

## Original Research Article

# Role of liver function test parameters in acute appendicitis and its complication: a prospective study

Braja Mohan Mishra, Malaya Krishna Nayak, Sandeep Mishra,  
Priyambad Sahu\*, Dibyajyoti Das

Department of General Surgery, VIMSAR, Burla, Odisha, India

**Received:** 23 October 2018

**Accepted:** 30 November 2018

**\*Correspondence:**

Dr. Priyambad Sahu,

E-mail: [drpriyambad.sahu@gmail.com](mailto:drpriyambad.sahu@gmail.com)

**Copyright:** © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

### ABSTRACT

**Background:** Although acute appendicitis is the most common surgically correctable cause of abdominal pain, the diagnosis is challenging. There may not be classical symptoms and signs of appendicitis always. Accurate diagnosis can be aided by biochemical testings and radiological evaluation and expectant management. These might delay laparotomy and lead to complications of appendicitis and increase the morbidity. Recent research literatures have shown that hyperbilirubinemia is a diagnostic tool for gangrenous/perforation of appendix. This study is designed to evaluate the association between the derangement of liver function test and severity of acute appendicitis and its complications like gangrene and perforation of appendix.

**Methods:** This was an observational prospective study on 66 consecutive cases of acute appendicitis done in the department of general surgery, VIMSAR, Burla. After taking informed consent, all patients included in the study were subjected to abdominal ultrasound and blood sample taken for routine blood examination, LFT and after appendectomy histopathology examination report were collected. A master chart prepared from above data and statistical analysis done.

**Results:** The LFT parameters are deranged in pathological appendix and more specifically the total bilirubin level but the sensitivity, specificity and PPV are specifically high for gangrenous and perforated appendix.

**Conclusions:** LFT can be added as adjunctive test to the investigation of acute appendicitis and its complications and earlier diagnosis of the complications of acute appendicitis and timelier management. It can also help in prevention of negative appendectomies.

**Keywords:** Acute appendicitis, Gangrenous appendicitis, LFT, Perforated appendicitis

### INTRODUCTION

Acute appendicitis remains one of the most common diseases faced by general surgeons which accounts for approximately 1% of all emergency surgical operations.<sup>1</sup>

Disease of appendix is as likely as old man. During Byzantine era in an Egyptian mummy it was found right lower quadrant adhesion, which was suggestive of previous appendicitis.<sup>2</sup> But the natural history of disease

and the term "Appendicitis" was just 132 years old, described by Reginald Fitz in 1886.<sup>3</sup> It affects more commonly male than females (1.4:1). Younger age is a risk factors with approximately 70% cases occur in 2<sup>nd</sup> decade of life.<sup>3</sup>

Although acute appendicitis is the most common surgically correctable cause of abdominal pain, the diagnosis is challenging. It requires a high index of suspicion on the part of treating surgeon to avoid

substantial morbidity and mortality due to its complications like gangrene of appendix or perforation of appendix. There may not be classical symptoms and signs of appendicitis always. An accurate diagnosis can be aided by additional testing and radiological evaluation and expectant management. These might delay laparotomy and lead to complications of appendicitis and increase the morbidity. So, a safe alternative is appendicectomy, but this strategy increases negative appendicectomies.<sup>4</sup>

Many scoring systems, laboratory tests, USG abdomen, CT, MRI are employed for an accurate earlier diagnosis of acute appendicitis. But none of the tests still now specific for the severity of acute appendicitis and complications. For acute appendicitis also, these tests are not stand alone as a diagnostic test rather all come in support of to the clinical assessment.<sup>4</sup>

Recent research literatures have shown that hyperbilirubinemia is a diagnostic tool for gangrenous/perforation of appendix.<sup>4</sup> In some literature it has mentioned that hyperbilirubinemia is a predictor of severity of acute appendicitis.<sup>5</sup>

Liver receives blood from the abdominal organs through the portal vein. So portal vein carries the nutrients, bacteria and toxins absorbed from the gut. Bacteria and toxins are cleared by the reticuloendothelial system of liver but up to certain limit. When the load is more than the functional capacity of Kupffer cells of liver it leads to liver parenchymal damage.<sup>4,6</sup> It leads to derangement of liver enzymes. In obstructive appendicitis there is transmigration of the bacteria occur through the appendicular wall and it goes to liver through portal vein.

There is also local release of cytokines like TNF, IL-6 in the liver parenchyma in response to the bacterial load. It also causes derangement of liver function.<sup>4</sup>

This study was designed to evaluate the association between the derangement of liver function test and severity of acute appendicitis and its complications. So that it can be used in earlier diagnosis and timelier appropriate management of acute appendicitis and its complication and also it can prevent negative appendicectomies.

**METHODS**

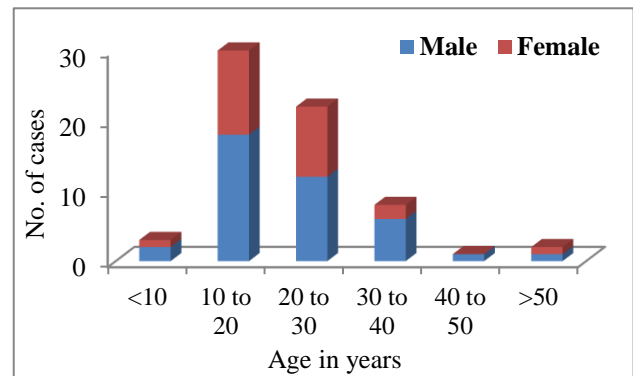
This was an observational prospective study done in the department of general surgery, Vimsar, Burla in the period from October 2016 to July 2018. 66 consecutive cases of acute appendicitis admitted to surgical unit III, irrespective of age and sex were recruited for the study. The patients with cases of acute appendicitis and its complications which was clinically diagnosed (Alvarado score  $\geq 7$ ) & USG confirmed are included. The patients with the cases of acute appendicitis and its complications with liver disease due to any cause, history of alcohol

intake and AST/ALT  $>2$ , past history of jaundice and history of hepatotoxic drug intake are excluded.

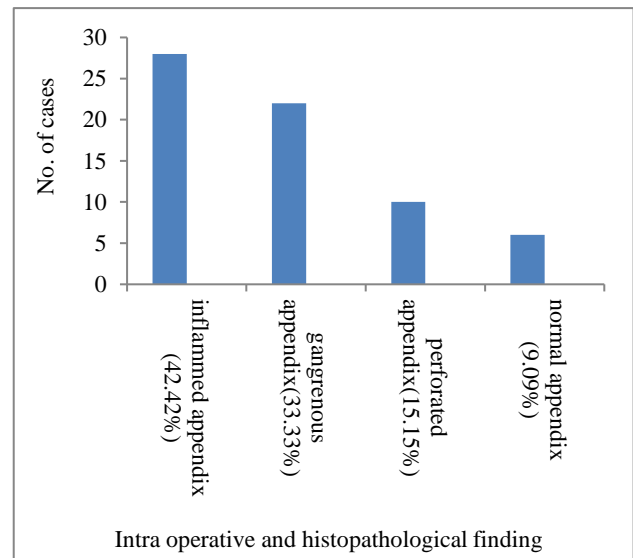
After taking informed consents, all patients included in the study were subjected to abdominal ultrasound and blood sample taken for routine blood examination, LFT and after appendicectomy histopathology examination report were collected. A master chart prepared entering the patients name, age, sex, USG findings, LFT parameters values, histopathology examination report of excised appendicular mass.

**RESULTS**

Figure 1 shows the demographic pattern of our study population. Maximum cases are between 10 to 30 years of age. It also shows that males are affected more than females.



**Figure 1: Demographic pattern of the study.**



**Figure 2: Distribution of normal and pathological appendix.**

Figure 2 shows out of total appendicectomies 42.42% cases are inflamed appendix, 48.48% cases are complicated appendix and rest 9.09% are negative

appendicectomies. Table 1 shows in case of pathological appendix 32 cases out of 60, 17 out of 60, 5 out of 60, 6 out of 60 have raised total bilirubin, AST, ALT, ALP

respectively. In case of normal appendix bilirubin and ALP not raised in any cases but 3 out of 6 and 1 out of 6 cases have raised AST and ALT respectively.

**Table 1: Relationship between LFT parameters and different appendicular pathology.**

	Total bilirubin		SGOT/AST		SGPT/ALT		ALP	
	Elevated	Normal	Elevated	Normal	Elevated	Normal	Elevated	Normal
Pathological appendix	32	28	17	43	5	55	6	54
Normal appendix	0	6	3	3	1	5	0	6
total	32	34	20	46	6	60	6	60

**Table 2: Relationship of LFT parameters with inflamed appendix and complicated appendicitis.**

	Total bilirubin		SGOT/AST		SGPT/ALT		ALP	
	Elevated	Normal	Elevated	Normal	Elevated	Normal	Elevated	Normal
Inflamed appendix	6	22	1	27	0	28	0	28
Gangrenous/perforated appendix	26	6	16	16	5	27	6	26

**Table 3: Sensitivity, specificity, PPV of LFT to pathologic appendix and its complications.**

LFT parameters	Sensitivity		Specificity		Positive predictive value (PPV)	
	Pathologic appendix	Gangrenous/Perforated appendix	Pathologic appendix	Gangrenous/Perforated appendix	Pathologic appendix	Gangrenous/Perforated appendix
Total bilirubin	53.33%	81.25%	100%	78%	93.33%	81.25%
SGOT/AST	25.75%	50%	50%	96.42%	85%	94.11%
SGPT/ALT	8.3%	15.62%	83.33%	100%	83.33%	100%
ALP	10%	18.75%	100%	100%	100%	100%

Table 2 shows in 26 cases of complicated appendix and 6 cases of inflamed appendix have raised total bilirubin. 16 cases of complicated appendix have raised AST. ALT and ALP raised in 5 cases and 6 cases of complicated appendix respectively but not raised in inflamed appendix. Table 3 shows the comparative value of sensitivity, specificity and positive predictive value between pathological appendix and gangrenous/perforated appendix. Elaboration of the table given in discussion part.

## DISCUSSION

This is a prospective study on 66 subjects with a purpose to find out the relationship between the LFT parameters and the appendicular pathologies.

Out of 66 cases 60 cases were found to have pathological appendix and rest 6 cases (9.09%) were undergone negative appendicectomy. Out of the 60 pathological appendix, 32 cases (48.48% of total study population) are gangrenous and perforated appendix. This large number may be due to the late presentation of the cases or late diagnosis of the cases.

In our study it was found 32 cases out of 60 pathological appendix, 17 out of 60, 5 out of 60, 6 out of 60 have raised total bilirubin (mixed), AST, ALT, ALP respectively. This derangement of liver function test can be explained by the study of Utili R et al, Dieulafoy G and Sisson RG et al.<sup>8-10</sup>

Utili et al,<sup>7</sup> describe in his paper about the dose dependant decrease in the bile salt excretion from liver by in vitro infusion of endotoxin into isolated rat liver.<sup>7,8</sup>

Dieulafoy G, study gave an evidence about the bacterial translocation from inflamed gastrointestinal tract and peritoneum to liver by portal vein that leads to development of hepatitis and pyogenic liver abscess.<sup>9</sup> There was also similarities present between the liver abscess organisms and gastrointestinal tract organisms.

Sisson et al,<sup>10</sup> describes the pathogenesis of the appendicitis and its complications.<sup>10</sup> He demonstrated in appendicitis there is mucosal ulceration and it facilitates the invasion of the bacteria into muscularis propria, that leads to acute suppurative appendicitis. Consequently, it leads to oedema, venous engorgement, rising of intra

luminal pressure than ischemic necrosis and lastly gangrene and perforation.

Translocation of pathological organisms from the inflamed appendix or gangrenous/perforated appendix to liver occurs through the portal vein. In liver these organisms are phagocytosed by the Kupffer cells. If the bacterial load is high it overcomes the capacity of the phagocytic cells and that leads to local multiplication of the organisms and release of the cytokines like TNF, IL-6 etc. It leads to damage of liver parenchyma and alteration of the liver function test.

Estrada et al, found patients with complicated appendicitis have high peritoneal culture for gastrointestinal tract.<sup>11</sup> According to the studies of Chaudhary et al, Yadav et al, Vineed S et al, Cheekuri SK et al, it was found that hyperbilirubinemia can be used as an indicator of complicated appendix like gangrenous or perforated appendix.<sup>4,5,12,13</sup>

In this study Table 2 shows in 81.25% cases of complicated appendix and 21.42% of inflamed appendix have raised total bilirubin. 50% cases of complicated appendix have raised AST. ALT and ALP raised in 15.62% and 18.75% cases of complicated appendix. ALT and ALP not deranged in inflamed appendix.

Table 3 shows that sensitivity, specificity and PPV for the total bilirubin for pathological appendix are 53.33%, 100%, 93.33% respectively but for the gangrenous/perforated appendix the values are 81.25%, 78%, 81.25% respectively for sensitivity, specificity, PPV. For AST sensitivity is low but specificity and PPV are 50% and 85% respectively in pathological appendix. But in case of gangrenous and perforated appendix the sensitivity, specificity and PPV for AST are 50%, 96.42%, 94.11% respectively.

If we observe for ALT and ALP though sensitivity is low but both specificity and PPV are high (83.33% and 100% respectively) in case of pathological appendix. In gangrenous/perforated appendix sensitivity is low but specificity and PPV are both 100%. These results are similar to the results found earlier by different studies as mentioned above.

## CONCLUSION

The conclusion of this study is that the LFT parameters are deranged in pathological appendix and more specifically the total bilirubin level. The sensitivity, specificity and PPV for LFT parameters are specifically high in gangrenous and perforated appendix. So LFT can be added as adjunctive test to the investigation of acute appendicitis and its complications and earlier diagnosis of the complications of acute appendicitis and timelier management. It can also help in prevention of negative appendicectomies as specificity of the LFT parameters are more than 80%.

*Funding: No funding sources*

*Conflict of interest: None declared*

*Ethical approval: The study was approved by the Institutional Ethics Committee*

## REFERENCES

1. Fasen Geoffrey, Bruce S, Traci LH. Appendix. In: Yeo CJ, eds. Shackelford's Surgery of the Elementary Tract. Elsevier. 8th ed. 2018:1951-1964.
2. Streck Jr CJ, Maxwell IV PJ. A brief history of appendicitis: familiar names and interesting patients. *Am Surg.* 2014;80(2):105-8.
3. Peranteau WH, Smink DS. Appendix, Meckel's and other small bowel diverticula. In: Michael J. Zinner, Stanley W. Ashley, eds. Maingot's Abdominal Operation. 12th ed. NY: McGraw-Hill; 2013:623-640.
4. Chaudhary P, Kumar A, Saxena N, Biswal UC. Hyperbilirubinemia as a predictor of gangrenous/perforated appendicitis: a prospective study. *Ann Gastroenterol: Quarterly Pub Hellenic Soc Gastroenterol.* 2013;26(4):325-31.
5. Cheekuri SK, Mohanty A, Ganesh T, Kannan R, Smile R. Hyperbilirubinemia as a predictor of the severity of acute appendicitis-an observational study. *Int Surg J.* 2017;4(4):1341-4.
6. Vaziri M, Pazouki A, Tamannaie Z, Maghsoudloo F, Pishgahroudsari M, Chaichian S. Comparison of pre-operative bilirubin level in simple appendicitis and perforated appendicitis. *Med J Islam Rep Iran.* 2013;27(3):109-12.
7. Utili R, Abernathy CO, Zimmerman HJ. Cholestatic effects of Escherichia coli endotoxin, endotoxin on the isolated perfused rat liver. *Gastroenterol.* 1976;70(2):248-53.
8. Utili R, Abernathy CO, Zimmerman HJ. Studies on the effects of E. coli endotoxin on canalicular bile formation in the isolated perfused rat liver. *J Lab Clin Med.* 1977; 89(3):471-82.
9. Dieulafoy G. The appendiceal liver: abscesses of faith concise with appendicitis. *Semin Med (Paris).* 1898;18:449.
10. Sisson RG, Ahlvin RC, Harlow MC. Superficial mucosal ulceration and the pathogenesis of acute appendicitis. *Am J Surg.* 1971 Sep 1;122(3):378-80.
11. Estrada JJ, Petrosyan M, Barnhart J, Tao M, Sohn H, Towfigh S, Mason RJ. Hyperbilirubinemia in appendicitis: a new predictor of perforation. *J Gastrointest Surg.* 2007;11(6):714-8.
12. Yadav S, Chandra K. Liver function test as a marker for acute appendicitis. *Janaki Med Coll J Med Sci.* 2015;3(1):31-6.
13. Vineed S, Naik RH. Diagnostic accuracy of hyperbilirubinemia in predicting perforated appendicitis. *Int Surg J.* 2017;4(10):3441-4.
14. Khan S. Evaluation of hyperbilirubinemia in acute inflammation of appendix: a prospective study of 45 cases. *Kathmandu Uni Med J.* 2006;4(3):281-9.

15. Kabir SA, Kabir SI, Sun R, Jafferbhoy S, Karim A. How to diagnose an acutely inflamed appendix; a systematic review of the latest evidence. *Int J Surg.* 2017;40:155-62.
16. Jamaluddin M, Hussain SM, Ahmad H. Hyperbilirubinaemia a predictive factor for complicated acute appendicitis: a study in a tertiary care hospital. *J Pak Med Assoc.* 2013;63:1374-8.
17. Franson TR, Hierholzer Jr WJ, LaBrecque DR. Frequency and characteristics of hyperbilirubinemia associated with bacteremia. *Rev Infectious Dis.* 1985;7(1):1-9.
18. Alanis-Rivera B, Zuñiga-Vazquez LA, Silva-Escamilla MD. Hyperbilirubinemia as a predictive factor of perforated appendicitis. *Med J Mexican Inst Social Security.* 2016; 54 (5): 552-61.
19. Sand M, Bechara FG, Holland-Letz T, Sand D, Mehnert G, Mann B. Diagnostic value of hyperbilirubinemia as a predictive factor for appendiceal perforation in acute appendicitis. *Am J Surg.* 2009;198(2):193-8.
20. Temple CL, Huchcroft SA, Temple WJ. The natural history of appendicitis in adults. A prospective study. *Ann Surg.* 1995;221(3):278.
21. Alvarado A. A practical score for the early diagnosis of acute appendicitis. *Ann Emerg Med.* 1986;15(5):557-64.
22. Jurić I, Primorac D, Žagar Ž, Biocić M, Pavić S, Furlan D, et al. Frequency of portal and systemic bacteremia in acute appendicitis. *Pediatr Int.* 2001;43(2):152-6.
23. Wang PI, Chaudry IH. Mechanism of hepatocellular dysfunction during hyperdynamic sepsis. *Am J Physiol-Regulatory, Integrative and Comparative Physiol.* 1996;270(5):R927-38.

**Cite this article as:** Braja Mohan Mishra, Malaya Krishna Nayak, Sandeep Mishra, Priyambad Sahu\*, Dibyajyoti Das. Role of liver function test parameters in acute appendicitis and its complication: a prospective study. *Int Surg J* 2019;6:193-7.