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SERUM ENZYMES IN THERMAL INJURY

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ABSTRACT

Various metabolic and biological changes follow burn injury. Serum Thio-barbituric acid reactive substances (TBARS), transaminases, alkaline phosphatase and amylase were measured in 43 patients with thermal injury over the first 10 days of post burn period. No clear correlation between elevated serum enzymes except amylase and the burn size was observed on admission. Mean serum TBARS were significantly increased in the burn patients. Transaminases values increased till 5th day then declined on 10th day, whereas alkaline phosphatase and amylase activities continued to rise till day 10. It is concluded that functional disturbances occur in liver and pancreas around a week after thermal injury. Monitoring serum ALP and amylase in post-burn period has valuable prognostic importance.

KEY WORDS

Alkaline phosphatase, Amylase, TBARS, Thermal injury, Transaminase,

INTRODUCTION

Thermal injury results in significant pathophysiological changes by interplay of various mediators in early stages. Theses changes further exacerbate the whole body inflammatory response into vicious cycle of accelerating organ dysfunction (1). Systemic changes in enzymes following burn injury has been reported to involve wide number of organs. Most vulnerable organs which succumb to these changes are liver (2), heart (3), pancreas (4), kidneys (5), gastrointestinal tract and Lungs (6).

Various metabolic and biochemical alterations that follow burn injury include increased free radical activity (7-9), bloods levels of ascorbic acid, uric acid (9) and elevation of the activity of some serum enzymes (10-13). Changes in the serum transaminases (AST & ALT) and alkaline phosphatase (ALP), creatinine kinase, lactate dehydrogenase, γ-glutamyl transpeptidase have been reported in burn patients after treatments (12, 13). This study reports prognostic value of serum AST, ALT, ALP and amylase in burn patients during delayed phase of the thermal injury.

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MATERIALS AND METHODS

The study involved of 43 hospitalized patients with burn injury and 15 clinically normal healthy individuals. Severity of burn injury was expressed as percentage of total body surface area (TBSA) affected by burn (burn size). Based on burn size, four groups were made (Table-1). Whole blood samples were collected at the time of admission, subsequently on 5th and 10th day after hospitalization. The patients received conventional treatments for the thermal injury. Serum AST, ALT and ALP were measured by standard photometric end-point methods (14). Serum amylase was estimated by modified amyloclastic method (15) and the activity is expressed in Street & Close units (1 SC unit = 3.8 Somogyi units). Serum TBARS was measured by modified colorimetric method (16). The values are expressed in terms of malondialdehyde (nmol/ml) as reference standard. The statistical tests included unpaired student's 't' test and regression analysis for correlation coefficient.

RESULTS

The mean values for AST, ALT and ALP on admission were

Table 1: Results of biochemical parameters in burn patients on admission.

Groups (% TBSA)	n	TBARS (nmol / ml)	AST (units/L)	ALT (Units/L)	ALP (KA units)	Amylase (SC units)
I (<25 %)	10	5.7 ± 1.8*	24.70 ± 3.74 (20 – 32)	21.30 ± 3.02 (18 – 27)	5.98 ± 1.55 (4.41 – 8.4)	28.44 ± 0.44* (27.77 – 29.09)
II (26-45 %)	14	6.3 ± 0.7*	25.00 ± 4.04 (20 – 33)	21.93 ± 4.60 (18 –27)	6.57 ± 1.35 (4.41 – 8.2)	32.02 ± 4.19* (27.77 – 39.34)
III (46-65 %)	11	8.2 ± 1.2*	24.00 ± 3.39 (18 – 28)	21.55 ± 3.42 (18 – 28)	7.87 ± 0.48 (7.06 – 8.41)	38.11 ± 7.70* (30 – 57.14)
IV (>65 %)	8	10.1 ± 1.6*	27.38 ± 2.26 (25 – 30)	24.13 ± 3.56 (20 – 32)	7.89 ± 0.81 (6.4 –8.82)	29.82 ± 1.41* (27.77 – 32.72)
NC	15	2.2 ± 0.3	21.20 ± 1.92 (18 – 25)	23.40 ± 1.97 (18 – 27)	8.67 ± 1.33 (6.0 – 11.3)	13.52 ± 2.01 (9.5 – 17.5)

The values are Mean ± SD. Figures in parenthesis are the range of values.; TBSA = Total body surface area; SC unit = Street & Close unit;
*P< 0.001 cf controls (NC) in all groups.

not different from the controls (Table-1), whereas amylase and TBARS were significantly (p<0.001) elevated in the patients as compared to the controls on the day of admission. The trends in the mean AST and ALT values show increase till 5th day then decline on 10th day however, it does not reach the value on the day of admission (Fig-1), whereas ALP and amylase activities continue to rise till day 10. Table-2 shows correlation coefficient 'r' values between the burn size and serum enzymes levels. The serum enzyme levels did not show satisfactory correlation with burn size on the day of admission whereas good correlation values were observed for ALT, ALP and amylase levels and burn size on 10th day (Fig-2).

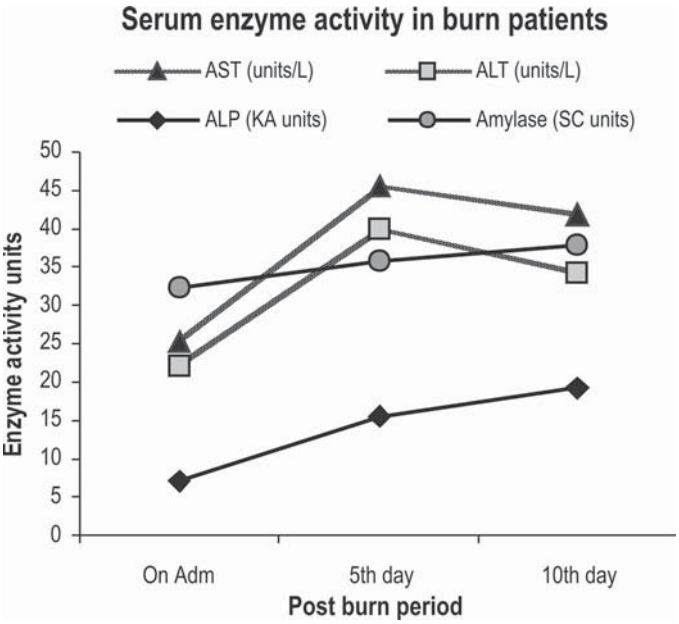

Fig.-1: Serum levels of enzymes during post burn period.

Table 2 : Correlation between burn size and serum enzyme levels

Period	ALT	AST	ALP	Amylase
On admission	0.152137	0.204797	0.4552	0.171433
On 10th day	0.540909	0.49767	0.5016	0.721726

Values are coefficient of correlation 'r' between burn size and serum enzyme levels

DISCUSSION

Burn injury is accompanied by complex pathophysiological alterations that exert deleterious effects on various organ systems. It was found that the serum enzyme levels on admission had poor correlation with burn size. This indicates that the severity of burn injury has no direct relationship with the serum enzyme levels on admission. It appears that there

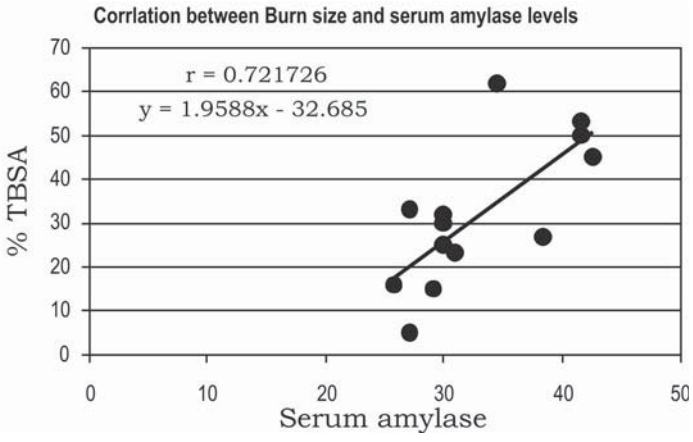

Fig.-2: Scatter diagram showing regression of burn size (% TBSA) as and serum amylase levels in the burn patients on 10th day of after admission.

are no acute changes in the functions of liver, heart or pancreas in early phase of thermal injury.

The amylase activity in the patients was significantly higher than the controls. The values of amylase in the burn patients were above the upper limit that found in the controls, however within the reference interval as reported for the method (15). The mean values of serum amylase show an increasing trend with severity, in general. Serum TBARS levels in the burn patients were significantly higher than the controls, indicating a direct relationship of lipid peroxidation with severity of thermal injury.

Serum enzyme levels in post burn period show interesting trends. It was found that the mean levels of AST and ALT were increased on 5^{th} day thereafter they declined on 10^{th} day. However, the levels were higher than the level at the time of admission. This trend in the values shows that the transaminases rise transiently in response to the thermal injury and they shortly fall back to original level. These changes in transaminases and ALP confirm the earlier reports (11, 12).

The mean values of serum amylase show an increasing trend from the baseline without any decline further till day 10 (Fig-1). Elevation of serum amylase is not due to reduced renal clearance. It is most likely due to release into circulation from organs rich in amylase such as pancreas, other sources being unlikely (17), since renal clearance of amylase has been reported to be increased following thermal injury (18).This suggests that thermal injury has some effect on the serum level of amylase.

The serum transaminases and ALP levels on 10^{th} day exhibited good correlation with burn size whereas amylase had much better correlation with burn size. These results indicate that the severity of thermal injury has no relation with serum enzyme levels at the onset whereas in the delayed phase, serum enzymes are better correlated with the severity of the injury.

Similarly it is found that serum TBARS levels were higher on the day of admission and they start declining on 10^{th} post burn day. The reason for the decline could be the effect of treatment given to the patients. This includes prophylactic therapy of ascorbic acid, which is a known antioxidant vitamin. In addition, it may be due to the reactivation of endogenous antioxidant defenses to counteract the oxidative stress generated by the thermal injury.

Several experimental studies have shown that thermal injury can result in increased lipid peroxidation mediated by free radicals, which are detectable in burnt skin, lung tissue and plasma (3, 6, 11). Similar results are reported earlier in human thermal injury (5, 7). Therefore, it is possible that the rise in serum ALP and amylase after burn injury is the direct consequence of the thermal trauma.

The clinical implications of the results are important in patient management. The lipid peroxidation process continues well beyond the period corresponding in time with recovery phase leading to lung inflammation, liver and pancreatic dysfunction. Thus monitoring of serum enzymes such as ALP and amylase has important prognostic value in the management of thermal injury. Taking adequate therapeutic and prophylactic measures, to counteract free radical activity in the initial stages, can prevent the distant organ injury and the resulting complications.

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