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A comparative study on the effect of inhaled anesthetics on alkaline phosphatase and alanine aminotransferase serum level in nursing team and operating room personnel.

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Abstract

Background: Inhaled anesthetics are widely used drugs in health centers and hospitals. However, several side effects concerning inhalational anesthetics have been reported. Liver damage is one of the well-known side effects of inhaled anesthetics and measurement of alkaline phosphatase and alanine aminotransferase serum level is the common method for assessing severity of these damages. Among hospital personnel, operating room team are the most exposed group to these drugs. Hence, we hypothesized that alkaline phosphatase and alanine aminotransferase serum level, should be higher in operating room personnel in comparison to other hospital personnel such as nursing team.
Results: Serum level of the enzymes in these two groups was measured and the results were analyzed statistically using SPSS software.
Conclusions: Operating room personnel showed a higher serum level of target enzymes. The results indicate that inhaled anesthetics exert more severe liver damages in operating room personnel which are more exposed to these drugs.

Keywords: Inhaled anesthetics; Alkaline phosphatase; Alanine aminotransferase; Liver damage.

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Introduction

Inhaled anesthetics are a group of volatile and inflammable liquids which are using for more than a century in health centers [1]. These liquid drugs are prescribed in gas form using evaporators. Isoflorane is one of the most common inhaled anesthetic which was introduced at 1980 for clinical application [2]. Isoflorane is Enflorane isomer which metabolizes more slowly in comparison to other inhaled anesthetics. A combination of inconsiderable metabolization and low blood solubility has generalized the application of this drug [3].

All of the inhaled anesthetics are lipid soluble small molecules, however, the desired toxicity is significantly different [4]. The metabolization rate of 20, 2, and less than 1% have been reported for halotane, enflorane and isoflorane, respectively [4-6]. It has been reported that halotane and isoflorane induced anesthesia under ventilation damage the hepatocytes [7]. Inhaled anesthetics also cause severe damages to liver in sensitive patients [5,8,9]. Toxic metabolites produced in the process of metabolization of anesthetic drugs exert severe liver and kidney poisoning [4]. Triflouoroacetic acid is (TFA) a common halotane and isoflorane metabolite which modifies liver proteins covalently. Modified liver protein antigens could exacerbate the incidence of hepatitis in response to increased concentration of TFA [5,8-10].

The high rate of metabolization of halotane on one hand and the enhanced liver damage in response to halotanes in comparison to enflorane and isoflorane on the other hand enforce the hypothesis that covalent modification of liver proteins through reaction with anesthetics metabolites is the main cause of liver damage [4]. Liver poisoning is defined based on biological parameters such as increase in serum levels of alkaline phosphatase (ALP), aspartate aminotransferase (AST), alanine aminotransferase (ALT) and gamma glutamyltransferase (GGT) or unnatural clinical symptoms of liver inflammation such as jaundice and several methods for measurement of liver damage level has been introduced based on enzyme level fluctuation [10,11].

Serum level increase in aminotransferases activity has been considered as hallmark in determination of liver damage caused by inhaled anesthetics [12,13]. However, aminotransferase activity assay doesn't show enough specificity due to the presence of these enzymes in other body organs such as heart and kidney [9]. It is believed that sevoflurane and isoflurane application results in lower liver poisoning in comparison to halotane and enflorane. Ozgol et al. have shown that post-surgery serum level of aminotransferases in comparison to international control have increased significantly in patients that have been anesthetized using isofloarne and propofole [13]. Animals that have been anesthetized with isofloran and desfloran also have shown increased serum level of aminotransferases [11]. The risk of hepatitis and kidney diseases have also increased among people that have kept in contact with this drugs [14-16].

But how these drugs affect liver inflammation risks in operating room personnel and nursing team which are in consistent contact with inhaled anesthetics. To assess this possibility we studied the serum level of aminotransferases among these two group of personnel in Shiraz Namazi hospital. Our results indicated the increased serum level of aminotransferase enzymes in response to inhaled anesthetics in operating room, while the distribution of serum level of ALP and ALT show a normal distribution among these two groups. These results are indicating the higher serum level of enzymes in operating room personnel which is due to the more exposition to anesthetics in operating room members.

Patients and Methods

Patients

The present cross sectional study was performed statistically on 400 people of nursing team and operating room personnel of Namazi Hospital of Shiraz. Inclusion criteria for cases involved working at least for 20 hours per week and exclusion criteria included: having hepatitis (C and B) or other liver diseases history, taking medications which causes increase in liver enzymes, alcohol consumption, liver diseases history among first-degree relatives such as fatty liver, pregnancy, working in operating room and operation history in last six months, infectious disease department, dialysis department and laboratory staff because of high risk of blood contamination, anesthesia history in last three months.

Sampling and data analysis

The personnel under study (operating room department personnel including: paramedic anesthesia, paramedic anesthesia assistant, anesthesia expert, senior anesthesia expert, operating room expert, operating room senior expert, operating room nurse and nursing group including all of the nurses in internal part) were tested for serum level of ALP and ALT in according to Namazi Hospital laboratory protocols and obtained data was analyzed using SPSS19 software. Kolmogorov-smirnov test was performed for investigation of normality and the results between two groups were compared occasionally by Mann-whitney U test.

Results

Normality tests for age of cases from both operating room and nursing team showed a p-value of 0.000 which indicates distribution is not normal and our cases cover all age ranges. Statistical test for activity of three enzymes in both group was performed. As Table 1 indicates Kolmogorov-smirnov and Shapiro-Wilk tests for ALP and ALT in operating room cases shows a p-value of zero which indicates abnormal distribution of data. The skewness and kurtosis value of ALP also indicates that distribution is not normal (Table 1). The same tests were performed for ALP in nursing team. Kolmogorov-Smirnov and Shapiro-Wilk tests with a p-Value of 0.052 and 0.014 respectively were obtained. Mann-Whitney test of ALP level showed that the results between nursing team and operating room personnel is significantly different with a Z and p-Value of -9.991 and 0.000, respectively (data not shown). The non-normal and normal distribution of serum ALP level in operating room and nursing personnel respectively, indicates the increased serum level of ALP in operating room personnel which are more exposed to these drugs.

ALT serum level was also measured and analyzed statistically between two groups. Kolmogorov-Smirnov and Shapiro-Wilk tests for nursing and operating room personnel show a p-value of 0.000 for both groups in both tests (Table 1). The p-value of 0.000 in both Kolmogorov-Smirnov and Shapiro-Wilk tests for operating room personnel shows the non-normal distribution of the ALP and ALT serum level. While these values for nursing team personnel is not convincing and Normality and non-normality is not determinable form these data. These plots are confirming boxplot data which indicates that ALP level in nursing personnel is slightly skewed and peaked with a 1.442 and 2.171 skewness and kurtosis value, while the same values for operating room is 2.745 and 9.088 respectively (data not shown). The data were then analyzed using Mann-Whitny test. The results of this test indicate a Z and p-value of -4.031 and 0.000 respectively which is illustrating that ALT level between two groups are significantly different.

Table 1. *Tests of normality for assessing the normal and non-normal distribution of the ALP and ALT serum level in nursing and operating room personnel.*

Group	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
ALP						
Nursing	0.074	145	0.052	0.977	145	0.014
Operating room	0.125	145	0.000	0.962	145	0.000
ALT						
Nursing	0.162	145	0.000	0.874	145	0.000
Operating room	0.173	145	0.000	0.713	145	0.000

[a]Lilliefors Significance Correction

Discussion

The deteriorative effects of inhaled anesthetics on liver have been reported previously. However, no work has been done to illustrate these effects in hospital personnel. In the present study, we report the difference in serum level of ALT and ALP between nursing and operating room personnel of Namazi Hospital of Shiraz. Our results indicate a significant higher serum level of ALT and ALP in operating room team in comparison to nursing team members.

In a study by Kusuma et al. it was shown that a 6-year-old child developed fulminant hepatic failure after craniotomy under general anaesthesia without any history of viral, autoimmune, or metabolic reasons of hepatitis. Therefore, they reported that it is resulted from exposure to isoflurane anaesthesia [17]. In another study by Turillazzi a 69-year-old man, having undergone sevoflurane general anesthesia twice in 2 days, showed reasonable jaundice. Liver enzymes increased and remained raised until death [18]. In a study by Thompson et al it was found that using halothane and enflurane for surgical anesthesia led to increase in liver enzyme values [19]. Brunt et al also showed that a 26-year-old woman was identified as having hepatic dysfunction 17 days folowing the third of three consecutive exposures to isoflurane anesthesia [16]. Ihtiyar et al study revealed that 68-year-old man developed fulminant and fatal hepatic necrosis 2 days after open cholecystectomy done under isoflurane anesthesia [20].

Operating room personnel showed a higher serum level of target enzymes. The results indicate that inhaled anesthetics exert more severe liver damages in operating room personnel which are more exposed to these drugs. It is supposed to be due to the longer durations that operating room personnel are exposed to these drugs. Shortening the working hours for operating room personnel is a possible way for prevention of liver damages in this group of people.

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