

## ROLE OF HYPERBILIRUBINAEMIA - A NEW DIAGNOSTIC TOOL AND A PREDICTOR OF GANGRENOUS/PERFORATED APPENDICITIS

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### ABSTRACT

#### BACKGROUND

Acute Appendicitis is one of the most common surgical emergency encountered in a day-to-day surgical practice and in emergency. Delay in diagnosis and treatment can lead to gangrene, perforation and diffuse peritonitis.

The aim of this study is to find out the specificity, sensitivity, predictive value of positive test and predictive value of negative test of Serum Bilirubin in diagnosis of acute appendicitis and acute complicated appendicitis.

#### MATERIALS AND METHODS

All the patients admitted with clinical diagnosis of Acute Appendicitis were tested by laboratory investigations and ultrasonography of the abdomen. Preoperatively, patient's blood was also collected for serum bilirubin and other liver enzymes estimation. Cases that underwent emergency appendectomy from August 2015 - August 2016 were included in present Prospective Analytical Study.

#### RESULTS

About 100 patients were included in this prospective analytical study. Hyperbilirubinaemia as a sensitivity of 84.7% and specificity of 80%, predictive value of positive test is 96% and predictive value of negative test is 48%. In complicated appendicitis that is gangrenous/perforated appendicitis, the serum bilirubin levels are higher compared to acute appendicitis.

#### CONCLUSION

The level of serum bilirubin aids in the diagnosis of Acute Appendicitis and higher levels as a predictive potential for the Acute Complicated Appendicitis (Gangrenous/Perforated).

#### KEYWORDS

Serum Bilirubin, Acute Appendicitis, Acute Complicated Appendicitis.

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#### BACKGROUND

Acute appendicitis is the most common surgical emergency seen in day-to-day practice in emergency department.<sup>1</sup> It can sometimes confuse the practitioners by its presentation. The delay in early diagnosis or failure in early diagnosis may happen many times.<sup>2</sup> This may lead on to the poor disease prognosis. This will further lead on to increase in morbidity as well as occasional mortality in the patient, though there are many recent trends in investigatory modalities.

Diagnosis of acute appendicitis is still a mystery. There is increase in the negative appendectomy rate of about 15% - 30% seen in literature.<sup>3</sup>

So number of various investigations were used to reduce the rate of negative appendectomy such as Laboratory investigations and Radiological investigations.<sup>4</sup>

#### Objectives

To find out the specificity, sensitivity, predictive value of positive test and predictive value of negative test of serum bilirubin in diagnosis of acute appendicitis and acute complicated appendicitis.

#### MATERIALS AND METHODS

This study was conducted as Prospective Analytical Study.

This study was conducted in 100 patients. These 100 patients are clinically diagnosed to have acute appendicitis and who underwent emergency appendectomy. This study conducted in Govt. Vellore Medical College Hospital, Vellore, Department of General Surgery, during the period from August 2015 to August 2016.

Serum bilirubin of more than 1.6 mg/dL considered high and more than 2.2 mg/dL considered very high.

#### Inclusion Criteria

All the patients above 15 years of age diagnosed to have appendicitis included in this study and subjected for appendectomy in Govt. Vellore Medical College, Vellore.

#### Exclusion Criteria

Patients who were HBsAg positive, patients taking hepatotoxic drugs, where serum bilirubin was raised.

- Sensitivity =  $\frac{TP}{TP + FN} \times 100$
- Specificity =  $\frac{TN}{TN + FP} \times 100$
- Predictive Value of Positive Test =  $\frac{TP}{TP + FP} \times 100$

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- Predictive Value of Negative Test =  $TN \times 100 / TN + FN$ .

## RESULTS

100 patients were included in this study and underwent Emergency Appendicectomy.

### Age Distribution

The acute appendicitis fall into 5 groups in the study population. In this study, maximum incidence is seen in 3<sup>rd</sup> decade of life, that is the age group between 21 and 30 years followed by the age group between 31 and 40 yrs., least incidence of appendicitis occurrence was seen in > 50 years' age group shown in Table 1.

Age (Years)	Incidence (Out of 100)	Percentage
15 - 20	22	22%
21 - 30	35	35%
31 - 40	27	27%
41 - 50	11	11%
> 50 yrs.	5	5%
<b>Total</b>	<b>100</b>	<b>100%</b>

*Table 1. Age Distribution*

### Sex Distribution

In our study, the number of male patients are 55 and female patients are 45 in number.

Serum Bilirubin	HPE		Total
	Positive	Negative	
Positive	72 TP	3 FP	75
Negative	13 FN	12 TN	25
<b>Total</b>	<b>85</b>	<b>15</b>	<b>100</b>

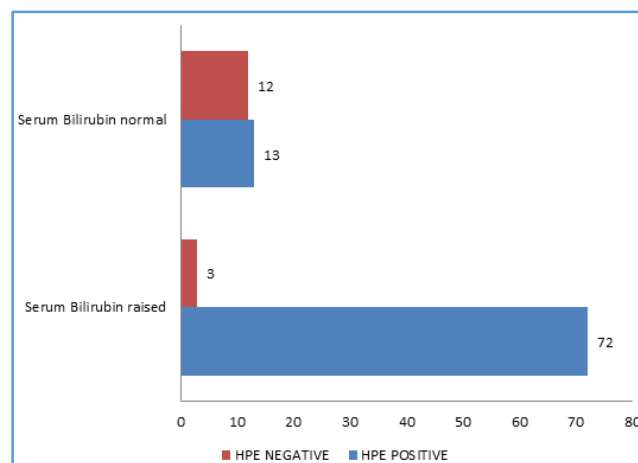
*Table 2. Role of Serum Bilirubin*

Table 2 depicts,

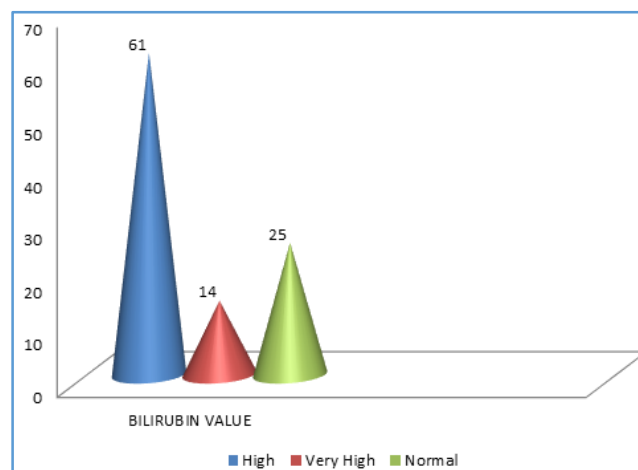
In the present study, out of 100 patients 85 patients had HPE positive, among 85 positive individuals, serum bilirubin was raised in 72 patients that is 84.7%; 13 patients had normal serum bilirubin value ( $\chi^2$  McNemor = 8.9,  $P = < 0.01$ ), significant association in diagnosis of acute appendicitis.

In this study among 14 complicated patients, 13 patients had very high raise in serum bilirubin value 92%, whereas only 1 patient had very high serum bilirubin value in an uncomplicated appendicitis.

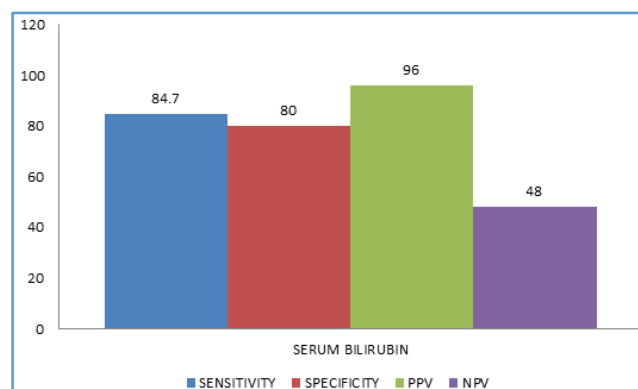
In present study serum bilirubin shows specificity of 80%, predictive value of positive test 96% and negative predictive value of 48%.



*Figure 1. Serum Bilirubin with HPE Correlation*



*Figure 2. Distribution of Cases according to Serum Bilirubin Value*



*Figure 3. Sensitivity, Specificity, Predictive Value of Positive Test and Negative Test of Serum Bilirubin*

## DISCUSSION

In this study it reveals that serum bilirubin is highly sensitive in diagnosis of complicated appendicitis, sensitivity of 92%. The sensitivity of serum bilirubin increase in uncomplicated appendicitis is 84.7%.

The interesting finding of this study was that the positive predictive value was 96%, which aids in the diagnosis of acute appendicitis. If the serum bilirubin goes beyond > 2.2 mg/dL, the possibility of complicated appendicitis is very high.

Bilirubin is not commonly known to be a relevant marker in appendicitis. However, previous studies have found hyperbilirubinaemia to be a marker with high specificity for perforated appendicitis. Adult bilirubin levels in the adult surgical population are usually raised due to liver or gallbladder problems.<sup>5</sup>

Hepatic dysfunction as a result of bacterial infection or sepsis without direct invasion of the liver has already been well described. The possible aetiologies include gram negative sepsis, shock and ischaemic liver, severe trauma or gut barrier failure. Gram negative organisms with *Escherichia coli* in particular have been shown to produce endotoxins that affect bile flow in rat liver models. None of the patients in our study had ischaemic liver or septic shock.<sup>6,7</sup>

In appendicitis, compromised appendix wall integrity leads to translocation of bacteria and endotoxins from the appendix lumen into the portal system. Inflammatory cytokines may then travel to the liver inducing intrahepatic cholestasis. Research has also shown that *E. coli* endotoxin causes dose dependent cholestasis, which would explain our findings of increased bilirubin levels with progressive appendicitis severity. It is possible that bilirubin may be raised in other sources of gram-negative related sepsis, which may be of a gastrointestinal origin (*E. coli* in diverticulitis) or from other sources such as pneumonia, endocarditis, pyelonephritis and soft-tissue abscesses.<sup>8</sup>

Estrada et al,<sup>9</sup> 2007 in his retrospective study of 170 patients with findings of hyperbilirubinaemia (17.1 mmol/L) and perforated appendicitis  $p < 0.031$ , Odds ratio of 2.96 (95% confidence interval 1.11e7.6).

Sand et al,<sup>10</sup> 2009 in his retrospective study of 538 patients with Hyperbilirubinaemia (26.5 mmol/L) and perforated appendicitis  $p < 0.05$ , specificity 86%.

Kaser et al,<sup>11</sup> 2010 in his retrospective study of 725 patients with Hyperbilirubinaemia (20 mmol/L) and perforated appendicitis  $p < 0.05$  and specificity 78%.

Atahan et al,<sup>12</sup> 2011 in his retrospective study of 351 patients with Hyperbilirubinaemia (17.1 mmol/L) and perforated appendicitis  $p = 0.000$  and specificity 87.21%.

Emmanuel et al,<sup>13</sup> 2011 in his Retrospective study of 472 patients with hyperbilirubinaemia (20.5 mmol/L) and simple appendicitis  $p < 0.001$ , specificity 88% Hyperbilirubinaemia and perforated appendicitis  $p < 0.001$ , Specificity 70%.

Beltran et al,<sup>14</sup> 2009 in his Prospective study of 134 patients Hyperbilirubinaemia (17.86 mmol/L) and perforated appendicitis Specificity 51% and Sensitivity 57%.

Khan et al,<sup>15</sup> 2004 observed among 110 individuals the serum bilirubin value was increased in acute appendicitis; it is more specifically elevated in complicated appendicitis. Specificity of this study in complicated appendicitis is 80.6%, in uncomplicated acute appendicitis 56.36%.

## CONCLUSION

Bilirubin is a specific marker for acute appendicitis with a good positive predictive value. It is also a valuable indicator of patients more likely to have appendiceal perforation or gangrene. Bilirubin should be used together with clinical examination and other laboratory investigations in the assessment of patients with suspected acute appendicitis.

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