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Original Article

Elevated serum bilirubin in acute appendicitis: A new diagnostic tool

Khan S

Department of surgery, Nepalgunj Medical College, Nepalgunj, Nepal

Abstract

Background: Acute appendicitis (AA) is one of the most common intra abdominal affections seen in surgical department, which can be treated easily if accurate diagnosis is made in time, otherwise delay in diagnosis and treatment can lead to gangrene perforation and diffuse peritonitis.

Aims and objectives: Of the study was to determine the role and predictive value of elevated total serum bilirubin (TSB) in the diagnosis of AA.

Materials and methods: All the patients admitted with clinical diagnosis of AA were tested by laboratory investigations and ultrasonograhy of the abdomen. Preoperatively patient's blood was also collected for serum bilirubin and other liver enzymes estimation. Cases that underwent emergency appendicectomy from January 2004-May 2007 were included in present study.

Results: All the patients presented within 5 hours to 7 days of onset of pain. Out of 110 patients studied, 71(64.54%) were males and 39(35.45%) were females. Age distribution was between 6 years to 73 years with a mean of 29.5years. Out off 110 cases, 106 cases had AA (positive cases). Among 106 positive cases, TSB was elevated in 87(82.07%) cases. The mean of elevated TSB was 2.26mg/dL, ranged 1.2-11.5mg/dL. An interesting finding was observed that patient's in whom the appendix was gangrenous or perforated; elevation of TSB was found to be higher as compared to simple suppurative AA. The specificity, sensitivity was 100%, 82.07%, respectively with predictive value of positive test 100% and predictive value of negative test 17.3%. The liver enzymes were either normal or marginally elevated (<1time) in most of the cases (Fig.1, 2, 3).

Conclusion: It was found in our study that elevated TSB (without severe abnormalities in the value of liver enzymes) is good indicator of AA. The specificity and sensitivity of elevated TSB was 100% and 82.07% respectively with a predictive value for positive test 100%. If TSB is added to already existing laboratory tests, then the diagnosis of AA in clinically suspected cases can be made with fair degree of accuracy and unnecessary or delay in appendicectomy can be avoided (Table 4).

Key words*:* Elevated Serum Bilirubin, Acute Appendicitis

Acute appendicitis is a common condition and diagnosis is made on the basis of history and physical findings with additional assistance from laboratory investigations[1]. Although most patients with AA be can easily diagnosed, in some cases the sign and symptoms are variable and a firm diagnosis can be difficult. This is particularly true where the appendix is retrocaecal or retroileal.

The percentage of appendicectomies performed where appendix subsequently found to be normal varies 15-50%[2] and postoperative complications can occur in up to 50%[3] of these patients. Delay in diagnosis of AA leads to perforation and peritonitis and increase mortality. Perforation ranges 50-90% in various series[4,5].

Hyperbilirubinemia (elevated serum bilirubin) is accumulation of bilirubin above physiological level in blood stream. It is because of imbalance between production and excretion. Broadly hyperbilirubinemia is divided in two categories 1. predominantly unconjugated, 2. predominantly conjugated or mixed. Predominantly conjugated or mixed type hyperbilirubinemia usually result from one of the three disorders: hepatocellular disease, intra or extra hepatic biliary obstruction. It is found in following situations e.g. hereditary disease, sepsis, post operative, drug induced cholestasis, alcoholic liver disease, parenteral nutrition, biliary cirrhosis, extra or intrahepatic biliary obstruction, acute appendicitis[6,7]. Conjugated hyperbilirubinemia without liver enzyme abnormality is relatively uncommon but can be seen in pregnancy, sepsis and recent surgery.

Correspondence
Dr. Salamat Khan
Dept. of Surgery
NGMC Teaching Hospital, Nepalgunj, Nepal
E-mail: drsalamatkhan63@yahoo.co.uk

Increased aminotrsferase level in liver disease reflects the leakage from injured cell.

The degree of elevation of aminotrasferase generally reflects the severity of hepatic necrosis. Elevation of aminotransferase out of proportion to the other liver enzymes suggests hepatocellular damage, most commonly seen in toxic, viral or ischaemic hepatitis. Prominent elevation (>3 times) of alkaline phosphatase (ALP), 5 nucleotidase or gama–glutamyltranpeptidase are more suggestive of intrahepatic or extrahepatic obstruction. Although these patterns are not diagnostic, they are helpful in directing the ensuing evaluation[6, 7].

Aims and objectives

The aim of present study was to evaluate the sensitivity, specificity, positive predictive value, negative predictive value of the elevated TSB in AA and its complication.

Material and methods

This is a prospective study conducted at NGMC Teaching hospital Nepalgunj, Nepal during January 2004 –May 2007. 110 Consecutive cases of clinically diagnosed acute appendicitis admitted in surgical unit III were recruited for the study. These were subjected to investigations to support the diagnosis. Investigations included total leucocytes count, differential leucocytes count, urine analysis and ultrasound. These cases were also subjected to liver function test. The SB was determined by semi-automatic analyser of the blood samples collected. Subsequently these cases were operated and clinical diagnosis was confirmed per–operatively and post operatively by histopathological examination. Their clinical and investigative data were compiled and analysed, and following observations were obtained. The upper limit of reference value of total serum bilirubin was 1.1mg/dL for both the sexes and all age groups

Criteria of selection for the cases: Patient with history of alcohol intake with AST/ALT <2 or no history of alcohol and hepatotoxic drug intake, HBsAg negative and no past history of jaundice with acute appendicitis were included in the study whereas the patient with history of alcohol intake and AST/ALT >2, history of hepatotoxic drug intake, HBsAg positive and /or past history of jaundice with acute appendicitis/normal appendix were excluded from the study.

Results

Total 110cases were recruited for the present study. Of 110, 52 cases (42.47%) were adult male and 34(30.90%) were adult female whereas 24(21.81%) cases belong to the child age group. Among children 19(17.27%) were males and 5(4.54%) were females. The over all age ranged from 6- 73 years .the commonest age group in adult male and female were 30-40years and 20-30years respectively.

Of 110 cases 106 (96.36%) cases had histopathological evidence of acute inflammation of appendix (positive exploration) where as 4(3.63%) cases appendix was found to be normal. Of 106 positive operative explorations, total SB was elevated in 87(82.07%) of cases whereas in 19(17.92%) cases it was normal. In complicated AA (gangrenous and perforation) TSB was more elevated than those in simple suppurative AA. Similarly TSB was more elevated in simple non-obstructive than simple obstructive AA. The mean of TSB in cases with positive operative exploration was 2.26mg/dL, ranged 1.2-11.5mg/dL and the mean of total SB in negative exploration was 0.7 mg/dL, ranged 0.5-1.1mg/dL (Fig.1). The specificity, sensitivity, positive predictive value, negative predictive value were 100%, 82.07%, 100%, and 17.3% respectively (Table 4). Among positive cases the liver enzymes e.g. serum alanine amino transferase (ALT) was normal in 74(69.98%), marginally elevated (<1time) in 23(21.69%), minimally elevated (>1-<2time) in 4(3.7%), moderately elevated (<3times) in 3(2.8%) and severely elevated (>3times) in 2(1.8%) of the cases. Serum aspertate aminotrasferase(AST) was normal in 68(64.15%), marginally elevated (<1time) in 33(31.13%), minimally elevated (>1time-<2times) in 7(6.60%), moderately elevated (3times) in 1(0.94%) and no case of severe elevation was observed. Age and sex adjusted ALP was normal in 54(50.90%), slightly elevated (1time) in 40(37.70%), moderately elevated (<2times) in 8(7.5%) and severely elevated (>2 times) in 4(3.7%) of the cases (Fig. 2, 3, 4).

Table 1: Distribution of the cases in different age groups (n=110)

Age Group	No. (%)
0-10	05 (4.54%)
10-20	20 (18.18%)
20-30	29 (26.36%)
30-40	33 (30.00%)
40-50	13 (11.81%)
50-60	07 (6.36%)
> 60	03 (2.77%)
Total	**110 (100%)**

Table 2: Sex wise distribution of the cases (n=110)

Sex	No. (%)
Adult	
Male	52 (47.27%)
Female	34 (30.90%)
Child	
Male	19 (17.27%)
Female	05 (4.54%)
Total	**110 (100%)**

Table 3: Distribution of the cases according to level of total SB (n=110)

Histopathology	Total SB		Total
	<1.1mg/dL	>1.1mg/dL	
	No. (%)	No. (%)	
Acute Appendicitis	13 (11.81%)	62 (56.36%)	75 (68.18%)
Gangrenous Appendix	2 (01.81%)	12 (10.90%)	14 (12.72%)
Perforated Appendix	4 (03.63%)	13(11.81%)	17 (15.45%)
Normal Appendix	4 (03.63%)	Nil	04 (03.63%)
Total	**23 (20.88%)**	**87 (79.07%)**	**100 (100%)**

Table 4: The Specificity, Sensitivity and the Predictive Values of SB Measurement in the diagnosis of AA

SB	Histopathology Negative	Histopathology Positive	Total
Elevated	Nil (FP)	87 (TP)	87
Normal	04 (TN)	19 (FN)	23
Total	**04**	**106**	**110**

Specificity = TN/TN+FP = 04/04+0 = 4/4 = 100%
Sensitivity = TP/TP+FN = 87/87+19 = 87/106 = 82.07%
Predictive Value (PV)
Of positive test =TP/TP+FP = 87/87+0 = 87/87 = 100%
Of Negative test = TN/TN+FN = 04/04+19 = 4/23 = 17.3%

(FP = false positive, TP = true positive, TN = true negative, FN = false negative)

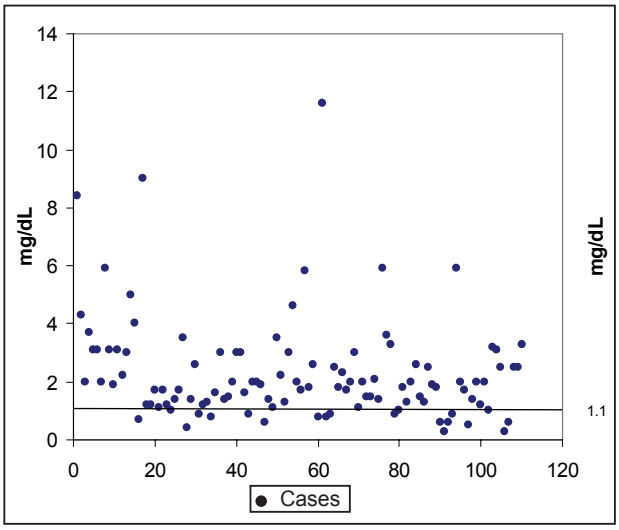

Fig 1: Distribution of SB in positive cases of AA (n=106)

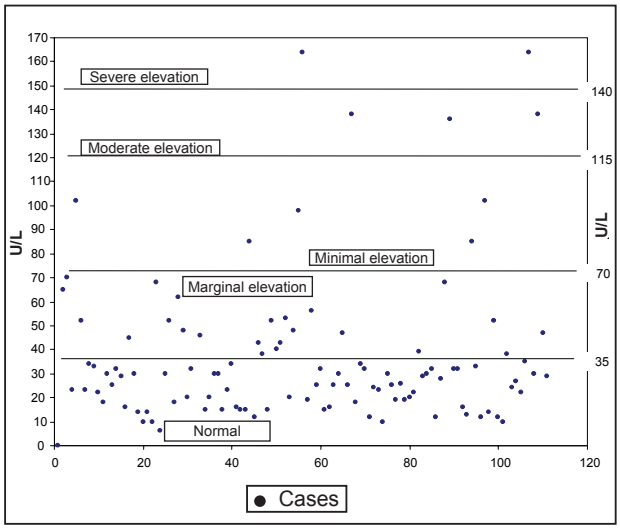

Fig 2: Distribution of ALT in positive cases of AA (n=106)

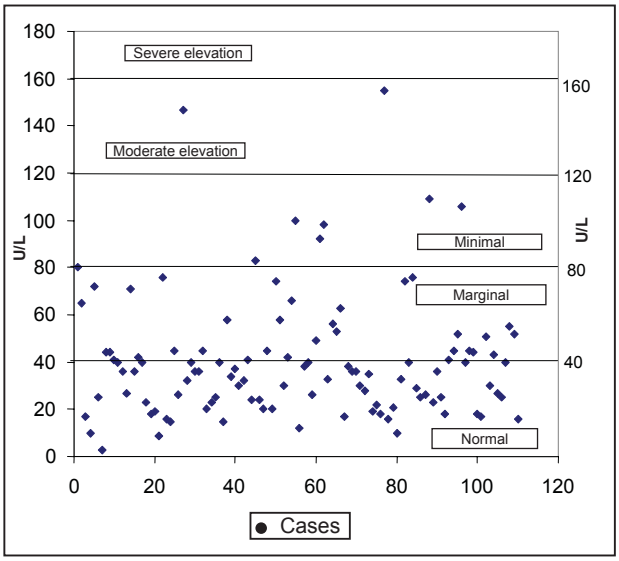

Fig 3: Distribution of AST in positive cases of AA (n=106)

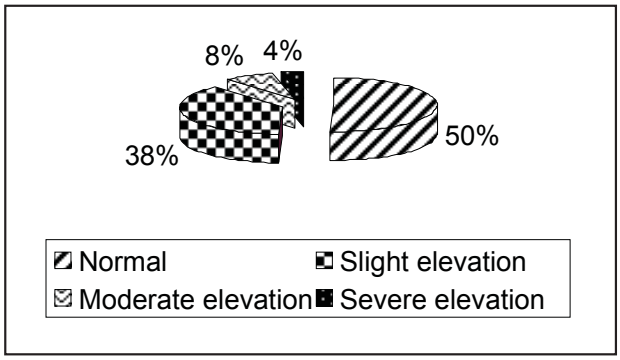

Fig 4: Distribution of ALP in positive cases of AA (n=106)

Discussion

The present study revealed that elevated TSB in AA was of mixed in type with either normal or marginal elevation of liver enzymes in majority of the cases. Broadly, we can say it is predominantly isolated hyperbilirubinemia in majority of the cases (Fig.2, 3,4). These findings are almost similar to the previous reports.[6,8] The interesting finding of this study was that all the cases of negative explorations had normal TSB where as it was elevated only in 82.07% of the cases of AA (i.e. Positive exploration). As the positive predictive value of the elevated total SB in clinically suspected cases of AA was 100%. Clinically suspected cases of AA with elevated TSB can be confidently diagnosed and managed as AA. On the other hand clinically suspected cases of AA without elevation of TSB do not exclude the AA (negative predictive value 16%).

The sensitivity of elevated TSB in AA is almost similar to that of elevation in total leukocyte count (TLC) and C-reactive protein (CRP)[3,9,10,11] but specificity of elevated TSB is (Without much change in liver enzymes in majority) higher (specificity 100%) as compared to TLC and CRP[9,10,11,12]. With above qualifications and being a simple, cheap and easily available in every laboratory,

this test can be added in routine investigation list of clinically suspected cases of AA for the confirmation of the diagnosis.

Conclusion

It was concluded from our study that elevated TSB (without severe abnormalities in the value of liver enzymes) is a good indicator of AA. Specificity and sensitivity of elevated TSB was 100% and 82.07% respectively with a predictive value for positive test 100%. If TSB can be added to already existing laboratory tests, then the diagnosis of AA with clinically suggestive signs can be made with fair degree of accuracy and unnecessary or delay in appendicectomy can be avoided (Table 4).

Suggestions

Most of the surgeons either they change their diagnosis or delay in starting correct treatment once elevated SB or jaundice is detected in a clinically suspected case of AA and this may cause life threatening complications like perforation and diffuse peritonitis. But now, this study has confirmed that whenever a clinically suspected case of AA with elevated total SB with normal or marginal elevation in liver enzymes is found. One should confidently label the diagnosis as AA (test positive PV=100%) and should not delay in beginning proper management of AA, suspecting that rise in total SB is because of primary hepatobillary pathology.

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