# EFFICACY AND COMPARATIVE ANALYSIS OF SUFENTANIL AND FENTANYL IN INDUCTION OF GENERAL ANESTHESIA IN ELDER PATIENTS

XING-PENG XIAO, XUAN HE, YI-FAN JIA, HAN-LIN REN, YAN-SHU XU*
Department of anaesthesiology, Renmin Hospital of Wuhan University, Wuhan, Hubei 430060, P.R. China

***ABSTRACT***

***Objective****:To explore the effects of sufentanil and fentanyl on hemodynamics and stress responses in induction of general anesthesia in elder patients.*

***Methods****: Randomly, we selected a total of 100 elder patients who would undergo general anesthesia in this hospital, and those patients were divided into two groups, i.e. the sufentanil group (n=50) and the fentanyl group (n=50). Respectively, induction in the sufentanil group and the fentanyl group was carried out with sufentanil (0.5 μg/kg) and fentanyl (4.0 μg/kg). Items to be observed in this study included the changes in hemodynamics and respiratory functions before induction and 1 min, 5 min and 10 min after intubation, and the variations in blood glucose and norepinephrine in venous blood that was drawn at 1 min after intubation.*

***Results****: From 1 min after intubation, the indicators of hemodynamics of patients in the sufentanil group were significantly lower than those in the fentanyl group and the difference had statistical significance (p<0.05), but at 10 min after intubation, no statistically significant difference was identified between two groups (p>0.05); at 1 min and 5 min after administration of drugs, respiratory depression in varying degrees was observed, while the reduction in respiratory rate in fentanyl group was more obvious than that in the sufentanil group, and the difference had statistical significance (p<0.05). However, comparison of the partial pressure of carbon dioxide (PaCO2) after intubation between two groups showed no statistically significant difference (p>0.05). At 1 min after intubation, decreases were identified in blood glucose and norepinephrine in the sufentanil group, while in the fentanyl group, these two indicators were elevated, and the differences between two groups had statistical significance (p<0.05).*

***Conclusion****: Sufentanil, with less inhibitory effect on respiration, can stabilize the hemodynamics, maintain the stability of circulation system and inhibit the stress response in the induction of general anesthesia for elderly patients. Thus, sufentanil is more applicable to the induction of general anesthesia.*

***Keywords****: Sufentanil, fentanyl, hemodynamics, stress response.*

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## Introduction

Complications, like hypertension or mellitus diabetes in elder patients, usually lead to adverse reaction in induction of general anesthesia and intubation, manifesting an increasing risk[1]. Thus, anesthetic method, drugs and effects should be considered adequately in general anesthesia of elder patients. Sufentanil, a new type of analgesics, can stabilize the cardiovascular system but without any release of histamine, and has a unique advantage for elder patients in general anesthesia[2].

In this study, we compared the efficacy of sufentanil and fentanyl to figure out the effect of sufentanil on hemodynamics, respiratory functions and stress responses of elder patients in induction of general anesthesia.

## Materials and methods

### *Clinical data*

A total of 100 elder patients who would undergo general anesthesia in this hospital between June 2016 and May 2017 were selected and divided ran-

domly into the sufentanil group (n=50) and the fentanyl group (n=50). In the sufentanil group, there were 27 males and 23 females aged between 65 and 80 years old; in the fentanyl group, there were 29 males and 21 females aged between 65 and 82 years old. Inclusion criteria: patients who regularly took anti-hypertension drugs before surgery; patients with Grade II or above in cardiac function; patients who were injected with atropine at 30 min before anesthesia. Exclusion criteria: patients with severe cardiac, cerebral, pulmonary or vascular diseases, or with any difficulty in intubation, or who were intolerant to operations. Comparisons of the general data between two groups showed no statistically significant difference ($p$>0.05), showing that data were comparable.

***Anesthetic methods***

Patients underwent internal jugular vein catheterization for intravenous injection of lactated Ringer's solution, during which indicators, including the mean arterial pressure (MAP) of upper arms with a non-invasive hemodynamic monitor. After 5 min's mask oxygen inhalation, patients received the intravenous injection of midazolam at a dose of 0.1 mg/kg, followed by induction in the sufentanil group and the fentanyl group, respectively by 0.5 μg/kg sufentanil and 4.0 μg/kg fentanyl. Afterwards, rocuronium bromide was injected at a dose of 0.1 mg/kg, followed by assisted ventilation for 5 min and intubation with the general anesthesia machine. Anesthetics would be withdrawn at 10 min after intubation.

***Observation indexes***

Items to be observed in this study included the changes in hemodynamics (MAP and heart rate) and respiratory functions (respiratory rate and PaCO2) before induction and 1 min, 5 min and 10 min after intubation, and the variations in blood glucose and norepinephrine in venous blood that was drawn at 1 min after intubation using a glucometer or through radio-immunoturbidimetry.

***Statistical methods***

SPSS 16.0 software wad adopted for data analysis in this study. Independent sample t-test was performed for measurement data in normal distribution, and $p$<0.05 suggested that the difference had statistical significance.

## Results

***Changes in hemodynamics before and after induction between two groups***

From 1 min after intubation, the indicators of hemodynamics of patients in the sufentanil group were significantly lower than those in the fentanyl group and the difference had statistical significance ($p$<0.05), but at 10 min after intubation, no statistically significant difference was identified between two groups ($p$>0.05; Table 1).

| Group | MAP | | | | Heart rate (beat/min) | | | |
|---|---|---|---|---|---|---|---|---|
| | Before induction | 1 min after intubation | 5 min after intubation | 10 min after intubation | Before induction | 1 min after intubation | 5 min after intubation | 10 min after intubation |
| Sufentanil group | 101.4±15.9 | 92.5±110.6 | 86.4±11.5 | 84.8±12.8 | 85.4±10.5 | 72.8±10.6 | 66.6±9.9 | 66.1±9.6 |
| Fentanyl group | 102.5±13.5 | 101.5±12.8 | 96.4±12.5 | 86.3±13.3 | 85.2±11.7 | 85.8±11.8 | 74.3±10.6 | 67.5±10.0 |
| $t$ | 0.652 | 5.66 | 7.15 | 1.02 | 0.62 | 6.27 | 7.52 | 1.11 |
| $p$ | >0.05 | <0.05 | <0.05 | >0.05 | >0.05 | <0.05 | <0.05 | >0.05 |

**Table 1**: Changes in hemodynamics before and after induction between two groups ($\bar{x}\pm s$).

***Changes in the respiratory functions in two groups***

At 1 min and 5 min after administration of drugs, respiratory depression in varying degrees was observed, while the reduction in respiratory rate in fentanyl group was more obvious than that in the sufentanil group, and the difference had statistical significance ($p$<0.05). However, comparison of $PaCO_2$ after intubation between two groups ((44.36±4.15) mmHg vs. (39.89±5.64) mmHg) showed no statistically significant difference (p>0.05; Table 2).

| Group | Before induction | 1 min after intubation | 5 min after intubation | 10 min after intubation |
|---|---|---|---|---|
| Sufentanil group | 16.35±2.15 | 14.23±2.11 | 10.35±3.11 | 10.23±3.02 |
| Fentanyl group | 16.03±2.12 | 11.28±2.52 | 7.16±2.23 | 8.17±2.58 |
| $t$ | 0.224 | 5.14 | 3.28 | 1.52 |
| $p$ | >0.05 | <0.05 | <0.05 | >0.05 |

**Table 2**: Changes in the respiratory functions in two groups ($\bar{x}\pm s$, beat/min).

***Changes in stress responses before and after induction in two groups***

At 1 min after intubation, decreases were identified in blood glucose and norepinephrine in the sufentanil group, while in the fentanyl group, these two indicators were elevated, and the differences

between two groups had statistical significance ($p$<0.05; Table 3).

| Group | N | Blood glucose (mmol/L) | Norepinephrine (ng/L) |
|---|---|---|---|
| Sufentanil group | 50 | 4.47±0.75 | 341.24±46.25 |
| Fentanyl group | 50 | 4.98±1.04 | 503.29±58.98 |
| $t$ | | 2.36 | 18.96 |
| $p$ | | <0.05 | <0.05 |

**Table 3**: Changes in stress responses before and after induction in two groups ($\bar{x}\pm s$).

## Discussion

Decreases in reserve function of heart, brain and lung in elder patients usually curb the regulatory effect of stress sensor inside the trachea during anesthesia, making them more susceptible to acute cough caused by intubation, which can activate the sympathetic nerves, thus giving rise to a variety of adverse reactions. Thus, drugs for induction of anesthesia is critical, not only to alleviating the adverse reactions, but also to stabilizing the cardiovascular system. Sufentanil is a newly developed analgesics with a good lipid solubility. In addition, compared to fentanyl, sufentanil has a variety of advantages, such as high affinity to opioids, rapid onset and little effect on circulation system, etc.[3].

Some scholars have analyzed the efficacy of combined medication of sufentanil at different doses and other anesthetics, like midazolam, and found that the combined medication can better inhibit the excessive stress response caused by intubation[4]. In China, it has been confirmed that the anesthetic effect of sufentanil is ten times that of the fentanyl with little inhibitory effect on respiration, and, thus, it has been promoted in clinical practice[5].

Nevertheless, few studies have focused on the inhibitory effect on stress responses in elder patients in different time periods after induction. Therefore, in this study, we aimed to investigate the changes in hemodynamics and stress responses at 1 min, 5 min and 10 min after induction of general anesthesia of sufentanil and fentanyl in elder patients.

Preliminarily, the results of this study showed that from 1 min after intubation, the indicators of hemodynamics of patients in the sufentanil group were significantly lower than those in the fentanyl group, but at 10 min after intubation, no statistically significant difference was identified between two groups, suggesting that sufentanil hardly affects the cardiovascular system with little changes in blood pressures before and after induction and relatively stable hemodynamics; this is partially because sufentanil can effectively suppress the excitability and sensitivity of stress sensors of airway[6, 7].

Further observation showed that at 1 min after induction, decreases were identified in blood glucose and norepinephrine in the sufentanil group, suggesting that sufentanil alleviates the stress responses caused by intubation effectively through inhibiting the neuroendocrine function, which conforms to the results of Schricker et al[8], while sufentanil can inhibit the sympathetic nerves to reduce the transmission of nervous pulse, thereby decreasing the secretion of catecholamine in adrenal medulla. In China, it has been reported that sufentanil can reduce the peripheral resistance, so as to guarantee the adequate oxygen supply to myocardium and avoid the direct dilation effect on vessels.

In this study, we found respiratory depression in varying degrees, while the reduction in respiratory rate in fentanyl group was more obvious than that in the sufentanil group, which, according to our opinion, is caused by a high affinity of sufentanil to μ1 receptor: In a certain range of concentration, sufentanil preferably bind to μ1 receptor; thus, in spite of the equivalent anesthetic effect, sufentanil has a slight inhibitory effect on respiration in comparison with fentanyl[9]. Clinically, $PaCO_2$ frequently serves as an indicator for assessing the respiratory function. In this study, we also detected this indicator, and found no statistically significant difference between two groups; this is possibly because the inhibitory effects of sufentanil or fentanyl are mainly exhibited as a reduction in respiratory frequency, which, however, is minimized by assisted ventilation minimizes[10].

Sufentanil can stabilize the hemodynamics and respiratory functions, maintain the stability of circulation system and inhibit the stress response in the induction of general anesthesia for elderly patients. Thus, sufentanil is more applicable to the induction of general anesthesia.

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*Corresponding author*
YAN-SHU XU
Department of anaesthesiology , Fengcheng Hospital of Shanghai Fengxian District, 9983# Chuannan Fenggong road, Fengcheng town, Fengxian district
Shanghai
*(China)*