

Original Research Article

Diagnostic accuracy of hyperbilirubinemia in predicting perforated appendicitis

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ABSTRACT

Background: Appendicitis is one of the commonest causes of abdominal pain requiring emergency surgery. Often, it is difficult to reach a proper diagnosis. There may not be classical symptoms and signs of appendicitis. Accurate diagnosis can be aided by additional testing or expectant management or both. These might delay interventions and lead to appendiceal perforation with increased morbidity, mortality and hospital stay. Studies have shown that simple appendicitis has got mortality of 0.3% and perforated appendicitis 6%. Hyperbilirubinemia is a new diagnostic tool for predicting perforation of appendix. The aim of the study is to establish the role of hyperbilirubinemia as a new diagnostic tool to predict perforated appendicitis.

Methods: This is a prospective study conducted on 100 consecutive cases of acute appendicitis admitted to the emergency ward. These were subjected to investigations to support the diagnosis. These cases were also subjected to liver function tests and clinical diagnosis was confirmed pre-operative investigations and post-operatively by histopathological examination. Their clinical and investigative data were compiled and analyzed. Statistical analysis was performed using either chi square test or fisher's exact test. The level of significance was set at $P < 0.05$.

Results: Total serum bilirubin including both direct and indirect was found to be significantly increased in case of acute suppurative appendicitis. Serum bilirubin was much higher ($P < 0.000$) in cases of gangrenous/perforated appendicitis.

Conclusions: Serum bilirubin is an important adjunct in diagnosing the presence of gangrenous/perforated appendicitis.

Keywords: Acute suppurative appendicitis, Gangrenous/perforated appendicitis, Hyperbilirubinemia

INTRODUCTION

Appendicitis is one of the commonest causes of abdominal pain requiring emergency surgery. Often, it is difficult to reach a proper diagnosis. All cases may not present with typical clinical features.¹ Different clinical signs and symptoms always mimic the diagnosis of acute appendicitis, as there are a number of causes leading to pain in right iliac fossa particularly in female patients. Diagnosing acute appendicitis clinically still remains a common surgical problem. Accurate diagnosis can be aided by additional testing or expectant management or

both. These might delay laparotomy and lead to appendiceal perforation with increased morbidity and hospital stay. A safe alternative seems to be appendectomy as soon as the condition is suspected, a strategy that increases the number of unnecessary appendectomies.² Diagnostic accuracy is improved by the employing additional laboratory tests, scoring systems, various imaging modalities and laparoscopy.³ None of these methods stands alone as they all come in support of, and are secondary to a primary clinical assessment. Hyperbilirubinemia is a new diagnostic tool for perforation of appendix.⁴ Portal blood carries nutrients

and other substances absorbed from gut including bacteria and its product (toxins). In a small percentage, even in normal healthy people, bacteria are found in portal blood. It is commonly cleared by detoxification and immunological action of the reticuloendothelial system of the liver that acts as first-line defense in clearing toxic substances, bacteria and its products. But when bacterial load overwhelms the Kupffer cell function, it may cause dysfunction or damage to hepatocytes. It reflects a rise in serum bilirubin alone or in combination with liver enzymes depending upon the type, severity and site of the lesion.

Appendicitis is the disease of the young with 40% of cases occurring in patients between the age of 10 and 29 years. Delay in diagnosis and treatment results in increase rate of perforation, postoperative morbidity, mortality and hospital length of stay.^{5,6} Studies have shown that simple appendicitis has got mortality of 0.3% and perforated appendicitis 6%. Several biochemical parameters including white blood cell count, C-reactive protein, interleukin-6, prolactin, and Alvarado score have been used to improve the clinical diagnosis of acute appendicitis but there is no test or scoring system to diagnose perforation. Recent studies have shown hyperbilirubinemia to be a useful predictor of perforated appendicitis and the gold standard test for diagnosis perforated appendicitis is per operative findings and postoperative histological report. The aim of the study is to establish role of hyperbilirubinemia as a new diagnostic tool to predict perforated appendicitis.

METHODS

It is a diagnostic test evaluation study done in tertiary care and teaching institute. 100 consecutive cases clinically diagnosed cases of appendicitis admitted in surgical ward and subjected to emergency appendectomy were studied. Patients with history of jaundice, known liver disease and those below 13 years of age are excluded. Clinical and laboratory information of the patients including age, sex, duration of symptoms, temperature, total white blood cell count and differential count and Alvarado’s score were recorded. Pre-operatively patient’s blood was taken for estimating serum bilirubin and serum liver enzyme level. Hyperbilirubinemia is defined as bilirubin level more than 1 mg/dl and elevated liver enzymes alanine aminotransferase (AST, SGPT) > 40 U/L and aspartate aminotransferase (AST, SGOT) >40 U/L. Patient who underwent open appendectomy were grouped into two groups: simple appendicitis and perforated appendicitis based on intra operative findings.

The collected data were analyzed using appropriate statistical tests using SPSS programme, which includes mean, standard deviation and frequency percentage calculation of all measurements. For normally distributed data the null hypothesis is based on the assumption that

no difference in values exist between two groups and statistical significance was be assessed.

RESULTS

Of the 100 patients studied, 64 (64%) were male and 36 (36%) were females (Figure 1).

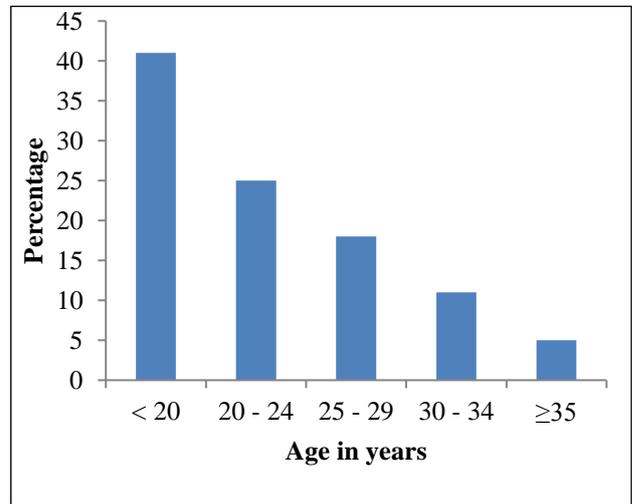


Figure 1: Age distribution in study population.

Maximum number of patients 41 were below 20 years old, followed by 20-24 years of age, 25% and least in the age group more than 35 years. The male to female ratio in present study is 1.77:1. Of the clinical variable observed, apart from pain abdomen, 90% had fever (Figure 2), 96% had nausea, and anorexia was present in 89% of cases.

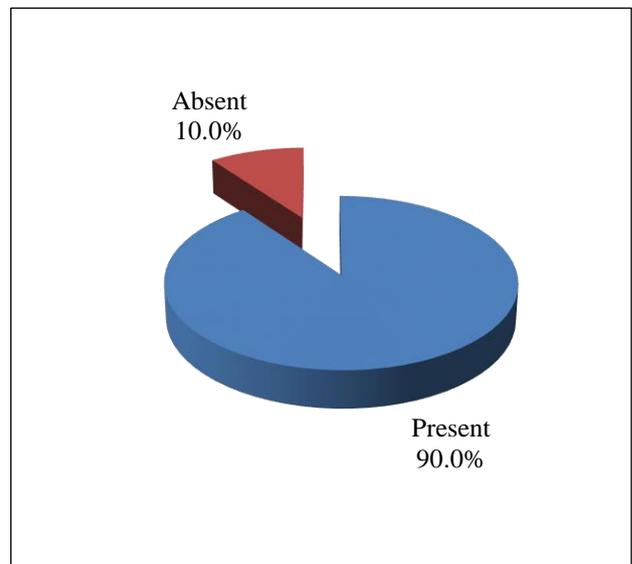


Figure 2: Fever in study population.

Total leukocyte count was elevated in 70% of cases and normal in 30% of patients. Of all clinically diagnosed cases of acute appendicitis, Alvarado score was 7 or above in 94% of cases and 6% have below 7 (Figure 3).

However, 96% of patients had normal levels of liver enzymes (ALT/AST) and only 4 percent had elevated enzymes levels.

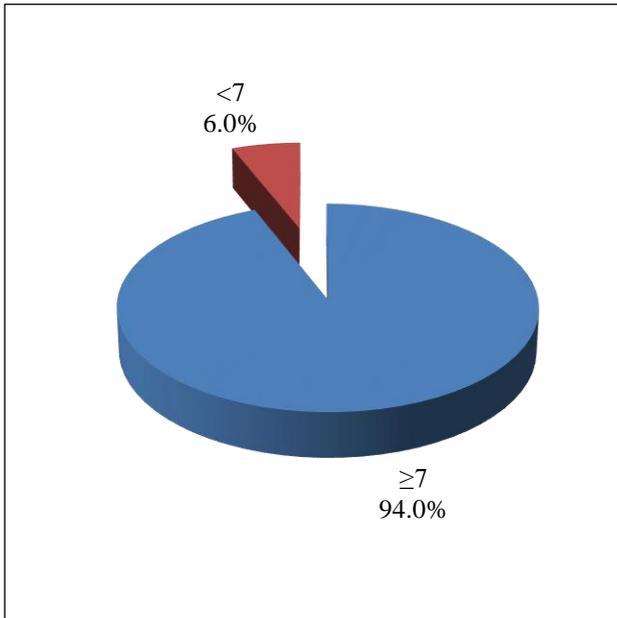


Figure 3: Alvarado score distribution in study population.

Intra-operatively 29 patients had perforated appendix and 71 had inflamed appendix (Table 1).

Table 1: Intraoperative finding.

Intra operative finding	Frequency	Percent
Perforated	29	29.0
Simple	71	71.0
Total	100	100.0

Raised total serum bilirubin level (>1mg/dl) was reported in 28% cases and normal in 72 % of total cases (Figure 4).

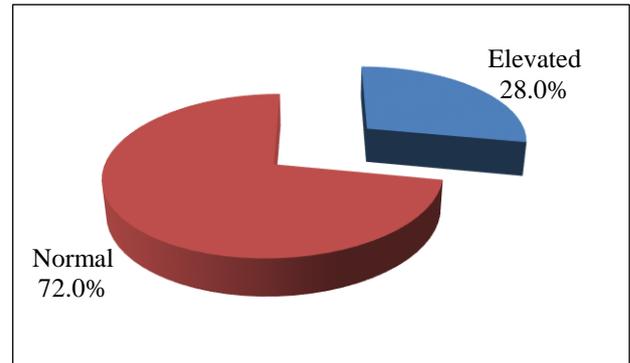


Figure 4: Serum bilirubin level.

Of the 29 perforated appendicitis patients 19 (65.5%) patients had elevated bilirubin levels whereas 71 patients with simple appendicitis only 9 (12%) patients had elevated bilirubin levels (Table 2).

Table 2: Bilirubin levels in perforated and simple appendicitis.

Operative finding	Normal		Elevated		Total	
	number	%	number	%	Number	%
Perforated	19	65.5	10	34.5	29	100
Simple	9	12.7	62	87.3	71	100
Total	28	28	72	72	100	100

The sensitivity, specificity, and accuracy of hyperbilirubinemia in predicting perforated appendicitis is 65.5%, 87.3% and 81% respectively.

DISCUSSION

In this study of 100 patients, hyperbilirubinemia was found in 19 of 29 patients with gangrenous/perforated appendicitis. This hyperbilirubinemia was mixed in type in most of the patients and at the same time there was no elevation or minimal elevation (<100 U/L) in ALT and AST in most of the cases. The level of serum bilirubin was higher than 1 mg/dL in cases of gangrenous/perforated appendicitis while in cases with acute appendicitis it was lower than 1mg/dL (P<0.05). For gangrenous/perforated appendicitis, the P-value of

SB was <0.001, specificity 87.3%, sensitivity 65.5%, positive predictive value 67.9% and negative predictive value was 86.1% and accuracy value of 81%

Since these findings were documented at the time of admission, it is unlikely that liver injury because of anaesthetic agents, blood transfusion, or medication was the cause of elevated bilirubin levels. Moreover, as per our exclusion criteria patients with alcoholic liver disease, viral hepatitis, haemolytic or congenital liver diseases were excluded from the study. The circulating endotoxemia following appendiceal infection may be reason for rise in serum bilirubin level. Experimental in-vitro studies have shown dose-dependent decrease in bile salt excretion from the liver following endotoxin infusion.⁷ In the early phase of appendicitis mucosal

ulceration occurs and this facilitates invasion of bacteria into the muscularis propria of the appendix thereby causing classical acute suppurative appendicitis. Subsequent events lead to edema, elevated intraluminal pressure, and ischemic necrosis of mucosa, causing tissue gangrene and perforation.⁸ The number of organisms isolated from patients with gangrenous appendicitis is greater than those with acute suppurative appendicitis.⁹ This higher level of bacteria in perforation of appendix reaches the portal circulation which in turn reaches the liver and interfere with bilirubin secretion into biliary canaliculi. The mechanism behind interference with the bilirubin secretion thought to be due to the action of many pro inflammatory factors.¹⁰⁻¹¹

This study shows that isolated hyperbilirubinemia without much elevation in the liver enzymes is a significant predictor of appendiceal perforation. The positive predictive value of elevated serum bilirubin level is comparable with the reported studies. This was demonstrated by a study by Estrada et al and other studies showing nearly a threefold risk of perforated appendicitis in patients with total bilirubin levels greater than 1 mg/dL.¹²⁻¹⁵

CONCLUSION

Serum bilirubin is significantly elevated in cases of appendiceal perforations. So, this can be included in routine investigation list of clinically suspected case of acute appendicitis and has high potential in predicting perforation of appendix.

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Conflict of interest: None declared

Ethical approval: The study was approved by the institutional ethics committee

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