




IJCRR  
Section: Healthcare  
ISI Impact Factor  
(2021-22): 2.176  
IC Value (2020): 91.47  
SJIF (2020) = 7.893  
  
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## Negative Appendectomy Rate in a Tertiary Care Hospital of Quetta: A Cross Sectional Study

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### ABSTRACT

**Introduction:** Acute appendicitis is the most common surgical pain requires surgical intervention in emergency. Diagnosis of acute appendicitis is mainly a clinical judgment but many clinical scoring systems and advance radiology is routinely used in developed countries. The aim is to reduce unnecessary removal of normal appendix, which is still very high up to 37% in some parts of the world.

**Aim:** The aim of this study was to assess the Negative appendectomy rate (NAR) in a tertiary care hospital of Quetta.

**Method:** This is a prospective observational study carried out between November 2020 and June 2021. 121 cases of acute appendicitis that underwent surgical management.

**Results:** The study data revealed a negative appendectomy rate of 59.5%. Tenderness rebound tenderness and total leucocyte count (TLC) showed statistical significance with histopathology findings. Female had high negative rate of appendectomy.

**Conclusion:** The study showed that on clinical judgment in diagnosis of acute appendicitis will result in high negative appendectomy rate, it is need of time to add radiology at least ultrasonography should be mandatory in every suspected case of appendicitis in our part of world and diagnostic laparoscopy in equivocal cases especially in female patients.

**Key Words:** Acute appendicitis, Advance radiology, Clinical judgment, Diagnostic laparoscopy, TLC, Histopathology

### INTRODUCTION

Acute appendicitis is 2<sup>nd</sup> most common acute emergency, after nonspecific abdominal pain in presentation to the emergency department<sup>1</sup>. It has a rate of 7-12% in the general population. The peak age of incidence is between 16 to 40 years in adults<sup>2</sup>. More common in males. However, in young women of child-bearing age, the diagnosis of appendicitis is difficult due to the wide range of differential diagnoses<sup>3</sup>. Acute appendicitis is a clinical diagnosis and many surgeon resorts to a clinical judgment for the management. This clinical decision has a lot of potential for improvement as reflected by the high negative appendectomy rate (NAR) up to 37%<sup>4</sup>. A major problem is overtreatment in the form of normal appendectomy (removal of the histologically normal appendix), which may be lead to high cost and postoperative complications<sup>5, 6</sup>. There is little consensus on optimal diagnostic pathways for right iliac fossa pain diagnosis<sup>7</sup>. Although different scoring systems are used to reduced negative appendectomy rate (NAR)., In the USA

and Europe, CT scan is routinely used for appendicitis diagnosis<sup>6</sup>, Equivocal cases Diagnostic laparoscopy is used routinely specially in female patients<sup>7, 8</sup>. which reduced the negative rate as low as 3.5%. But in South Asia like Pakistan lack of routine CT scans and even the non-availability of routine use of U/S, the NAR is as high as up to 20—37%<sup>9</sup>.

The negative appendectomy rate is 11-36%<sup>8, 9</sup> in Australia and 15-33% in the United Kingdom<sup>10, 11</sup>. But in the United States the NAR rate is less than 5%<sup>11</sup>. The availability of advance radiology and its utilization in appendicitis reducing the negative appendectomy rate. Despite this great achievement The questions remains regarding the cost-benefit of imaging verses to other clinical indicators<sup>9</sup>. Diagnosis of appendicitis is possible only on histological examination, regardless of the gross appearance of the appendix and the clinical picture<sup>12</sup>.

This study was conducted at a tertiary care teaching hospital where the emergency presentation of acute abdominal pain is attended by junior residents. We evaluate and diagnose

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ISSN: 2231-2196 (Print) ISSN: 0975-5241 (Online)

Received: 06.03.2022

Revised: 19.03.2022

Accepted: 07.04.2022

Published: 03.05.2022

acute appendicitis on clinical judgment with histopathological findings rather than a specific scoring system. Whenever needed or was available ultrasonography was done. So the objective of this study was to find out the NAR in a tertiary care hospital of Quetta and to see the positive clinical predictors in our sitting.

## MATERIAL AND METHOD

The study is a prospective observational study conducted between Nov 2020 and June 2021. The study was approved by the institutional review board, informed consent was taken from all the study participants. 121 consecutive adults patients who presented with the clinical feature of acute appendicitis and underwent appendectomy were included in the study.

### Inclusion criteria:

1. All patients with acute pain in right lower quadrant and with clinical features suggestive of acute appendicitis
2. All patients who underwent open appendectomy after satisfying the above mention criteria
3. Adults patients aged 15 and above
4. Patients whose appendix was sent for Biopsy with standard protocol.

### Exclusion criteria:

1. Age below 15 years
2. Female patient with known gynecological conditions
3. Patient had a recent abdominal surgery minor or major
4. Interval appendectomy

All patients admitted with features suggestive of acute appendicitis like right iliac fossa pain, rebound tenderness, nausea, total leucocyte count, and-in case of u/s- a high suspicion of acute appendicitis underwent appendectomy. The appendectomy specimen was sent for histopathology as the final step for diagnosis. And the histopathology report was used as the gold standard reference for the study. All the biographic and demographic data, clinical assessment and per operative finding were recorded on a proforma prospectively then analyzed.

The statistical analysis of the study was performed by using a statistical package for social sciences (SPSS version 21. IBM corporation USA). In the study p-value of less than 0.05 was considered to be statistically significant. The mathematical tools used in the analysis were the chi-square test and Binary regression analysis.

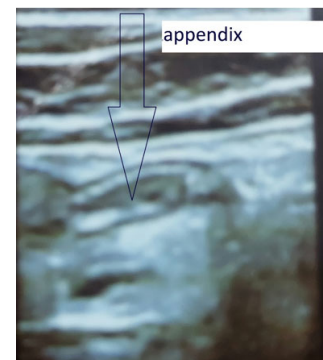
## RESULTS

A total of 121 appendectomies were performed. About 88.4% of the patients were 30 years old or younger. Only

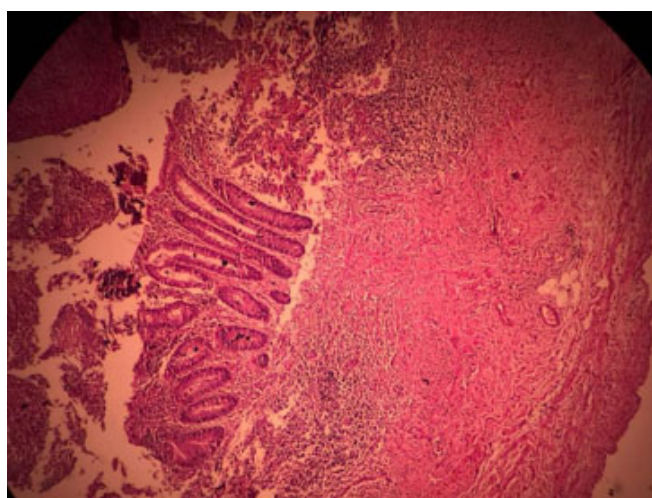
11.6% of this population was older than 30 years of age (Table 1). Out of 121 patients, 43% were males, and 57% were females. Migration of pain to the right iliac fossa (RIF) was present in 55.4% of the patients. Anorexia was present in 66.9%, and nausea in 84.3% of patients. Although rebound tenderness in RIF was present in 40.5% of patients, tenderness in RIF was present in 17.4 % of the patients. Rovsing's sign was positive in 47.1%. (Table 1). TLC was  $\geq 12,000/\text{mm}^3$  in 47.9% of patients, Ultrasound abdomen showed inflamed in appendix in 41.3% of patients. Histopathology was suggestive of acute appendicitis only in 40.5% of patients (Table 1).

Crosstabs between histopathological findings (inflamed or normal appendix) and gender showed that they had a statistically significant ( $p=0.002$ ), but weak and positive correlation ( $r=0.277$ ) (Table 2; Fig 1a). Similarly, both tenderness in RIF and rebound tenderness in RIF had a statistically significant ( $p=0.007$ ,  $r=0.244$ , and  $p=0.007$ ,  $r=0.245$ , respectively), but weak, positive correlation with histopathological appearance (Table 2; Fig 1b, 1c). Histopathological findings and TLC also showed that they had a statistically significant ( $p=0.031$ ), but weak and positive correlation ( $r=0.186$ ) (Table 2; Fig 1a). No other significant correlations were found.

Binary logistic regression analysis was done to assess the effects of various predictors on inflammation of the appendix (through positive or negative histopathological reports) (Table 3). The model was statistically significant ( $p=0.000$ ), variation in the dependent variable based on our model ranged from 22.0% to 30.0%, and the model correctly classified about 72% of patients. Results showed that only gender and rebound tenderness in RIF was the true predictors of histopathological proven inflammation of the appendix (Table 3). The odds ratio for the male gender was found to be 3.52 (95% CI [1.47, 8.38]), for rebound tenderness was found to be 3.5 (95% CI [1.02, 12.13]), and for TLC was 2.96 (95% CI [1.23, 7.13]), after adjusting for all remaining variables included, plus age, gender, and ultrasound findings. Male gender, rebound tenderness in RIF, and TLC was found to be strong predictors of inflammation of the appendix.



**Figure :** Ultrasound finding of Acute Appendicitis Distended, diameter more than 6mm.



**Histopathology:** shows luminal exudate mucosal ulceration with dense and filtrates of neutrophils in the muscle and serosal layer.



Grossly inflamed appendix with swollen tip full of pus

**Table 1: Distribution of variables in categories:**

Measures:	Categories:	Frequency	%age:	Males:	Females:
Age (n=121)	≤30	107	88.4	42.1%	57.9%
	>30	14	11.6	-----	-----
Gender (n=119)	Male	52	43.0	-----	-----
	Female	69	57	-----	-----
Rovsing's sign (n=120)	Yes	57	47.1	47.4%	52.6%
	No	63	52.1	-----	-----
Migration of pain to RIF <sup>1</sup> (n=121)	Yes	67	55.4	35.8%	64.2%
	No	54	44.6	-----	-----
Nausea (n=120)	Yes	102	84.3	42.2%	57.8%
	No	18	14.9	-----	-----
Anorexia (n=121)	Yes	81	66.9	43.2%	56.8%
	No	40	33.1	-----	-----
Tenderness in RIF (n=121)	Yes	21	17.4	52.4%	47.6%
	No	100	82.6	-----	-----
Rebound tenderness in RIF (n=121)	Yes	49	40.5	44.9%	55.1%
	No	72	59.5	-----	-----
		40.5			
TLC <sup>2</sup> (n=121)	≥12000	58	47.9	46.6%	53.4%
	<12000	63	52.1	-----	-----
U/S <sup>3</sup> findings (n=121)	Infected	50	41.3	44%	56%
	Normal + other	71	58.7	-----	-----
Histological findings (n=121)	Inflamed	49	40.5	59.2%	40.8%
	Normal + other	72	59.5	31.9% <sup>4</sup>	68.1% <sup>4</sup>
Gross appearance (n=121)	Inflamed	121	100	-----	-----
	Normal	0	0	-----	-----

<sup>1</sup>RIF=Right iliac fossa, <sup>2</sup>TLC=Total leucocyte count, <sup>3</sup>U/S=Ultrasound, <sup>4</sup>Negative appendicectomy percentages within gender  
(a) (b)

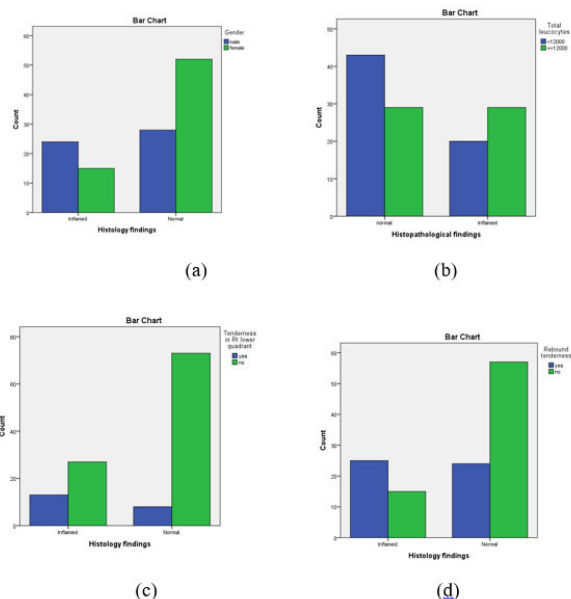


Figure 1: Statistically significant Chi-square results in the study.

Table 2: Significant Pearson Chi-square and correlations of histopathological findings:\

Variable 1:	Variable 2:	p-value:	Correlation:
Histopathological findings	Gender	0.003	0.270
Histopathological findings	Tenderness in RIF <sup>1</sup>	0.007	0.244
Histopathological findings	Rebound tenderness in RIF	0.007	0.245
Histopathological findings	TLC <sup>2</sup>	0.031	0.186

<sup>1</sup>RIF=Right iliac fossa, <sup>2</sup>TLC=Total leucocyte count

Table 3: Binary logistic regression analysis of histological findings with independent variables

Model =0.000	p-value:	OR <sup>1</sup> :	95% C.I. for OR	
			Lower	Upper
Age	0.256	-----	-----	-----
Gender (Male)	0.004	3.52	1.478	8.380
Pain migration	0.112	-----	-----	-----
Nausea	0.455	-----	-----	-----
Anorexia	0.363	-----	-----	-----
Fever	0.248	-----	-----	-----
Rebound tenderness in RIF <sup>2</sup>	0.047	3.51	1.02	12.134
Tenderness in RIF	0.071	-----	-----	-----
TLC <sup>3</sup>	0.016	2.96	1.23	7.137
U/S findings	-----	-----	-----	-----

<sup>1</sup>OR=Odds ratio <sup>2</sup>RIF=Right iliac fossa, <sup>3</sup>TLC=Total leucocyte count, <sup>4</sup>U/S=Ultrasound findings

## DISCUSSION

Acute appendicitis can often prove to be a diagnostic perplexity. More so in female patients. This is attributed to the myriad presentations, these patients can have the numerous other conditions that mimic acute appendicitis

In our study, more than 88.4% of the patients were ≤30 years of age (Table 2). In this younger age group, the males was less than females i.e. 43%. However, 59.2% of the histologically inflamed appendix belonged to the male group, only 31.9% of female appendix was inflamed. These findings were comparable with the literature, where it was found that acute appendicitis was commoner in younger people, and in males, but it was falsely diagnosed twice as commonly in females<sup>2</sup>.

The negative appendectomy rate (NAR) ranges from 19% to 34% in the UK<sup>12</sup>. In our study, however, only about 40.5% of the appendectomy specimens were found to be inflamed, and the rest of the samples either showed normal histopathology or some other pathology. It meant that about 59.5% of the patients had undergone negative appendectomy. This finding was alarming.

In a study done in Australia, NAR for males was 9.0%, and for females was 12.7%<sup>13</sup> and in a Pakistani study, it was 7%-12.7% for males, and 7%-29% for females. In our sample, about 19% of males, and 40% of the females had undergone negative appendectomy. Negative appendectomy rate (NAR) is common in females due to certain gynecological conditions like ovarian cysts, pelvic inflammatory disease, ectopic pregnancy, etc.<sup>14</sup> To reduce NAR among young age females, a transvaginal ultrasound would be required, in addition to abdominal ultrasound, in suspected gynecological issues<sup>15</sup> which is not practiced routinely in our setups. Apart from gynecological causes, certain non-gynecological causes can also cause lower abdominal pain in young girls, which might mimic acute appendicitis, and lead to unnecessary surgery<sup>16</sup> These causes might include mood disorders, depression, anxiety, eating disorders (anorexia nervosa, bulimia), or other emotional problems.

Another important reason for this sizeable NAR was a fear of appendix perforation. Perforation of appendix rate was reported to be 7% to 13% in Pakistan. Therefore, surgeons prefer to do appendectomy as soon as possible to avoid perforation and peritonitis. But avoidable surgery is a financial burden for the patients as well as for the healthcare system.

NAR of 15 to 30% is mostly acceptable<sup>17</sup>. However, efforts are being made to reduce it further. Different scoring systems have been developed for proper diagnosis. In a study done in India, it was suggested that this could have been prevented by using criteria of RIPASA>11 instead of 7.5<sup>18</sup>. Similarly, ultrasound together with a modified Alvarado score could be



a better way for better diagnosis<sup>19</sup>. Appendicitis was histologically confirmed in more than 95% of patients with help of CT and abdominal ultrasound. About 97% of these cases were diagnosed with help of a CT scan, and 93% of the cases with ultrasonography<sup>20</sup> The false-positive rate for assessing appendicitis was 5.4% with ultrasound, and 2.3% with CT scan<sup>21</sup>. Hence, the negative appendectomy rate could be improved by preoperative imaging<sup>22</sup>. The diagnostic laparoscopy<sup>7</sup>. This could also save costs of surgery, hence avoiding wastage of resources<sup>23</sup>. However, in developing countries, like India and Pakistan, using imaging in every patient is expensive nor all time available in the hospital premises in government set up. And very expensive for patients from private systems to have u/s.<sup>24</sup> Hence, making decisions under these circumstances can be difficult for surgeons, especially junior doctors<sup>25</sup> According to a study in Pakistan, even imaging techniques were believed not to significantly reduce the negative appendectomy rate<sup>26</sup>, probably due to comparatively inexperienced sonographers, because regardless of a high rate of negative appendectomies, about 25% of the non-inflamed appendix was found to be with other pathologies which might have caused RIF pain and they could not be differentiated on imaging.

## CONCLUSION

The Negative appendectomy rate was very high in comparison to other regional and global setups. Tenderness in right iliac fossa (RIF), rebound tenderness, total leukocyte count were found to be the positive predictor of acute appendicitis. Moreover negative appendectomy rate was found more prevalent in female population.

### Recommendation:

Further studies needed to be carried out to take a deep insight and causative factors of High negative appendectomy rate in this area. Need of time to add advance radiology routinely like ultrasonography and CT Scan to avoid unnecessary removal of appendix.

**Disclosure:** The authors declare no conflicts of interest and no source of funding for this study.

## ACKNOWLEDGEMENT

The authors are grateful to Immaduddin Khan a 9<sup>th</sup> class student for his contribution in formatting and typing of the this article.

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