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Research Paper

Effect of Anesthetics on Oxidant and Antioxidant Parameters After Inguinal Hernia Surgery in Older Patients

Raheleh Alimoradzadeh[1], Mohammad Amin Abbasi[1], Forough Zabihi[1], *Hossein Mirmiranpour[2]

1. Clinical Research Development Unit, Firoozabadi Hospital, Iran University of Medical Sciences, Tehran, Iran.
2. Endocrinology and Metabolism Research Center, Vali-Asr Hospital, Tehran University of Medical of Sciences, Tehran, Iran.

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ABSTRACT

Objectives The effects of anesthesia techniques and anesthetics on different systems and organs of the body, especially the immune system, in older patients undergoing surgery, have always been of interest to researchers. This study aims to compare the effects of general anesthesia with isoflurane and spinal anesthesia with lidocaine on oxidative and antioxidant parameters in older patients with inguinal hernia surgery.

Methods & Materials This is a double-blinded randomized clinical trial with parallel design conducted on 70 older patients referred to the surgery department of hospitals in Tehran, Iran during 2018-2019. They were randomly divided into two groups of 35; the first group received general anesthesia with isoflurane and the second group received spinal anesthesia with lidocaine. Blood sampling was performed in two stages; one day before and one day after surgery. Advanced Glycation End Products (AGEs), Advanced Oxidation Protein Products (AOPP), Malondialdehyde (MDA), oxidized Low-Density Lipoprotein (LDL), Ferric-Reducing Ability of Plasma (FRAP), glutathione peroxidase, superoxide dismutase and catalase levels were measured before and after anesthesia using standard methods. Collected data were analyzed in SPSS v.22 software.

Results The Mean±SD age of patients in the lidocaine group was 69.94±8.31 years and in the isoflurane as 70.23±4.98 (P>0.81). In the isoflurane group, there was a significant difference between pre- and postoperative levels of AOPP, MDA, oxidized LDL, FRAP, catalase, glutathione peroxidase and superoxide dismutase. In the lidocaine group, this difference was significant in MDA, oxidized LDL, catalase and superoxide dismutase.

Conclusion Given the positive effects of isoflurane on oxidative and antioxidant parameters in older patients with inguinal hernia surgery, it is recommended that this anesthetic be considered in the selection of anesthesia methods and drugs for this group of older patients.

Extended Abstract

1. Introduction

Oxidant and antioxidant levels have a fundamental relationship with the elderly's immune system and their degree of exposure to anesthetics in surgery is important [3]. Isoflurane, by affecting hydrogen peroxide (as an oxidant), changes its amount in serum [4]. This anesthetic can also affect antioxidant properties and increase DNA damage [5]. Lidocaine is used as an anesthetic for spinal anesthesia [6]. Spinal anesthesia with

* *Corresponding Author:*
Hossein Mirmiranpour, PhD.
Address: Endocrinology and Metabolism Research Center, Vali-Asr Hospital, Tehran University of Medical of Sciences, Tehran, Iran.
Tel: +98 (912) 3388654
E-mail: h_mirmiranpoor@yahoo.com

lidocaine further modulates oxidative stress and the amount of antioxidants to the normal range compared to general anesthesia [7]. Study of changes in oxidant and antioxidant parameters after anesthesia with isoflurane and spinal anesthesia with lidocaine, helps to choose a safer method for the elderly with underlying diseases [1, 2].

2. Methods & Materials

This double-blinded clinical trial study (ethics code: IR.IUMS.FMD.REC.1397.304) was performed on older patients aged 60-70 years who were not using oxidant or antioxidant drugs and had no acute cardiovascular disease, acute renal failure, liver cirrhosis, malignancy and infection. Patients were randomly divided into two groups of 35. In one group, anesthesia with isoflurane and in the other group, spinal anesthesia with lidocaine was used. Sample collection was done in two stages; one day before and one day after inguinal hernia surgery. Samples obtained at baseline were considered as control group and those obtained after surgery were considered as case group. AGEs, Advanced Oxidation Protein Products (AOPP), Malondialdehyde (MDA), oxidized LDL, Ferric-Reducing Ability of Plasma (FRAP), glutathione peroxidase, superoxide dismutase and catalase were measured as immune system indices by standard methods before and after anesthesia. Enzymatic colorimetric method was used to measure the antioxidant activity of catalase, glutathione peroxidase and superoxide dismutase and the oxidant activity of MDA. The oxidized LDL was measured by ELISA technique. Determination of AOPP was performed using a spectrophotometric method described by Kalousová et al. [??].In measuring the antioxidant capacity of plasma or FRAP, 750 µl of reagent was added to 25 µl of plasma in the test tubes and their absorbance at 593 nm was read using a spectrophotometer. For statistical analysis, SPSS software V. 20 was used and quantitative data were described using mean and standard deviation.

3. Results

In the present study, 70 older patients (34 males) with a history of inguinal hernia surgery, were studied. Their mean age in the two groups (69.94±5.15 vs. 70.23±4.98 years; P = 0.81), and their other demographic characteristics were not significantly different from each other. The mean systolic pressure (124.29±9.16 vs. 123.7±9.10 mm Hg; P= 0.79) and diastolic pressure (72.29±6.89 vs. 72.29±7.31 mmHg; P= 0.99) measured before the surgery was not significantly different between the two groups. After surgery, although the measured systolic pressure in the spinal anesthesia group was higher than in the general anesthesia group, but this difference was not significant (127.43±8.52 vs. 126.29±8.43 mmHg; P = 0.58). The same results was reported for their diastolic pressure after surgery (76±5.53 vs. 75.71±6.08 mmHg; P= 0.83).

In statistical analysis of oxidative and antioxidant indices, results showed a significant difference between pre- and postoperative status in AOPP, MDA, oxidized LDL, FRAP, catalase, glutathione peroxidase and superoxide dismutase in the group received general anesthesia with isoflurane. In the spinal anesthesia group, there was a significant difference between pre- and postoperative status in MDA, oxidized LDL, catalase, and superoxide dismutase.

4. Conclusion

The pre- and postoperative levels of AOPP, MDA, oxidized LDL, FRAP, catalase, glutathione peroxidase and superoxide dismutase was significantly different in the patients with inguinal hernia surgery received general anesthesia with isoflurane. In the patients received spinal anesthesia with lidocaine, the difference was significant only in MDA, oxidized LDL, catalase, and superoxide dismutase levels. Considering the observed effects of anesthetics on oxidative and antioxidant indices in elderly patients, especially in those receiving anesthesia with isoflurane, these results should be considered in the selection of anesthesia methods and gases for the elderly undergoing inguinal hernia surgery. It is recommended to conduct further studies on the elderly patients using a larger sample size so that the results can be generalized with more confidence.

Ethical Considerations

Compliance with ethical guidelines

This study was approved by the Research Ethics Committee of Iran University of Medical Sciences (Code: IR.IUMS.FMD.REC.1397.304). All ethical principles are considered in this article. The participants were informed about the purpose of the research and its implementation stages. They were also assured about the confidentiality of their information and were free to leave the study whenever they wished, and if desired, the research results would be available to them.

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Authors' contributions

Conceptualization, research: Hossein Mirmiranpour and Raheleh Alimoradzadeh; Editing and final approval: All authors.

Conflicts of interest

The authors declare no conflict of interest.