

PRE-OPERATIVE LOW SERUM ALKALINE PHOSPHATASE AN ADDITIONAL RISK FACTOR FOR NON-UNION OR DELAYED-UNION TIBIA

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ABSTRACT

Tibial shaft fracture is the most commonly occurring long bone fracture. These fractures are more prone to complications such as delayed or non-union as compare to other due to certain factors. There are many systemic and local factor which predict for such complications. In systemic factors, apart from nutritional status, drinking alcohol and smoking habits of patients, there is no specific factor which indicate the patient's bone healing ability (Osteoblastic activity). Pre-operative serum ALP level was estimated in 124 healthy adult patients with fresh closed traumatic diaphyseal fractures of tibia and correlated with end results of healing.

The proportion of delayed or nonunion was statistically significantly higher in group A (preoperative serum ALP level <80) as compared to group B (preoperative serum ALP level >80). So estimation of serum ALP level can be used as an additional prognostic indicator for the risk of delayed or nonunion in fracture shaft of tibia.

KEYWORDS: Alkaline Phosphatase

INTRODUCTION

Tibial shaft fractures are the commonest long bone fracture and also prone to a number of complications. Many of these fractures require re-surgery or any other intervention to augment healing.¹ By 2020, road accident (commonest cause of fractures) is expected to be leading cause for disabilities among all causes of disabilities.²

Delayed or non-union occurs in 4%-48% of tibial shaft fractures for which secondary surgery or additional treatment to stimulate the bony union is required.³ various local and systemic factor that may predict risk of delayed or non-union of fracture have been identified in various clinical studies⁴⁻¹³

Systemic factors include the patient's metabolic and nutritional status, general health and activity level along with use of tobacco and alcohol¹⁴.

The fracture healing is a continuous proliferative and physiological process to repair the fracture¹⁵. This is characterized by the production of new bony matrix (osteoid) and its subsequent mineralization, thus bridging the gap between two bony fragments (an osteoblastic function)¹⁶.

There is no quantifiable marker to assess the patient's ability to regenerate the bone after fracture.

With this background, we estimated the pre-operative serum alkaline phosphatase level of patients and follow them post-operatively till end results and try to find the correlation between pre-operative serum ALP level and end results (Healing outcome).

MATERIALS AND METHODS

Total 124 patients of age group 18 to 45 years with closed, traumatic, fresh (< 7 days) diaphyseal fractures of Tibia managed surgically by internal fixation were included in this study.

Exclusion Criterion

- Patient with polytrauma
- Pathological fractures
- Pregnant woman
- Immunocompromised patients
- Patients on oral contraceptives and immunosuppressive drugs,
- Patients with uncontrolled diabetes, Hepatobiliary diseases, Inflammatory bowel disease and those who were not willing to give consent for inclusion in the study

2ml of peripheral venous blood was collected in EDTA vials prior to surgery. Quantitative estimation of serum ALP activity (at pH-10.4, Temp-37°C) was done spectrophotometrically (405nm) using p-Nitrophenylphosphate as a substrate and the reagent provided by BEACON. The sample was processed in standardized manner under set protocol in the department of biochemistry, New Medical College and Hospital, Kota. Patients were followed-up post-operatively clinic - radiologically in association with the department of orthopaedic, New Medical College and Hospital, Kota at 3weeks, 6 weeks, 3 months, 6 months and 1 year till the end results.

Gentle clinical examination of the fracture site was done at each visit during follow-up for the assessment of – skin condition, abnormal mobility, bony tenderness, transmitted movements. Patients were evaluated radiologically also at each visit. Based on the Pre-operative Serum ALP level, patients were divided into two group. Group A include the patients having serum ALP level less than 80 and Group B had serum ALP level more than 80. Both groups were evaluated clinico-radiologically at regular interval until the union occurred or some re-operation done to augment the fracture healing. Fracture union was defined clinically when the fracture site painless (No tenderness), motionless (No abnormal mobility), with presence of transmitted movements. Radiologically union was said to be present when bony callus was evident on atleast three cortices in standard AP and lateral views. Re-operation was defined as any invasive procedure performed to promote fracture healing. Such invasive procedures included, but were not limited to bone grafting, nail dynamization or implant exchange.

Data was compiled on excel sheet and analysed statistically. Results on categorical measurement were compared by standard error of difference between proportions. The level of significance was kept 95% for all statistical analysis.

RESULTS AND DISCUSSIONS

Total 124 patients were enrolled in this study, who were allocated in to group A (n=64) and group B (n=60) depending upon Pre-operative serum ALP level. The average age of group A was 35.4 years (range 18-45) and group B was 40 years (range 22-50). The difference between mean ages of these group was not found to be significant. The mean age of the fractures at the time of surgery in group A and B was 1.6 days (range 1-4) and 1.3 days (range 1-2) respectively.

The difference between the the age fracture at the time of surgery was not significant.

The proportion of patients having delayed or non-union were more in group A 50% as compared to group B in which 17% of patients had delayed or non-union.(Table 1) (statistically significant)

Normal fracture healing is generated by increased osteoblastic activity. There is secretion of large quantity of alkaline phosphatase by osteoblast those involved in the formation of bone matrix and its mineralization¹⁷. Although serum Alkaline phosphatase level correlates well with the osteoblastic activity, the bone isoenzyme of Alkaline phosphatase (BALP) is considered more specific marker of osteoblastic activity¹⁷. The inclusion and exclusion criterias set in our study eliminated the possibility of other alkaline phosphatase isoenzymes being responsible for the serum alkaline phosphatase level in the enrolled cases.

In 1989 Oni and Mahabir et al found decreased ALP level in slowly healing fractures and postulated that it was due to decreased osteoblastic activity¹⁸. In jan 2014 Gulab kanwar and Mamta yadav et al correlated post-operative serum alkaline phosphatase level during follow-up to fracture healing and found persistently low serum alkaline phosphatase level in non-union group.

In our knowledge, there is no clinical study in in which pre-operative serum alkaline phosphatase level is correlated with fracture healing process. That is why there is no similar datas to compare the findings of our study with others.

Through our study we conclude that pre-operative serum alkaline phosphatase level reflect the patients osteoblastic activity which in turn reflect his/her bone regenerating ability.

we recommend further studies to cofirm this observation. we also recommend for similar studies with larger sample size and including the patients with all long bone fractures not only tibia.

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