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A Comparative Study of Non-Perforated and Perforated Appendicitis

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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.

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A Comparative Study of Non-Perforated and Perforated Appendicitis

Akhil Murthy

I. INTRODUCTION

Acute 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

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.

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.

b) Objective

1. To analyze the profile of the patient, age, sex of non-perforated 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.

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5. To evaluate the role of Ultrasound imaging and CT scan (when performed) in non-perforated and perforated appendicitis.
6. To analyze the outcome of morbidity and mortality between non-perforated and perforated appendicitis.
7. To analyze the various bacteria's associated in non-perforated and perforated appendicitis.

III. MATERIALS AND METHODS

a) Materials

- i. *Type of study:* Prospective & Comparative study.
- ii. *Place of study:* Dr. D Y Patil Medical College and Hospital and Research Centre, Pimpri, Pune-18.
- iii. *Period of study:* July 2015 To September 2017.
- iv. *Sample Size:* Total 100 cases.

v. Inclusion criteria

All patients operated for acute appendicitis by open appendectomy.

vi. Exclusion criteria

- Patients on conservative management.
- Cases of appendicular abscess, lump.

Institutional ethical committee clearance was taken prior to the study.

b) Methods

Informed and written consent of all the patients was taken before including them in the study (Appendix I)

Consent for surgery (Appendix II)

Plan of study:

1. All patients with pain in RIF were admitted.
2. History and physical examination were done and findings recorded in proforma attached (Appendix III)



Gangrenous appendicitis with appendicoliths



Gangrenous appendicitis



Cut open specimen of appendix with appendicolith

3. The secretions of appendicular lumen was sent for bacteriological examination.
4. Histopathology were classified as follows:
 - a) Normal appendix
 - b) Acute appendicitis
 - c) Gangrenous appendicitis
 - d) Perforated appendicitis
5. Patients were treated with IV fluids, antibiotics and analgesics post-operatively. Oral feeds were started as soon as bowel sounds were heard. Non-perforated 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.

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. OBSERVATIONS AND RESULTS

Table 1: Age group

		Appendicitis		Total
		Non-Perforated	Perforated	
Age	0 – 15	3	6	9
	15 – 30	41	10	51
	30 – 45	19	9	28
	45 – 60	6	1	7
	More than 60	2	3	5
Total		71	29	100

$p = 0.021$. As P-value less than α we may reject H_0 . Hence, there is significant association between Age group and Appendicitis.

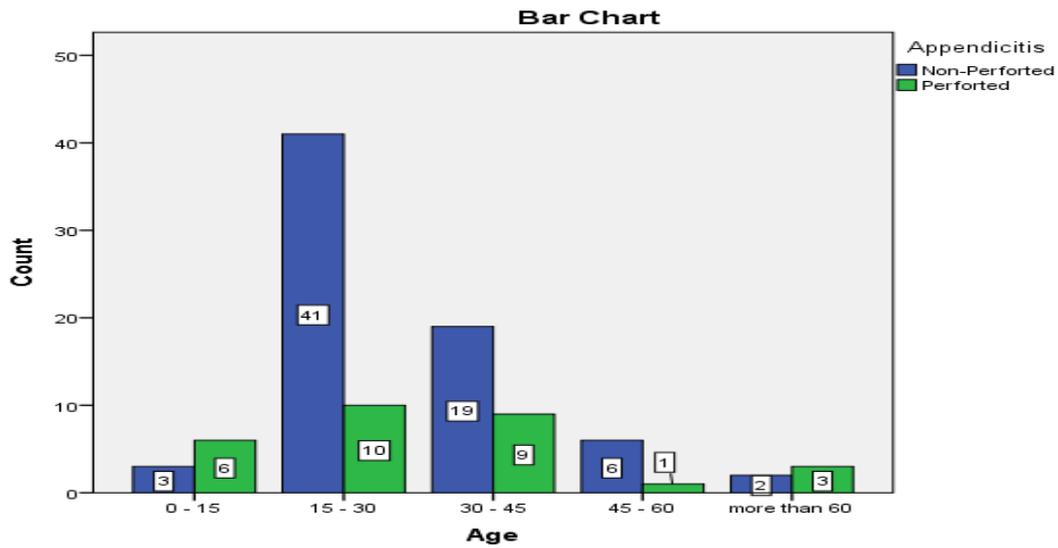
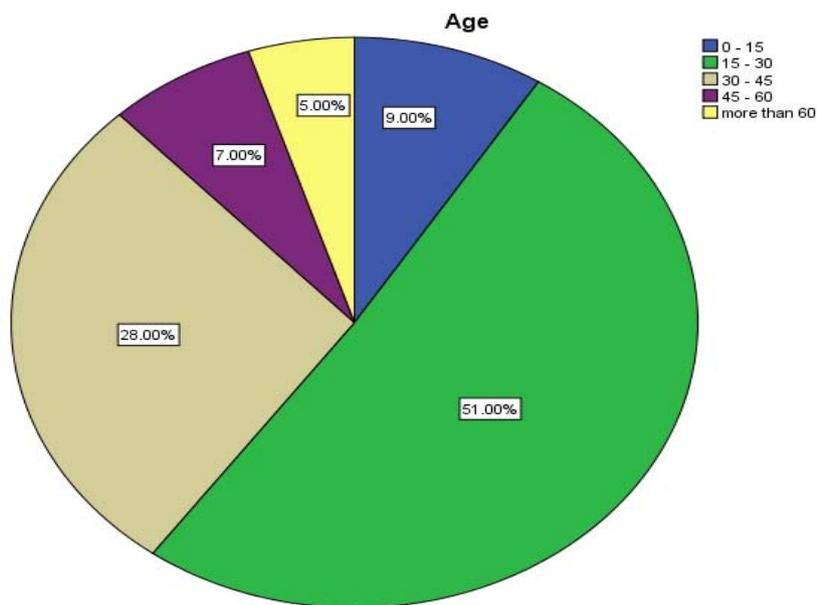


Figure 1



Pie diagram 1



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.

Table 2: Gender Count

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

p= 0.781. There is no significant association.

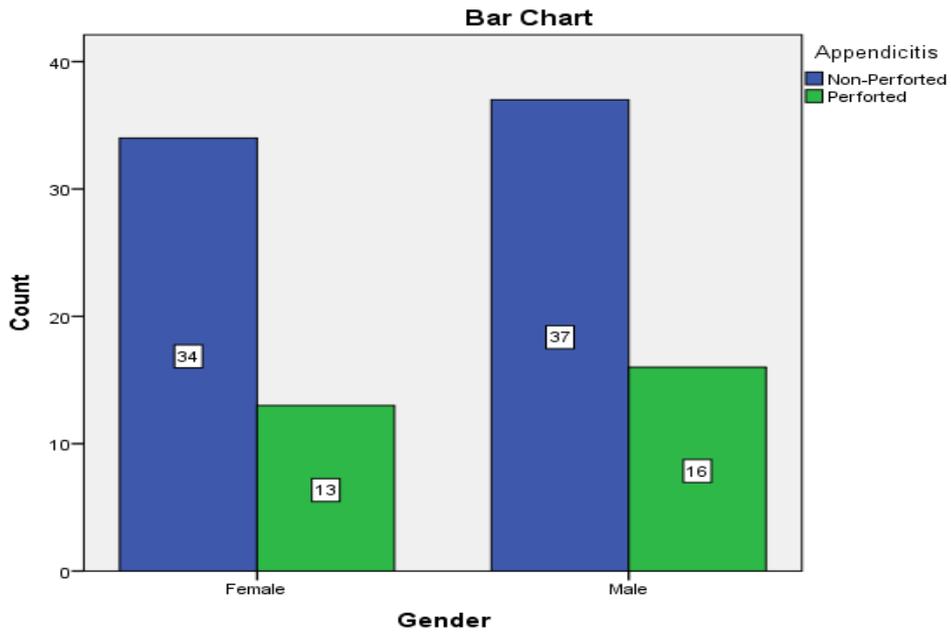
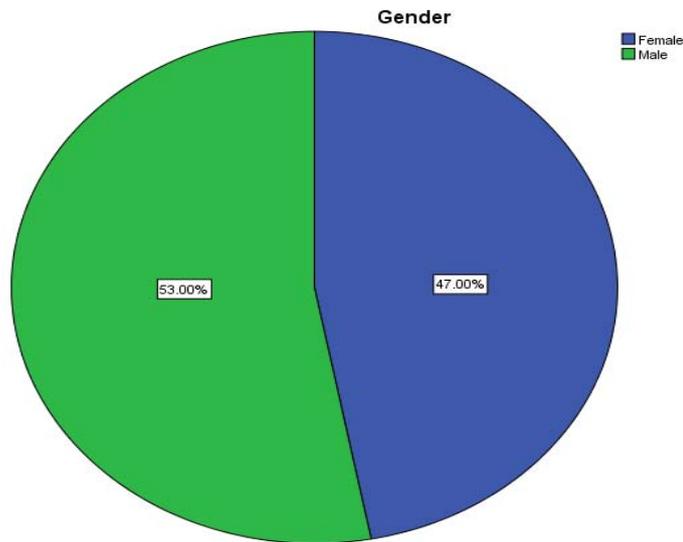


Figure 2



Pie diagram 2

Graph reveals that, in females 34% appendectomies were non-perforated and 16% appendectomies were non-perforated and 13% appendectomies were perforated. In males 37% appendectomies were perforated.

Table 3: Duration

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

p= 0.993. There was no significant association.

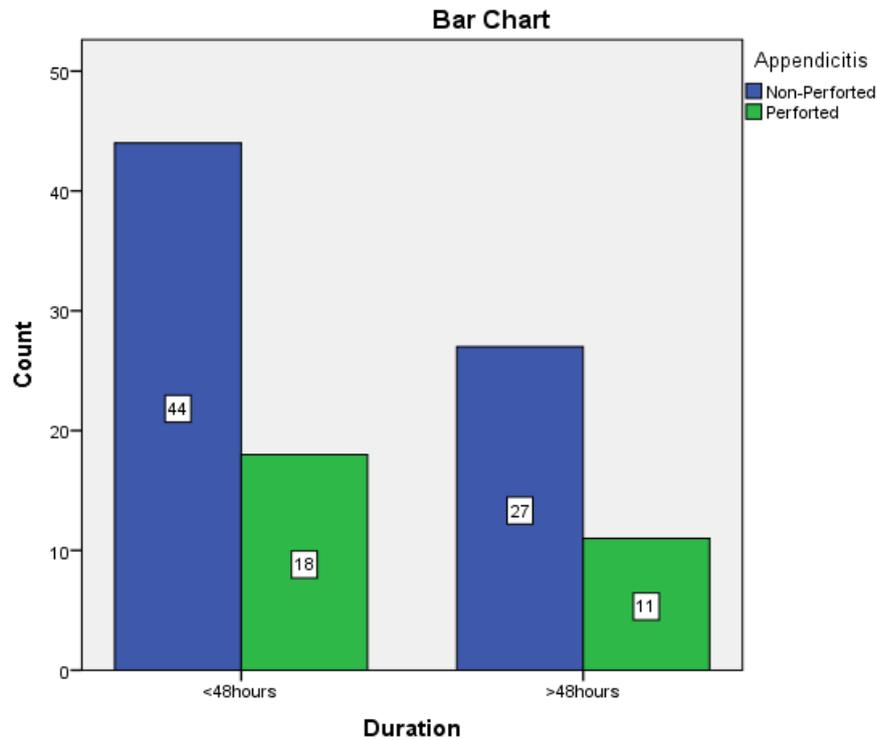


Figure 3

Graph reveals that, 44% appendectomies were non-perforated 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.

Table 4: RIPASA Score

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

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

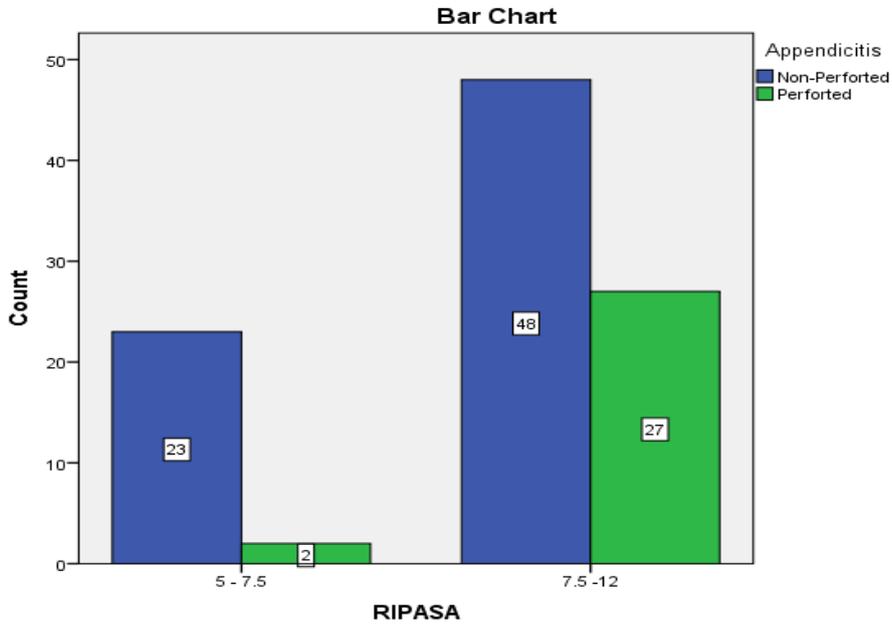


Figure 4

Graph reveals that with a 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.

Table 5: Leukocytosis

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

p= 0.000. There was a significant association in diagnosing appendicitis based on TLC counts.

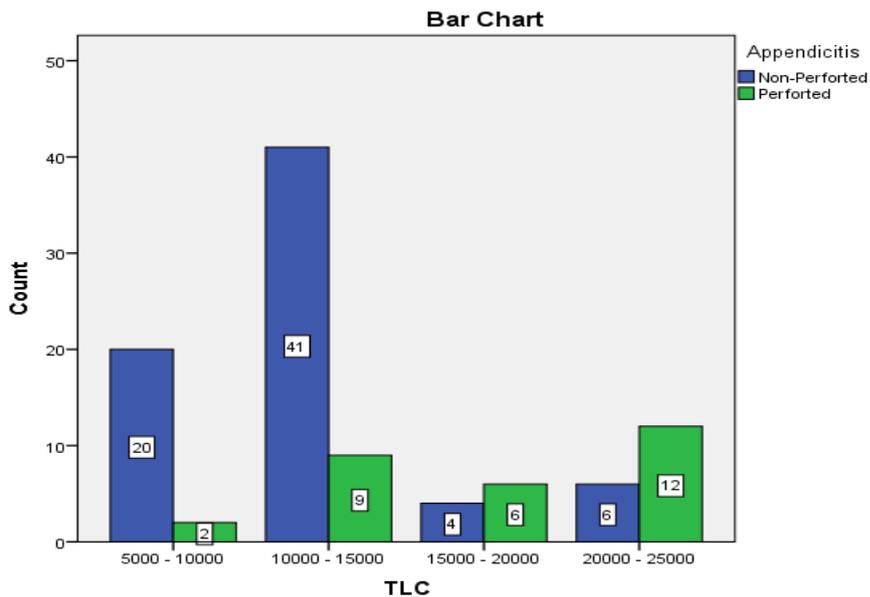
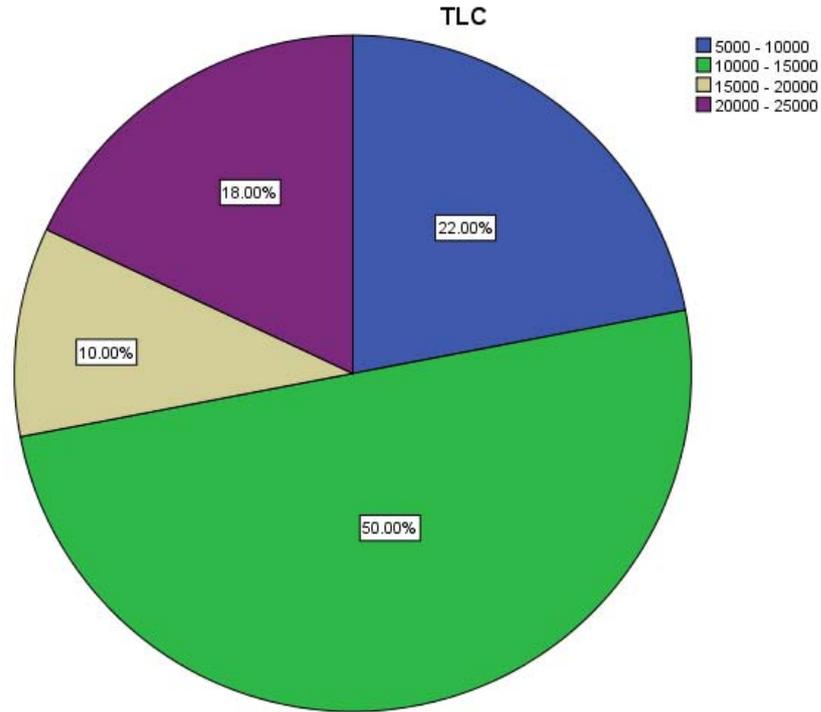


Figure 5

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	5000 - 10000	22	22.0	22.0	22.0
	10000 - 15000	50	50.0	50.0	72.0
	15000 - 20000	10	10.0	10.0	82.0
	20000 - 25000	18	18.0	18.0	100.0
	Total	100	100.0	100.0	



Pie diagram 3

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 non-perforated 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.

Table 6: Co-Relation of Total Leucocyte Count with HPE

TLC	HPE		TOTAL
	Non-Perforated	Perforated	
TLC-RAISED	51	27	78
TLC-NORMAL	20	2	22
TOTAL	71	29	100

p=0.020. There was a significant association of TLC in relation to diagnosing appendicitis.

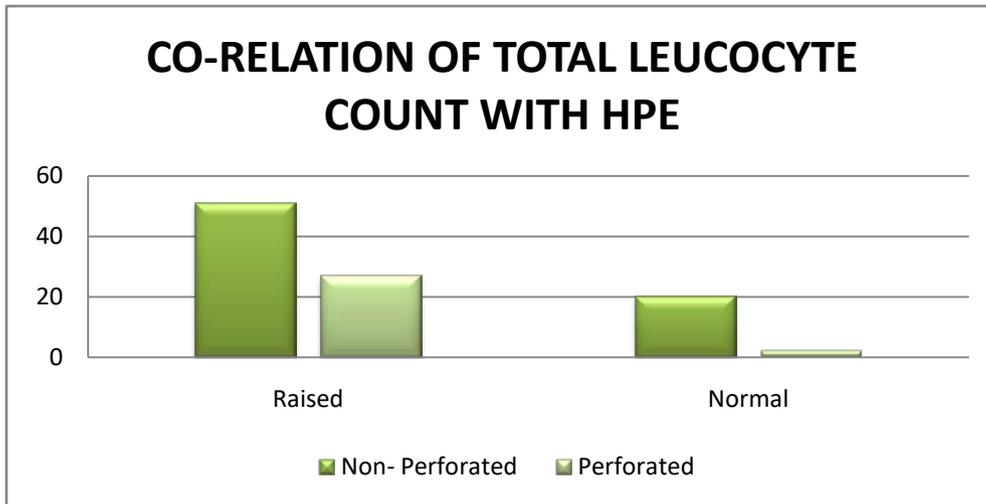


Figure 6

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.

Table 7: Serum bilirubin

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

p=0.089. There was no significant association between LFTs and diagnosis of appendicitis.

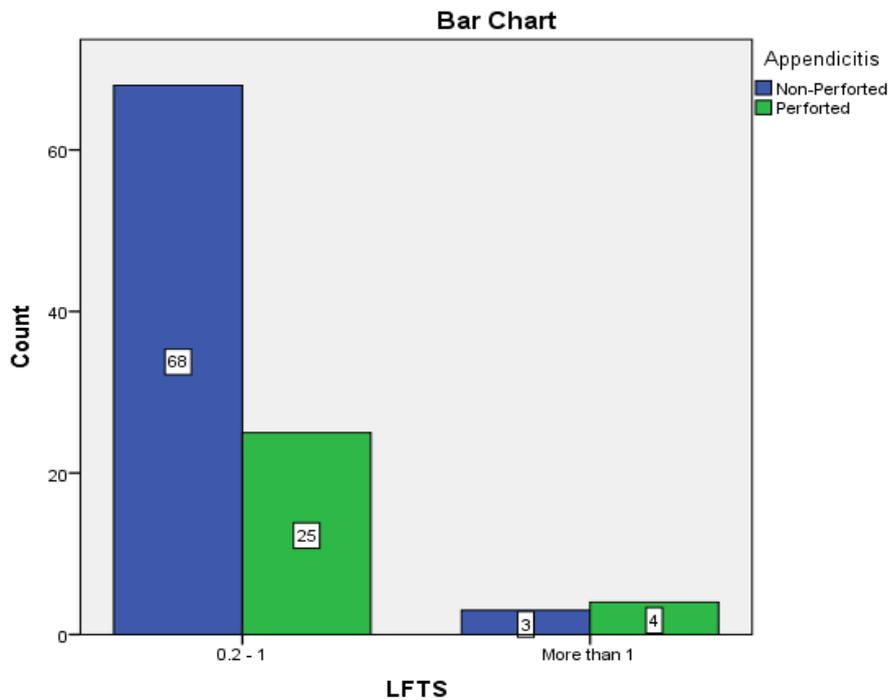


Figure 7

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.

Table 8: Post-operative mortality and morbidity

Days/ Complication	Day 1		Day 3		Day 5	
	Non-Perforated	Perforated	Non-Perforated	Perforated	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

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.

Table 9: USG findings

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

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 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.

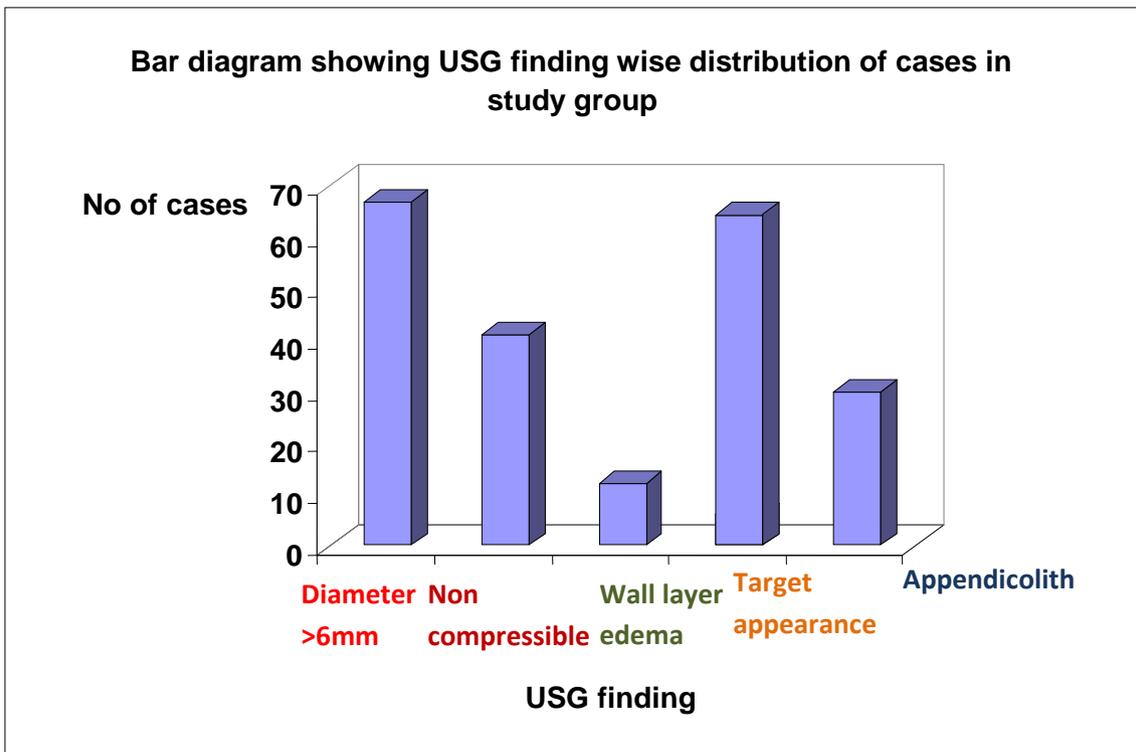
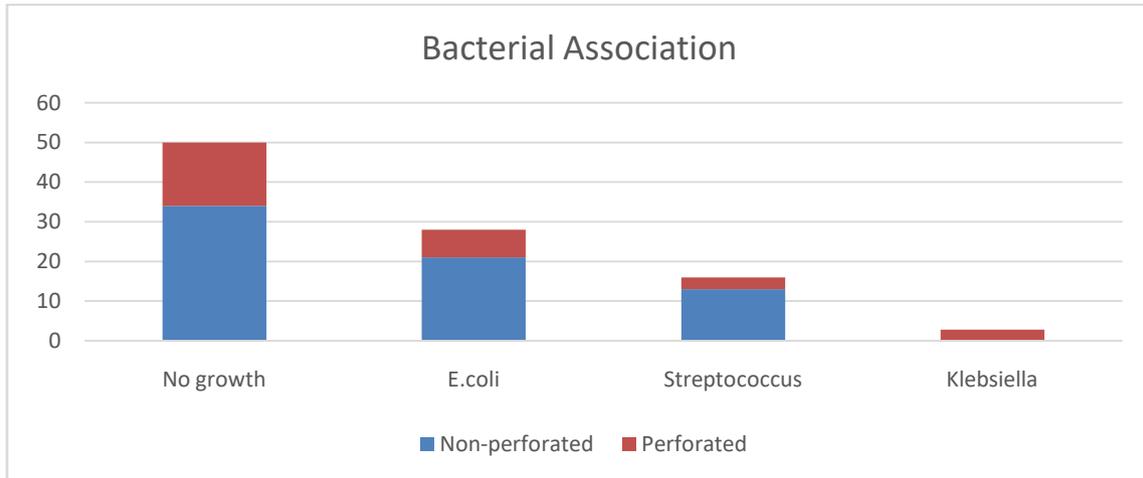


Figure 8

Table 10: Bacterial Association

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



$p = 0.035$. There is a significant association of bacteria causing appendicitis.

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.

Table 11: Operative procedure

Operative procedure	Non-perforated	Perforated	Total
Open Appendectomy	71	25	96
Right Hemicolectomy	0	2	2
Open Appendectomy with purse string sutures	0	2	2
Total	71	29	100

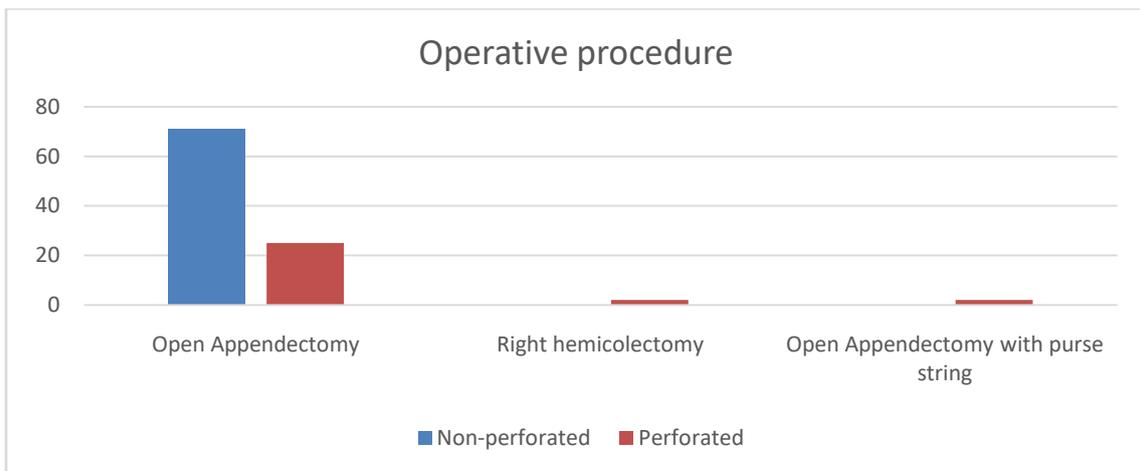


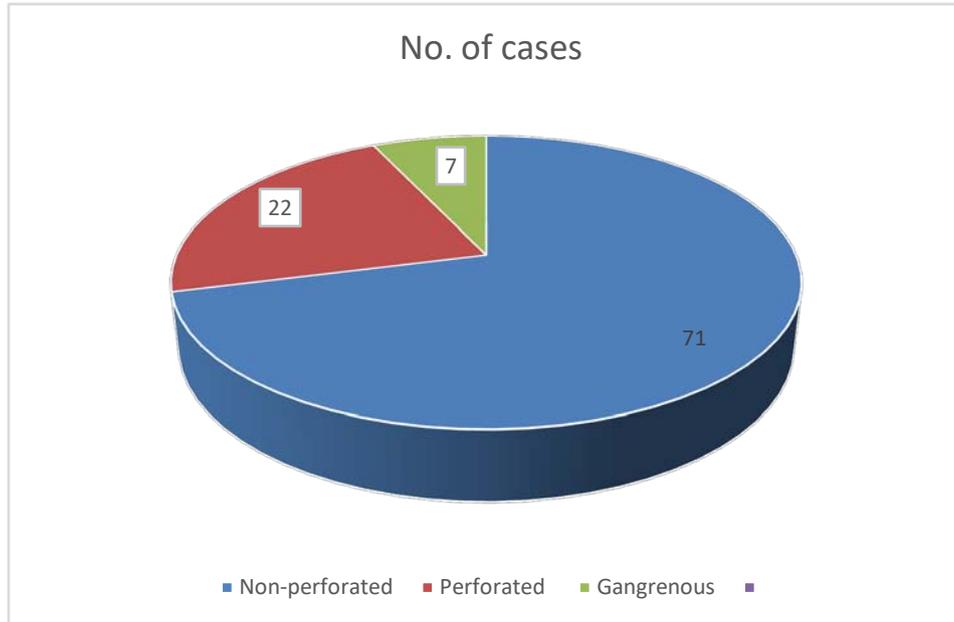
Figure 10

All patients underwent emergency open appendectomy. 2 patients of perforated appendicitis required conversion of surgery to right hemicolectomy due to caecal perforation. 2 patients could be managed with purse-string sutures.

Table 12: Histology

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

Among hundred cases, 71 cases had acute appendicitis, 22 cases had perforated appendix and 7 had gangrenous appendicitis. There were no cases with normal appendix.



Pie diagram 4

Table 13: Association between RIPASA score and HPE in cases group

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

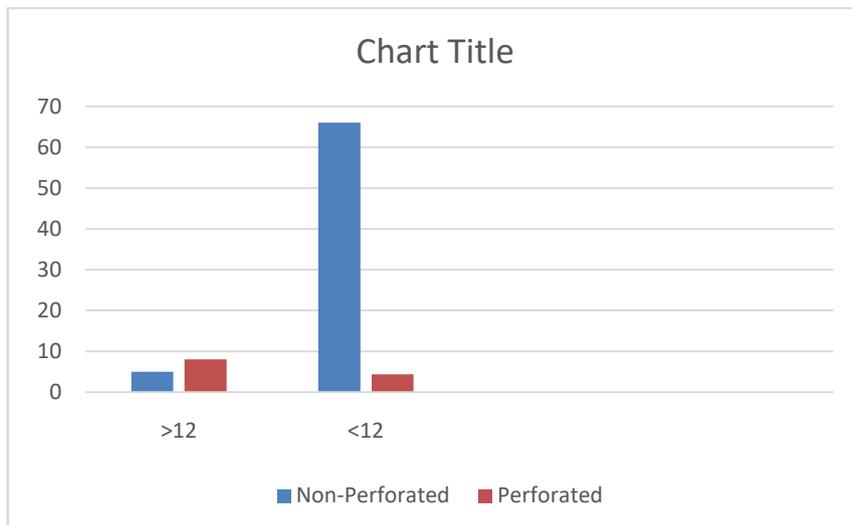


Figure 12

Table 14: Use of Modalities

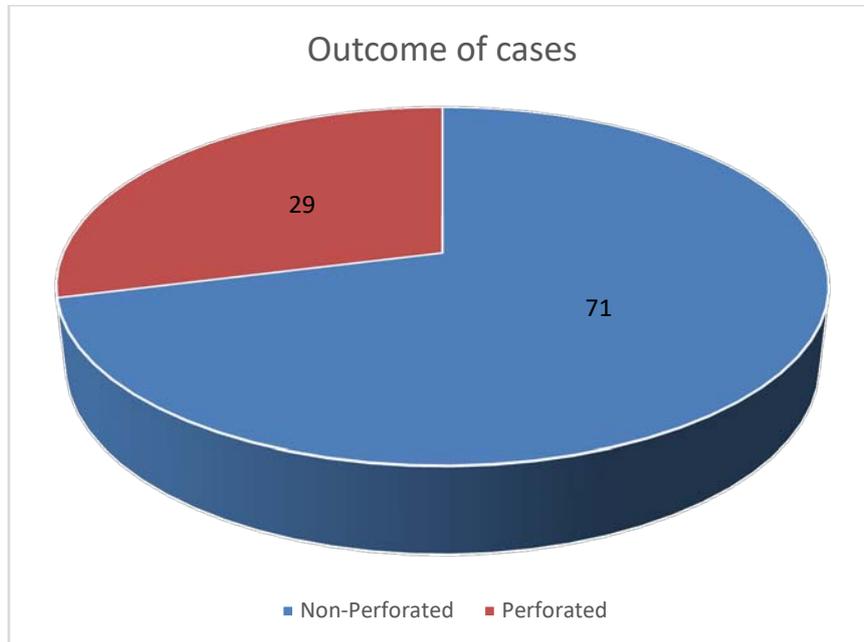
Modality	Cases done	No. of cases positive
RIPASA score 7.5>12	75	75
USG	100	90
CT scan	10	10

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.

Table 15: Outcome of cases in study group

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



Pie diagram 5

71 cases had non-perforated appendicitis based on HPE and 29 cases had perforated appendicitis.

V. 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 cases in the age group of 30 to 45 yrs.

nine cases were in age group of 0-15 yrs. With advancing age, the number of cases of appendicitis encountered in our study decreased, with only 12 cases in age group of 45 yrs and above. Thus, 88% of the patients were below the age of 40 years and 12% were above the age of 45 years. The mean age for non-perforated appendicitis was 28.92 ± 11.40 and that for perforated appendicitis was 28.65 ± 15.64 .

Hartwig et.al⁵³ conducted a similar study on incidence of non-perforated and perforated appendicitis in relation to age and sex specificity. The results were similar to our study group with median age being 22 years. Most of the patients were adolescents and young adults.

The incidence of non-perforated appendicitis varied among the age groups, occurring most

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. (2013) 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 ± 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.⁵⁴

In our study 44% appendectomies were non-perforated 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. al⁵⁵ 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. Al³⁴ 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 8th day ($p < 0.001$).

Tanveer Ahmed et.al⁵⁶ 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.al³⁵ concluded that when the interval was < 12 hours, 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 12.⁵⁷

Out of the 14 cases with $RIPASA \geq 12$, 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 12.⁵⁴

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 al⁵⁸ 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 Hoffmann³⁸ (81-84%) Peltola⁵⁹ (76%) Marchand⁶¹ (81-84%) Yang⁵⁸ (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.

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.⁶²

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.⁶³

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%.⁶⁴

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.⁶⁸

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.⁶⁹

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.⁷⁰

VI. CONCLUSION

In a study of 100 cases, 71 cases were non-perforated 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, non-invasive, 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 where other diagnostic modalities are not available.

VII. SUMMARY

AIM: 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.

Introduction: The diagnosis of acute appendicitis has always been clinical. Clinical scoring systems such as

RIPASA score and ALVARADO score, USG, CT scan have been used in the past as modalities for diagnosis. 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.

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.

REFERENCES RÉFÉRENCES REFERENCIAS

- Guthery S L, Hutchings C, Dean J M, Hoff C. National estimates of hospital utilization by children with gastrointestinal disorders: analysis of the 1997 kids' inpatient database. *J Pediatr.* 2004; 144:589.
- Addiss D G, Shaffer N, Fowler B S, Tauxe R V. The epidemiology of appendicitis and appendectomy in the United States. *Am J Epidemiol.* 1990; 132:910.
- JAMA Surgery, Time to Appendectomy and Risk of Perforation in Acute Appendicitis. *Res.* 2014 Nov; 8(11): NC03-NC05.
- Scher K S, Coil J A Jr. Appendicitis: factors that influence the frequency of perforation. *South Med J.* 1980; 73(12):1561-1563.
- Detmer D E, Nevers L E, Sikes E D Jr. Regional results of acute appendicitis care. *JAMA* 1981; 246 (12): 1318 – 20.
- Fits R H: Perforating Inflammation of Vermiform Appendix: with special references to its early diagnosis and treatment. *Trans Assoc Am Physicians.*, 1886; 1: 107.
- Kearney D, Cahill R A, O'Brien E, Kirwan W O, Redmond H P. Influence of delays on perforation risk in adults with acute appendicitis. *Dis Colon Rectum.* 2008; 51(12):1823-1827.
- Liu K, Ahanchi S, Pissanchi M, Lin I, Walter R. Can acute appendicitis be treated by antibiotic alone. *Am Surg.* 2007; 73:1161-1165.
- Anderson R. E.: Meta-analysis of the clinical and laboratory diagnosis of appendicitis. *Br. J. Surg.* 2004; 91: 28-37.
- Borushok K F, Jeffrey R B Jr, Laing F C, et al. Sonographic diagnosis of perforation in patients with acute appendicitis. *AJR Am J Roentgenol.* 1990; 154(2):275Y278.
- Lally K P, Cox C S Jr, Andrassy R J. Appendix. In: Townsend C M, Beauchamp R D, Evers B M, Mattox K L, editors. *Sabiston text book of surgery.* 16th edn. Philadelphia: WB Saunders Company; 2001. p 918, 919, 920.
- J.W Glover, the human vermiform appendix A general surgeon's reflections. *TJ (now journal of creation)* 1988; 3(1):31-38.
- Ellis H. Appendix, in Schwartz Si (ed). *Maingot's abdominal operations*, 8th ed, vol 2. Norwalk, Conn: Appleton-Century-Crofts, 1985; 1255.
- Mc Burney C: Experience with early operative interference in cases of disease of the vermin form appendix. *Ny state med J* 50: 676; 1889.
- Seymour I Schwartz; F Charles Brunicardi; et al. *Schwartz's principles of surgery*. 9th edition, New York. McGraw-Hill, Medical Pub. Division, 2010; 1-47.
- Volker Schumpelick, Bernhard dreuw, Kerstin Ophoff, Andreas Prescher, appendix and caecum Embryology, Anatomy, and Surgical applications *Surgical Clinics of North America*, Feb 2000; 8(1): 295-318.
- Poole G V. Anatomic basis for delayed diagnosis of appendicitis. *South Med J* 1990; 83(7): 771-773.
- Williams P I, Bannister L H, Berry M M, Collins P, Dyson M, Dussec J E, et-al *alimentary system In GRAY'S ANATOMY ..36th edition*, Churchill Livingstone, New York. 1995, 1353-1354.
- SAHANA'S HUMAN ANATOMY, Descriptive and Applied. Vol-II, Ankur Publications (AP): Jul 1994, 362-367.
- Romanes, CUNNINGHAM'S TEXT BOOK OF ANATOMY 12th edition OXFORD: 1981, 462-463.
- Treaves F, Lectures on the anatomy of the intestinal canal and peritoneum in man. *Brit Med J*, 1885; 1:527-530.
- Wakeley CPG. The position of vermiform appendix as ascertained by the analysis of 10,000 cases *J. Anat* 1933; 67: 277-283.
- Nicholson, Percy: Mechanical lesions of the Appendix in children as a basis for appendicitis. *Jour. Paediatrics*, 1936 Nov; 9:647-654.

24. Downs TMK. Congenital malformations of Vermiform appendix: A Familial Disease. *Ann Surg*, 1942; 115: 21-24.
25. Collins D C, Agenesis of vermiform appendix. *Am J Surg*. 1951; 82:689.
26. Waugh T H. Appendix Vermiformis Duplex. *Arch Surg* 1941; 42: 311-320.
27. Russel, Norman S. Williams, Christopher J.K.Bulstrode, Bailey & Love's SHORT PRACTICE OF SURGERY , 24th edition. London: ARNOLD: 2004; 1203-1218.
28. Harold Ellis, L. Keith Nathanson. Appendix and Appendectomy in Maingot's ABDOMINAL OPERATIONS, Vol-II, 10th edition. APPLETON AND LANGE: 1997; 1191-1227.
29. Stanley L, Robbins et-al, Basic pathology. WB Saunders International, 5th edition, 1994, 519-520.
30. Seymour I Schwartz; F Charles Brunicaudi; et al. Schwartz's principles of surgery.9th edition, new York. McGraw-Hill, Medical Pub. Division, 2010; 1-47.
31. Bickell N A, Aufses A H Jr, Rojas M, Bodian C. How time affects the risk of rupture in appendicitis.*J Am Coll Surg*. 2006; 202(3):401-406.
32. Redmond J M, Smith G W, Wilasrusmee C, Kittur DS. A new perspective in appendicitis: calculation of half time (T (1/2)) for perforation. *Am Surg*. 2002; 68(7):593-597.
33. Kearney D, Cahill R A, O'Brien E, Kirwan W O, Redmond H P. Influence of delays on perforation risk in adults with acute appendicitis. *Dis Colon Rectum*. 2008; 51(12):1823-1827.
34. Papandria D, Goldstein S D, Rhee D, et al. Risk of perforation increases with delay in recognition and surgery for acute appendicitis. *J Surg Res*. 2013; 184(2):723-729.
35. Michael F. Ditillo, D O,* James D. Dziura, PhD, † and Reuven Rabinovici, M D*et al Is it safe to delay appendectomy in adults with acute appendicitis.
36. Chng C F, Adi M I, Thien A, et al, Development of the RIPASA score: a new appendicitis scoring system for the diagnosis of acute appendicitis. *Singapore Med J*. 2010; 51:220-25.
37. Cueto J, D'Allemagne B, Vazquez-Frias J A, Gomez S, Delgado F, Trullenque, et al. RIPASA score: a new appendicitis scoring system 2012.
38. Alvarado A. A practical score for the early diagnosis of acute appendicitis. *Ann Emerg Med* 1986; 15:557-64.
39. Chong C F, Adi M I, Thien A, et al, Development of the RIPASA score: a new appendicitis scoring system for the diagnosis of acute appendicitis. *Singapore Med J*. 2010; 51:220-25.
40. Puylaert JCBM. Acute appendicitis: US evaluation using graded compression. *Radiology* 1986; 158:355-360.
41. Orr R K, Porter D, Hartman D. Ultrasonography to evaluate adults for appendicitis: decision making based on meta-analysis and probabilistic reasoning .*Acad Emerg Med* 1995; 2:644-65.
42. Erdem H, Çetinküner S, Daş K, Reyhan E, Değer C, Aziret M et al. Alvarado, Eskelinen, Ohlmann and Raja Isteri Pengiran Anak Saleha Appendicitis scores for diagnosis of acute appendicitis. *World J Gastroenterol*. 2013; 19(47):9057-62.
43. International Research Journal of Medical Sciences, Bacterial Profile Associated with AppendicitisI, SSN 2320 -7353 Vol. 1(2), 1-4, March (2013) *Int. Res. J. Medical Sci*.
44. Rao P M, Rhea J T, Novelline R A, et al. Effect of computed tomography of the appendix on treatment of patients and use of hospital resources. *N Engl J Med*. 1998; 338:141-146.
45. Hansen A J, Scott Y W, De Petris G, et al. Histologic severity of appendicitis can be predicted by computed tomography. *Arch Surg*. 2004; 139: 1304 -1308.
46. Eriksson S, Granstrom L, Bark S. Laboratory tests in patients with suspected acute appendicitis. *Acta chirurgica Scandinavica* 1989; 155:117-120.
47. Vermeulen B, Morabia A, Unger PP. Influence of white cell count on surgical decision making in patients with abdominal pain in the right lower quadrant. *Eur J Surg* 1995; 161:483-6.
48. Doraiswamy N V. Leucocyte counts in the diagnosis and prognosis of acute appendicitis in children. *Br J Surg* 1979; 66:782.
49. Poole G V. Anatomic basis for delayed diagnosis of appendicitis. *South Med J* 1990; 83(7): 771-773.
50. Gurleyik G, Gurleyik E. Age related clinical features in older patients with acute appendicitis. *Eur J Emerg Med* 2003; 10:200-3.
51. Luckman, R. Davis P: The epidemiology of acute appendicitis in California :racial, gender and seasonal lvariation. *Epidemiology* 2:323 1991.
52. Anderson R Hugader, A, Thulin, Nystrom, P. O. Olaison G: Indications for operation in suspected appendicitis and incidence of perforation 1994.
53. Hartwig Korner, Karl Sondenaar, Jon Arne Soreide: Incidence of Acute Non-Perforated Appendicitis: Age-specific and sex-specific analysis 1997.