnosis				Total
		Inflamed perforated	Gangrenous	Normal Appendix	Total	
Clinical Diagnosis	Acute Appendicitis	62 (62.0)	0 (0.0)	0 (0.0)	16 (16.0)	78 (78.0)
	Burst appendix	0 (0.0)	15 (15.0)	7 (7.0)	0 (0.0)	22 (22.0)

Table 15: Concordance of intra-operative clinical diagnosis and intra-operative diagnosis (N = 100).

Discussion

The aim of this study was to assess the correlation among pre-operative diagnosis, intra-operative findings and histopathological analysis of acute appendicitis. Age of our patients was ranging from 15 to 59 years with the mean age of 29.080 ± 1.202 years. Thirty-four percent of the patients were between the age group of 10 - 19 years, 32% of the patients were between the age group of 20 - 29 years, 17%, of the patients were between the age group of 30 - 39 years, 10% of the patients were between the age group of 40 - 49 years and 7% of the patients were between the age group of 50-

59 years. Appendicitis is a disease of young [1] and this statement was reinforced in this study in which 66% of cases occurred in the second and third decade of life. This finding was also supported by Santacrose and Ochoa (2009) [11] that acute appendicitis affects all ages, with highest incidence occurring during the second and third decades of life. In this study 62% of the patients were male and rest of the patients were female (38%). The male-female ratio was 1.63:1. This study also shows that there was statistically significant association between the sex of the patients and histopathological diagnosis (p = 0.019). This result was supported

by Gauf (2000) [12] that male was affected more often than women with a ratio 1.5 to 10. But the incidence of primary appendectomy is approximately equal in both sexes was reported by Craig (2009) [13]. This study showed that, pulse was 100/min or less in 79% and more than 100/min was 21% of patients. Temperature was normal in 15% of cases, 98.6 to 101°F in 22% and more than 101°F in 15% of cases. Tenderness was localized in 72% and diffused in 28% of patients. Other positive signs were muscle guard (63%), pointing sign (81%), rebound tenderness (74%), Rovsing's sign (70%), Psoas test (65%) and Obturator test (43%). In a study, Khan (2006) [14] found pulse was 90/min or less in 85% and more than 90/min was 15% of patients; temperature around 100°F in 90% and above 100°F in 10%; tenderness in 100% of cases, pointing sign 90%, rebound tenderness in 76%, Rovsing's sign (78%), Psoas test (70%) and Obturator test (15%). In the present study three quarter (75%) of the patients, WBC count was more than 11,000/mm³ of blood and in one quarter of the patients (25%) WBC count was less than 11,000/mm³ of blood. This study result was supported by Azad (2003) and Khan (2006) [14] where total count of WBG was more than 1000/mm³ in 66% and 67% respectively. In this study, it was found that more than 70% neutrophil count was in 79% of the patients and below 70% was in 21% of the patients. Azad (2003) [7] had also reported similar result of 88% and 12% respectively. Appendix was found retrocaecal in 67%, pelvic in 30% and pracaecal, subcaecal and postileal each comprises 1% of the patients in the current study. Other study suggest that the positions of the vermiform appendix are as follows: (a) retrocaecal passes retroperitoneally behind the caecum and ascending colon, and is the commonest type (64%), (b) pelvic tip of appendix passes downwards and medially, crosses right pelvic brim, and is this second commonest type (32%), (c) subcaecal lies below caecum and tip by the side of the ascending colon (2%), and (d) splenic or Heal type tip of the appendix passes upwards and medially in front or behind the terminal part of the ileum (pre or post Heal) 1% and 0.5% respectively reviewed Paul., *et al.* In the laparotomy findings appendix was found inflamed in 62% of patients, infected and perforated appendix in 15%, gangrenous appendix in 7% abnormal looking appendix in 16% of patients. Mahbub., *et al.* (1991) [15] found Inflamed appendix-including perforated and gangrenous in 63% of cases and normal looking appendix in 36% of cases. Khan (2006) [14] found inflamed appendix in 43% of patients, inflamed and perforated appendix in 21% gangrenous

appendix in 8% and normal looking appendix in 5% of patents. Feolith was found in 33%, purulent materials in 27%, faecal matter in 13%, worm in 8% and empty in 19% of patients in the present study as the luminal content of resected appendix. Hosain and Haq 2001 [8] found fecolith in 5%, purulent materials in 24%, faecal matter in 32%, worm in 8% and empty 25% of patients. On histopathological examination, acute appendicitis was found in 89% of patients and rest 11% was found unremarkable appendix. So, diagnostic accuracy was 89% and diagnostic error or negative appendectomy was performed in 11% of patients. This result was concordance with Law., *et al.* (1976) [16] and Singhal., *et al.* (2007) [1] that diagnostic error or negative appendectomy was performed in 11% and 10.9% respectively. But Khan (2006) [14] found diagnostic error in 28%, Azad., *et al.* (1998) [7] performed negative appendectomy in 6.3%, Hossain and Haq (2001) [8] had diagnostic-error of 7%, Silberrnan (1981) [17] performed diagnostic error in 14.7%, Mahbub., *et al.* (1991) [15] had diagnostic error in 25% of their patients.

Limitation of the Study

This was a single centered study with small sized samples. Moreover, the study was conducted at a very short period of time. So, the findings of this study may not reflect the exact scenario of the whole country.

Conclusion and Recommendation

59% male patients and 32% female patients were proved with acute appendicitis on histopathological examination indicate that statistically significant association between the sex of the patients and histopathological diagnosis ($p = 0.019$). Clinical diagnosis was concordance with intra-operative diagnosis in 84% of cases and discordant in 16% of cases, whereas clinical diagnosis was concordance with histopathological diagnosis in 89% of cases and discordant in 11% of cases. So, diagnostic accuracy was 89% and diagnostic error or negative appendectomy was performed in 11% of patients. From the outcome of this study, it is concluded that, the surgeon should be careful about the pre-operative assessment of the cases in diagnosis of acute appendicitis and thereby minimize the number of unnecessary appendectomy.

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