

Comparison of Sensitivity of TLC and Liver Assay in Diagnosing Appendicitis and Complicated Appendicitis at a Rural Medical Institution

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ABSTRACT

BACKGROUND

Diagnosis of acute appendicitis is always a challenging task in emergency ward which can most of the time be diagnosed with thorough history and physical examination by surgeon, various clinical signs and laboratory investigations like total leukocyte count (TLC), neutrophils shift to left. Unnecessary surgical interventions of appendix can be reduced by precise diagnosis of levels of TLC and total serum bilirubin values. We wanted to evaluate the sensitivity of laboratory marker like TLC and liver function tests in diagnosing a case of appendicitis and complicated appendicitis.

METHODS

100 patients who were admitted in the Department of General Surgery, Maharaja Agrasen Medical Collage, Agroha (Hisar), with clinical diagnosis of acute appendicitis were included in the study. Data was statistically analysed and sensitivity of TLC and liver function test in diagnosing acute appendicitis was compared.

RESULTS

Sensitivity of TLC was found to be 47 %; that of total serum bilirubin was 72 % which is significant; that of SGOT was 26 %; that of SGPT was 21 % and that of ALP was 8 % in diagnosing acute appendicitis. While comparing sensitivity of this marker to diagnose complicated appendicitis (gangrenous and perforated appendix) it was 56.3 % for TLC, 100 % for total serum bilirubin, 31.3 % for SGOT, 37.5 % for SGPT and 12.5 % for ALP.

CONCLUSIONS

Raised total serum bilirubin has potential to detect complications of appendicitis and the need for early intervention by surgeon.

KEYWORDS

Appendicitis; Liver Function Tests; Serum Bilirubin

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BACKGROUND

Diagnosing a case of acute appendicitis is always a challenging task in the emergency ward which can be done most of the time through thorough history and physical examination by the surgeon. Sometimes symptoms and signs are variable. The most common region involved is the right iliac fossa. Position of appendix i.e. retro-caecal or retro-ileal also leads to different clinical symptoms particularly location of pain and its presentation.^{1,2}

More is the time lapse between the detection of acute appendicitis more the chance of appendicular perforation, peritonitis and thus increased death rate. Incidence of perforation can be as high as 90 % and other major complication can be in 60 % of the patient.³ Laboratory investigations is a helpful add on tools in diagnosis, but no single test result is definitive till date. Both under diagnosis and over diagnosis have impact on mortality and morbidity. Delay in diagnosis leads to appendicitis complication like appendicular perforation and gangrenous appendix leading to septic shock and death. Over diagnosis with appendectomy lead to various complication of surgery, deleterious effect of anaesthetic drug on human body and financial burden on country health expenditure.^{1,2}

Unnecessary surgical intervention of appendix can be reduced by precise diagnosis of levels of C-reactive protein (CRP) and total serum bilirubin values.⁴ Ultrasonography of abdomen is important investigation for appendicitis and it has been widely known and well accepted in various studies.⁵⁻⁷ Abdominal ultra-sonography has a sensitivity of about 78 % to 83 % and specificity of about 83 % to 93 % to diagnose acute appendicitis.⁷ It is more useful investigation in paediatric and pregnant patient. Computer Tomography (CT) has sensitivity of 90 % to nearly 100 % and specificity of 91 % to 99 % for diagnosis of acute appendicitis.^{7,8}

Invasion of micro-organism activates the immune system of body which further activates the defense mechanism. During inflammatory response, there is ransom of pro-inflammatory proteins such as prostaglandins, interleukins and cytokine, these cyto-proteins invade at the site of inflammation i.e. in the liver through superior mesenteric vein and may produce inflammation, abscess or malfunctioning of hepatic tissue by primarily or indirectly changing the liver blood flow.⁹⁻¹⁵ Hence, the current study was carried out to find the association of liver function tests with different stages of acute appendicitis and also find out peculiar indicator for acute appendicitis and complicated appendicitis like gangrenous and perforated appendix.

METHODS

Current study included 100 patients admitted to Department of General Surgery, Maharaja Agrasen Medical College, Agroha (Hisar) with clinical diagnosis of acute appendicitis and their post appendectomy histopathological report suggesting various stages of appendicitis. Data collection was done after taking the informed consent. Clinical

examination, routine blood examination with liver function test taken within 2 hr. of admission to hospital. The primary data for this study is liver function test of the patients.

Exclusion criteria included the patients with liver disease, HBsAg, HCV and HIV positive, chronic alcoholism, haemolytic disease, chronic illness like DM (Diabetes Mellitus) and any malignancy, cholelithiasis and post-surgery histopathological normal appendix. The liver function tests was done by using the semi-auto analyzer machine accessible in our hospital. HbsAg, HCV and HIV were tested with Tridot spot kit.

RESULTS

Out of total 100 cases included, 81 were male and 19 were female with age between 5 and 58 years. Most cases were in age group of 15 - 24 years. Mean age for female was 21.7 years and for male mean age was 27.6 years. The overall average for age was 26.48 years.

In present study, 100 cases were clinically diagnosed as acute appendicitis preoperatively, 84 had acute appendicitis, 7 had gangrenous appendix, 9 cases had perforated appendix and no patient had normal appendix.

Histopathological Diagnosis	No. of Cases
Acute Appendicitis	84
Gangrenous Appendix	7
Perforated Appendix	9
Normal Appendix	0
Total	100

Table 1. Distribution of Cases According to Histopathological Diagnosis

Histo-Pathology	Total Serum Bilirubin (SB) Level			Total
	< 1.0 mg / dL No. (%)	1 - 3 mg / dL No. (%)	> 3 mg / dL No. (%)	
Acute Appendicitis	28 (28 %)	56 (56 %)	0	84 (84 %)
Gangrenous Appendix	0	0	7 (7 %)	7 (7 %)
Perforated Appendix	0	0	9 (9 %)	9 (9 %)
Normal Appendix	0	0	0	0
Total	28 (28 %)	56 (56 %)	16 (16 %)	100 (100 %)

Table 2. Distribution of Cases According to Level of Total Serum Bilirubin and Histological Examination

Total serum bilirubin was elevated in 72 (72 %) cases whereas 28 (28 %) cases had normal total serum bilirubin level. Total serum bilirubin was increased in every case and elevation was > 3 mg / dL in gangrenous and perforated appendix. Total serum bilirubin mean in acute appendicitis cases without perforation or gangrene was 1.2 mg / dL and the mean of total serum bilirubin in cases with perforated or gangrenous appendix was 3.53 mg / dL (ranged from 3.1 - 4.5 mg / dL).

Sensitivity of different parameter (TLC, Total serum bilirubin, SGOT, SGPT, ALP) is compared on the basis of histopathology diagnosis categorized as acute appendicitis and complex appendicitis (perforated appendix and gangrenous appendix).

		Histopathologic Diagnosis			
		Acute Appendicitis	Complicated Appendicitis	Total	
TLC	Normal	Count	46	7	53
		% within Histopathologic Diagnosis	54.8 %	43.8 %	53.0 %
	Abnormal	Count	38	9	47
		% within Histopathologic Diagnosis	45.2 %	56.3 %	47 %
	Total	Count	84	16	100
		% within Histopathologic Diagnosis	100.0 %	100.0 %	100.0 %

Table 3. Sensitivity of TLC in Diagnosing Appendicitis

		Histopathologic Diagnosis			Total
		Acute Appendicitis	Complicated Appendicitis		
Total Serum Bilirubin	Normal	Count	28	0	28
		% within Histopathologic	33.3 %	0.0 %	28.0 %
	Abnormal	Count	56	16	72
		% within Histopath CAT	66.7 %	100.0 %	72.0 %
	Total	Count	84	16	100
% within Histopath CAT		100.0 %	100.0 %	100.0 %	

Table 4. Sensitivity of Bilirubin in Diagnosing Appendicitis

			Histopathologic Diagnosis		Total
			Acute Appendicitis	Complicated Appendicitis	
		Count			
SGOT	Normal	Count	63	11	74
		% within Histopath CAT	75.0 %	68.8 %	74 %
	Abnormal	Count	21	5	26
		% within Histopath CAT	25.0 %	31.3 %	26 %
	Total	Count	84	16	100
% within Histopath CAT		100.0 %	100.0 %	100.0 %	

Table 5. Sensitivity of SGOT in Diagnosing Appendicitis

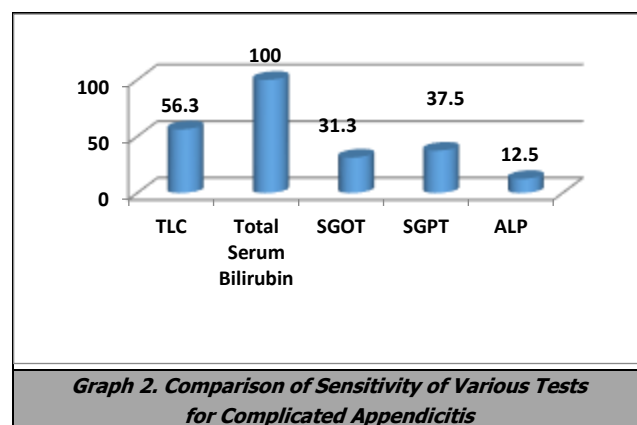
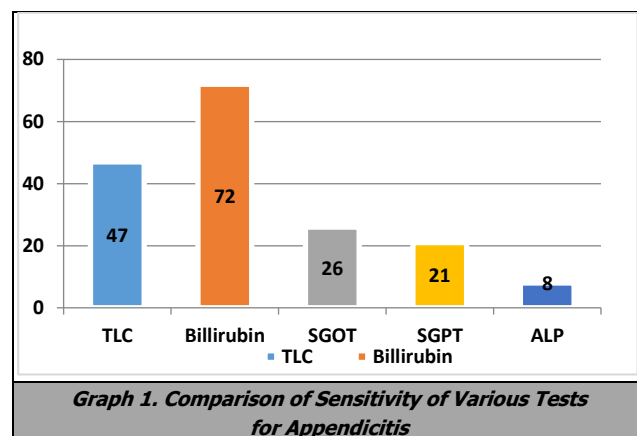
		Histopathologic Diagnosis			
		Acute	Complicated	Total	
		Appendicitis	Appendicitis		
SGPT	Normal	Count	69	10	79
		% within Histopath CAT	82.1 %	62.5 %	79.0 %
	Abnormal	Count	15	6	21
		% within Histopath CAT	17.9 %	37.5 %	21.0 %
	Total	Count	84	16	100
	% within Histopath CAT	100.0 %	100.0 %	100.0 %	

Table 6. Sensitivity of SGPT in Diagnosing Appendicitis

The sensitivity of TLC was found to be 47 %, of total serum bilirubin was 72 %, of SGOT was 26 %, of SGPT was 21 % and of ALP was 8 % (Table 4 - 8, Graph 1) to diagnose all case of appendicitis. The present study found sensitivity of total serum bilirubin is high i.e. 72 % which is significant. While sensitivity of diagnosing complex appendicitis is 100 % with total bilirubin, 56.3 % with TLC, 31.3 % with SGOT, 37.5 % with SGPT and 12.5 % with ALP (Graph 2). Hence total serum bilirubin can be a good diagnostic tool for appendix and its role in complex appendicitis (perforated appendix and gangrenous appendix) is very significant.

			Histopathologic Diagnosis		Total
			Acute Appendicitis	Complicated Appendicitis	
ALP	Normal	Count	78	14	92
		% within Histopath CAT	92.9 %	87.5 %	92.0 %
	Abnormal	Count	6	2	8
		% within Histopath CAT	7.1 %	12.5 %	8.0 %
	Total	Count	84	16	100
% within Histopath CAT		100.0 %	100.0 %	100.0 %	

Table 7. Sensitivity of ALP in Diagnosing Appendicitis



DISCUSSION

In recent years, hyperbilirubinemia found to be related to acute appendicitis, but very few studies show the association of hyperbilirubinemia in patients with acute appendicitis.¹⁶⁻¹⁸ So for the present study, it was presupposed that there was a correlation existing between raised serum bilirubin and acute appendicitis and its dilemma.¹⁶ The aim of current study was to compare and evaluate the accuracy of TLC and liver function test sensitivity in diagnosing acute appendicitis and to establish whether it could a valuable indicator for acute appendicitis and complicated appendicitis (gangrenous appendix or appendicular perforation).

It is demonstrated in our study that exceptional rise in levels of bilirubin without much increase in levels of the other hepatic enzymes is a significant measure for acute appendicitis with sensitivity of 72 % and with sensitivity of 100 % for complicated appendicitis. A retroactive study done by Estrada et al, 16 found elevated blood bilirubin levels in

38 % of cases with acute appendicitis and patients with gangrene / perforation had much more elevation in levels of bilirubin as compared to those with acute appendicitis.

In present study, total serum bilirubin concentration ≥ 3 mg / dL in cases of gangrenous / perforated appendicitis while for acute appendicitis ≤ 3 mg / dL. These results were almost similar to the study done by Khan S. [17] He assessed that increased total serum bilirubin in almost 87 % of the cases. The mean raised serum bilirubin was 2.26 mg / dL in patients with convoluted appendix. The range of hyperbilirubinemia is 1.2 mg - 8.4 mg / dL with mixed type (direct and indirect) of serum bilirubin.

A retrospective study conducted by Michael Sand et al, found elevated bilirubin in all patients in the range of 0.1 - 4.3 mg / dL, while patients with perforation of appendix had bilirubin in the range of 4.0 - 4.3 mg / dL. [18] The sensitivity of current study was greater than that by Sand et al [18] in which, sensitivity and specificity for predicting appendicular perforation was 70 % and 86.0 % respectively.

Current study evaluated that total serum bilirubin is more accurate, practical and easy to carry out test in every laboratory with high sensitivity to detect acute appendicitis and thus it should be included to the routine investigation protocol for clinically doubted case of acute appendicitis for its firm diagnosis. Since every case of convoluted appendicitis (gangrenous appendix or appendicular perforation) showed elevated total serum bilirubin level in present study, hence it shows 100 % sensitivity in predicting complicated appendicitis. Therefore, during routine blood examination, total serum bilirubin levels testing should be included in the protocol to determine the presence of perforation or any other complication and thus aid in prompt clinical management.

CONCLUSIONS

Raised total serum bilirubin level without much abnormalities of other liver enzymes is a new biochemical indicator of acute appendicitis. Total serum bilirubin level if added to laboratory investigation protocol for diagnosis of appendicitis then accuracy of diagnosing appendicitis can be enhanced and delay in surgical intervention can be avoided.

Data sharing statement provided by the authors is available with the full text of this article at jebmh.com.

Financial or other competing interests: None.

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REFERENCES

- [1] Peranteau WH, Smink DS. Appendix, Meckel's and other small bowel diverticula. In: Zinner MJ, Ashley SW, eds. *Mainiot's abdominal operations*. 12th edn. USA: McGraw-Hill 2013: p. 623-648.
- [2] Richmond B. The appendix. In: Townsend CM, Beauchamp RD, Evers BM, et al. eds. *Sabiston text book of surgery*. 1st South Asian edition. India: Elsevier 2017: p.1296-1311.
- [3] Von Titte SN, McCabe CJ, Ottinger LW. Delayed appendectomy for appendicitis causes and consequences. *Am J Emerg Med* 1996;14(7):620-622.
- [4] Gans SL, Atema JJ, Stoker J, et al. C-reactive protein and white blood cell count as triage test between urgent and non-urgent conditions in 2961 patients with acute abdominal pain. *Medicine (Baltimore)* 2015;94(9):e569.
- [5] Rioux M. Sonographic detection of the normal and abnormal appendix. *AJR Am J Roentgenol* 1992;158(4):773-778.
- [6] Lim HK, Lee WJ, Lee SJ, et al. Focal appendicitis confined to the tip: diagnosis at US. *Radiology* 1996;200(3):799-801.
- [7] Parks NA, Schroepel TJ. Update on imaging for acute appendicitis. *Surg Clin North Am* 2011;91(1):141-154.
- [8] Birnbaum BA, Wilson SR. Appendicitis at the millennium. *Radiology* 2000;215(2):337-348.
- [9] Beg RB, Garlunton AW. Translocation of certain endogenous bacteria from the GI tract to mesenteric lymph node and other organ in Gonobiotic mouse model. *Infect Immunol* 1979;23(2):403-411.
- [10] Juric I, Primorac D, Zagar Z, et al. Frequency of portal and systemic bacteremia in acute appendicitis. *Pediatr Int* 2001;43(2):152-156.
- [11] Scathen KWE, Desprez JD, Holden WD. A bacteriologic study in portal blood in man. *Arch Surg* 1995;71:404-409.
- [12] Wang P, Ayala A, Ba ZF, et al. Tumor necrosis factor – alpha produces hepatocellular dysfunction despite of normal cardiac output and hepatic microcirculation. *Am J Physiol Gastrointest Liver Physiol* 1993;265(1):126-132.
- [13] Wang P, Ba ZF, Chaudhary IH. Hepatic extraction of indo-cyanine green is depressed in early sepsis despite increase hepatic blood flow and cardiac output. *Arch Surg* 1991;126(2):219-224.
- [14] Wang P, Chudhary IH. Mechanism of hepatocellular dysfunction during hyper dynamic sepsis. *Am J Physiol* 1996;270(5 Pt 2):R927-R938.
- [15] Whiting JF, Green RM, Rosen AB, et al. TNF-alpha decreases hepatocyte bile salt uptake and mediated endotoxin-induced cholestasis. *Hepatology* 1995;22(4 Pt 1):1273-1278.
- [16] Estrada JJ, Petrosyan M, Krumenacker J, et al. Hyperbilirubinemia in appendicitis: a new predictor of perforation. *Journal of Gastrointestinal Surgery* 2007;11(6):714-718.
- [17] Khan S. Elevated serum bilirubin in acute appendicitis: a new diagnostic tool. *Kathmandu University Medical Journal* 2008;6(2):161-165.
- [18] Sand M, Bechara GF, Holland-Letz T, et al. Diagnostic value of hyperbilirubinemia as a predictive factor for appendiceal perforation in acute appendicitis. *Am J Surg* 2009;198(2):193-198.