Serum alanine transaminase (ALT) reference ranges estimated from blood donors

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Abstract

It has been suggested that an increase in serum alanine transaminase (ALT) activity in blood donors may identify infection with non-A, non-B hepatitis. To facilitate identification of such donors, the reference range for ALT was measured on a Technicon SMAC 1 Analyser, using serum from 364 blood donors and 567 plasmapheresis donors. The distribution of ALT activities displayed a positive skewness, and so both logarithmic transformation and subsequent calculation of mean and standard deviation as well as non-parametric analysis were used to obtain best estimates of reference ranges for men and women, 5-65 IU/l and 5-35 IU/l, respectively. ALT activities were found to be higher in plasmapheresis donors than in normal blood donors of both sexes, and it is postulated that this difference may be related to the increased frequency of donation in the former group.

Post-transfusion hepatitis is usually due to the non-A, non-B (NANB) viruses, for which there is no test routinely used for screening in the United Kingdom. Most of these cases of non-A, non-B hepatitis following transfusions are now thought to be due to hepatitis C for which an antibody screening test has recently become available,¹ although none was available at the time of this study. Observations in haemophilic patients indicate that NANB infection may often be subicteric, presenting as an influenza-like illness, with disordered liver function tests.² The incidence of post-transfusion hepatitis due to NANB viruses is unknown but is thought to be of the order of 90% of all post-transfusion hepatitis cases in the United States.² It has been suggested that screening with liver function tests, especially of alanine transaminase activity, may identify a proportion of infective donors.³ Furthermore, it has been reported that the higher the increase of ALT in donor blood, the higher the risk of the donor being a carrier.^{4,5} In assessing the normality of ALT activity the difference in the reference range between the

sexes must be recognised.^{6,7} If ALT is to be used to identify infected donors it is of course essential that reference ranges should be defined with as much confidence as possible; consequently it was decided to assess the reference range for our current ALT method (Technicon method number SG4-0079M84).

Methods

Blood samples from 364 blood donors and from 567 plasmapheresis donors, bled between 1985 and 1987, were randomly selected and analysed on the next routine assay for ALT. Any sample which was haemolysed or unseparated overnight was discarded, and samples were stored at 4°C until assay. Both groups of samples were handled in an identical manner. The age and sex of each donor were recorded. The ALT estimations were carried out on a Technicon SMAC 1 analyser at 37°C. The possibility of following up patients who had received specific identifiable donations of blood or plasmapheresis products was rejected as impractical because transfusion usually involved several donors and the difficulty of matching donors and recipients across a large region would be formidable.

Results

The distribution of ALT activities found (figure) displayed a positive skewness similar to that reported by Mijovic *et al.*⁷ A total of five results which were manifestly abnormal (greater than 90 IU/l) were excluded. Because the distributions were non-normal, a logarithmic transformation was performed to attempt to achieve an approximately normal distribution from which the mean and standard deviation were calculated. Anti-logarithmic transformation of the mean, mean + 2 SD, and mean - 2 SD were carried out to give the results tabulated overleaf. Non-parametric estimation of the 2.5th and 97.5th centiles was also done. The results are shown in the table: higher ALT activities were found in plasmapheresis donors of both sexes than in whole blood donors. Unpaired *t* testing, however, showed this difference to be significant only in the two male groups (0.001 < *p* < 0.01).

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Distribution of ALT activities in normal and plasmapheresis donors.

Estimates of reference ranges for ALT (IU)

	Mean	Mean - 2 SD	Mean + 2 SD	Median	Mode	2.5th-97.5th centile range
Male blood donors (n = 209)	20.1	6	72	20	20	6-64
Male plasmapheresis donors (n = 374)	23.4	7	75	25	25	5-62
Female blood donors (n = 155)	14.1	6	35	13	11	5-32
Female plasmapheresis donors (n = 193)	15.2	5	48	16	15	5-46

Discussion

The reference ranges derived from the two different procedures yielded different results, and under these circumstances the best estimates are expected to be derived by non-parametric means. It is suggested, therefore, that reference ranges of 5-65 IU/l for men and 5-35 IU/l for women may be regarded as appropriate. These ranges differ from the upper limits reported recently by Mijovic *et al* (52.4 IU/l for men and 30.3 IU/l for women). The reason for these differences is unclear but

may be related to methodological differences in that the analyses reported by Mijovic *et al* were performed on an EPOS analyser.

The higher ALT activities found in plasmapheresis donors of both sexes is interesting and may be related to the fact that plasmapheresis donors donate considerably more frequently than blood donors (about once every four weeks as opposed to twice yearly). This more frequent depletion of plasma protein might be expected to cause an increased flux of protein from hepatic paren-

chymal cells which may be associated with excessive loss of ALT into the circulation.

An alternative explanation might have been associated with age differences between the two donor groups as it has been reported that ALT values (in men) peak at age 34 years.⁸ In this study, however, the mean and median ages of the two male groups were virtually identical (normal donors mean 34 years, median 31 years; plasmapheresis donors mean 33 years, median 30 years).

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