Serum Marker Enzymes Activities in Cancer Patients

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Abstract

The aim of this study was to estimate the serum marker enzymes: alkaline phosphates (ALP), gamma glutamyl transpeptidase (GGT), lactate dehydrogenase (LDH), aspartate amino transferase transaminase (AST), and alanine amino transferase (ALT) levels from patients diagnosed with cancers (liver, prostate, colon, leukemia, uterine, cervical, breast and ovarian) and the control subjects (healthy individual) using established methods. A significant increase (p<0.05) was recorded in the serum activities of ALT, AST, ALT and GGT in both liver and colon cancer patients when compared with the control and among the cancer types. The evidence of associations between elevated activities of the marker enzymes and risk of developing cancer (especially liver and colon) as observed from this study could be used as tumor markers in the prognosis, diagnosis and management of malignancies.

Keywords: Serum, Cancer, Maker, Enzyme, Patients

Introduction

Cancer, known medically as a malignant neoplasm, is a broad group of diseases, all involving unregulated cell growth. There are over 200 different known cancers that afflict humans (Lee and Mary, 2009).

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Cancer cells are able to invade other tissues by spreading to other parts of the body through the blood lymph system (Croce, 2008). All cancer begins in cells, the body’s basic unit of life. The body is made up of many types of cells. These cells grow and divide in an uncontrolled way to produce more cells as they are needed to keep the body healthy. When cells become old or damaged, they die and are replaced with new cells. Sometimes this orderly process goes wrong.

The genetic material (DNA) of a cell can become damaged or changed, producing mutations that affect normal cell growth division. When this happens, cells do not die when they should and new cells are formed when the body does not need them. The extra cells may form a mass of tissue called tumor. (Gupta et al., 1993). Cancer as a group of disease accounts for approximately 13% of all deaths each year with the most common being lung cancer (1.4 million deaths), stomach cancer (740,000 deaths), liver cancer (700,000 deaths), colon cancer (610,000 deaths) and breast cancer (460,000 deaths). This makes invasive cancer the leading cause of death in the developed world and the second leading cause of death in the developed world (Shetty et al., 2003).

Early detection of cancer can be potentially cured through surgery especially, when the tumor is very small and has not metastasized. In view of this, there is need for simple biochemical investigations, for early detection such as the use of tumor markers which include prostate specific antigen (PSA), alkaline phosphatase (ALP), gamma glutamyl transpeptidase (GGT), human chorionic gondotropin, lactate dehydrogenase (LDH) and alanine transaminase (ALT), aspartate amino transferase (AST). These markers could be used in population screening, diagnosis, prognosis and staging of cancer (Arun et al., 2008). However, this study has been undertaken to assess the clinical utility of some biochemical markers including GGT, ALP, AST, LDH and ALT in eight(8) different types of cancer.
These could be easily assayed and are less expensive in the diagnosis and management of cancer. The enzymes are found in large amount in the liver and can be released when the liver is injured or inflamed (as in hepatitis), and in the case of heart or skeletal muscle damage (Arun et al., 2008).

**Materials and Methods**

A total of 700 freshly diagnosed cancer patients (8 different cancer types) and 300 control subjects (healthy individual) were examined in this study. 10ml each of their blood samples was collected with the help of medical personnels in three University Teaching Hospitals in Nigeria. The blood sample was incubated at 37°C for 10 minutes after which it was centrifuged at 10,000 revolutions per minute (10,000rpm) for ten (10) minutes and the serum layer was removed and stored at 4°C prior analysis. The enzymes activities were determined spectophotometrically using established method. Statistical analysis was done using Duncan Multiple Range Test and ANOVA.

**Results**

![Graph showing serum level of ALP and LDH in patients with different types of cancer](image)
Discussion

Marker enzymes such as ALP, LDH, GGT and AST could be used for the detection of risk, population screening, diagnosis, staging and prognosis of some diseases. (Sharma and Ray 2000). Figures 1a and b show the activities of these marker enzymes in cancer patients. Alkaline phosphate (ALP) comprises a group of enzymes that catalyze the hydrolysis of phosphate esters in an alkaline environment, generating organic radical and inorganic phosphates (Kher et al., 1997). From this study, serum ALP (U/L) revealed no significant difference (P < 0.05) in ovarian cancer (90.68 ± 4.79), leukemia (85.17 ± 2.27), breast cancer patients (80.92 ± 2.58) and uterine cancer patients (65.81 ± 2.06) when compared with the control subjects (110.72 ± 5.23), however a significant increase was observed in prostate cancer patients (180.49 ± 9.94), liver cancer patients (205.06 ± 15.82) and colon cancer patients (225.87 ± 18.57) when compared with the control subjects and among the cancer patients.
This is in agreement with the findings of was if et al., (2005) and Philips et al., (2004) who reported increase in the activates of ALP in colorectal and liver cancer. This study also revealed elevated levels in other types of cancer. This increase in the serum activity of ALP may be an indicator of metastatic disease (Halliwell 2002). ALT and AST are enzymes in the liver that rearrange the building blocks of proteins. The enzymes are released from damaged liver cells. AST activity from this study showed no significant difference (P < 0.05) in cervical, ovarian and prostate cancer patients and ALT activity also showed no significant difference (P < 0.05) in cervical, leukemia and prostate cancer patients (Figure 1b).

However, the mean value of AST is significantly increased (P < 0.05) in liver, colon, leukemia, breast and uterine cancer patients while that of ALT significantly increased (P < 0.05) in uterine, breast, ovarian, liver and colon cancer patients (Figure 1b). Similar findings was also reported by Arun et al., (2008) and Philips et al. (2004). The increase in the activities of both AST and ALT could be attributed to hepatocellular damage (Henry 2001), and this could be the reason why these enzymes activity are highest in liver cancer patients among other cancer patients.

Statistical significant increase (P < 0.05) was also observed in the serum LDH (U/L) activity of all the cancer patients except in leukemia and colon cancer patients when compared with the healthy individuals (Figure 1b) and among the cancer patients. This is in agreement with the report of Sandhya (2004) who reported high activity LDH in neoplastic tissues as well as in the serum of patients with a variety of epithelial tumors. The elevated LDH activity observed might be due to the fact that cancer cells rely on anaerobic respiration for the conversion of glucose to lactate even under oxygen-sufficient conditions and this state of fermentative glycolysis is catalysed by LDH (Sandhya 2004).
Gamma-glutamyl transferase (GGT) is a membrane band enzyme catabolising reduced glutathione to cystein and glycine. The serum GGT (U/L) activity ranged from $38.99 \pm 10.21$ to $61.93 \pm 15.23$. This study shows a significant increase ($P < 0.05$) in the levels of all the cancer patients except in ovarian cancer patients when compared with the control subjects (Figure 1b). The elevated activity of GGT in this study is in accordance with the findings of Taniguchi et al., (1985). The result obtained from this study revealed a relationship balance between GGT activity and cancer. (Kultigin et al., 2010).

**Conclusion**

The associations between elevated activities of these enzymes and risk of developing cancer (especially liver and colon) could be used as tumor markers in the prognosis, diagnosis and management of cancer.

**References**


