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Frequency of perforation in cases operated for acute appendicitis at Sandeman Provincial Hospital, Quetta

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Keywords: Alvarado Score, Appendicectomy, Acute Appendicitis, Perforation, Specificity.

Abstract

Background: Acute appendicitis is the most common indication for urgent intra- abdominal surgery [1]. The conventional pathophysiologic model of acute appendicitis is based on a relationship between time and disease progression; risk of perforation increases as time elapses from onset of disease to treatment. Observational research has demonstrated an association between time to treatment and perforation [2]; indirect evidence for this association has also come from studies linking impaired health care access to increased risk of perforation [3].

Objective: Determine the frequency of perforation in patients undergoing appendectomy for acute appendicitis at Sandeman Provincial Hospital, Quetta.

Study Design: Descriptive Cross-Sectional Study.
Setting: This study was conducted at Department of General Surgery, Sandeman Provincial Hospital, Quetta, Pakistan.
Duration: Six months after the approval of synopsis from December 20, 2020
to June 19, 2021.

Materials and Methods: patients who fulfilled the inclusion criteria and visited to Sandeman Provincial Hospital, Quetta were included in the study. Informed consent was taken after explaining the procedure, risks and benefits of the study. Alvarado score of all patients was determined. Patients were diagnosed as cases of acute appendicitis. An ultrasound abdomen was requested in all patients to confirm the diagnosis of acute appendicitis. All patients then underwent open appendicectomy under general anesthesia. All the collected data were entered into the proforma attached at the end and used electronically for research purpose.

Results: Mean ± SD of age was 31.6±4.9 years. In distribution of gender, 120 (67.8%) were male while 57 (32.2%) were female. Mean ± SD of Alvarado score was 7.6±2.2 with C.I (7.27…….7.92). Perforation was found to be in 44 (24.9%) patients.

Conclusion: Ir is to be concluded that perforation is a frequent finding in patients undergoing appendectomy for acute appendicitis. Furthermore, our findings outline the need for future research to investigate those factors that could be considered as higher risk of perforation.

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INTRODUCTION

Acute Appendicitis is the most common surgical emergency presenting as 'acute abdomen' in the emergency department with a peak incidence in the second and third decades of life [1]. The overall lifetime risk of acute appendicitis is 6.7 to 8.6% with a slight female preponderance [2]. Appendicectomy is the gold standard treatment option for cases of acute appendicitis. If not readily diagnosed and promptly treated, acute appendicitis can progress to complications like perforation, gangrene, formation of appendicular mass, abscess, and development of localized or generalized peritonitis in severe cases [3]. Perforated appendicitis is a common complication of acute appendicitis that is associated with considerable morbidity. A number of risk factors have been reported to increase the risk of perforation in cases of acute appendicitis. They include extremes of age i-e. young children and old age patients, male gender, delayed presentation to the hospital, presence of fever, anorexia and presence of co-morbids [4,5]. Acute appendicitis has been reported to carry a high rate of perforation (40%) and morbidity (up to 28%) especially in the elderly patients[5].

A study by Palachandra et al in 2017 reported that the frequency of perforated appendicitis was 8% in patients undergoing appendicectomy for acute appendicitis. The mean age of patients was 26.8±13.2 years in nonperforated cases vs 22.4±12.3 years in perforated cases, the difference being statistically non-significant ($p>0.05$). No difference was observed between perforated and non- perforated cases in terms of gender and season ($p>0.05$). The frequency of perforation was 4.3% in patients belonging to urban vs 9.7% in those belonging to rural areas, the difference was statistically significant ($p<0.05$) [6].

Another study by Drake et al reported that the frequency of perforated appendicitis was 15.8%. The mean age of patients was 38.2±15.8 years in non-perforated cases vs 48.8±17.6 years in perforated cases, which was statistically significant ($p<0.001$). The percentage of male patients among perforated cases was 55.3% vs 52.1% in non-perforated cases which was also significant ($p=0.03$). There was no difference between the two groups in terms of time of presentation with the mean time being 8.6 hours in both groups ($p=0.82$) [7]. A study by Balogan et al reported in 2019 that the rate of perforation in acute appendicitis was 28.5% [8]. Another study by Sirikurnpiboon et al in 2015 reported that the frequency of perforation was 50% in patients presenting with acute appendicitis [4]. The rationale of this study is that there is wide disparity in the existing literature on the frequency of perforation in acute appendicitis amongst different studies [7-10]. Acute appendicitis is the most common surgical emergency and correct and prompt identification of the cases of perforated appendicitis is essential to prevent complications. In the current era of evidence-based practices, the findings of my study will help in determining the exact frequency of perforation of appendix in patients presenting to our setup according to age, gender, BMI, season, place of residence and duration of symptoms. These findings would help to alert the surgeons if any specific aforementioned variable is found to have a higher frequency.

MATERIAL & METHODS

It was Descriptive Cross-Sectional Study in Department of General Surgery, Sandeman Provincial Hospital, Quetta. Duration was Six months after the approval of synopsis from December 20, 2020 to June 19, 2021.Sample size was calculated using WHO sample size calculator as follows:

Confidence Level (1-a) =95% Absolute precision required (d) =0.04 Anticipated opulation proportion (P) = 8%[8] (frequency of perforation) Sample size (n) = 177 patients. Sampling technique was Non-Probability, Consecutive Sampling.

Patients of both genders. Patients diagnosed as cases of acute appendicitis as per operational definition.

Age between 15 to 70 years. BMI between 19-30 Kg/m2

. ASA Class I, II & III (attached as Annexure C)

Patients managed conservatively with antibiotics (since they were not undergoing surgery, therefore excluded). History of previous abdominal surgery (the adhesions due to previous surgeries can influence the operation). Pregnant females. (The signs and symptoms, workup and operative procedure in pregnancy can differ from the conventional appendicitis). Patients did not give informed consent. Diabetes mellitus. (Diabetic patients can feel less severity of symptoms as compared to non-diabetics and can present with complications despite having milder symptoms).

After approval of synopsis from CPSP and hospital ethical review committee, a total of 177 patients admitted to the surgical wards in the Department of General Surgery, Sandeman Provincial Hospital, Quetta with the diagnosis of acute appendicitis and who met the inclusion and exclusion criteria were enrolled in the study. A written informed consent was taken from all patients included in the study

attached as "Annexure A".

The demographic details of all patients were documented including gender and the place of residence. The season of the year at the time of presentation was recorded. A detailed history was taken from all patients with record of duration of symptoms of pain abdomen, nausea or vomiting, anorexia and fever. A thorough physical examination was performed with a detailed abdominal examination to look for tenderness and rebound tenderness in the right iliac fossa. All baseline investigations were requested including blood complete picture to look for raised total leukocyte count (TLC), urine routine examination, liver and renal function tests, hepatitis B and C screening, electrocardiogram (ECG), and chest X-ray. Alvarado score of all patients was determined. Patients were diagnosed as cases of acute appendicitis as per the operational definition. An ultrasound abdomen was requested in all patients to confirm the diagnosis of acute appendicitis. All patients underwent open appendicectomy under general anesthesia. All operations were carried out by a consultant having a fellowship degree assisted by a trainee. Patients had perforated appendix on operation was recorded. Data of all patients was recorded on a predesigned proforma attached in the end as Annexure B. All patients were given due respect and their comfort was taken care of during the study. All operations were performed by the same surgical team. I myself recorded the data of all patients included in the study.

DATA ANALYSIS

Data was entered and analyzed by SPSS Version 25. Mean and standard deviation were calculated for quantitative variables i.e. age, BMI (to check if there was any variation in the frequency of perforation), TLC, duration of symptoms and Alvarado score. Qualitative variables like gender, ASA class (to check if there was any variation in the frequency of perforation based on ASA status), place of residence, and perforated appendix were measured in terms of frequency percentages. Effect modifiers like age, BMI, gender, ASA Class, TLC count, place of residence, duration of symptoms, Alvarado score were controlled through stratification. Post-stratification, Chi- square test was applied keeping P-value ≤ 0.05 as significant.

RESULTS

In this study 177 patients were included to assess the perforation in patients undergoing appendicectomy for acute appendicitis at Sandeman Provincial Hospital, Quetta and the result showed that:

TABLE # 1
DESCRIPTIVE STATISTICS OF AGE
n=177

MEAN	31.6 (Years)
STANDARD DEVIATION	4.9
95% CONFIDENCE INTERVAL	30.87…….32.32
MINIMUM	15
MAXIMUM	70
RANGE	55

TABLE # 2
DESCRIPTIVE STATISTICS OF BODY MASS INDEX
n=177

MEAN	25.4 (kg/m^2)
STANDARD DEVIATION	4.1
95% CONFIDENCE INTERVAL	24.79…….26.00
MINIMUM	19
MAXIMUM	30
RANGE	11

TABLE # 3
DESCRIPTIVE STATISTICS OF TOTAL LEUCOCYTE COUNT
n=177

MEAN	5.7 ($10^9/L$)
STANDARD DEVIATION	2.4
95% CONFIDENCE INTERVAL	5.34…….6.05
MINIMUM	4
MAXIMUM	11
RANGE	7

TABLE # 4
DESCRIPTIVE STATISTICS FOR DURATION OF SYMPTOMS
n=177

MEAN	8.5 (Hours)
STANDARD DEVIATION	3.6
95% CONFIDENCE INTERVAL	7.96…….9.03
MINIMUM	3
MAXIMUM	18
RANGE	15

TABLE # 5
DESCRIPTIVE STATISTICS OF ALVARADO SCORE
n=177

MEAN	7.6
STANDARD DEVIATION	2.2
95% CONFIDENCE INTERVAL	7.27…….7.92
MINIMUM	1
MAXIMUM	10
RANGE	9

FIGURE # 4
FREQUENCY OF GENDER
n=177

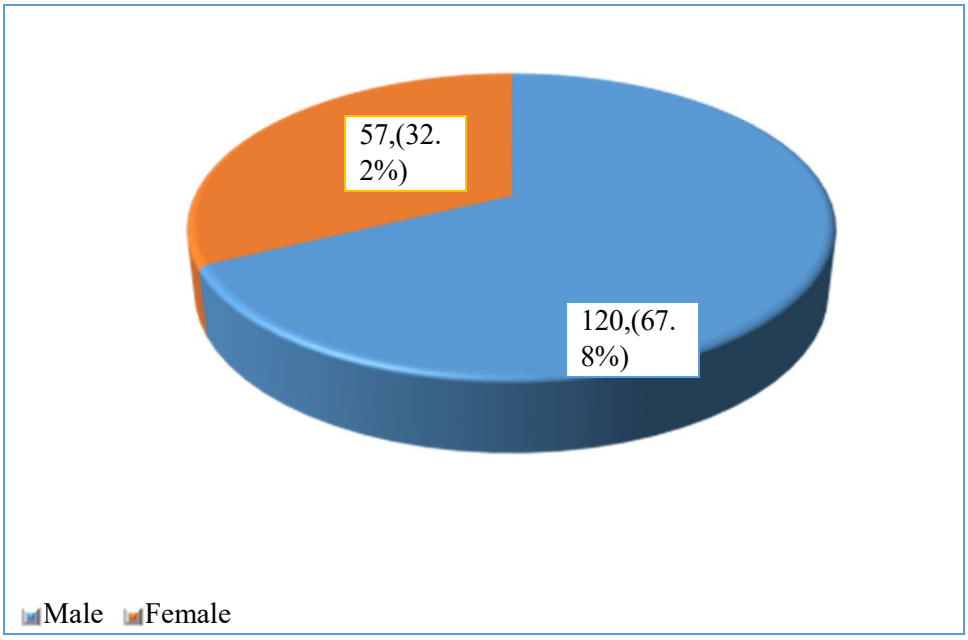

FIGURE # 5
FREQUENCY OF ASA STATUS
n=177

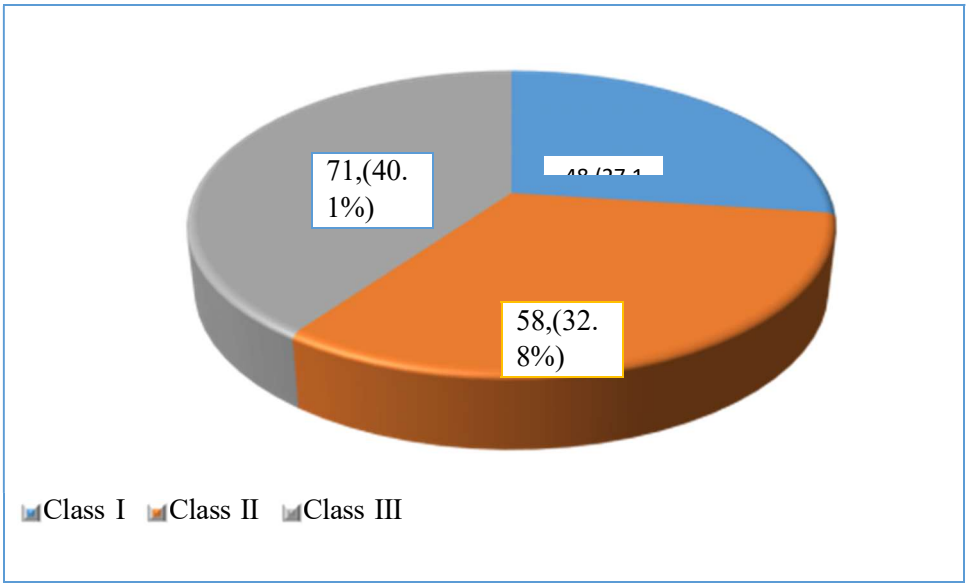

FIGURE # 6
FREQUENCY FOR PLACE OF RESIDENCE
n=177

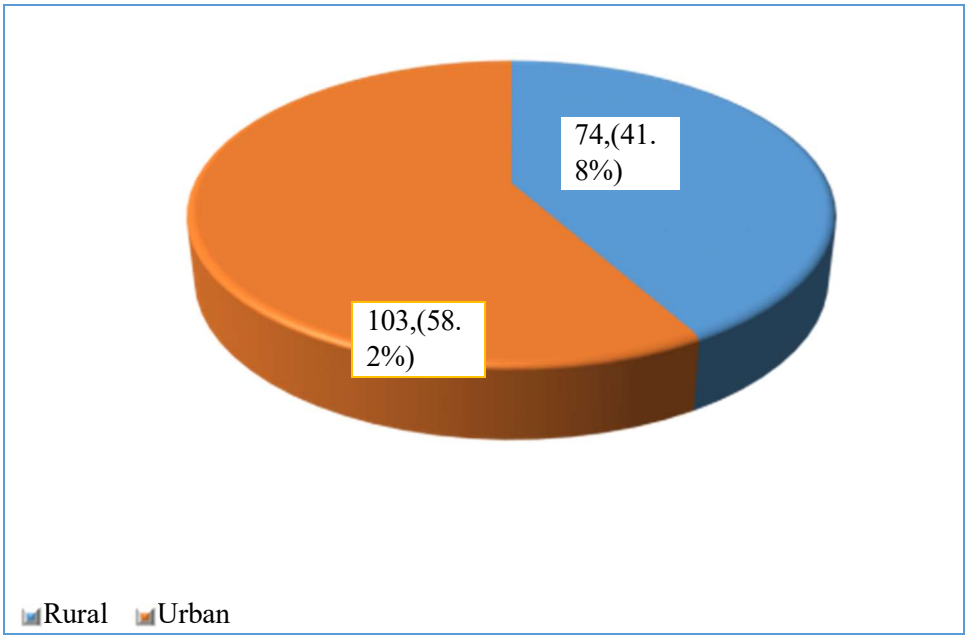

FIGURE # 7
FREQUENCY OF PERFORATED APPENDICITIS
n=177

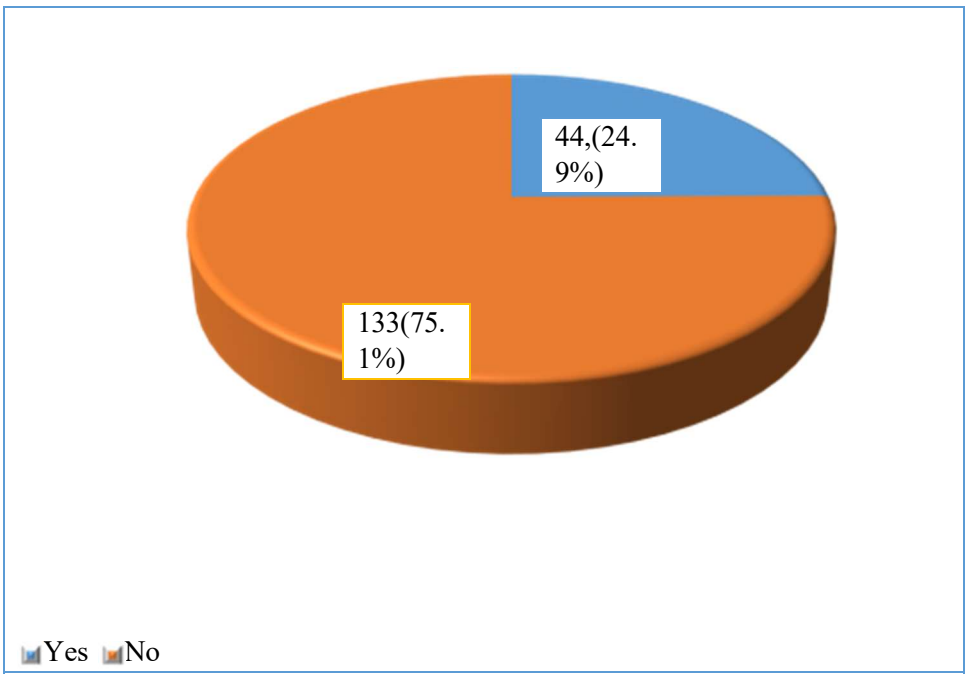

TABLE # 6
STRATIFICATION OF AGE GROUP WITH PERFORATED APPENDICITIS
n=177

AGE GROUP [In years]	**PERFORATED APPENDICITIS**		**P-VALUE**
	Yes	No	
15 – 30	32 (18.1%)	68 (38.4%)	0.012
>30	12 (6.8%)	65 (36.7%)	

Applied Chi-Square test

TABLE # 7
STRATIFICATION OF GENDER WITH PERFORATED APPENDICITIS
n=177

GENDER	**PERFORATED APPENDICITIS**		**P-VALUE**
	Yes	No	
Male	34 (19.2%)	86 (48.6%)	0.121
Female	10 (5.6%)	47 (26.6%)	

Applied Chi-Square test

TABLE # 8
STRATIFICATION OF BODY MASS INDEX WITH PERFORATED APPENDICITIS
n=177

BMI [In kg/m^2]	**PERFORATED APPENDICITIS**		**P-VALUE**
	Yes	No	
19 – 24	29 (16.4%)	65 (36.7%)	0.050
>24	15 (8.5%)	68 (38.4%)	

Applied Chi-Square test

TABLE # 9
STRATIFICATION OF ASA STATUS WITH PERFORATED APPENDICITIS
n=177

ASA STATUS	**PERFORATED APPENDICITIS**		**P-VALUE**
	Yes	No	
Class I	14 (7.9%)	34 (19.2%)	0.056
Class II	19 (10.7%)	39 (22.0%)	
Class III	11 (6.2%)	60 (33.9%)	

Applied Chi-Square test

TABLE # 10
STRATIFICATION OF TLC WITH PERFORATED APPENDICITIS
n=177

TLC [In 10^9/L]	**PERFORATED APPENDICITIS**		**P-VALUE**
	Yes	No	
4 – 6	33 (18.6%)	85 (48.0%)	0.176
>6	11 (6.2%)	48 (27.1%)	

Applied Chi-Square test

TABLE # 11
STRATIFICATION FOR PLACE OF RESIDENCE WITH PERFORATED APPENDICITIS
n=177

RESIDENCE	**PERFORATED APPENDICITIS**		**P-VALUE**
	Yes	No	
Rural	12 (6.8%)	62 (35.0%)	0.024
>Urban	32 (18.1%)	71 (40.1%)	

Applied Chi-Square test

TABLE # 12
STRATIFICATION FOR DURATION OF SYMPTOMS WITH PERFORATED APPENDICITIS n=177

DURATION [In Hours]	PERFORATED APPENDICITIS		P-VALUE
	Yes	No	
3 – 9	35 (19.8%)	89 (50.3%)	0.050
>9	9 (5.1%)	44 (24.9%)	

Applied Chi-Square test

TABLE # 13
STRATIFICATION OF ALVARADO SCORE WITH PERFORATED APPENDICITIS n=177

ALVARADO SCORE	PERFORATED APPENDICITIS		P-VALUE
	Yes	No	
1 – 6	13 (7.3%)	96 (54.2%)	0.0001
>6	31 (17.5%)	37 (20.9%)	

Applied Chi-Square test

DISCUSSION

Appendicitis is among the most common abdominal conditions requiring admission to emergency surgery departments. It has a life time risk of 6% [33]. Untreated appendicitis may be complicated with development of gangrene or perforation, resulting in high morbidity and mortality rates in almost all age groups. Acute appendicitis is the most common surgical disease, with an incidence of about 100 per 100,000. The life-time risk of developing appendicitis is 8.6% for males and 6.7% for females [34,35], with 90% found in children and young adults and 10% in patients over 60 years old [36,37].

Diagnosis of appendicitis is made mainly by history and physical examination, and laboratory study and radiologic investigation are helpful in equivocal cases. Clinical presentation has overall sensitivity and specificity of 45-81% and 36-53% [38], respectively. The possible cause is variation of appendix [39]. With regard to laboratory study, an increase in white blood cell count (WBC), predominance of polymorphonuclear leukocytes (PMN), and increased C-reactive protein (CRP) levels were associated with the risk and severity of complications in appendicitis [40]. In relation to risk factors, this research found that being of male sex was significantly related to perforation, and this is in line with the results of previous reports [41-43]. A possible explanation for this is elderly males' culture of reluctance to

go to hospital, as found in a report by Sheu et al. [43].

With regard to social factors, living in metropolitan areas and living alone were risks for delaying seeking medical services. The author did not attempt to delve into this factor in detail, but possible explanations are changes in family structure, an increase in living away from one's family, and less real social participation.

Acute appendicitis is one of the commonest abdominal emergencies and appendectomy is one of the commonest emergency procedures performed all over the world [44,45]. Appendicitis is the most common cause of acute abdomen in all age groups. Almost 10% of the general population develops acute appendicitis with a highest incidence in the second and third decades of life. Late diagnosis and surgical intervention is regarded as an important cause of morbidity in acute appendicitis. Delay in treatment results in complications like perforation, but there are controversies as to whether preadmission or post admission delay is more important. Death due to acute appendicitis is now rare (mortality rate, 0–2.4%). Different factors are responsible for perforation in acute appendicitis in different age groups and this can be explained by the difference in immune status and aetiologies of appendicitis. Appendicectomy is relatively safe with a mortality rate for non-perforated appendicitis of 0.8 per 1,000 and mortality after perforation of 5.1 per 1,000. Delaying the diagnosis and operative intervention can lead to increase morbidity and mortality [46]. The mortality rate is more than 20% in patients older than 70 years because of delayed diagnosis and hospitalization, and delayed treatment. The high incidence of co-morbidities and the wide range of differential diagnostic possibilities in this age group are also factors [47]. Acute appendicitis can proceed to gangrene, perforation, appendicular mass, abscess localized or generalized peritonitis if not readily diagnosed or treated. Men having life time risk of acute appendicitis is about 8.6% and female having 6.7% [48,49]. As the late presentation of acute appendicitis can proceed to gangrene and perforation therefore it needs to be diagnosed and treated as early as possible. In children the perforation occurs within 8 to 24 hours while in adolescents and young children it occurs within 36 hours [50]. Causes of delay in diagnosis and treatment of acute appendicitis are many like delaying at home (home remedies), local doctors, homeopathic, quacks, molvies, medical practitioners, etc. complicated appendicitis can lead to high morbidity, mortality, prolonged hospital stay and financial burden.8 The diagnosis of acute appendicitis is often complicated by non-specific symptoms. As the symptoms of appendicitis overlap considerably with other clinical conditions like gastro-enteritis, urinary tract infection, and pelvic inflammatory disease and there is no specific test to differentiate among all the mentioned diseases, it ultimately results in the delay of diagnosis and further treatment. The significance of a specific symptom, sign, or test result is determined by a test's sensitivity and specificity and also by disease prevalence in the population, i.e., positive and negative predictive values. Intermittent abdominal complaints and parental delay have also been described to cause diagnostic delay. Misdiagnosis of appendicitis is in the top five medical malpractice categories for lawsuits against emergency room doctors. Nevertheless, failure to diagnose appendicitis early is still a leading cause of increased perforation and complications.

In our study, mean age was 31.6±4.9 years. The study of Drake FT, et al [51] reported to have a mean age of 39.8±16.6 years. Palachandra A, et al noted age as 26.8±13.2 while Adnan N, et al noted as 35.4±2.7 years [53]. Kearney D, et al [54] reported mean age to be 30.3 years. this study, mean body mass index was 25.4±4.1 kg/m2 .Sirikurnpiboon S, et al [55] reported BMI to be 23.8±4.2 kg/m2 . In this study, 120 (67.8%) were male while 57 (32.2%) were female. There were 52% male cases and 48% female cases noted in the findings of Drake FT, et al]. In the study of Palachandra A, et al, 294 (56%) were males and 238 (44%) were females, Adnan N, et al reported to have 58 (58%) males and 42 (42%) females, Kearney D, et al [54] have 68% males and 32% females while Sirikurnpiboon S, et al noted to have 49 (47.6%) males and 54 (52.4%) females.

ASA status showed that 48 (27.1%) patients belonged to class I, 58 (32.8%) were involved in class II while class III status was noted in 71 (40.1%) patients. ASA

status in the findings of Sirikurnpiboon S, et al documented to have 11 (10.7%) patients involved in class I, 76 (73.8%) in class II and 16 (15.5%) in class III.

Out of 177 patients, 74 (41.8%) patients were resident of rural areas while 103 (58.2%) were resident of urban areas. The study of Palachandra A, et al further noted that 349 (65.61%) patients were resident of rural areas and 183 (34.39%) were from urban areas. The study of Sirikurnpiboon S, et al further reported that 74 (71.9%) patients were from urban areas [18-21].

In present study, perforated appendicitis on operation was found in 44 (24.9%) patients. Drake FT, et al reported perforation in 15.8% cases [22]. Palachandra A, et al reported that out of 532 patients, 42 (8%) patients had perforated appendicitis [23]. The study of Adnan N, et al [25] further noted the presence of perforated appendicitis in 40 (40%) cases. The study of Kearney D, et al found the prevalence in 20 (17%) patients [26]. In our study, stratification of confounders / effect modifiers with respect to perforated appendicitis on operation, significant difference was noted in age group (P=0.012), body mass index (P=0.050), place of residence (P=0.024), duration of symptoms (P=0.050), Alvarado score (P=0.0001) whereas insignificant difference was reported in gender (P=0.121), ASA status (P=0.056) and total leucocyte count (P=0.176).

CONCLUSION

It is to be concluded that perforation is a frequent finding in patients undergoing appendectomy for acute appendicitis. Furthermore, our findings outline the need for future research to investigate those factors that could be considered as higher risk of perforation. Additional studies are required probably with a larger sample size and with more parameters in multiple study centers in Pakistan are needed to validate the findings of the present study

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