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Correlation Of Serum Bilirubin Level In Diagnosed Case Of Appendicitis.

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ABSTRACT

Appendicitis is one of the most common surgical emergencies, requiring prompt diagnosis and management to prevent complications. This study explores whether serum bilirubin is correlated to appendicitis. A prospective observational study was conducted at a tertiary care hospital in Maharashtra from April 2024 to February 2025, enrolling 70 patients diagnosed with appendicitis. Serum bilirubin levels were measured at admission and discharge, with statistical analysis performed using IBM SPSS. Patients were stratified based on the Alvarado score, with scores above 7 leading to surgical intervention. Among 45 operative patients, 36 exhibited a postoperative reduction in bilirubin levels, while 9 showed an increase. Conversely, in 25 non-operative patients, 10 demonstrated a decrease, while 15 had elevated bilirubin levels upon discharge. Statistical analysis revealed a significant correlation (p -value = 0.000729) between elevated serum bilirubin and appendicitis, supporting its role as a biochemical marker. These findings suggest that serum bilirubin, despite moderate sensitivity, may serve as a valuable adjunct to existing diagnostic tools. Incorporating bilirubin levels into clinical assessment could enhance diagnostic accuracy, particularly in cases with borderline Alvarado scores, aiding in timely and effective management of appendicitis.

Keywords: Serum bilirubin, appendicitis.

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INTRODUCTION

Appendicitis is one of the most common surgical emergencies encountered worldwide, necessitating prompt diagnosis and appropriate management to prevent complications. In recent years, there has been growing interest in exploring novel diagnostic markers to aid in the timely and accurate diagnosis of this condition.

Sometimes, a definitive clinical diagnosis of the disease may also be difficult for experienced surgeons [2]. Serum bilirubin, a by product of heme metabolism, has emerged as a potential new diagnostic marker for appendicitis. Traditionally, serum bilirubin levels have been primarily associated with liver function and disorders. However, recent research has shed light on the role of serum bilirubin in inflammatory processes and its correlation with various pathological conditions beyond hepatic dysfunction.

This aims to explore the role of serum bilirubin as a diagnostic test in acute appendicitis, with a specific focus on its efficacy compared to traditional diagnostic methods.

Different scoring systems have been designed to help diagnose acute appendicitis, including criteria for inflammatory response and the Alvarado scale [3,4].

Appendicitis remains a common surgical emergency with diagnostic challenges often encountered in clinical practice. Recent studies have explored the potential of serum bilirubin as a novel diagnostic marker for this condition. The investigations have focused on elucidating the role of hyperbilirubinemia in identifying appendicitis, particularly its association with disease severity and complications. Hyperbilirubinemia has been identified as a specific marker for appendicitis and its complications, including gangrenous and perforated appendicitis [7].

The underlying mechanisms linking hyperbilirubinemia to appendicitis involve bacterial translocation and endotoxin-induced cholestasis. Compromised integrity of the appendix wall leads to the release of inflammatory cytokines and endotoxins, resulting in hepatocellular dysfunction and impaired bilirubin excretion. This mechanistic insight provides valuable context for understanding the diagnostic significance of serum bilirubin in appendicitis.

Studies have consistently reported elevated serum bilirubin levels in patients with appendicitis compared to those with other causes of right iliac fossa pain. Moreover, hyperbilirubinemia demonstrated higher specificity than traditional markers such as white blood cell count (WBC) and C-reactive protein (CRP), indicating its potential utility as a diagnostic tool. Elevated bilirubin levels were observed to increase with the progression of appendicitis from uncomplicated to complicated forms, suggesting that bilirubin may serve as a marker of disease severity and inflammation. This finding underscores the potential of serum bilirubin as a prognostic indicator in appendicitis, aiding in risk stratification and timely intervention.

Serum bilirubin has demonstrated promising diagnostic accuracy in distinguishing between simple and perforated appendicitis[5]. Studies have reported higher bilirubin levels in patients with perforated appendicitis, indicating its potential to identify cases requiring urgent surgical intervention. However, it is important to note that while serum bilirubin exhibits high specificity and positive predictive value, its sensitivity and negative predictive value are relatively lower, necessitating the use of complementary diagnostic modalities for comprehensive evaluation.

MATERIALS AND METHODS

This was a prospective observational study conducted in the department of general surgery at a tertiary care hospital in Maharashtra from April 2024 to February 2025. The study population included all patients getting admitted to the department of general surgery with the diagnosis of appendicitis.

Sample size estimation: To determine the sample size of this study we have considered the diagnostic accuracy of bilirubin in terms of sensitivity and specificity for correlation of serum bilirubin in case of appendicitis.

In a study conducted by Emmanuel et al [1], the sensitivity and specificity of bilirubin for differentiating perforated or gangrenous appendicitis from simple acute appendicitis are 60% & 70% respectively. They also observed that 10% of patients have Perforated or gangrenous appendix. Therefore, the sample size of this study is determined using the following formula.

Sample size formula

The sample size of 70 is calculated based on the sensitivity of the bilirubin for correlation of bilirubin with appendicitis, at a 97 % confidence interval and confidence limits of 5%. Therefore, we will select 70 patients in this study as per OpenEpi.

Sampling Method

Consecutive sampling method.

Statistical analysis plan

The data was stored in Microsoft Excel Spreadsheet and data analysis was performed using IBM SPSS statistics version 28.0. The data was represented in the form of tables and graphs.

Complications predictive accuracy of the Bilirubin was evaluated using sensitivity, specificity, predictive values. The chi-square test was used to detect the association between variables. A P-value less than 0.05 will be considered statistically significant.

METHODOLOGY

All patients diagnosed with appendicitis based on ultrasonography, clinical diagnosis admitted to surgery department were included in the study. Written and informed valid consent was taken from each patient willing to be a part of this study. After stabilizing the patient, data was collected prospectively from the day of admission until discharge from hospital. Included were patients who were admitted in the emergency room or OPD and subsequently received intermediate treatment.

Following data was recorded in each patient

- Registration number
- Age
- Sex
- Vitals (Pulse rate, blood pressure, respiration rate, temperature)
- Findings of per abdominal examination
- Complete blood count
- Live function test : serum bilirubin
- USG (A + P)

After relevant history, clinical examination, and getting the above-mentioned parameters, the correlation of serum bilirubin with appendicitis will be calculated. Bilirubin was calculated on admission and on day of discharge. The change in bilirubin was noted in both operated and non operated patient of appendicitis.

Inclusion criteria

- Patients clinically diagnosed with appendicitis.
- Patients of 5-50 yrs presenting with appendicitis.

Exclusion criteria

Patients with known liver disease, hemolysis, consumption of alcohol, hepatotoxic drugs, CHF or any other systemic condition affecting serum bilirubin levels will be excluded from the study.

RESULTS

A study was conducted on a group of 70 patients to analyze the correlation between serum bilirubin levels and appendicitis. The total bilirubin level was measured for each patient. Serum bilirubin levels were evaluated in both operative and non-operative patients. The decision regarding surgery was based on the Alvarado score. Patients with an Alvarado score greater than 7 were selected for appendectomy, while those with a score of 7 or lower were treated non-operatively with antibiotics.

For non-operative patients, antibiotic treatment was administered, and bilirubin levels were tested on the day of discharge. Operative patients underwent surgery, and their bilirubin levels were measured postoperatively to determine changes.

In this study, 45 patients underwent surgery, while 25 patients were treated non-operatively. Among the 45 operative patients, 36 experienced a reduction in bilirubin levels postoperatively, whereas 9 showed an increase. In the non-operative group, 10 patients exhibited a reduction in bilirubin levels, while 15 had an increase. To analyze the statistical significance of these findings, a chi-square test was performed using the Social Science Statistics tool. The p-value obtained was 0.000729, which is statistically significant. This result indicates a correlation between serum bilirubin levels and appendicitis.

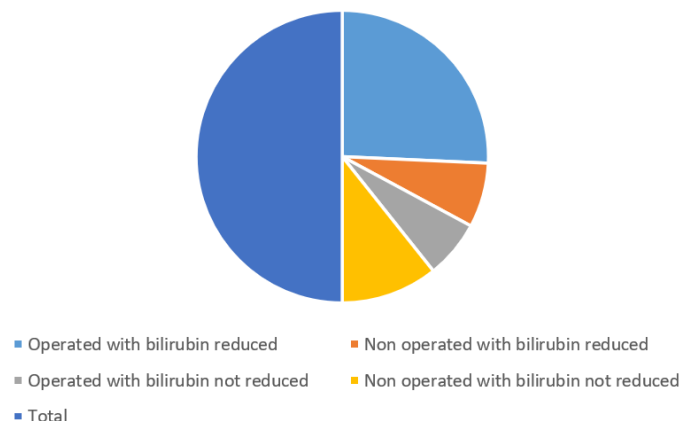
The findings suggest that elevated serum bilirubin levels could serve as a marker for appendicitis. Patients who underwent surgery showed a higher likelihood of bilirubin reduction postoperatively, supporting the hypothesis that elevated bilirubin levels in appendicitis may be linked to systemic inflammatory responses. On the other hand, a significant proportion of non-operative patients exhibited increased bilirubin levels, possibly due to persistent inflammation despite antibiotic treatment.

The Alvarado score remains a widely used tool for diagnosing acute appendicitis, incorporating parameters such as tenderness in the right lower quadrant, elevated white blood cell count, fever, rebound tenderness, and nausea. Serum bilirubin as an additional biomarker could enhance diagnostic accuracy, particularly in cases where the Alvarado score is intermediate, making surgical decisions more challenging.

In conclusion, this study demonstrates a significant correlation between serum bilirubin levels and appendicitis, as indicated by the statistically significant p-value. The findings suggest that elevated bilirubin levels may serve as a biochemical marker for appendicitis, complementing the Alvarado score. Specificity and sensitivity is calculated from Medcalc showing

Statistic	Value
Sensitivity	80.00%
Specificity	60.00%
Positive Predictive Value (*)	78.26%
Negative Predictive Value (*)	62.50%
Accuracy (*)	72.86%

Correlation Of Serum Bilirubin In Case Of Appendicitis



DISCUSSION

Serum bilirubin has gained increasing attention as a potential marker for both the diagnosis and severity assessment of acute appendicitis.

In our study, a prospective observational study, investigated whether serum bilirubin is correlated in case appendicitis. The results demonstrated a statistically significant correlation ($p = 0.000729$) between hyperbilirubinemia and appendicitis, with 80% of operative cases showing a postoperative decline in bilirubin levels. This trend suggests that bilirubin elevation is linked to the inflammatory process of appendicitis and diminishes following surgical intervention. However, in non-operative patients, bilirubin levels displayed variability, indicating that bilirubin alone may not be a definitive diagnostic marker but can be valuable when combined with WBC, CRP, and clinical scoring systems.

The other study conducted like the Parsa et al. study, employing a case-control design, explored the prognostic value of bilirubin in predicting complicated appendicitis. The findings indicated that patients with elevated bilirubin levels were 16.4 times more likely to develop perforated or gangrenous appendicitis.

Muller *et al.* (2015) reported that 95% of patients with perforated appendicitis had abnormal WBC [6]. Additionally, the study identified a notable relationship between hyperbilirubinemia and elevated WBC counts in complicated cases, although previous studies have reported inconsistent results regarding this correlation. The research aligns with findings from Souza et al., Naya et al., and Emmanuel et al., further supporting the role of bilirubin as a predictor of appendiceal perforation and gangrene.

From a clinical perspective, these findings have important applications in patient evaluation and management. Our study supports the integration of bilirubin with appendicitis. Additionally, monitoring bilirubin levels pre- and postoperatively may provide insights into disease resolution. In contrast, the Parsa et al. study suggests that hyperbilirubinemia could serve as a predictive marker for appendicitis complications, helping clinicians identify high-risk patients who may require early surgical intervention to prevent disease progression [7-22].

CONCLUSION

This study establishes a significant correlation between serum bilirubin levels and appendicitis. With a sample size of 70 patients, the results suggest that elevated serum bilirubin may serve as a valuable biochemical marker for appendicitis, complementing existing diagnostic tools such as the Alvarado score.

Among the 45 patients who underwent surgery, 36 exhibited a postoperative reduction in bilirubin levels, while 9 experienced an increase. Conversely, in the non-operative group, 10 patients showed a decrease in bilirubin levels, whereas 15 had an increase. The statistical analysis using the chi-square test yielded a p-value of 0.000729, confirming the significance of this correlation.

The study findings indicate that patients with appendicitis often present with elevated bilirubin levels, which tend to decrease following surgical intervention.

These values indicate that while serum bilirubin is a relatively sensitive marker, its specificity remains moderate. Nevertheless, its incorporation into the diagnostic framework and may improve diagnostic accuracy, particularly in cases with borderline scores where clinical decisions are challenging.

In conclusion, this study underscores the potential role of serum bilirubin as an adjunct diagnostic biomarker for appendicitis.

REFERENCES

- [1] Roepke C, Benjamin E, Jhun P, Bright A, Herbert M. Air in the belly: A discussion of abdominal compartment syndrome. *Ann Emerg Med* 2016; 67(1): 17-9.
- [2] Nomura S, Watanabe M, Komine O, *et al.* Serum total bilirubin elevation is a predictor of the

- clinicopathological severity of acute appendicitis. *Surg Today* 2014; 44(6): 1104-8.
- [3] Moon HM, Park BS, Moon DJ. Diagnostic value of C-reactive protein in complicated appendicitis. *J Korean Soc Coloproctol* 2011; 27(3): 122-6.
- [4] Alhamdani Y, Rizk H, Algethami M, *et al*. Negative appendectomy rate and risk factors that influence improper diagnosis at King Abdulaziz University hospital. *Mater Sociomed* 2018; 30(2): 215-20.
- [5] Chambers AC, Bismohun SL, Davies H, White P, Patil AV. Predictive value of abnormally raised serum bilirubin in acute appendicitis: A cohort study. *Int J Surg* 2015; 13: 207-10.
- [6] Muller S, Falch C, Axt S, *et al*. Diagnostic accuracy of hyperbilirubinaemia in anticipating appendicitis and its severity. *Emerg Med J* 2015; 32(9): 698-702.
- [7] Chambers, A. C.; Bismohun, S. L.; Davies, H.; White, P.; Patil, A. V. Predictive Value of Abnormally Raised Serum Bilirubin in Acute Appendicitis: A Cohort Study. *International Journal of Surgery* 2015, 13, 207–210. <https://doi.org/10.1016/j.ijsu.2014.11.041>.
- [8] Pogorelić Z, Lukšić AM, Mihanović J, Đikić D, Balta V. Hyperbilirubinemia as an Indicator of Perforated Acute Appendicitis in Pediatric Population: A Prospective Study. *Surgical Infections*. 2021 Dec 1;22(10):1064–71.
- [9] Sandstrom A, Grieve DA. Hyperbilirubinaemia: its utility in non-perforated appendicitis. *ANZ Journal of Surgery*. 2015 Nov 17;87(7-8):587–90.
- [10] Parekh D, Jain D, Mohite S, Phalgune D. Comparison of Outer Diameter of Appendix, C-reactive Protein, and Serum Bilirubin Levels in Complicated Versus Uncomplicated Appendicitis. *Indian Journal of Surgery*. 2019 Aug 2;82(3):314–8.
- [11] Young Ran Hong, Chung CW, Jong Woo Kim, Chang Il Kwon, Dae Ho Ahn, Sung Won Kwon, *et al*. Hyperbilirubinemia Is a Significant Indicator for the Severity of Acute Appendicitis. *Journal of the Korean society of coloproctology*. 2012 Jan 1;28(5):247–7.
- [12] Giordano S, Pääkkönen M, Salminen P, Grönroos JM. Elevated serum bilirubin in assessing the likelihood of perforation in acute appendicitis: A diagnostic meta-analysis. *International Journal of Surgery*. 2013 Nov;11(9):795–800.
- [13] Akturk OM, Yıldırım D, Çakır M, Vardar YM. Elevated serum bilirubin levels may predict perforation of the appendix. *Annali Italiani di Chirurgia [Internet]*. 2019 Sep 1 [cited 2024 Apr 12];90(5):427–31. Available from: <https://annaliitalianidichirurgia.it/index.php/aic/article/view/2441>
- [14] Nomura S, Watanabe M, Osamu Komine, Takeshi Shioya, Toyoda T, Bou H, *et al*. Serum total bilirubin elevation is a predictor of the clinicopathological severity of acute appendicitis. 2013 Jul 24;44(6):1104–8.
- [15] Shuaib A, Alhamdan N, Arian H, Sallam MA, Shuaib A. Hyperbilirubinemia and Hyponatremia as Predictors of Complicated Appendicitis. *Medical Sciences*. 2022 Jul 4;10(3):36.
- [16] Kanlıöz M, Ekici U. Correlation between perforated appendicitis and total bilirubin. *acikerisimgelisimedutr [Internet]*. 2019 [cited 2024 Apr 12]; Available from: <https://acikerisim.gelisim.edu.tr/xmlui/handle/11363/6396>
- [17] Farooqui W, Pommergaard H-C, Burcharth J, Eriksen JR. The diagnostic value of a panel of serological markers in acute appendicitis. *Scandinavian Journal of Surgery*. 2014 Apr 15;104(2):72–8.
- [18] Serum Bilirubin as a New Diagnostic Marker for Acute Appendicitis and its Role in the Prediction of Appendicular Perforation - ProQuest [Internet]. www.proquest.com. [cited 2024 Apr 12].