



Original Contribution

Arteriosclerosis can predict hypotension during anesthesia induction in patients 40 years and older^{☆, ☆ ☆}



Yoshinari Morimoto DDS, PhD (Associate Professor)^{a, b, *},
Kazuaki Yamagata DDS (Graduate School student)^b,
Hiroshi Hanamoto DDS, PhD (Assistant Professor)^b,
Aiji Boku DDS, PhD (Assistant Professor)^b,
Chiho Kudo DDS, PhD (Associate Professor)^b,
Chizuko Yokoe DDS, PhD (Research Associate)^b,
Mitsutaka Sugimura DDS, PhD (Associate Professor)^b,
Hitoshi Niwa DDS, PhD (Professor)^b

^aSpecial Patient Oral Care Unit, Kyushu University Hospital, 3-1-1, Maidashi, Higashi-ku, Fukuoka, Fukuoka 812-8582, Japan

^bDepartment of Dental Anesthesiology, Graduate School of Dentistry, Osaka University, 1-8, Yamadaoka, Suita, Osaka 565-0871, Japan

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Abstract

Study Objectives: To identify the factors that predict blood pressure (BP) changes during induction of general anesthesia, and the relationship between the level of arteriosclerosis and BP changes during anesthesia induction.

Design: Prospective, case-control observational study.

Settings: Operating room of a university hospital.

Patients: Seventy-two patients who received general anesthesia for oral and maxillofacial surgery.

Measurements: Brachial-ankle pulse wave velocity (baPWV) and central BP were measured.

The primary variable was the parameters affecting BP changes during the induction of general anesthesia. For additional analyses, the parameters were compared between high and low PWV groups (1606 cm/s was the cutoff value of baPWV). To measure the relationships between the parameters and BP changes, bivariate and multiple linear regression analyses were performed.

Results: Seventy-two patients (including 41 men) with a mean age of 61.7 years and a median baPWV value of 1606 cm/s were evaluated. Significantly higher values for age, central BP, preoperative systolic

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* Corresponding author at: Special Patient Oral Care Unit, Kyushu University Hospital, 3-1-1, Maidashi, Higashi-ku, Fukuoka, Fukuoka 812-8582, Japan. Tel.: +81 92 642 6483; fax: +81 92 642 6487.

E-mail address: ysn-mori@dent.kyushu-u.ac.jp (Y. Morimoto).

BP (SBP), amount of decrease in SBP and diastolic BP, and number of patients with diabetes mellitus (DM) and hypertension were observed in the high PWV group. Multiple linear regression analysis demonstrated that age, baPWV, and DM were factors independently associated with the amount of decrease in SBP.

Conclusion: In patients 40 years and older, age, baPWV, and DM are thought to be effective predictors of the amount of decrease in SBP during induction of general anesthesia.

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1. Introduction

Pulse wave velocity (PWV), central blood pressure (cBP), and augmentation index (AI) are parameters used to measure the severity of arteriosclerosis; these parameters reflect the stiffness of the arterial wall. Many reports have described the relationship between PWV or cBP and various circulatory diseases, with one meta-analysis indicating that elevation of brachial-ankle PWV (baPWV) is associated with the incidence of cardiovascular events and mortality rate from cardiovascular diseases (odds ratio, 2.95-5.36) [1]. Based on the result of the ASCOT-CAFÉ trial [2] showing that cBP is a significant index to assess the effect of antihypertensives, the European guidelines for the management of arterial hypertension give lowering cBP as one of the goals of antihypertensive treatment [3]. Furthermore, there are some reports that patients with diabetes mellitus (DM) and hypercholesterolemia (especially hyper-low-density lipoprotein patients) have significantly higher baPWV values; hyperglycemia and hypercholesterolemia can both accelerate stiffness of the arterial wall [4–7].

Two reports addressed the relationship between the severity of arteriosclerosis, determined using PWV, and blood pressure (BP) fluctuations during general anesthesia. In one study, a correlation was reported between elevation of the carotid-femoral PWV (cfPWV) and large decreases in systolic BP (SBP) when anesthesia was induced using propofol and remifentanyl in elderly patients 60 years or older [8]. The other, however, reported no correlation between elevation in cfPWV and BP fluctuations when anesthesia was induced using volatile anesthesia in women with a mean age of 45 years [9]. Thus, the findings are not conclusive. As in the former report [8], many cases of decreased BP were seen with anesthesia using a combination of propofol and remifentanyl in elderly patients [10–12]; hence, it is possible that decreases in BP are also associated with the method of anesthesia. Therefore, changes in BP during the use of volatile anesthetics have been thoroughly studied. Moreover, because arteriosclerotic diseases increase from middle age onward, evaluations need to be performed with the inclusion of these age groups.

The main outcomes of this study were assessment of the severity of arteriosclerosis from measurements of PWV and cBP in patients 40 years or older, and identification of factors associated with fluctuations in BP during induction of general anesthesia using thiamylal and sevoflurane and tracheal intubation.

2. Materials and methods

The investigators designed and implemented a prospective case-control observational clinical trial. The present study was conducted in accordance with the Declaration of Helsinki, and the study protocol was approved by the institutional review board and ethics committee of Osaka University Dental Hospital. The significance of the study, safety issues, and potential risks were fully explained to patients, and only patients from whom written consent was obtained were included as subjects.

The study population included patients scheduled for oral surgery during general anesthesia with tracheal intubation at Osaka University Dental Hospital between August 2007 and March 2009. All patients were 40 years or older and were American Society of Anesthesiologists Physical Status 1-2. Only patients in whom nasotracheal intubation was successful in the first attempt were evaluated. Exclusion criteria were occurrence of a new circulatory disease within the preceding year, arrhythmias such as atrial fibrillation and premature beats, arteriosclerosis obliterans, aortic aneurysm, and history of vascular surgery that would affect the measured values of baPWV, cBP, and AI. In addition, patients who required 2 or more attempts for tracheal intubation were excluded.

2.1. Preoperative measurements

Preoperative measurements of all the assessed parameters were performed between 16:00 and 18:00 hours, when subjects visited the hospital 5 to 14 days before their scheduled date of surgery. After they rested for 15 minutes on a bed in a quiet room with an ambient temperature of about 25°C, preoperative SBP (pre-SBP), preoperative diastolic BP (pre-DBP), and preoperative heart rate were measured with an automated oscillometric sphygmomanometer (IntelliVue MP50; Philips Electronics Japan, Tokyo, Japan), and baPWV and ankle-brachial index (ABI) were measured using an ABI-form (Omron Healthcare Co, Inc, Kyoto, Japan). Next, cBP and AI were measured with an HEM-9000AI (Omron Healthcare Co, Inc) in the sitting position. The attending anesthesiologist was not informed of the preoperative baPWV, ABI, cBP, and AI values. The patients' body mass index (BMI) was also calculated, and patients were surveyed for whether or not they were using antihypertensive medications or antidiabetic drugs (including insulin).

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