

Diagnostic Accuracy Of Hyperbilirubinemia In Acute Appendicitis

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Abstract

Objective: To determine the diagnostic accuracy of serum Bilirubin in suspected cases of acute appendicitis keeping the histopathological findings as Gold standard.

Study Design: Cross-sectional validation study.

Place and Duration of the Study: Surgical Unit, Sheikh Khalifa Bin Zayed Al-Nayhan Hospital (Combined Military Hospital), Rawalakot, Azad Kashmir, from Jan 2022 to June 2022.

Methodology: A total of 380 patients suspected of having acute appendicitis clinically between the ages of 18 to 65 years of either gender were included. All individuals matched the inclusion and exclusion criteria. Serum Bilirubin level was noted pre-op. An appendectomy was done. Specimen of the appendix was sent for histopathological analysis post-op for confirmation of the diagnosis.

Results: In our study, the mean age of the patients was 34.015 years with a standard deviation of 13.32 years. 65% (n=247) of the patients were males and 35% (n=133) were females. The frequency of acute appendicitis on histopathology was 82.89% (n=315) while 17.1% (n=65) had no findings of the disease on histopathology. Validity of serum Bilirubin in diagnosing acute appendicitis using histopathology showed 57.36% (n=218) were true positive, 2.1% (n=8) were false positive, 15% (n=57) were true negative and 25.52% (n=97) were false negative. Specificity, sensitivity, negative predictive value, positive predictive value, accuracy rate, positive likelihood ratio and negative likelihood ratio were calculated as 87.69%, 69.20%, 37.01%, 96.46%, 72.36%, 5.62 and 0.35 respectively.

Conclusion: Serum Bilirubin is a useful marker for diagnosing acute appendicitis and can be used as a good alternative diagnostic modality in suspected cases of acute appendicitis.

Keywords: Diagnostic accuracy, Serum Bilirubin, Acute appendicitis.

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Cite this Article: Baseer, S. , Rehman, A. U., Kalwar, A. , Jamal, H., Razzaq, S., & Zareen, N. (2023). The Diagnostic Accuracy Of Hyperbilirubinemia In Acute Appendicitis. *Journal of Rawalpindi Medical College*, 27(3). https://doi.org/10.37939/jrmc.v27i3.2245.

Received February 08, 2023; accepted September 12, 2023; published online September 26, 2023

1. Introduction

Acute appendicitis is among the commonest causes of pain abdomen requiring immediate surgery¹. It is the most common cause of patients reporting in the emergency department with acute abdomen². In cases of acute appendicitis, male to female ratio is 1.44:1³. The prevalence of acute appendicitis is 7-8%⁴. The mainstay of diagnosis in cases of acute appendicitis is usually the history, examination and radiological studies⁵. Laboratory investigations aid in the diagnosis but do not confirm the diagnosis⁶. In most of the cases, it is difficult to reach a definitive diagnosis. Many patients do not show the classical signs and symptoms of acute appendicitis⁷. Various other conditions result in right iliac fossa pain, especially in females, which may complicate further the process of diagnosis¹. Hence the diagnosis of acute appendicitis persists as an unsolved surgical dilemma⁸. The accuracy of diagnosis can further be

improved by additional investigations. Even well-experienced surgeons make their diagnosis on history, clinical examination and laboratory investigations have a diagnostic accuracy of less than 80%⁹. Computed Tomography is the standard radiological study to diagnose acute appendicitis¹⁰. Computed tomography (CT) is unavailable, especially in rural areas¹¹. To reduce negative appendectomies and delay in diagnosis of complicated appendicitis there arises a gap in available diagnostic markers. Delayed surgical intervention can lead to abscess, peritonitis, sepsis, and death¹². The most common alternate strategy is doing appendectomy as soon as the suspicion of acute appendicitis is encountered; this strategy greatly raises the number of negative appendectomies¹³. Serum Bilirubin levels and various other acute phase proteins increase in response to tissue inflammation¹⁴. Serum Bilirubin level measurement is a simple test done by the 2, 5

dichlorophenyldiazonium (DPD) method. Normal Bilirubin level is 0.1 to 1.2 mg/dL.

This study was planned to explore the accuracy of serum Bilirubin in diagnosing cases of acute appendicitis in the local population.

2. Materials & Methods

This was a cross-sectional validation study, conducted in the Surgical Unit, Sheikh Khalifa Bin Zayed Al-Nayhan Hospital (Combined Military Hospital), Rawalakot, Azad Kashmir, from Jan 2022 to June 2022. Ethical approval was obtained from the Ethical Committee. Written consent was signed by each patient for participation in this study. The sample size calculation was done with a confidence level of 95% and a margin of error of 5%. The sample size was 380. Non-probability consecutive sampling technique was followed to enrol the patients.

Selection Criteria

Inclusion Criteria: Patients of either gender, aged between 18-65 years, presenting in the hospital with pain in the right iliac fossa, with or without fever and vomiting, tenderness in the right lower abdomen and with no previous history of jaundice, were included in the study.

Exclusion Criteria: Patients with a history of acute hepatitis (drug-induced, viral and unknown), alcoholism, chronic liver disease, Dublin-Johnson syndrome, Gilbert syndrome, hemolytic, biliary or liver disease associated with raised Bilirubin and recurrent intrahepatic cholestasis, were excluded from the study.

All patients recruited for this study went through the initial assessment by history, examination and relevant laboratory investigations. Investigations required for general anaesthesia fitness were also carried out. Serum Bilirubin levels were recorded and the level above 1.2 mg/dL was considered high.

Informed consent was signed by each patient for surgery. The appendectomy was performed under general anaesthesia. The appendix was sent for histopathology post-operatively. If the findings like acute inflammation, gangrene, suppuration, and perforation were seen in histopathology then it was labelled as acute appendicitis otherwise it was declared as negative appendectomy.

All data collected was entered and analyzed with the help of Statistical Package for Social Sciences (SPSS) version 26. Qualitative variables such as gender were

measured in terms of percentage and frequency. Quantitative variables like age were presented as mean and standard deviation. Effect modifiers like age and gender were controlled by stratification and a post-stratification diagnostic accuracy test was applied. Frequency and percentages for false positive, true positive, false negative, true negative, and were observed. Sensitivity, specificity, NPV, and PPV, were calculated by the given formula and 2x2 tables. Likelihood ratios and ROC curves were also measured.

3. Results

In our study, 71% of the patients (n=270) were 18-35 years old while 29% (n=110) were 36-65 old. The mean age of the patients was 34.015 years with a 13.32 standard deviation. 65% (n=247) were male and 35% (n=133) were females. Male to female ratio came out to be 1.86:1.

Table 1: Diagnostic accuracy of serum Bilirubin concerning different age groups

	Age group 18-35	Age group 36-65
Sensitivity	68.42%	71.26%
Specificity	92.85%	78.26%
Positive Predictive Value (PPV)	98.11%	92.53%
Negative Predictive Value (NPV)	35.13%	62.79%
Diagnostic Accuracy	72.22%	72.72%
(+) Likelihood Ratio	9.57	3.27
(-) Likelihood Ratio	0.34	0.367

The acute appendicitis frequency based on histopathological findings (gold standard) was recorded as 82.89% (n=315), whereas 17.1% (n=65) had no histopathological findings of the acute appendicitis.

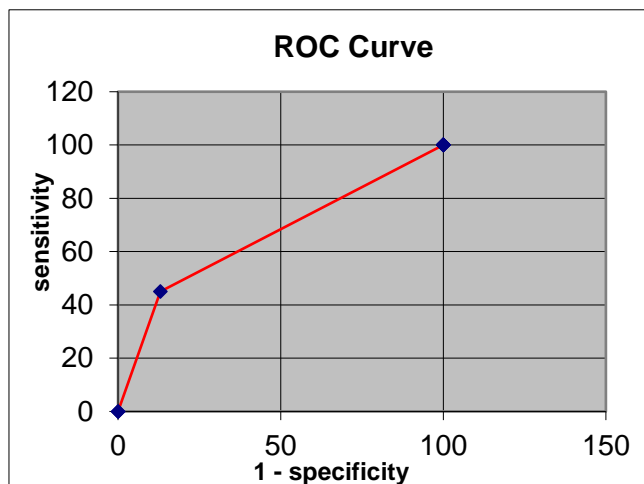
Validity of serum Bilirubin in diagnosing acute appendicitis using histopathological findings was recorded, where 2.1% (n=8) were false positive, 57.36% (n=218) were true positive, 25.52% (n=97) were false negative and 15% (n=57) were false negative.

Table 2: Diagnostic accuracy of serum Bilirubin concerning gender

	Male	Female
Sensitivity	69.75%	68.18%
Specificity	92.85%	78.26%
Positive Predictive Value (PPV)	97.94%	93.75%
Negative Predictive Value (NPV)	38.61%	33.96%
Diagnostic Accuracy	73.68%	69.93%
(+) Likelihood Ratio	9.76	3.13
(-) Likelihood Ratio	0.32	0.4

Specificity, sensitivity, negative predictive value, positive predictive value, accuracy rate (+) likelihood ratio and (-) likelihood ratio were 87.69%, 69.20%, 37.01%, 96.46%, 72.36%, 5.62 and 0.35 respectively.

The diagnostic accuracy of Serum Bilirubin concerning different age groups and gender is shown in Tables 1 to 2. The ROC curve concerning the sensitivity and specificity of different serum Bilirubin levels to diagnose Appendicitis is shown in Figure 1.



5. Discussion

In young adults, acute appendicitis is among the most common causes of acute abdomen worldwide¹. If there is a clinical suspicion of acute appendicitis then emergency appendectomy is the treatment of choice. It is usually observed that a lot of patients who undergo an emergency appendectomy are proven to be negative

based on histopathological findings (Gold standard for diagnosing appendicitis)¹⁵.

Despite many advances in medical science, a negative appendectomy rate of 15-25%¹⁶ and perforation rate of 25.8%¹⁷ exists worldwide. Timely diagnosis is crucial to avoid grave complications and to carry out timely surgery to remove an inflamed appendix. Failure to do so may result in perforation, ileus, abscess formation and various other life-threatening complications.

Recent studies have revealed that serum Bilirubin is a useful marker for diagnosing acute appendicitis. The frequency of confirmed acute appendicitis based on positive histopathological findings was noted as 82.89% (n=315) while 17.1% (n=65) patients had no positive findings on the same basis. The validity of serum Bilirubin in diagnosing acute appendicitis based on histopathological findings was noted as 57.36% (n=218) true positive, 2.1% (n=8) false positive, 15% (n=57) true negative, and 25.52% (n=97) false negative. Specificity, sensitivity, negative predictive value, positive predictive value, positive likelihood ratio negative likelihood ratio, and accuracy rates were computed as 87.69%, 69.2%, 37.01%, 96.46%, 5.62, 0.35 and 72.36% respectively. The findings of our study are comparable with a study by Hiren Judal, showing the sensitivity of serum Bilirubin in acute appendicitis as 65% and a specificity of 70%¹⁸.

Birkan Birben also conducted a study on this topic. His study revealed that the sensitivity of hyperbilirubinemia in acute appendicitis was 50.65% while the specificity was 62.79%¹⁹. Another study conducted by Long Long Li and his colleagues for diagnostic accuracy of serum Bilirubin in anticipating appendicitis claimed that it had a sensitivity of 88.7% and a specificity of 78%²⁰.

A study conducted by Seerwan Hama Shareef revealed that Bilirubin has more specificity (85%) than total leukocyte count (36%), for differentiating complicated appendicitis²¹.

5. Conclusion

In the end, we can conclude that the sensitivity and specificity of serum Bilirubin have proved to be a useful yet simple tool for the timely diagnosis of acute appendicitis and in the future serum Bilirubin may be used for the timely diagnosing the acute appendicitis to avoid the high rate of negative appendectomies. Serum Bilirubin level, which is a very economical, simple test and is easily available, may be carried out in routine

investigations in cases of clinically suspected acute appendicitis for timely confirmation of the diagnosis.

CONFLICTS OF INTEREST- None

Financial support: None to report.

Potential competing interests: None to report

Contributions:

S.B - Conception of study

S.B, A.U.R - Experimentation/Study Conduction

S.B, A.K - Analysis/Interpretation/Discussion

H.J - Manuscript Writing

S.R - Critical Review

N.Z - Facilitation and Material analysis

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