ORIGINAL ARTICLE

Role of Total Leukocyte Count in Different Stages of Acute Appendicitis and Frequency of Negative Appendectomy in Tertiary Care Hospital

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Abstract

Objective
To study the role of total leukocyte count (TLC) in different stages of acute appendicitis. To find out the frequency of negative appendectomy in a tertiary care hospital.

Study design
This was a cross-sectional study.

Place and duration of the study
The study was conducted in Surgical Unit 1 of Jinnah Postgraduate Medical Center, Karachi, Pakistan, from December 2019 to December 2020.

Methodology
One hundred twelve participants were included, above 12 years of acute appendicitis. Clinical findings and TLC recorded on Performa. Appendectomy was performed, and operative results were recorded. Specimens of the appendix were sent for histopathological evaluation recorded as usual, catarrhal, suppurative, and gangrenous.

Results
Out of 112 patients, 82 (73%) were male, and 30 (27%) were female. Ten (9%) patients were 13–20 years old, 62(55%) were 21–30 years old, 30 (27%) were 31–40 years old, 8 (7%) were 41–50 years old, and 2 (1.79%) were older than 50 years. TLC was elevated in 108 patients (96%): more than 13,000 in 56 (50%) patients. On histopathology, catarrhal appendicitis in 60 (54%), suppurative appendicitis in 30 (27%), gangrenous appendicitis in 18 (16.07%), and negative appendectomy in 4 (3.6%). TLC was more than 13,000 in gangrenous appendicitis in 16 (88.88%) out of 18 patients, in suppurative appendicitis in 28 (93%) out of 30, and in catarrhal appendicitis in 12 (20%) out of 60.

Conclusion
Raised TLC has diagnostic significance and is helpful in the diagnosis of appendectomy to prevent complications of appendicitis, and TLC greater than 13,000 shows complicated appendicitis.

Keywords
Acute appendicitis, total leukocyte count, gangrenous appendicitis.

Introduction
Acute appendicitis is the most common surgical emergency, and a raised total leukocyte count (TLC) proves helpful in its diagnosis. TLC plays a role in diagnosing pediatric acute appendicitis and the duration of symptoms in different stages of appendicitis.[1]

TLC is not always a good diagnostic indicator of acute appendicitis. Still, as an adjunct to clinical examination, it is helpful in decision-making for appendectomy.[2] A raised TLC is diagnostic of acute appendicitis. With a neutrophil count, greater than 78% of the patients are confirmed to have acute appendicitis. However, TLC is not specific to appendicitis only. Acute appendicitis does not have symptoms in children. It indicates that the obstruction of the appendix causes congestion and perforation. Thus, a high TLC index in children indicates acute appendicitis.[3] TLC in females and children leads to suspicion of appendicitis in the presence of clinical findings. The preoperative percentage of the lymphocyte count helps differentiate between simple and complicated appendicitis. TLC more than 13,500, neutrophils count more excellent than 75%, and lymphocyte count greater than 14.8% are associated with complicated appendicitis.[4]

The diagnostic value of TLC is increased when it is combined with C-reactive protein (CRP). Patients with signs and symptoms of acute appendicitis may have a regular TLC. This study showed a regular TLC with signs and symptoms of acute appendicitis in 22% of the patients diagnosed with acute appendicitis on histopathological examination.[5] However, appendicitis is difficult to diagnose during pregnancy because of the already high TLC, so imaging clearance via ultrasonography is necessary.[6] The misdiagnosis of acute appendicitis happens in 20%–40% of the cases, resulting in complications. Negative appendectomy also causes complications such as hospital-acquired infections, so accurate diagnosis is crucial.[7] Imaging, such as ultrasonography and

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TLC, have a significant role in equivocal signs.

The rationale behind this study is that TLC is nonspecific for acute appendicitis. However, it still has a role in decision-making for surgical intervention to know the severity of acute appendicitis, such as suppurative or gangrenous cases. Therefore, this study was conducted to determine the significance of TLC in the severity of acute appendicitis.

The objective was to understand the role of TLC in diagnosing and differentiating complicated appendicitis, such as suppurative and gangrenous, from uncomplicated appendicitis, such as catarrhal, and the frequency of negative appendectomy is calculated.

Methodology

This cross-sectional observational study was conducted over one year from December 2019 to December 2020 in Ward 3 of Jinnah Postgraduate Medical Center, Karachi, Pakistan. Both male and female patients older than 12 years were registered. The patients presented to the emergency room with complaints of migratory pain in the right iliac fossa and discomfort within 48 hours with tenders and rebound tenders. The provisional diagnosis of acute appendicitis is considered with raised TLC and clinical diagnosis. An emergency appendectomy was performed.

In an emergency after the consent, operative findings include a taut-like appendix in the catarrhal stage, pus in the right iliac fossa in the suppurative location, and black color of the appendix in the gangrenous place were recorded. If the appendix looked normal, the terminal ileum up to 2 feet and the ovaries in female patients were also examined during the operation. An appendix specimen was sent for histopathological examination, and the report was collected. Findings such as routine, catarrhal, suppurative, and gangrenous appendicitis were recorded on Performa. The leukocyte count was also recorded for every patient, and TLC less than 11,000 was considered normal, between 11,000 and 13,000 mild, and more than 13,000 severe.

The duration of pain was recorded in hours before appendectomy, and the significance of the time during each stage of appendicitis was noted on Performa. Patients with other infections associated with appendicitis, such as respiratory tract infection and acute cholecystitis, were excluded because they can affect the TLC. Those with an appendicular lump and acute peritonitis due to ruptured appendix were also excluded. Data were analyzed by SPSS (v.25; IBM Corp., Armonk, NY, USA).

The significance of TLC in different stages of acute appendicitis calculated in frequency and the impact of duration on the steps of acute appendicitis were also noted.

Results

Out of 112 patients, 30(26.79%) were female, and 82 (73.21%) males; 10(8.92%) belonged to the 13–20 years age group, 62 (55.35%) to the 21–30 years age group, 30 (26.79%) to the 31–40 years age group, 8 (7.41%) to the 41–50 years age group, and 2 (1.79%) were older than 50 years. Sixty (53.57%) patients presented within 12 hours,30 (26.79%) within 24 hours, and 22 (19.64%) within 24–48 hours. TLC was found to be elevated in 108 (96.42%) patients. Histopathological examination showed that 4 (3.57%) patients had a normal appendix. All the patients had a neutrophil count of more than75%.

Uncomplicated acute appendicitis, such as acute catarrhal, was reported in 60 (53.57%) patients. Complicated appendix, such as suppurative and gangrenous, was found in 48(42.85%) patients. Table 1 presented the histopathological stage of acute appendicitis and elevated TLC.

Figure 1 shows the duration of the presentation. Sixty (53.57%) patients presented within 12 hours who had acute catarrhal appendicitis, 30 (26.78%) delivered within 24 hours with suppurative appendicitis, and 22 (19.64%) given after 24–48 hours. Eighteen patients presented with gangrenous appendicitis.

Discussion

Appendicitis is an inflammation of the appendix that is most common among young adults. It may be simple, but it may also lead to complications, such as an appendicular abscess, gangrene, or perforation. Appendicitis is usually diagnosed on history and physical examination (i.e., migratory pain, right iliac fossa tenderness, rebound tenderness) and white cell count.

Ultrasonography, CT scans, and laparoscopy may also be helpful in the diagnosis, but CT scans are not available at every primary and secondary center. CT scans work by providing high radiation levels to patients, so their hazards weigh more than the benefits. They are expensive as well. Simple TLC does not cause any harm to patients, is readily available at every center, has a diagnostic value, and can help with early decision-making for appendectomy. The diagnosis of acute appendicitis in children is challenging in many cases.[8] The Appendicitis Inflammatory Response Score, such as the Alvarado score, helps perform the diagnosis, but it remains uncertain.[9] The Alvarado score is 94% sensitive, and TLC is raised to 90%.[10] This study indicates that the Alvarado score was 90% diagnostic, and TLC was increased by 98%.[11] The diagnostic value of CRP and TLC was 96.25%. The sensitivity of TLC was more than 90% in the diagnosis of acute appendicitis.[12] The diagnostic criteria of TLC, CRP, and bilirubin in patients suspected of acute appendicitis was significantly raised by 96.6% more than 11,000.[13] TLC, and CRP was diagnostic in acute cases should be performed in every suspected case of appendicitis. TLC and CRP have 100% sensitivity; however, only TLC is 93% sensitive. Therefore, both should be done.[14] TLC is found to be significantly raised if measured within 24 hours of the onset of symptoms, and antibiotics should not be administered if TLC is considerably less. If antibiotics are taken (37.8%) compared to the non-

Table 1. Total leukocyte counts in different stages of acute appendicitis

Stages of acute appendicitis	No. patients	Raised TLC		
		>11,000	<13,000	>13,000
Acute catarrhal appendicitis	60/112 (53.57%) (44.3–62.6) 95% CI	60/60 (100%) (95.1–100.0) 95% CI	48/60 (80%) (68.4–88.6) 95% CI	12/60 (20%) (11.3–1.5) 95% CI
Acute suppurative appendicitis	30/112 (26.78%) (19.2–35.5) 95% CI	30/30 (100%) (90.5–100.0) 95% CI	2/30 (6.66%) (1.1–20.2) 95% CI	28/30 (93.33%) (79.6–98.8) 95% CI
Acute gangrenous appendicitis	18/112 (16.07%) (10.1–23.7) 95% CI	18/18 (100%) (84.6–100.0) 95% CI	2/18 (11.12%) (1.9–32.1) 95% CI	16/18 (88.88%) (67.8–98.0) 95% CI
Normal appendix/negative appendectomy	4/112 (3.57%) (1.1–8.3) 95% CI	0/4 (0%) (0.0–52.7) 95% CI	0/4 (0%) (0.0–52.7) 95% CI	0/4 (0%) (0.0–52.7) 95% CI
Total patients	112 (100%)	108/112 (96.42%) (91.6–98.8) 95% CI	52/112 (46.42%) (37.3–55.7) 95% CI	56/112 (50%) (40.8–59.2) 95% CI

CI, confidence interval.

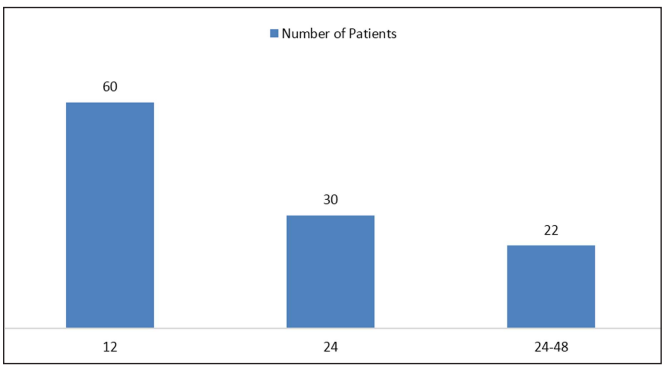

Fig 1. Duration of presentation.
The *x*-axis shows hours from pain onset, which indicates the number of patients who presented with acute appendicitis.

antibiotics group (62.2%), the duration of antibiotics also lowers the levels of TLC.[15] TLC is a widely available test, is less costly than radiological investigation, has a sensitivity and specificity of 20%–80%, and is not replaced in clinical judgment. Decision-making for appendectomy in patients suspected of appendicitis is complicated because regular appendix removal is embarrassing for surgeons and exposes patients to complications caused by anesthesia and surgical site wound infection. Any delay in decision-making for appendectomy of patients with complex appendicitis can prove fatal.

Appendicular rupture can lead to peritonitis and morbidity. Even if the appendix is not ruptured, delay in appendectomy can lead to preoperative complications, such as adhesion formation and frozen pelvis in females. Frozen pelvis, later on, causes infertility in young females. Appendectomy in the case

of catarrhal appendicitis can prevent complications, and early decision-making for an appendectomy is beneficial to patients. As always-elevated TLC is helpful in decision-making adjuvant to clinical examination. In patients who are obese and female, it is sometimes difficult to diagnose with equivocal signs and symptoms. TLC helps in elevated decisions, but salpingitis can confuse females, making the decision-making process difficult. It is better to go for an appendectomy because complications caused by appendicitis are fatal, and mistakes should be avoided to be on the safe side, as a ruptured appendix is more dangerous. Thus, in females, wound complications of the normal appendix and infertility cause stress and psychosis, so prevention is better than cure.

In this study, TLC was found to be significantly raised in appendicitis (96.42%), and it had diagnostic and decision-making roles in appendectomy. Appendicitis can be divided into catarrhal, suppurative, gangrenous, perforated, resolving, and chronic; an increased leukocyte count reported mainly in males was diagnostic of gangrenous appendicitis.[16] TLC, serum bilirubin, and CRP indicated perforation of the appendix and predictive value of TLC, bilirubin, and CRP in the diagnosis of gangrenous and perforated appendicitis.[17]

A TLC of more than 13,000 is indicative of gangrenous appendicitis. The same findings were noted in this study: TLC was more incredible than 14,000 in gangrenous appendicitis in 13% of the cases. Gangrenous appendicular rupture can lead to peritonitis, which can cause death. Appendectomy can prevent further complications, but a postoperative intraperitoneal abscess can still occur, which can cause morbidity. In this study, TLC was found to be markedly raised to more than 13,000 ingangrenous appendicitis. TLC has a significantly important role in diagnosing suppurative and gangrenous appendicitis and can cause intestinal obstruction because of adhesion formation and infertility due to the frozen pelvis. It can be prevented by early decision-making for appendectomy in patients suspected of appendicitis with the help of elevated TLC.

A negative appendectomy is associated with more extended hospital stays, more significant morbidity, and higher cost than catarrhal non-perforated appendectomy.[18] A negative appendectomy rate of 15%–25% was acceptable in women, and 9.5% was recorded in this study; 63.3% was in females.[19] Elevated TLC helps in the diagnosis and can prevent negative appendectomy. Complications are related to negative appendectomy. In this study, negative appendectomy was less common (3.57%) than catarrhal. This was due to an excellent clinical assessment and raised TLC so that elevated TLC can also prevent negative appendectomy. In the case of regular TLC, further investigation should be carried out to diagnose the problem.

Eighty-seven percent of the cases with appendicitis are reported in those younger than 40 years, and predominantly, males are involved.[20] In this study, mainly male patients and those younger than 40 years were affected (90%).

The limitation of this study was that children were excluded from it, which can alter the results. The sample size was adequate; however, it can affect the results if increased, so further study should be conducted.

Conclusion

Raised TLC has diagnostic significance and is helpful in early decision-making for appendectomy to prevent complications caused by appendicitis. TLC greater than 13,000 indicates complicated appendicitis, as in suppurative or gangrenous cases.

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