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A Comparitive Study of Non-Perforated and Perforated Appendicitis

Akhil Murthy

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Abstract

Introduction: Acute appendicitis is the commonest surgical emergency. The lifetime incidence of appendicitis is 6-7

Index terms—

1 Introduction

cute appendicitis is the commonest surgical emergency. The lifetime incidence of appendicitis is 6-7% and is more in males than in females with maximum incidence in 10-14 year male and 15-19 year female. 1-2 Appendicitis presents as right iliac fossa pain, nausea, vomiting, and decreased appetite. But only 50% of patients present with these classical symptoms. Hence there is delay in diagnosis.

The pathophysiology leading to appendicitis is not clear, it is likely that luminal obstruction by external (lymphoid hyperplasia) or internal (inspissated fecal material, appendicoliths) compression plays a key pathogenic role. The luminal obstruction leads to increased mucus production, bacterial overgrowth, and stasis, which increases appendiceal wall tension. Consequently, blood and lymph flow is diminished, and necrosis and perforation follow. As these events occur over time, it is conceivable that early surgical intervention prevents progression of the disease. Indeed, this notion provided the basis for the historical concept of early operation for patients with acute appendicitis.

Complications of acute appendicitis include perforation, gangrene, appendicular lump, appendicular abscess, peritonitis and sepsis.

Incidence of complicated appendicitis including perforation is about 28-29 % 3. The mortality rate of non-perforated appendicitis is less than 1 percent. Perforated appendicitis is associated with a higher mortality rate as high as five percent and may be particularly more in elderly. 4 It is believed that the perforation of appendicitis is part of pathological changes in appendix and is related to duration of inflammation from time of onset. Longer the duration of symptoms, higher the rate of perforation. Usually the delay occurs at patient ends i.e. from onset of symptoms to reporting at hospital and these results in perforation. Delay in hospital after admission is minimal and is not responsible for perforation.

The goal of surgery in appendicitis is to operate before the appendix perforates and to reduce the negative appendectomy. Negative appendectomy is surgically removed appendix which is pathologically normal. It has been in between 15 and 25 % 5 but even

Author: e-mail: akhilmurthy@gmail.com higher in women where making a diagnosis is even more difficult. The diagnosis of appendicitis should be early and accurate to reduce the negative appendectomy.

The Fitz hypothesis 6, "Treatment of acute appendicitis is appendectomy" is being challenged. The new hypothesis stating that perforated appendicitis is different entity to acute appendicitis and is age, sex, co-morbid related and depends upon virulence of bacteria. The perforation occurs as per above pathology and not due to delay of presentation of symptoms. [6][7] There is another school of thought which advocates antibiotics as the sole treatment modality for acute appendicitis. It also challenges the concept of interval appendectomy. The incidence of recurrence of acute appendicitis after non-operative management is only 13 % which is slightly higher than incidence of acute appendicitis in general population. 8 It is being believed that acute appendicitis and perforated appendicitis are two different pathologies. They need to be differentiated at the time of admission with precise clinical examination, various inflammatory markers and the use of modern radiological investigation of USG and CT scan. [9][10] Hence there is need to have prospective study to analyze the two disease entities i.e. Non-perforated appendicitis and perforated appendicitis.

2 II. Aims And Objectives a) Aim

Aim of the study was to carry out a comparative Study of clinico-pathological profile of patients undergoing emergency appendectomies and to determine the factors influencing the risk of perforated appendicitis.

3 b) Objective

4 1.

To analyze the profile of the patient, age, sex of nonperforated and perforated appendicitis. 2. To compare incidence between non-perforated and perforated appendicitis since time of onset. 3. To evaluate the role of clinical diagnosis using RIPASA SCORE between non-perforated and perforated appendicitis. 4. To evaluate the relation of inflammatory markers like leukocytosis, and serum bilirubin in diagnosis of non-perforated and perforated appendicitis. analgesics post-operatively. Oral feeds were started as soon as bowel sounds were heard. Nonperforated appendicitis were given Inj Cefotaxime 1gm IV 12 hrly for 3 days. In perforated appendicitis patient were given Inj Taxim 1gm IV 12hrly and Inj Metro 500mg IV 8hrly for 5-7days. 6. Data was collected and statistically analyzed.

5 Statistical Analysis:

Data was summed up on a spreadsheet and analysis was done using the ordinal logistic regression.

The ordinal logistic regression is a proportional odds model that determines the cumulative odds of a less favorable response compared with a more favorable response. IV.

6 Observations And Results

Table **??**: Age group p= 0.021. As P-value less than ? we may reject H 0. Hence, there is significant association between Age group and Appendicitis.

7 I

Graph reveals that, in the age group 0 -15 are 3% of appendectomies were non-perforated and 6% appendectomies were perforated. In the age group 15 -30, 41% appendectomies were non-perforated and 10 % appendectomies were perforated. In the age group 30 -45, 19% were non-perforated and 9% were perforated. In the age group 45 -60, 6% appendectomies were non-perforated and 1% appendectomies were perforated. In the age group more than 60 yrs 2% were non-perforated and 3% appendectomies were perforated. Graph reveals that, in females 34% appendectomies were non-perforated and 13% appendectomies were perforated. In males 37% appendectomies were non-perforated and 16% appendectomies were perforated. p= 0.993. There was no significant association.

8 Figure 3

Graph reveals that, 44% appendectomies were non-perforated and 18% appendectomies were perforated when diagnosed within 48 hours of onset of symtoms. In the duration greater than 48 hours 27% appendectomies were non-perforated and 11% appendectomies were perforated. Graph reveals that with a score in the range of 5 -7.5, 23% appendectomies were non-perforated and 2% appendectomies performed were perforated. In the range 7.5 -12, 48% appendectomies were nonperforated and 27% appendectomies were perforated. p= 0.000. There was a significant association in diagnosing appendicitis based on TLC counts. Graph reveals that, in the range of 5000 -10000 20% appendectomies were non-perforated and 2% appendectomies were perforated. In the range of 10000 -15000 41% appendectomies were nonperforated and 9% appendectomies were perforated.

In the range of 15000 -20000 4% appendectomies were non-perforated and 6% appendectomies were perforated. In the range of 20000 -25000 6% appendectomies were non-perforated and 12% appendectomies were perforated. Graph shows that a total of 51 cases had raised TLC in case of non-perforated appendicitis and 27 cases had raised TLC in case of perforated appendicitis.

Figure 7

Graph reveals that, in the range 0.2 -1 68% appendectomies were non-perforated and 25% appendectomies were perforated. In the range more than 1 3% appendectomies were non-perforated and 4% appendectomies were perforated. In our study there was no difference noted in the effect of pain in both the groups of patients on day 1. Pain was more evident in patients operated with perforated appendicitis on day 3 whereas decreased in case of non-perforated appendicitis.

Most common morbidity was suture site infection and seroma which was more common in case of perforated appendicitis. There was no mortality noted in our study. The above table shows the USG findings in all patients who underwent USG. The majority 67 cases had diameter $>$ 6 mm of appendix, 63 cases had target appearance of appendix and 30 cases had appendicolith on USG. 41 cases had noncompressibility. Total 90 cases were diagnosed on the basis of USG were taken for surgery. 10 cases were doubtful of appendicitis so, subjected for CT scan. p= 0.035. There is a significant association of bacteria causing appendicitis.

9 Figure 9

Graph showed that there was no growth of any bacteria in 34 patients of non-perforated appendicitis and 16 patients of perforated appendicitis. The commonest bacteria causing appendicitis was E. coli followed by streptococcus and klebsiella. I Table 14: Use of Modalities USG was done in all cases, out of which 90 cases were diagnosed positive for diagnosis of acute appendicitis i.e. 90%. RIPASA score was used in 75 cases where the score was 7.5-12 and it was 100% accurate in diagnosing acute appendicitis but with increase in complications. CT scan was done in 10 cases in which the diagnosis was confirmed. V.

Figure 12

10 Discussion

The present study was carried out to compare the clinico-pathological profile of patients undergoing emergency appendectomies and factors influencing the risk of perforated appendicitis.

Total of 100 cases were included in the study, with 71 patients being diagnosed as non-perforated appendicitis and 29 patients with perforated appendicitis of which 47 were females and 53 were male.

Age wise distribution among study group showed 51 cases within the age group of 15 to 30 yrs followed by 28 commonly in patients between 13 to 40 years. In contrast perforated appendicitis occurred with a similar incidence in all age group, irrespective of gender. This study concluded that overall perforation rate was 19%, being significantly ($p<0.0001$) higher in elderly patients and small children. There were no differences between genders in various age groups. 32,33 Our study had no difference in the male to female ratio as 59 % were males and 49 % were females.

A study conducted by Hasan Erdem et al. (**??**013) which assessed patients with suspected acute appendicitis also bore similar results. One hundred and thirteen patients with suspected acute appendicitis were included in the study. Of the 113 patients the mean age was 30.2 $\pm$ 10.1 (range 18-67) years. 29 His study had 62 male patients and 51 female patients.

The study by Marwah Karan et al. showed similar findings; out of 96 cases with Right iliac fossa pain, 71 were males and 25 were females. **??**4 In our study 44% appendectomies were nonperforated and 18% appendectomies were perforated when diagnosed within 48 hours of onset of symptoms. In the duration greater than 48 hours 27% appendectomies were non-perforated and 11% appendectomies were perforated (0.993). There was no significant association between duration of symptoms and diagnosis of appendicitis.

A similar study was conducted by Frederick Thurston Drake et. al 55 who concluded that there was no association between perforation and in-hospital time prior to surgery among adults treated with appendectomy. He also stated that perforation is most often a pre-hospital occurrence and/or not strictly time dependent phenomenon. Dominic Papandria et. Al 34 performed a study on 683 patients from 1988-2008 and concluded that a delay in appendectomy is associated with increased perforation rates for children and adults. He concluded that the perforation rate was 28.8% on day of admission, this increased to 33.3% for surgeries done on day 2 and 78.8% for day 8 ($p<0.001$). Odds of perforation increased from 1.20 for adults and 1.08 for children on day 2 to 4.76 for adults and 15.42 in children for patients admitted in hospital till 8 th day ($p<0.001$).

Tanveer Ahmed et.al 56 concluded in his study that a mean delay from onset of symptoms to surgery for perforated appendicitis is 4.2 days. He also said that patient with diabetes have more incidence of perforation of appendix.

Michael F. Ditillo et.al 35 concluded that when the interval was $<$ 12hours, the risk of developing acute appendicitis was 94% and that of perforation was 0-3%. These values changed to 60% for acute appendicitis and 30% for perforation when duration was between 48 to 71 hours. The odds for progressive pathology was 13 times higher for interval $>$71 hours compared with total interval $<$12 hours.

In our study, RIPASA score in the range of 5 -7.5, 23% appendectomies were non-perforated and 2% appendectomies were perforated. In the range 7.5 -12, 48% appendectomies were non-perforated and 27% appendectomies were perforated.

Similar findings were also observed in a study conducted by Wen Liu, Jin Wei Qiang and Rong Xun Sun (2014), who compared RIPASA and Alvarado scores with multi slice computed tomography (MSCT) for diagnosing acute appendicitis (AA). The mean RIPASA score was 11 in the Simple Acute Appendicitis group compared with other forms of Acute Appendicitis such as perforated appendicitis, gangrenous appendicitis etc. which had a score of more than 12. **??**7 Out of the 14 cases with RIPASA ?12, 12 were gangrenous/perforated appendicitis. Of the remaining two, one was found to be acute suppurative appendicitis and the other, acute appendicitis on HPE. Thus, the probability of gangrenous/perforated appendicitis was very high with a RIPASA score ?12.

Similar findings were observed in the previously mentioned study by Marwah Karan et al., who concluded that there is high possibility of finding a gangrenous appendix when the RIPASA score exceeded 12. **??**4 Among the 19 cases with RIPASA 10-11.5, there were 12 cases of suppurative appendicitis, 6 cases of acute appendicitis and 1 case of perforated appendicitis on HPE. Out of 67 cases with RIPASA 7-9.5, all were acute appendicitis on HPE. Similar findings were reported by Marwah Karan et al., who concluded that for the RIPASA scoring system, mean scores of 8.6, 10.1 and 11.9 correlated with acute appendicitis, suppurative and gangrenous appendicitis respectively.

In 15 cases with RIPASA 5-7, on active observation two cases upgraded to a score >7 while the rest were excluded from the study.

The relation of TLC and appendicitis was quite significant in our study with 51 cases of acute appendicitis and 27 patients of perforated appendicitis having leukocytosis.

These results were in accordance with study by Yang et al 58 including high association between TLC and acute appendicitis (Chi-square= 12.80, P< 0.0001).

On correlating TLC with HPE positive and negative cases it was found that the sensitivity and specificity of the TLC count was 80.9% and 75%. It was comparable with the studies done by Hoffmann 38 (81-84%) Peltola 59 (76%) Marchand 61 (81-84%) Yang 58 (71.4%) indicating high association between TLC count and acute appendicitis (p= 0.011439>0.025).

Our study had no significant association in relation to serum bilirubin markers and diagnosis of appendicitis.

11 I

This was comparable in a study done by Broker M.E.E et.al who performed a study on 498 patients and concluded that there was no significant association of serum bilirubin and diagnosis of appendicitis.

In our study, all patients underwent USG of which a majority of 67 cases had diameter > 6 mm of appendix, 63 cases had target appearance of appendix and 30 cases had appendicolith on USG. 41 cases had non-compressibility. Total 90 cases were diagnosed on the basis of USG were taken for surgery. 10 cases were doubtful of appendicitis so, subjected for CT scan.

P. Antonopoulos et al (2006) demonstrated the usefulness and validity of spiral CT in the evaluation and diagnosis of acute gangrenous appendicitis. Common imaging finding in all patients that were examined by spiral CT was the enlargement of the appendix >6mm, intraluminal air-bubbles and calcified faecoliths, the wall of the inflamed appendix was demonstrated abnormally thin and thickening of the appendiceal wall. **??**2 Similar finding were seen in a study conducted by Sachar Sudhir, (2013) the main USG features for diagnosing acute appendicitis were an incompressible appendix with a transverse outer diameter of >7 within compressible periappendicular inflamed fat with or without an appendicolith. **??**3 In a study by Hussain S, Rahman A, Abbasi T, Aziz T (2014) established diagnostic accuracy of Ultrasonography (USG) in acute appendicitis taking histopathology of removed appendix as the gold standard. Results showed out of 60 patients for whom USG of right lower quadrant was performed, 30 patients were correctly diagnosed as having acute appendicitis on USG. USG has sensitivity of 88%, specificity of 92%, and positive predictive value of 94%. **??**4 Sinan Cakirer, Muzaffer Basak, Bulent Colakoglu, Mujdat Bankaoglu (2002) determined the sensitivity, specificity, and diagnostic accuracy of helical computed tomography (CT) in confirming the diagnosis of acute appendicitis. Results yielded a sensitivity of 94.7%, a specificity of 91.7%, a positive predictive value of 96.7%, and a negative predictive value of 86.8%. **??**65] **??**66] In our study there was no difference noted in the effect of pain in both the groups of patients on day 1. Pain was more evident in patients operated with perforated appendicitis on day 3 whereas decreased in case of non-perforated appendicitis.

Most common morbidity was suture site infection and seroma which was more common in case of perforated appendicitis. There was no mortality noted in our study.

A similar study was done by Paul G. Blomqvist et.al and the results were similar with low incidence of mortality or morbidity. There was a higher risk of morbidity in cases with perforated appendicitis with commonest being wound infection. **??**8 In our study, non-perforated appendicitis yielded no growth of any bacteria in 34 patients and in 16 patients of perforated appendicitis. The most common bacteria associated with appendicitis were E. coli, followed by streptococcus and klebsiella in perforated appendix.

A similar study was performed by V. K. E. LIM et.al E. coli was found to be the most commonly encountered organism. This was followed in order of decreasing frequency by streptococci, Bacteroides species, Klebsiella Enterobacter group and Pseudomonas aeruginosa. From the results of the antibiotic sensitivities an antibiotic regimen comprising of a combination of gentamicin, metronidazole and penicillin is recommended as appropriate chemotherapy in perforated appendix. **??**9 Bennion R S et.al performed a study on 30 patients and concluded results similar to our study with the commonest bacteria associated as E. coli. **??**0 VI.

12 Conclusion

In a study of 100 cases, 71 cases were nonperforated and 29 cases were perforated appendix. The most common age group being 15-30 years.

There was a significant association in diagnosis of perforated and non-perforated appendicitis based on TLC.

The factors which influenced diagnosing perforated appendicitis were age, TLC, increase time duration, RIPASA score >10, bacterial association.

Perforation was not associated with elapsed time to hospital presentation among adult patients admitted for appendectomy across a large number of diverse hospitals. Our findings are consistent with the hypothesis that perforation is more often a prehospital event and that delays in presentation confer increased risk.

RIPASA score is a fast, simple, reliable, noninvasive, repeatable and safe diagnostic modality without extra expense. It is very handy in peripheral hospitals (rural India) where back up facilities like USG scan or CT scan is not available. It can be very helpful for junior doctors provided it is applied purposefully and objectively

in patients of abdominal emergencies. The application of this scoring system improves diagnostic accuracy and consequently reduces negative appendectomy and thus reduces complication rates. Thus we recommended use of RIPASA scoring system in rural hospitals were other diagnostic modalities are not available. They have been used as separate modalities but never in adjunct to each other. So these modalities were used to determine the factors influencing the risk of perforated appendicitis.

Materials and methods: 100 cases of pain in right iliac fossa, which were operated for acute appendicitis were included in the study. The cases which were managed conservatively, appendicular lump and abscess were excluded from the study.

13 Results:

The mean age for perforated appendicitis was 28.65 ± 15.64 as compared to that of non-perforated appendicitis was 28.92 ± 11.40. TLC >15,000 was a high indicator for perforation. 8 patients had perforated appendix with a RIPASA score greater than 12. USG was a good modality for diagnosis with 90% sensitivity and CT scan when performed diagnosed appendicitis. E. coli was the most common bacteria causing appendicitis in 28 patients. The most common immediate post-operative complication was pain and delayed complication being suture site infection in cases of perforated appendicitis. There was no death recorded in our study. Conclusion: There was no association between perforation and delay in presentation to hospital among patients treated with emergency appendectomy. RIPASA score is a better diagnostic score in comparison to other scoring modalities. The factors which influenced diagnosing perforated appendicitis were age, TLC, increase time duration, RIPASA score >10, bacterial association. [1] [2]

5

Figure 1: 5 .

[1] © 2018 Global JournalsA Comparitive Study of Non-Perforated and Perforated Appendicitis
[2] © 2018 Global Journals

Figure 2:

Figure 3:

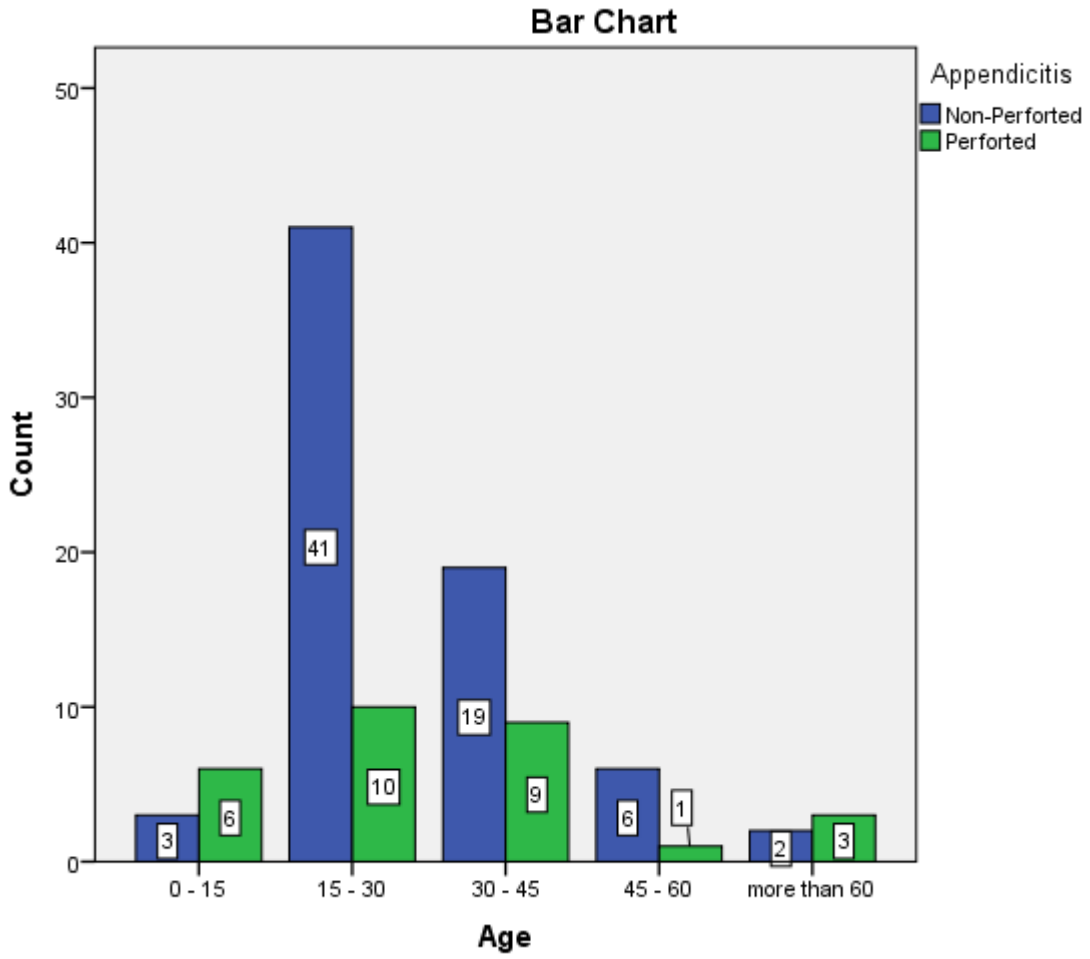

Bar Chart
Appendicitis
Non-Perforted
Perforted
Count
50
40
30
20
10
0
3
6
41
10
19
9
6
1
2
3
0 - 15
15 - 30
30 - 45
45 - 60
more than 60
Age

Figure 4:

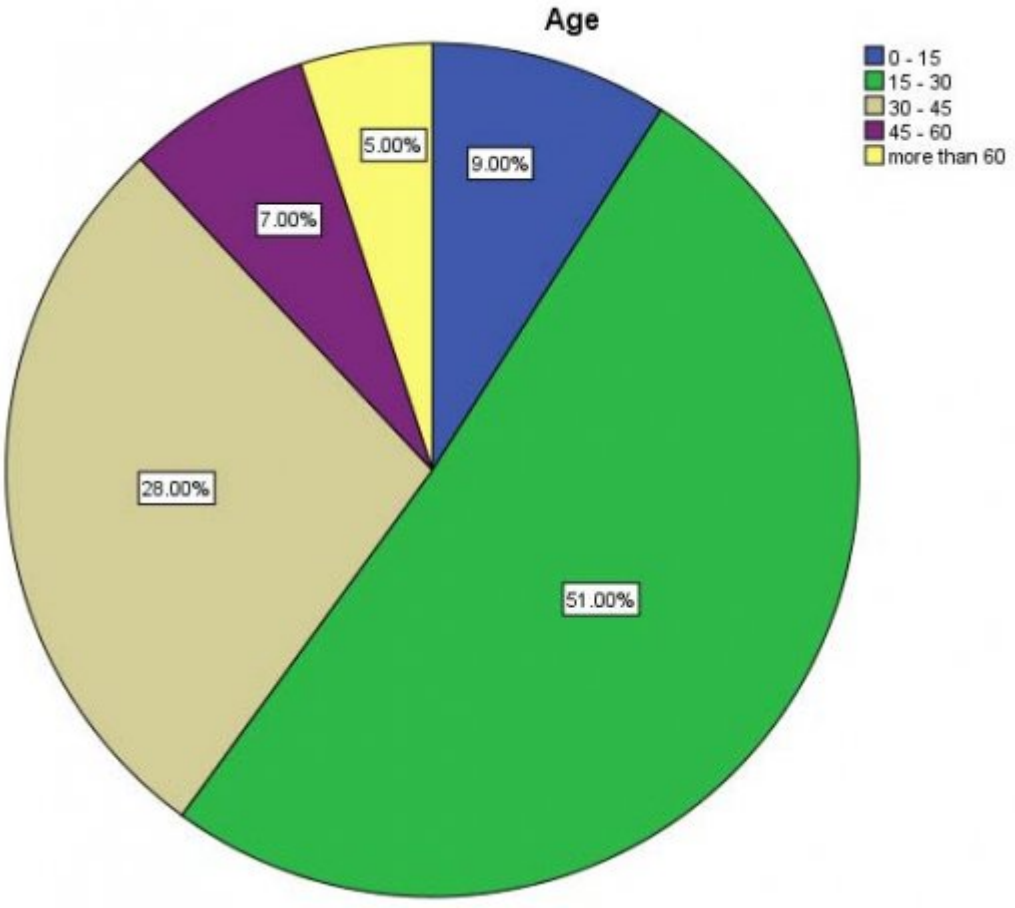
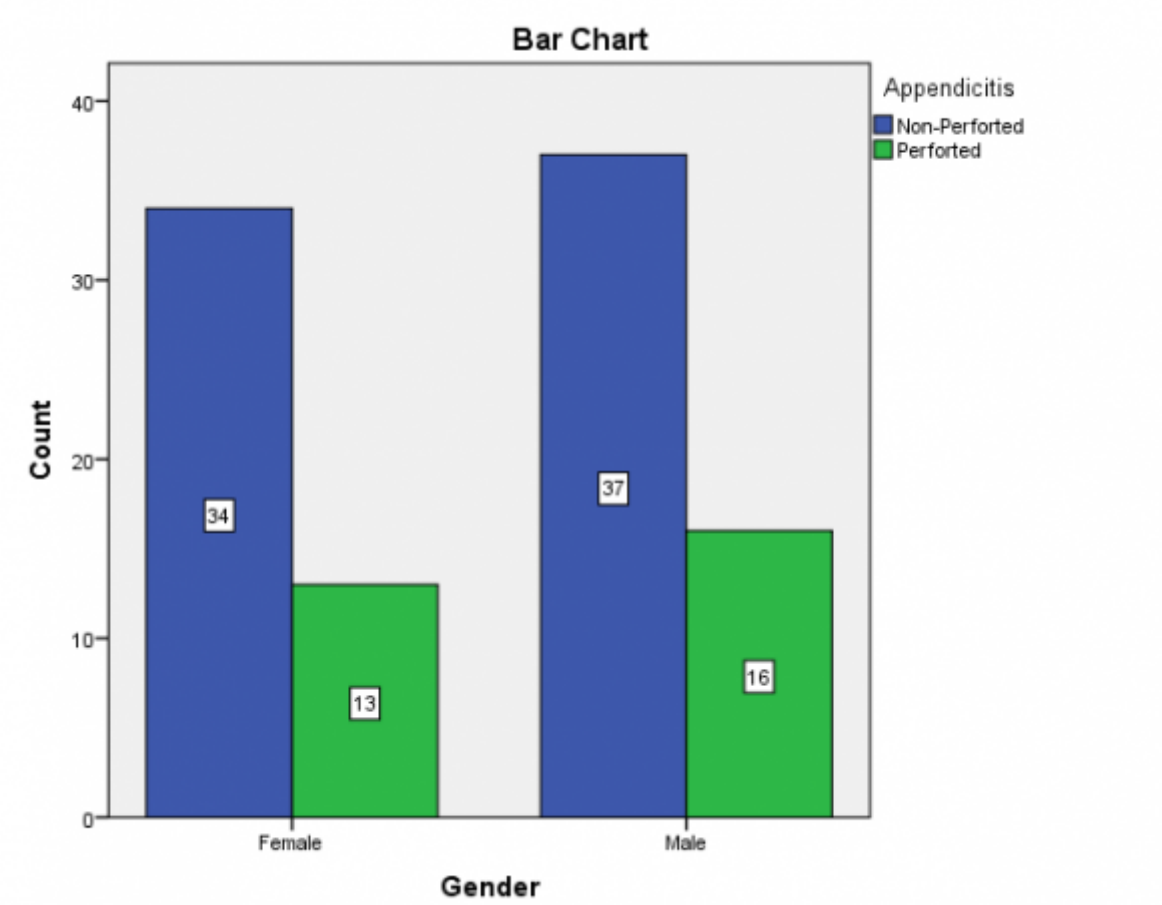


Figure 5:


Bar Chart
Appendicitis
Non-Perforted
Perforted
Count
40
30
20
10
0
34
13
37
16
Female
Male
Gender

1

Figure 6: 1 A

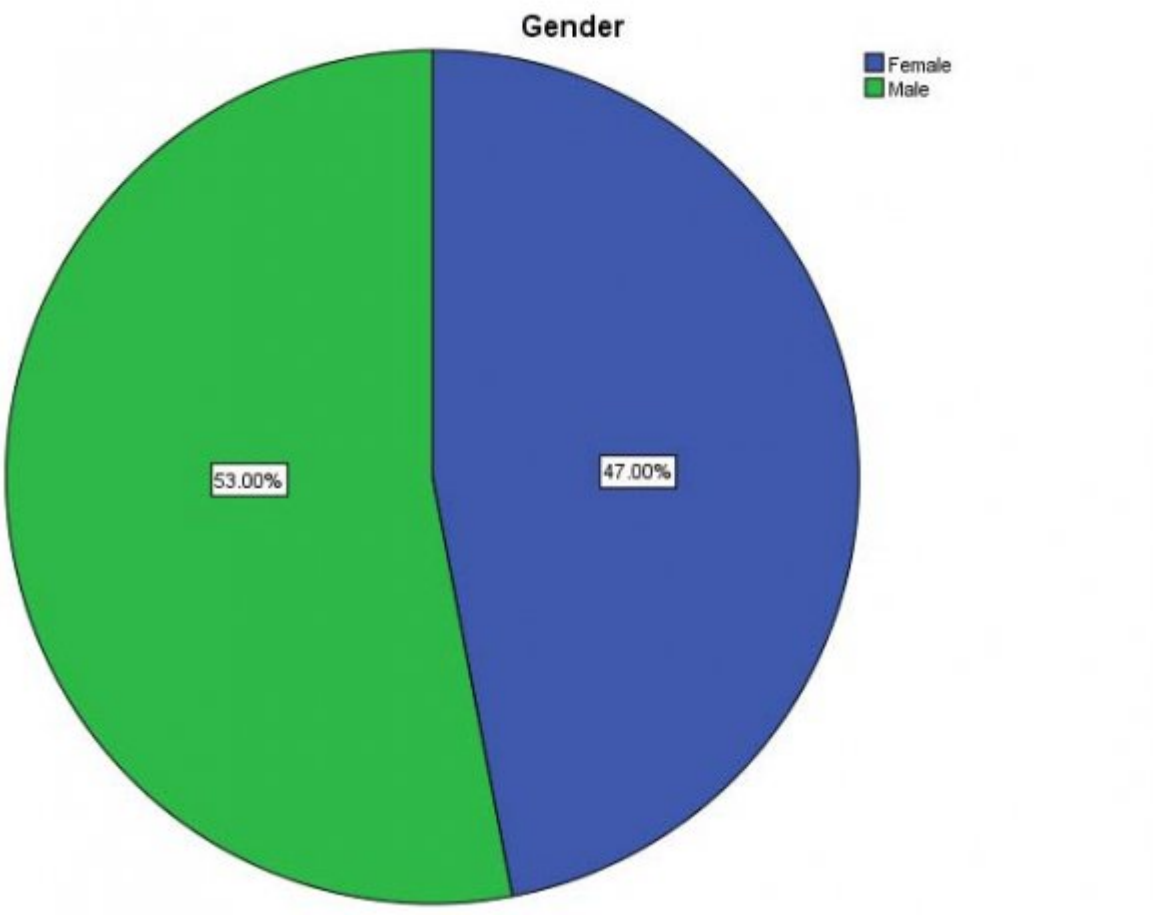


Figure 7: Figure

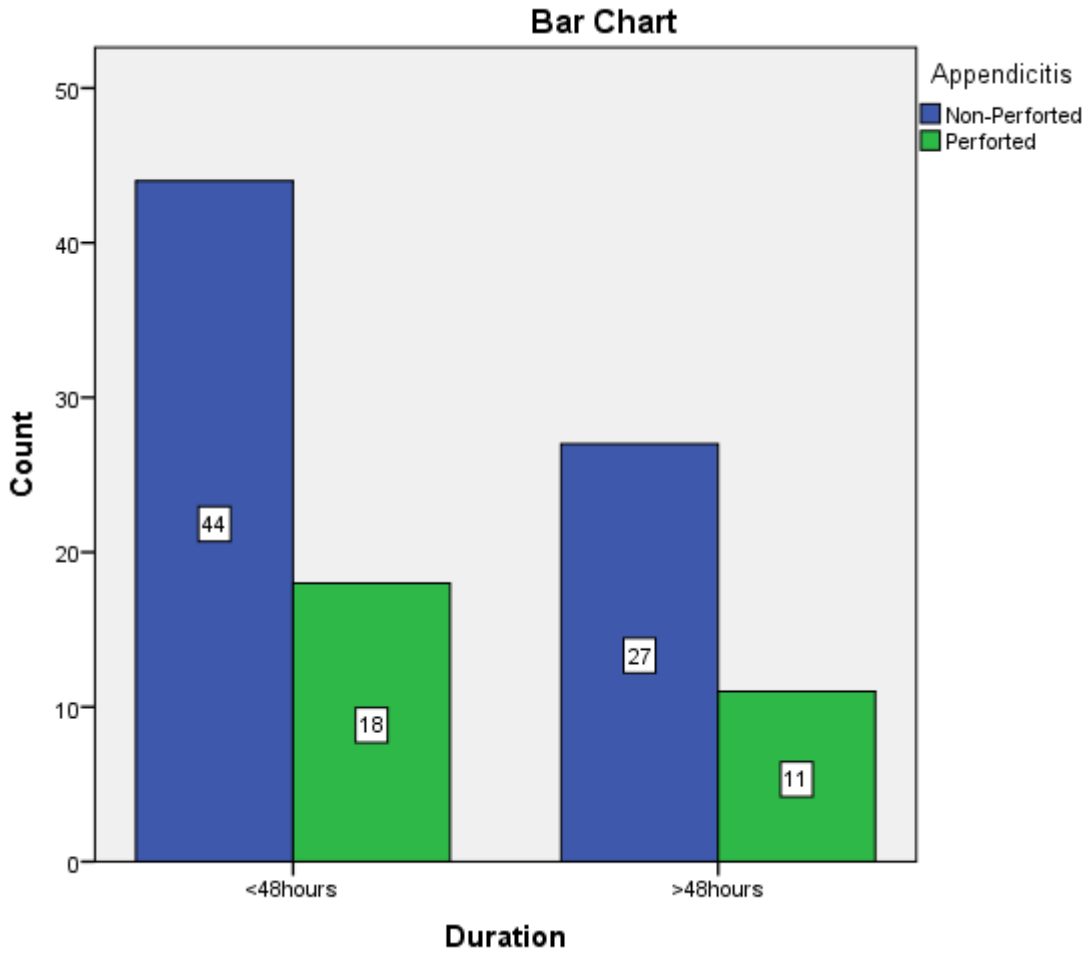
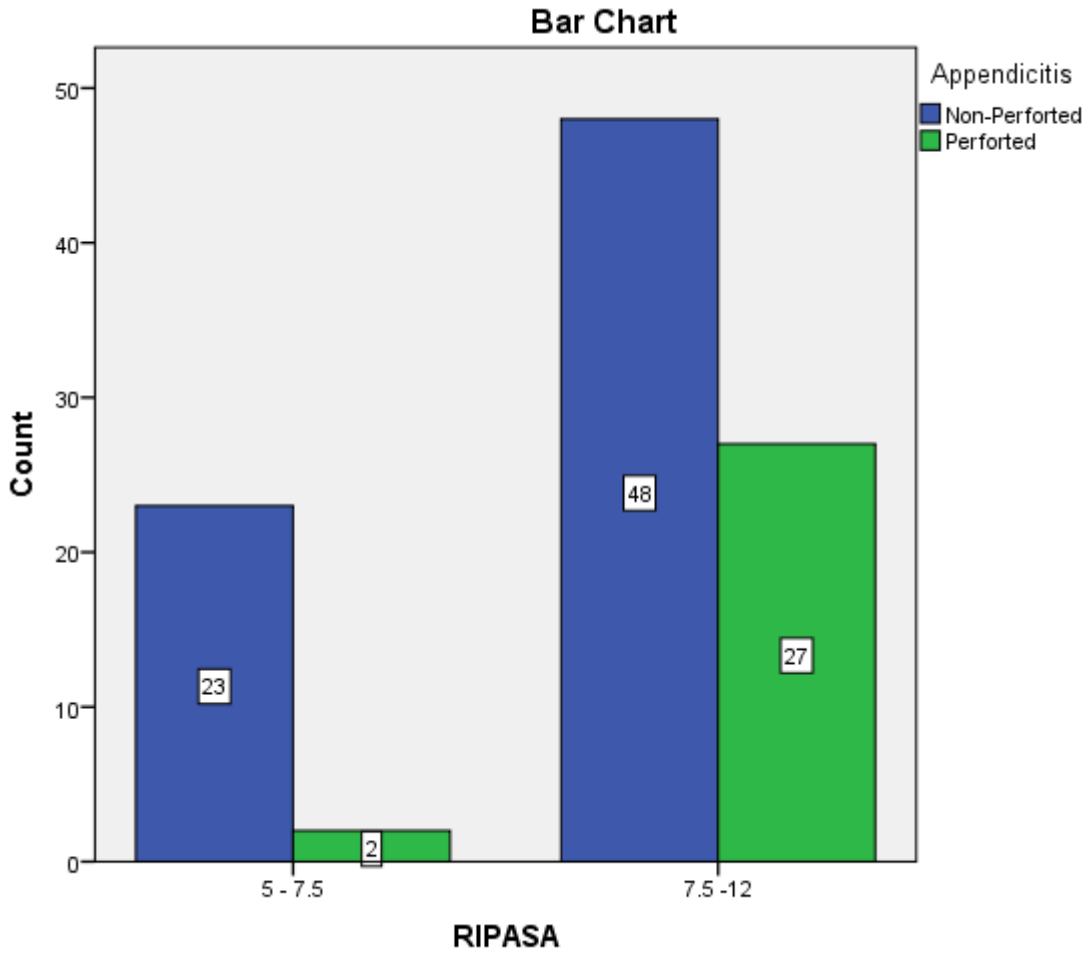

Bar Chart
Appendicitis
Non-Perforted
Perforted
Count
50
40
30
20
10
0
44
18
27
11
<48hours
>48hours
Duration

Figure 8: I


Bar Chart
Appendicitis
Non-Perforted
Perforted
Count
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40
30
20
10
0
23
2
48
27
5 - 7.5
7.5 -12
RIPASA

Figure 9:

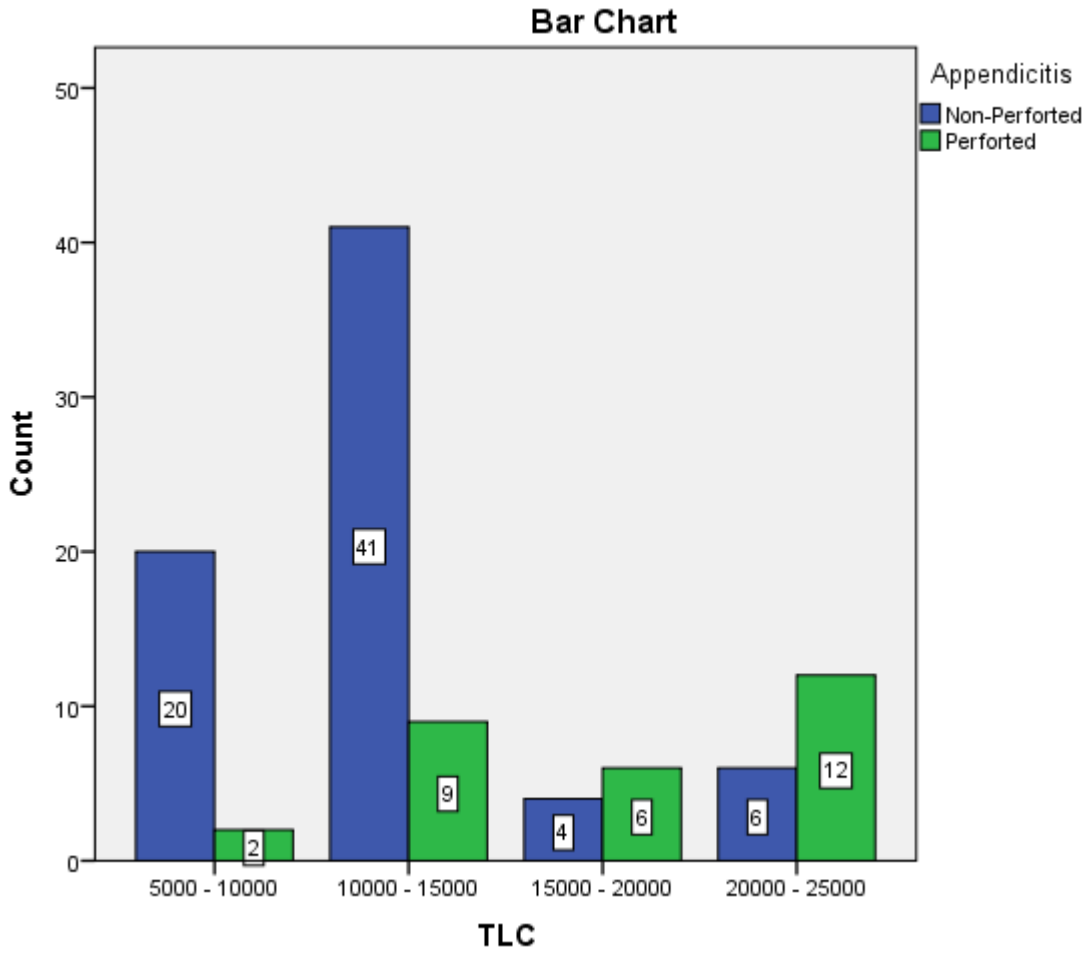

Figure 10:

2

		Appendicitis Non-Perforated Perforated		Total
Gender	Female	34 37	13 16	47 53
	Male			
Total		71	29	100

[Note: p= 0.781. There is no significant association.]

Figure 11: Table 2 :

3

		Appendicitis Non-Perforated	Perforated	Total
Duration	<48hours	44 27	18 11	62 38
	>48hours			
Total		71	29	100

Figure 12: Table 3 :

4

		Appendicitis Non-Perforated	Perforated	Total
RIPASA	5 -7.5 7.5 -12	23 48	2 27	25 75
Total		71	29	100

p= 0.008. There was a significant association in diagnosis of appendicitis using RIPASA score.

Figure 13: Table 4 :

5

		Appendicitis Non-Perforated	Perforated	Total
TLC	5000 -10000	20	2	22
	10000 -15000 15000 -20000	41 4	9 6	50 10
	20000 -25000	6	12	18
	Total	71	29	100

Figure 14: Table 5 :

6

Figure 15: Table 6 :

7

		Appendicitis Non-Perforated	Perforated	Total
LFTS	0.2 -1 More than 1	68 3	25 4	93 7
	Total	71	29	100

[Note: p=0.089. There was no significant association between LFTs and diagnosis of appendicitis.]

Figure 16: Table 7 :

8

Figure 17: Table 8 :

9

USG finding	No. of cases	Percentage (n=100)
Diameter>6mm	67	67
Non compressible	41	41
Wall layer oedema	12	12
Target appearance	63	63
Appendicolith	30	30

Figure 18: Table 9 :

Days/ Complication	Day 1 Non-Perforated	Perforated	Day 3 Non-Perforated	Perforated	Day 5 Non-Perforated	Perforated
Pain (VAS)	71	29	24	16	Resolved	Resolved
Nausea	8	12	Resolved	5	Resolved	Resolved
Vomiting	4	8	Resolved	Resolved	Resolved	Resolved
Seroma	Not elicited	Not elicited	9	12	5	16
Suture Site Infection	Not elicited	Not elicited	Nil	8	Nil	5

Figure 19:

10

Bacteria	Non-Perforated	Perforated	Total
No growth	34	16	50
E. coli	21	7	28
Streptococcus	13	3	16
Klebseilla	-	3	3
Total	71	29	100

Figure 20: Table 10 :

11

			Bacterial Association	
	60			
Year 2018	30 40 50			
14	20			
Volume XVIII Issue IV Version I (D D D D) I	0 10	No growth	E.coli Non-perforated	Streptococcus Perforated
		Operation pro-ce-dure	Non-perforated	
Medical Research	Open Appendectomy Right Hemicolectomy Open Appendectomy with purse string sutures Tota			
Global Journal of	0 20 40 60 80			
		Open Ap-pen-dec-tomy	Right hemicolectomy	
			Non-perforated	Perforated
			Figure 10	
	All patients underwent emergency open appendectomy. 2 patients of perforated appendicitis required conversion of surgery to right hemicolectomy			due to caecal perforation. 2 patients co with purse-string sutures.

Figure 21: Table 11 :

12

HPE	No. of cases	Percentage
Acute appendicitis	71	71
Perforated appendicitis	22	22
Gangrenous appendicitis	7	7
Total	100	100

Figure 22: Table 12 :

13

RIPASA score	Non-Perforated	HPE Perforated	Total
?12	5	8	13
<12	66	21	87
Total	71	29	100

Figure 23: Table 13 :

15

	No. of cases	Percentage
Non-perforated appendicitis	71	71
Perforated appendicitis	29	29
Total	100	100

Figure 24: Table 15 :

Modality	Cases done	No. of cases positive
RIPASA score 7.5>12	75	75
USG	100	90
CT scan	10	10

Year 2018
16
Volume XVIII Issue IV Version I
29 Outcome of cases 71
D D D D)
(
Medical Research

	Non-Perforated	Perforated

Global Journal of

[Note: The incidence of non-perforated appendicitis varied among the age groups, occurring most]

Figure 25:

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[Seymour and Schwartz] , I Seymour , Schwartz .

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