Serum B_{12} Levels amongst Anaesthesiologists and non-Anaesthesiologists

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Abstract

Objective: To assess whether exposure to nitrous oxide causes Vitamin B_{12} deficiency among anaesthesiologists.

Subjects and Methods: Twenty five anaesthesiologists and same number of non-anaesthesiologists were selected from Aga Khan University Hospital, Liaquat National Hospital, Abbasi Shahid Hospital, Baqai Hospital and Hamdard University Hospital.

The criteria for selection of anaesthesiologists was laid down (as in text), and non-anaesthesiologist doctors were controls. Serum B_{12} levels were done using Radioimmunoassay method.

Results: Serum B_{12} levels of anaesthesiologists were significantly lower (mean = 231 pcg/ml), than non-anaesthesiologists (mean = 354.6 pg/ml).

Conclusion: Anaesthesiologists have significantly lower Serum B_{12} levels because of exposure to patients expired gases containing nitrous oxide (JPMA 53:237;2003).

Introduction

Nitrous oxide is an anaesthetic gas used routinely in almost all cases requiring general anaesthesia. However prolonged exposure to nitrous oxide causes interference in vitamin B_{12} and folate metabolism thereby causing vitamin B_{12} and folate deficiency which results in megaloblastic anaemia, myeloneuropathies in the form of motor, sensory co-ordination and reflex defects and increased risk of abortion in females. Anaesthesiologists are repeatedly exposed to the patients expired gases in operation theatres. The aim of the study was to see whether chronic exposure to Nitrous oxide among anaesthesiologists causes vitamin B_{I2} deficiency .

Subjects and Methods

Serum B_{12} levels of fifty doctors were measured. Informed consent was obtained from all participants and the study was approved by the ethical committee of Hamdard University Hospital Research Department.

Fifty physicians were recruited in the trial. They were divided into two study groups. Group I were practicing anaesthesiologists from Aga Khan University Hospital, Liaquat National Hospital, Abbasi Shaheed Hospital, Baqai Hospital and Hamdard University Hospital.

Group 1 were 25 anaesthesiologists working in operation theatres for more than five years and were using nitrous oxide in almost all cases where general anaesthesia was given . None were taking any Vitamin B_{12} supplements. All were using open or semi-open circuits for giving anaesthesia. Active scavenging system for exhaust gases was not present in any operation theatre.

Group 2 (control group) were 22 (non-anaesthesiologists) physicians working in the same institutions. Five ml of blood was drawn from each study participant. Vitamin B_{12} was done at the Aga Khan University Hospital Laboratory using Radioimmunoassay method.

Sensitivity of the test was high, i.e. 35 to 2400 pg/ml could be measured. The technician performing the test was blinded to the exposure of nitrous oxide among physicians.

Results

The age and sex distribution of the two study groups is shown in Table I. No difference was observed among the two groups. Serum B_{12} levels of the combined samples were plotted in stem and leaf plot in pg/ml, where stem width was 100 pg/ml and each leaf represented 1 case (Table 2). Maximum readings i.e. ten were in the range of

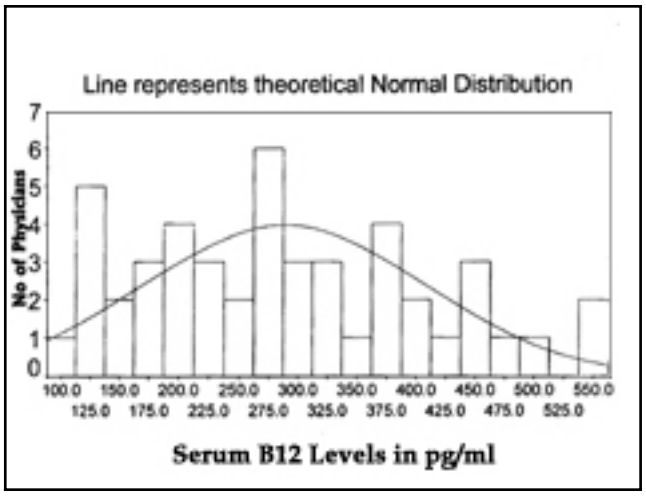


Figure 1. Serum B-12 levels (pg/ml) in two combined samples.

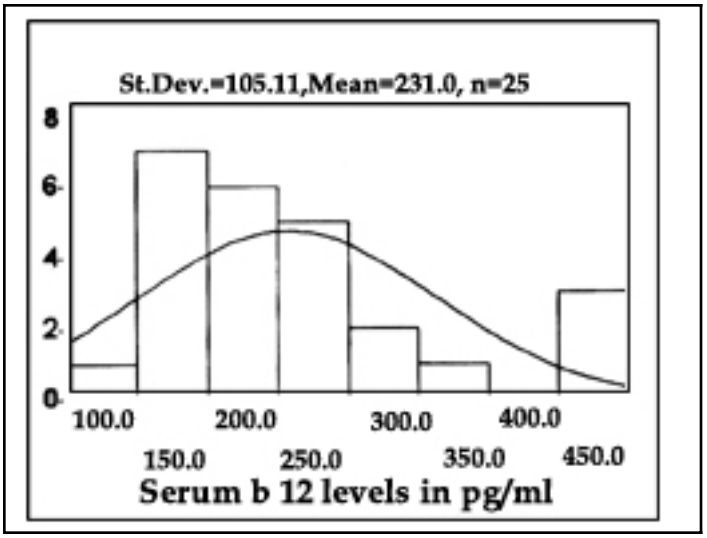


Figure 2. Anaesthetists.

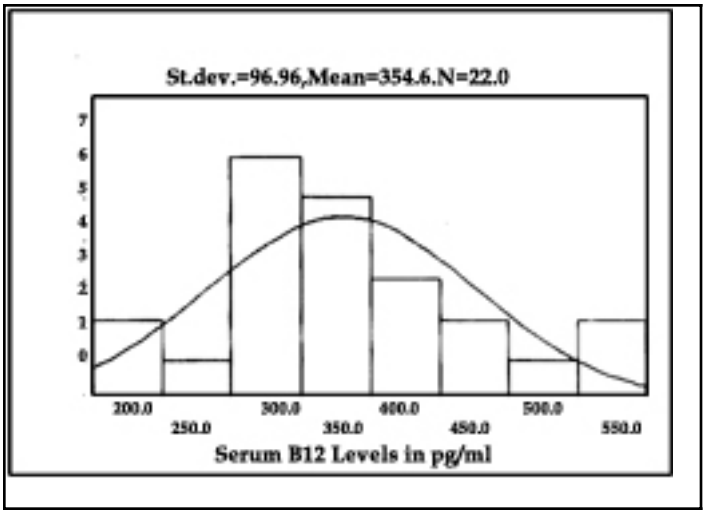


Figure 3. Non-anaesthetists.

250 to 290 pg/ml in the combined samples. The values were also plotted as histograms, as combined sample and separately for anaesthesiologists and the control group (Figures 1, 2 and 3).

Table 1. Age and sex distribution.

Group	Number	Age	Males	Females
I	25 Anaesthesiologists	31-58 years	6	19
II	22 non-anaesthesiologists	32-56 years	5	17

Serum B_{12} levels in pg/ml showed the theoretical normal distribution represented by the lines and the bars denoting individual readings in respective groups.The mean B_{12} level in anaesthesiologists was 231.0 pg /ml with a standard deviation of 105.11and in the control group 354.6 pg/ml with a standard deviation of 96.96.

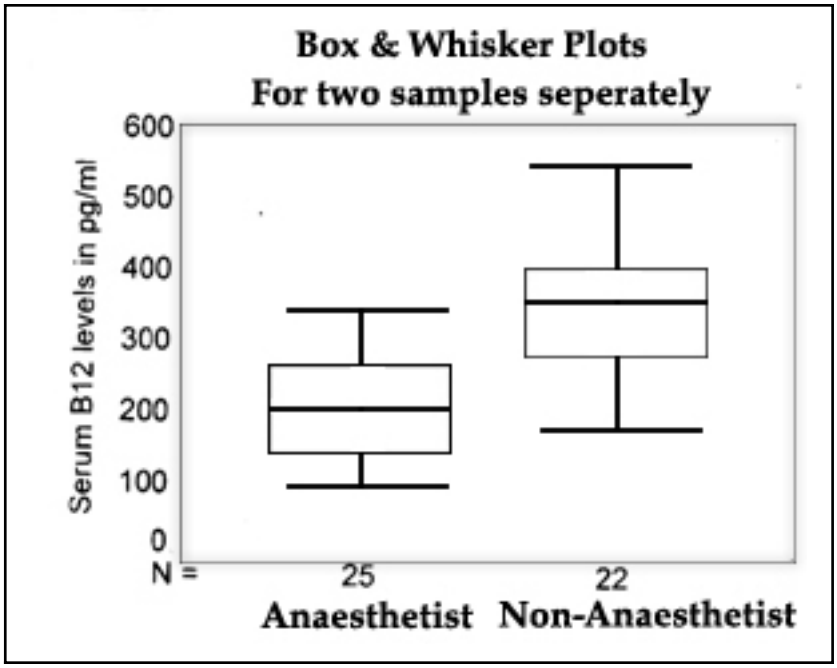
Table 2. Stem and leaf plot showing serum B_{12} levels in pg/ml in the combined samples.

Frequency	Stem and leaf
7.00	1. 0333334
8.00	1. 57889999
3.00	2 223
10.00	2 5567778899
5.00	3 02334
6.00	3 666899
2.00	4 24
4.00	4 5679
2.00	5 44
Stem widh:	100.0
each leaf	case (s)

The Box and Whisker plot (Figure 4) shows distribution of serum B_{12} (pg/ml) separately for the two sample groups. The median for anaesthesiologists was 200 pg/ml and for non-anaesthesiologists group above 350pg/ml. The boxes denote the central 50% cases showing that values in anaesthesiologists were below and the control group above 270 Pg/ml.

Statistical Analysis

The Kolmogrov Smirnov test was applied with Lillieforts significance correction for test normality in the combined samples and the two samples separately. The test is based on the largest absolute difference between the observed and the expected cumulative distribution. The results indicated that deviation from normal distribution were non-significant. Thus parametric test could be applied to the data. To fulfill the assumption of equality of variances for two independent sample t-test. Levene's test was applied (as in table) which yielded non-significant values.



To test the null hypothesis that serum B_{12} levels in the two populations are same a t-test of independent samples was performed . The results indicated that the null hypothesis could be rejected ($P<0.001$).Thus it was concluded that the levels of serum B_{12} among anaesthesiologists were significantly lower than those of controls.

Discussion

Vitamin B_{12} is a bound co-enzyme of methionine synthase and has a tetrapyrrole ring with a monovalent cobalt at the center. The cobalt functions as a methyl carrier in the transmethylation reaction. Nitrous oxide converts the cobalt from the monovalent form to the bivalent form. As a result the activity of methionine synthase is inhibited. Recovery is believed to require absorption of new unoxidised Vitamin B_{12} and synthesis of new apoenzyme. Thus gradually B_{12} deficiency sets in.[1]

Normal vitamin B_{12} values range from 200 pg/ml to 900 pg/ml. Occupational exposure to high levels of nitrous oxide has been associated with a higher incidence of spontaneous abortions[2] and adverse effects on health.[3] In another study it was found that anaesthesiologists complained of weakness and recurrent infections and had decreased peripheral blood leukocyte counts.[4] Hazards of nitrous oxide have been reported even in patients who received it for a prolonged period of time.[5]

This study confirmed significantly lower levels of serum B_{12} in occupationally exposed anaesthesiologists as compared to normal controls.

There is no active scavenging system for removal of patients' expired gases from the operation theatres. It is recommended that these be installed to overcome this occupational hazard but until such time that scavenging becomes available, anaesthesiologists should keep taking vitamin B_{12} supplements to prevent its deficiency. Although not determined in this study, but serum folic acid is likely to be low and should therefore be supplemented. It is suggested that all theatre personnel including surgeons should be checked for these deficiencies and alternative anaesthetic method not requiring nitrous oxide should be practiced.

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