Alanine And Aspartate Transaminases In The Serum Of Acute Appendicitis Patients Before And After Surgery

G Ibrahim Hassan, G Donatien, A Mahmoud, G Joyce

Citation

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Abstract

Introduction: The serum activities of alanine aminotransferase (L- alanine: 2-oxoglutarate aminotransferase, EC. 2.6.1.2) and aspartate aminotransferase (L-aspartate: 2-oxoglutarate aminotransferase EC. 2.6.1.1) were assayed in patients with acute appendicitis. The aim was to assess the effect of acute appendicitis and surgical intervention on the serum levels of these enzymes considering their location in significant amounts in the cells of the gastrointestinal tract.
Methods: Patient selection and pre-qualification was done by simple random sampling of individuals presenting at the Bauchi Specialist Hospital with acute appendicitis and who were not subsequently found to be presenting concomitantly with liver, heart, kidney and muscle disease, including infectious mononucleosis. Based on these criteria 13 adult male patients (Age range = 18 – 45) were found to qualify for participation in the study.
Results: Pre-surgical serum aminotransferase levels were all elevated relative to the control activity. Pre-surgical alanine aminotransferase activity versus post-surgical activity of the same enzyme was 22.08 ± 3.20 IU Vs 20.08 ± 1.75 IU respectively, $p < 0.05$. A similar picture was obtained with respect to serum aspartate aminotransferase activity. Pre-surgical Vs post-surgical serum aspartate aminotransferase activities were 23.15 ± 3.87 IU Vs 18.92 ± 3.33, $p < 0.05$.
Conclusion: These results indicate an enzymological evidence for the beneficial effect of surgical intervention in acute appendicitis and the potential for the use of these enzymes in monitoring the progress of recovery in acute appendicitis patients.

INTRODUCTION

Acute appendicitis is the most common acute surgical condition of the abdomen [1]. I t has an average life-time occurrence of 7 % with peak incidence occurring between the age of 10 and 30 years [2]. Predominant symptoms of acute appendicitis are abdominal pain and anorexia [3]. Other important symptoms include vomiting, nausea and pain migration [4]. The clinical illness of acute appendicitis is initiated by obstruction of the narrow appendiceal lumen [5]. Among the multiple causes of this obstruction are the following: lymphoid hyperplasia (related to viral illnesses, including upper respiratory tract infection, mononucleosis, and gastroenteritis), fecaliths [6], [7] parasites, foreign bodies, Crohn's disease, primary or metastatic cancer and carcinoid syndrome [8], [9]. The usual laboratory findings in appendicitis patients are an elevated white blood cell count (> 10,000 / mm^3) [10] and nuetrophilia [11]. The standard for the management of non-perforated appendicitis is appendectomy [12] which can be performed by laparatomy [13] or laparoscopy [14].

Alanine and aspartate aminotransferase are two closely related transaminases involved in the reversible transfer of an amino group to a keto-acid. Tissue levels of these enzymes are highest in the heart, liver, kidneys, pancreas, red blood cells and the gastrointestinal tract [15]. Serum activities of both enzymes have been reported to increase in many disorders, including liver damage, myocardial infarction, haemolytic anaemia and muscle disease [16]. Other conditions associated with increased serum transaminases are infectious mononucleosis, alcohol abuse, acute renal hepatitis and intra-hepatic cholestasis [17]. In this study we assessed the changes in the serum activities of these two transaminases in patients with acute, appendicitis before and after surgery (appendectomy) considering the location of these enzymes in clinically significant amounts the gastrointestinal tract. Based on the paucity of data on the surgical enzymology of acute appendicitis, the aim of the study was to assess the effect of surgical intervention on the serum activities of these transaminases and the potential for their use as enzymatic tools for monitoring the progress of recovery from appendectomy.

METHODS

PATIENT SELECTION AND PRE-QUALIFICATION

The subjects involved in this study were selected by simple random sampling of surgical patients presenting at the Bauchi State Specialist Hospital. Furthermore, the randomly selected subjects were screened to eliminate concomitant infections of the liver, red blood cells, kidney or muscle disease since diseases affecting these organs or tissues are associated with changes in serum alanine and aspartate aminotransferase activities [15,16,17]. Based on this selection criteria, 13 adult male appendectomy patients (age range = 18 – 45) were found to be eligible for participation in the study. A control group of 10 age and sex-matched healthy adults were also enrolled in the study for comparative purposes.

SERUM

Blood sample (5 ml) was collected from each patient 24 hours before surgery (pre-surgical samples) and 24 hours after surgery (post-surgical sample) using sterile needle and syringe. Serum was prepared by transferring the blood sample into a clean, sterile centrifuge tube. The sample was centrifuged at 3000g for 5 minutes and the supernatant serum sample removed by aspiration using a Pasteur pipette. The sample was then transferred into a clean, sterile container and stored at – 4° C until analyzed. The control serum was prepared by collecting blood samples from 10 healthy male donors using the procedure described above.

ENZYME ASSAYS

Serum alanine and aspartate aminotransferase activities were assayed according to the method described in Bergemeyer [18].

ETHICS

Approval for this work was obtained from the management of the Bauchi state Specialist Hospital. In addition, we conformed strictly to the World Medical Association's ethical declaration on the rights of the patients in medical research. [19].

STATISTICS

Data was analyzed using Minitab – 10 Statistical Software. The non-parametric test of Friedman's One Way ANOVA was used to assess the differences between means for pre-surgical, post-surgical and control enzyme activities. $P < 0.05$ was considered significant.

RESULTS

The results obtained are shown in table 1.

Figure 1

Table 1: Alanine and aspartate transaminase activities in the serum of acute appendicitis patients and healthy controls.

ENZYME	ENZYME ACTIVITY (MEAN ± SD) IU
Alanine transaminase	
Pre-surgical	22.08 ± 3.20[a]
Post-surgical	20.08 ± 1.75[b]
Control	20.10 ± 1.39[b]
Aspartate transaminase	
Pre-surgical	23.15 ± 3.87[c]
Post-surgical	18.92 ± 3.33[d]
Control	20.95 ± 1.34[d]

[a,b,c,d,e] Values with different superscripts differ significantly at $p < 0.05$

Pre-surgical serum alanine transaminase activity was found to be 22.08 ± 3.20 IU, while the post-surgical serum alanine transminase activity was 20.08 ± 1.75 IU, $p = 0.021$. This implies a significant drop in the serum activity of alanine transaminase following surgery. Similarly, pre-surgical activity of serum aspartate transaminase was found to be significantly higher (23.15 ± 3.87 IU) than the post-surgical serum aspartate transaminase activity of 18.92 ± 3.33 IU, $p = 0.019$. The serum alanine and aspartate transaminase activities in the healthy control group are 20.10 1.39 IU and 20.95 1.34 IU respectively. These values are all significantly different from the pre-surgical alanine and aspartate transaminase activities while they were not found to differ from the post-surgical enzyme activities as shown in table 1.

DISCUSSION

Obstruction and infection are the two etiological factors involved in the predisposition to acute appendicitis [20]. Among these, the most dominant factor is obstruction. Causes of obstruction include contraction of the sphincter-like mechanism at the base of the appendix, swelling of the abundant lymphoid tissue in the appendiceal wall, previous fibrosis of the proximal end of the appendix or acute kinking of the appendix by a band of old adhesions or by a congenital fold [10, 20]. Regardless of the cause of obstruction, the result is a distention of the appendiceal lumen consequent to increased intra-luminal pressure, blood vessel rupture and haemorrhage. The increased serum activities of both alanine and aspartate aminotransferases in the pre-surgical patients can be accounted for by the destruction of the cells of the appendiceal lumen which contain high concentrations of these two enzymes. As seen in the results obtained from this study, within 24 hours of the surgical intervention, post-surgical serum alanine and aspartate aminotransferase activities have dropped significantly. This

provides an enzymatic evidence for the beneficial effect of surgical intervention in the management of acute appendicitis. In addition, serum alanine and aspartate aminotransferase activities can serve as enzymatic markers of acute appendicitis in adult patients who are not concomitantly presenting with other pathologies traditionally documented to be associated with elevated serum alanine and aspartate aminotransferase activities [21,22,23] where such increases are over 100 % above normal serum values. Furthermore, the significant decrease in post-surgical serum alanine and aspartate aminotransferase activities implies a great potential for the use of these enzymes in the prognosis of acute appendicitis patients.

CORRESPONDENCE TO

Garba Ibrahim Hassan (B.Sc, M Sc.) Bauchi, Nigeria E-MAIL: ihgarba2002@yahoo.com TEL. (+234) 0804-5252-720

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Author Information

Garba Ibrahim Hassan, B.Sc, M Sc.
Chemistry Programme, School of Science Technology, Abubakar Tafawa Balewa University

Gatsing Donatien, B.Sc. M. Sc. Ph. D
Department of Biochemistry, Faculty of Sciences, University of Dschang

Awwal Mahmoud, B.Tech
Chemistry Programme, School of Science Technology, Abubakar Tafawa Balewa University

Gadzama Joyce, B. Tech
Chemistry Programme, School of Science Technology, Abubakar Tafawa Balewa University