Survey the relationship between chronic exposure to anesthetic gases and spontaneous abortion, fetal abnormalities

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Introduction: The relationship between exposure to waste anesthetic gases and harmful effects on health and pregnancy outcomes as health officials expressed concern, the aim of the study was determine the relationship between chronic exposure to the anesthetic gases and occurrence of spontaneous abortion as well as fetal abnormalities.

Material & Methods: A case-control study that in which two groups of operating room personnel and other personnel sectors were selected randomly from 6 hospitals in Ahvaz and samples of the two groups in terms of age, education, consanguinity, gender, work experience, number of children and hours of work were matched. The study uses data from a questionnaire that its validity through content validity and its reliability by test-retest measures were collected and data using spss software version 19, were analyzed.

Result: The study subjects (n = 40) operating room personnel (n = 40) were the other staff. Spontaneous abortion rate of 30% on operating room personnel and personnel in other departments was 15% that no significant differences were found between the two groups (P>0.05). And history of fetal abnormalities in operating room personnel 17.5% and 7.5% of personnel in other sectors that no significant differences were found between the two groups (P>0.05).

Conclusions: Based on the findings, no significant association between spontaneous abortion and fetal malformations and occupational exposure to anesthetic gases was observed.

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Introduction: today the role of women in society has significantly changed. From 1990 onwards, women have been more likely to have formal education, work outside home, and postpone marriage and childbirth to older ages. During the last decade, in the United States of America, the number of employed women has increased almost 3 times [1]. Iran as a developing country in which economic and social changes and changes in social relationships have occurred, more job opportunities have given to women [2]. Many women experience 1-2 pregnancies when they are employed and many of them work to the end of their pregnancy [3]. Over 50% of women get involved in pregnancy issues when they are employed so investigating the occupational exposures and pregnancy outcomes are important in work [5-4]. Many studies have been conducted on the harmful effects of chemicals on pregnancy outcome that one of these chemicals are anesthetic gases used in the operating rooms and operating room personnel are exposed to the risk of them. Possible adverse effects of chronic exposure to these gases on pregnancy outcomes are spontaneous abortion, premature delivery, low birth weight, birth defects and infertility [8-6] which have been a
concern for health personnel for years [9]. Post-
anesthesia care staff are also exposed to more
than the standard amount of isoflurane, Desflurane
and Nytrvaksayd [10]. Chronic inhalation
anesthetic nitrous oxide gas by surgery and
recovery room staff may lead to serious risks
such as decline in cerebral performance and in
vision and hearing, disorders in reproductive
system, increase in spontaneous abortion and
liver and kidney diseases. Among the causes of
air pollution, some causes can be mentioned such
as lack of air conditioning and scavenging
system, high concentrations of nitrous oxide gas
in exhaled air of patients after anesthesia, gas
leakage from cylinders and anesthetic machine
[11]. Some of the effective mechanisms on
spontaneous abortion include genotoxic effects
such as chromosomal problems, immunological
effects such as humoral and cellular effects [5].
A study conducted by Cubizolles showed that the
rate of spontaneous abortion in women working
in operating rooms were clearly more than other
pregnancies [12]. Teschke et al. in a study titled
relationship between exposure to anesthetic
gases and congenital anomalies in offspring of
nurses, showed that exposing to halogen and
nitroxide gases were followed with congenital
anomalies [8]. In the past 50 years, many studies
have indicated the relationship between various
occupations and reproductive disorders. Several
materials such as anesthetics, solvents and
pharmaceutical compounds which people are
dealt with cause reproductive disorders in them
[13]. Shuhaiber et al. in a study mentioned that
exposure to waste anesthetic gases was not
associated with an increased risk of major
malformations but the risk of spontaneous
abortion might slowly increase; although this risk
could decrease with using the ventilation system
of anesthetic gases [14]. In a study conducted by
Macgreger, a relationship between adverse
effects on health such as spontaneous abortion
and fetal anomalies in individuals working in
operating rooms were observed, but any type of
relationship was not found in next analyses [9].
According to the widespread health, social,
economic complications of spontaneous
abortion, congenital anomalies, growing increase
in pregnant women working in Iran, possible
complications of working in operating rooms,
and contradicting results of previous studies on
the relationship between inhalation of anesthetic
gases and spontaneous abortion and congenital
anomalies, this study has examined the
relationship between work in operating rooms
and history of spontaneous abortion and
congenital anomalies.

Method
This is a Case - control analytic study in which,
according to the inclusion criteria, all married
employees with a history of pregnancy in 6
hospitals in Ahvaz including nurses,
anesthesiologists, operating room technicians
and workers, who were exposed to anesthesia
gases, were selected as the case group and a
group including nurses, midwives, auxiliary
forces, workers, who were not exposed to such
gases, were also selected as the control group.
Inclusion criteria included being married,
working more than two years in operating rooms
for the case group, experience of pregnancy at
least a year after working in operating rooms,
physical health of both wife and husband.
Excluding criteria included contacting with
chemical substances in a spouse, consuming
medicine, drug addiction in wife or husband,
smoking by wife or husband, abnormal birth
history in first degree relatives, abortion or
abnormal birth history in previous pregnancies
etc. After considering the conditions, only 40
operating room personnel were entered into the
study. 40 other personnel, after homogenizing
their job, level of education, number of
pregnancies, number of births, consanguinity,
wife’s age, husband’s age, work experience and
daily work hours, were selected from other parts
of the hospitals as the control group. Data were
collected using a researcher-made questionnaire.
Its validity through the content validity and its reliability through test-retest reliability was assessed. The questionnaire consisted of demographic information, occupational status, history of pregnancy etc. After completing questionnaires by the subjects, the obtained data were analyzed in SPSS software version 19. To analyze the data chi-square test was used. And P <0/05 was statistically considered significant.

Results
The case group consisted of 40 persons (27 women (67.5%) and 13 men (32%)) and the control group 40 persons, (25 women (62.5 %) and 15 men (37.5%)). The minimum frequency of education level in both groups was related to diploma (5%) and a maximum frequency was related to bachelor's degree (about 57%). No significant difference was found in chi-square test in both groups (P = 0/91). Out of 40 operating room personnel 5 persons (12.5%) were workers, 3 persons (7.5%) operating-room technicians, 5 persons (12.5%) anesthesia technicians and 27 persons (67.5%) nurses; out of staff of other sectors, 3 persons (7.5%) were workers, 2 persons (5%) auxiliary forces, 13 persons (32.5%) midwives and 22 persons (55%) nurses. In terms of age, number of children, employment history, family relationship between couples and the gender of child, couple’s age and daily working hours, after comparing two groups, no significant difference was observed. The average age in the case group (operating room personnel group) was 38.13 ± 8.59 years and in the control group (group of other sectors’ personnel) was 38.30 ± 8.38 years; the average number of children in the case group was 2.1 ± 1.12 and in the control group was 2.3 ± 1.18; the average of duration of employment in the case group was 13.4 ± 8.1 years and in the control group was 13.78 ± 8.5 years; the average age of the spouses in the case group was 41.03 ± 4.59 years and in the control group was 41.8 ± 3.78 years; and the average of working hours in the case group was 9.08 ± 1.97 and in the control group was 9.1 ± 2.02. The rate of spontaneous abortion in the case group was 12 (30%) and in the control group was 9 (15%) (Table 1) and based on the chi-square test P = 0.18, there was no significant difference. and also the rate abnormal birth in the case group was 7 (17.5%) and in the control group was 3 (7.5%) so based on the chi-square test P = 0.64, there was no significant difference (Tables 1 and 2).

<table>
<thead>
<tr>
<th>Table 1: Distribution of absolute and relative frequency of abortions in each section</th>
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<tbody>
<tr>
<td><strong>History of abortion</strong></td>
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<td>Case (operating room staff)</td>
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<td>Control (personnel of other sectors)</td>
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<tr>
<th>Table 2: Distribution of absolute and relative frequency of abnormal newborn birth in each section</th>
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<tr>
<td><strong>History of abnormal newborn</strong></td>
</tr>
<tr>
<td>Case (operating room staff)</td>
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<td>Control (personnel of other sectors)</td>
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Discussion and Conclusion: In the study, it has been mentioned that more than 50% of the women are involved in pregnancy issues when they are employed. So taking care of occupational exposures and pregnancy outcomes should be considered as important issues in work [4-5]. Based on the findings, 67.5% of operating room personnel and 62.5% of staff of other sections are women. In this study, in terms of education level, the lowest frequency was related to higher than bachelor’s degree (2.5%) and the highest frequency was related to bachelor’s degree (57.5%) among the operating room personnel and 55% among the staff of other sections. This fact indicates that these two groups were homogenous in terms of this feature. Rate of abortion among health personnel is 10%-20% while this rate is 10%-15% among public population. Numerous studies have been published on the effects of anesthetic gases on the operating room staff and dentists. In some of these studies, it was reported that the relative risk of spontaneous abortion in women exposed to anesthetic gases was 1.3 and congenital anomalies in children of women exposed to such gases was 1.2 times more than others [16]. In the present study, no relation between spontaneous abortion and work in operating rooms was observed. And also, in terms of abnormal birth history, there was no significant relationship between two groups. Probably, this fact that there was no significant difference between two groups is because of limited number of subjects and also because of the standard level of gas in the operating rooms. It is noteworthy that all qualified persons were entered into the research so there was no way to increase the number of subjects. Therefore, measuring the level of anesthetic gases in the atmosphere of operating rooms seems necessary. On the other hand, the atmosphere of other sections of hospitals may be inappropriate regard to pollutants so in other studies, considering another control group of people working in offices can be helpful. Studies conducted by Macgreger et al. during the late 1960s and early 1970s, showed that there was a relationship between adverse health effects such as spontaneous abortion and fetal malformations and being exposed to anesthetic gases. However, in further analyses, no relationship was found between being exposed to anesthetic gases and adverse health effects [9]. In a review article, the relationship between occupational exposure to anesthetic gases and spontaneous abortion and congenital malformations among nurses and doctors have been indicated [17]. In the meta-analyses conducted on 40 studies from 1996 to 2009, in 7 studies on the anesthetic gases and congenital malformations, and in other 7 studies on the chemicals and abnormalities and in other 4 studies on work shifts and abortion, a significant relationship was obtained [18]. Virginia et al. (2002), compared anesthetists who were exposed to high concentrations of anesthetic gases to those anesthesiologists who were less exposed and found out that the rate of abortions was higher among those anesthesiologists who were more exposed to anesthetic gases. In a study conducted by Aminian et al. no significant relation was found between exposing to anesthetic gases and spontaneous abortion which was consistent with the results of our study [5].

Conclusion: Based on the results of this study, the rate of abortion in the case group was 2 times and anomalies was over 2 times more than this rate in other group. In spite of this fact that there was no significant statistically difference, it seems that this is a considerable number. Therefore an appropriate ventilation for operating rooms or decrease in working hours of employees working in operating rooms and standardization of hospital construction, especially operating rooms should be considered.
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