

Study of Serum Pseudocholinesterase Enzyme in Burn Patients

Chauhan A¹, Dutt CK², Sharma S^{3*}

¹Associate Professor, Department of Surgery, G.R.M.C., Gwalior, India

²Associate Professor, Department of Surgery, G.R.M.C., Gwalior, India

³P.G. Student, Department of Surgery, G.R.M.C., Gwalior, India

Original Research Article

*Corresponding author

Dutt CK

Article History

Received: 14.07.2018

Accepted: 26.07.2018

Published: 30.07.2018

DOI:

10.36347/sasjs.2018.v04i07.004



Abstract: Serum pseudo cholinesterase activities were estimated in 53 normal and 53 burn patients. The samples we drawn in patients after admission on 1st, 4th, 8th, 12th, 16th and 20th post burn days. According to the burn severity, a characteristic decrease was noted from 1st to 12th post burn day, and then it started increasing in lower degrees of burn, while it continued to decrease in greater degrees of burn. The decline during the subsequent days as well as its value was found to be correlated with the percentage of total burnt body surface area. The serum pseudo cholinesterase enzyme seems to be a good prognostic marker to predict the outcome and course of illness after a burn injury. Our study suggests a correlation between serum pseudo cholinesterase enzyme activity and morbidity in burn patients.

INTRODUCTION

From early of civilization in India the burn problems are eminent. Right from resuscitation to rehabilitation, it is a challenge with equal chances of losing. It is ironical but true that in burns, problems start after the patient has been successfully resuscitated.

Burn injury is a multifaceted, multidimensional injury which deranges almost all the functions of the body in one way or other, depending on the extent of injury.

Enzymes are macromolecular catalysts with the unique property of accelerating and controlling the multitude of chemical reactions upon which all forms of life are based.

By virtue of recent advances in technology, it has been revealed that destruction or alterations of cellular functions by disease processes affect the level of enzymatic activity in blood.

Pseudo cholinesterase (PChE) is an enzyme with a complex molecular structure [1]. It is synthesized in the liver and immediately released into the plasma[2]. The plasma half life has been estimated to be approximately 12 days[3] PChE activity may be reduced by a number of concomitant administered drugs and also by a number of diseases. Physiologic reductions may occur with the extremes of age and during pregnancy[4] Other causes include renal and liver diseases, malignancy, burns, chronic debilitation, myocardial infarction, collagen diseases, myxedema and organophosphate poisoning[4].

Pseudocholinesterase has also been considered as a useful biomarker for the diagnosis and monitoring of malnutrition and in general as a prognostic indicator in the elderly[5, 6]. In literature, plasma esterase's were found to decrease in acute illnesses. The activity of pseudo cholinesterase strongly depends on liver

function[8] More than 170 inflammation biomarkers have been described in literature and proposed for diagnostic and prognosis of the systemic inflammation or sepsis[10].

Serum cholinesterase is a sensitive indicator of hepatic dysfunction in systemic sepsis syndrome, a significant correlation of the concentration of cholinesterase and clinical outcome was found, the mean level in patients who died that was significantly lower in comparison to those who survived. Ba *et al.* reported a dynamic change of serum pseudo cholinesterase activity following a severe traumatic injury also[7].

AIMS AND OBJECTIVES

The present work has been taken up with a view to study following aims and objectives:

- To estimate serum pseudo cholinesterase activity in normal healthy individuals.
- To estimate the serum pseudo cholinesterase activity in burnt patients.

- To evaluate the prognostic significance of serum pseudo cholinesterase activity.
- To study the effect of age, sex, depth and percentage of burn over level of serum pseudo cholinesterase.

MATERIALS AND METHODS

This study was conducted in Burns and Plastic Surgery, Department of Gandhi Medical College, Bhopal from 1st June 2002 to 31st May 2003.

The serum pseudo cholinesterase estimation was done in 53 normal individuals, comprising of 26 males and 27 females and 53 patients of thermal burn comprising of 23 males and 30 females of different age groups.

Selection of normal individuals

The normal individuals were selected from amongst the doctors, medical students, nursing staff and attendants of the patients admitted in burn ward, who could fulfill the following criteria:

- Having the sense of physical and mental well being and could carry out routine duties without any difficulty.

- Not suffering from any acute or chronic illness.
- Found normal on clinical examination and routine investigations.
- In females having no pregnancy or menstrual period.

Normal subjects were divided in 4 age groups to demonstrate a change in serum pseudo cholinesterase level if any according to age:

- Group I - below 15 years
- Group II - between 16 to 30 years
- Group III- between 31 to 45 years
- Group IV- above 46 years

The burn patient were routinely investigated and examined. The blood samples were collected under perfect aseptic and in sterile vials.

OBSERVATIONS IN NORMAL INDIVIDUAL

Serum pseudo cholinesterase was determined in 53 normal individuals comprising of 26 males and 27 females. Data has been converted into various tables indicating the analysis of observations and their significance. These tables have been statistically analyzed to find their significance.

Table-1: Showing statistical analysis of the values of serum pseudo cholinesterase in 26 males and 27 females

Statistical measures	Serum pseudo cholinesterase in units/ml in male	Serum pseudo cholinesterase in units/ml in female	Average
Mean	78.2	77.63	77.89
S.D.	±9.4	±9.1	
Range	63-92	64-92	63-92

Remark

Statistical analysis revealed that sex had no bearing on the value of serum pseudo cholinesterase activity in normal individuals.

Remark

Statistical analysis revealed that age had no bearing on the value of serum pseudo cholinesterase activity in normal individuals.

Table-2: Showing statistical analysis of the values of serum pseudo cholinesterase in different age groups

Statistical	Serum pseudo cholinesterase activity in diff. age groups			
	Upto 15 yrs	16 yrs to 30 yrs	31 to 45yrs	45 yrs & avg.
Mean	79.43	77.6	77.55	78.39
Range	65-92	63-92	65-92	64-92

OBSERVATION IN BURN PATIENTS

The serum pseudo cholinesterase in 53 available cases of burn of both the sexes (23 males and 30 females) of different ages was assessed. The groups were divided as follows:-

- Group I : upto 15 yrs
- Group II : 16 to 30 yrs
- Group III : 31 to 45 yrs
- Group IV : above 45 yrs

Percentage of burn was calculated with the help of "Wallace's Rule of Nine". Most of the survivor cases had superficial degree of burns except 2 cases. Thorough clinical examination and routine

investigations were done to find out any possibility of acute or chronic disease.

The serum pseudo cholinesterase estimations were done on 1st, 4th, 8th, 12th, 16th and 20th post burn days. In male burnt patients, the statistical analysis showed that the serum pseudo cholinesterase in males with average burn of 34.37% was lower on the 1st day to average 47.72 units/ml (range 24-64). The lowest readings were found as 12th BPD average 29.76 units/ml (range 16-44) and after that it started rising again.

In female burnt patients, the serum pseudo cholinesterase in patients of average burn 31.75% was

lower on the 1st day, average 49.45 units/ml (range 34-64). The lowest reading was found on 12th BPD to average 31.82 units/ml (range 16-54 units/ml) and after that it started rising again.

The mean values in all four age groups vary between 44-53 units/ml on 1st BPD. Further pattern of decline and elevation is almost identical in all the four age groups. It revealed that age has got no bearing with serum pseudo cholinesterase values in burns.

Table-3: Statistical analysis of serum pseudo cholinesterase values in comparison to percentage of burns

% of burn	Pseudo cholinesterase value units/ml (BPD)					
	1st	4th	8th	12th	16th	20th
Upto 20%	57.7	51.7	46.13	44.33	53.0	55.5
21-40%	48.55	44.91	37.76	30.41	36.29	41.44
41-60%	35.44	32.63	28.0	22.14	27.4	29.33
61-80%	21.25	18.33	12	10	8	6
81-100%	16.22	11.43	-	-	-	-

It is observed that serum pseudo cholinesterase values were lowest (16.22 units/ml) in more extensive burns 81-100% and vice-versa. It was also observed that serum pseudo cholinesterase values continued to decline in 4th group and in last group, the patients could not survive for subsequent readings after 1st and 2nd readings.

DISCUSSION

The mean value of serum pseudo cholinesterase observed in normal subjects was 77.89 units/ml with a range from 63 units to 92 units/ml. No variation in the enzyme activity was observed in different sexes. In the males it was found to be, on an average, 78.2 units/ml varying from 63 to 92 units/ml. In females the value varied from 64 to 92 units/ml with a mean of 77.63 units/ml. Similarly serum pseudo cholinesterase had no bearing with the age and sex.

In cases of burns a significant fall in serum pseudo cholinesterase was noted. This also has been noted in study conducted by Viby Mogensen *et al.* [9]. In 39 survivors with average 33.02% burn the serum pseudo cholinesterase values decrease decreased to 47.72 units/ml on an average (24-64 units/ml) in males; with an average of 34.37% burn, pseudo cholinesterase levels were 49.45 units/ml (range 34-64) in females on the first day and for twelfth consecutive days the enzyme level continued to fall. Afterwards it started rising towards normal.

In 14 patients who died of burn, conspicuously low levels of enzymatic activity was observed amounting to an average of 17.86 units/ml with a range of 13-24 units/ml which continued to decline till death.

Pseudo cholinesterase depletion appeared to be related to the extent of burn injuries. The greatest enzyme depletion (13 units/ml) occurred in persons with extensive burns (100%) and the minimum reduction in pseudo cholinesterase enzyme (64 units/ml) was found with least percentage of burns (10%).

The study done by Kamolz LP [11] *et al.* also suggested that there was decrease in the activity of pseudo cholinesterase in burn patients in proportion to the severity of burn. They also detected a significant relationship between serum pseudo-cholinesterase activity and the severity of morbidity.

It was observed that in those patients with extensive burns in whom repeated blood transfusion were given, could survive for a longer period as compared to others.

From the above observations it was concluded that there was a highly significant fall in the serum pseudo cholinesterase levels in cases of burn patients, in proportion to the extent of injury having no relation with sex or age.

The probable cause for the fall in the enzyme activity was related to the loss of plasma which contains active pseudo cholinesterase, into oedematous tissue, blister fluids, and from open surface wound. Thus the repeated fresh whole blood or plasma transfusion are necessary for effective management of burn patients, and the serum pseudo cholinesterase activity may prove to be sensitive index of the effective therapy.

CONCLUSION

Serum pseudo cholinesterase measurement results in an accurate functional and prognostic indicator, useful for monitoring the clinical and therapeutic intervention according to patient's survival expectance [12].

However additional studies of pseudo cholinesterase depletion in patients with burns will be required to corroborate these findings and to develop a more effective method of treatment, in order to ensure a more useful social and family life with minimum or none of the sequelae.

REFERENCES

1. Lockridge O, Bartels CF, Vaughan TA, Wang CK, Norton SE, Johnson LJ. Complete amino acid sequence of human serum cholinesterase. *J boill chem.* 1987;265:549-557.
2. Perderson NA, Jensen FS. Clinical importance of plasma cholinesterase for the anaesthetist. *Ann Acad Med Singapore.* 1994;23(Suppl):120-124.
3. Ostergaard D, Viby-Mogensen J, Hanel HK, Skovgaard LT. Half life of plasma cholinesterase. *Acta Anaesthesiol Scand.* 1988;32:266-69.
4. Davis L, Britten JJ, Morgan M. Cholinesterase: Its significance in anaesthetic practice. *Anaesthesia.* 1997;52:244-260.
5. Seiter WO, Stahelin HB. Special aspects of malnutrition in geriatrics. *Schweiz med Wochenschr.* 1995;125:149-58.
6. Mitrache C, Passweb JR, Libura J, Petrikos L, Seiler WO, Gratwoh A. Anemia: An indicator of malnutrition in the elderly. *Ann Hematol.* 2001;80:235-8.
7. Ba L, Wu DQ, Qian AY, Zhang M, Xiong B. Dynamic changes of serum cholinesterase activity after severe trauma. *Journal of Zhejiang University SCIENCE B.* 2014 Dec 1;15(12):1023-31.
8. Jokanović M, Maksimović M. Abnormal cholinesterase activity: understanding and interpretation. In *European journal of clinical chemistry and clinical biochemistry: journal of the Forum of European Clinical Chemistry Societies* 1997 Jan (Vol. 35, No. 1, pp. 11-16).
9. Viby-Mogensen J, Hanel HK, Hansen E, Sørensen B, Graae J. Serum cholinesterase activity in burned patients I: biochemical findings. *Acta Anaesthesiologica Scandinavica.* 1975 Jun;19(3):159-68.
10. Pierrakos C, Vincent JL. Sepsis biomarkers: a review. *Critical care.* 2010 Feb;14(1):R15.
11. Kamolz LP, Andel H, Greher M, Ploner M, Meissl G, Frey M. Serum cholinesterase activity reflects morbidity in burned patients. *Burns.* 2002 Mar 1;28(2):147-50.
12. Santarpia L, Marra M, Montagnese C, Alfonsi L, Pasanisi F, Contaldo F. Prognostic significance of bioelectrical impedance phase angle in advanced cancer: preliminary observations. *Nutrition.* 2009 Sep 1;25(9):930-1.