

## ARTICLE

## A COMPARISON OF THE EFFECTS OF REMIFENTANIL, ALFENTANIL, SUFENTANIL AND FENTANIL ON THE INCIDENCE RATE OF NAUSEA AND VOMITING AFTER GENERAL ANESTHESIA WITH LARYNGEAL MASK IN CATARACT SURGERY

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## ABSTRACT

**Introduction:** One of the side effects of general anesthesia and anesthetic drugs, especially opioids, is nausea and vomiting. The aim of this study was to examine the effect of fentanyl, alfentanil, sufentanil and remifentanil on the incidence of nausea and vomiting after general anesthesia with laryngeal mask in cataract surgery. **Materials and methods:** In this cross-sectional study, 416 patients in four groups: fentanyl, alfentanil, sufentanil and remifentanil who have got cataract surgery in the Motahari hospital operating room under general anesthesia with a laryngeal mask have been studied. To determine the relationship between the incidence of nausea and vomiting, and opioid, Chi-square test was used. **Findings:** Chi-square test results show that among four remifentanil, alfentanil, sufentanil and fentanyl and the incidence of nausea after anesthesia with laryngeal mask in cataract surgery there is a significant difference ( $p$ -value < 0.05). Fentanyl and Sufentanil had the highest and lowest incidence of nausea in patients, respectively. The incidence of nausea in patients using fentanyl was 14.4, alfentanil 13.5, Sufentanil 1.9, remifentanil 9.6%. **Conclusion:** Sufentanil compared with other opioids had the least side effects of nausea and vomiting. Therefore, it is suggested that Sufentanil be used for cataract eye surgery.

## INTRODUCTION

**KEY WORDS**  
Nausea and vomiting,  
Laryngeal masks,  
Cataract surgery

Any opacity in the lens of the eye is called cataracts or cataract. [1] Of the major causes of cataract, age, genetic factors, inflammation, trauma and others can be mentioned. [2] 90 percent of all cataracts are age-related. [3] Many studies have found that prevalence is higher in women than men and more patients are older than 65 years. [4] Sudden movements or attempts to cough, while opening the eyeball can cause protrusion of visual content and permanent damage. That's why when cataract surgery, general anesthesia is chosen, it is necessary that sufficient depth of anesthesia [analgesia] to be maintained. [5] Nausea and vomiting as the second most common complaint of patients after surgery have nearly 20 to 30% prevalence. [6] Nausea and vomiting after surgery is cited as one of the reasons for delay in discharge of patients from anesthesia care unit, so that each time vomiting after surgery caused delays in discharge from the recovery room for at least 20 minutes [6-7]. Among the materials that are used during anesthesia, and it is indicated that they can be effective on nausea and vomiting after surgery, are opioid analgesics [8-9]. Fentanyl with analgesic potency 80 times more than morphine was introduced into medicine as an intravenous anesthetic in the 1960s. Its primary use is as a premedication or sedative before anesthesia in the operating room. Today, fentanils are widely used for anesthesia and pain relief. Its mechanism of action is agonist Mo-Opioid receptor and its side effects are reduced diastolic blood pressure and blood oxygen saturation, nausea and vomiting [10]. Sufentanil due to the power of weakening the central nervous system is used as main or auxiliary anesthetic drug. This drug is seven times more powerful than fentanyl and its recovery from anesthesia is faster than fentanyl [11]. Alfentanil is preservative agent in anesthesia and pain control after surgery. This drug has short-term effect and it is a narcotic analgesic that used as a concomitant drug and to induce anesthesia. The drug also with intrathecal and dura matter injection is used to induce analgesia after surgery [12]. Remifentanil has rapid onset and short duration of action, so that when compared with fentanyl and same drugs it has shorter half-life [about 5 minutes]. This drug also such as alfentanil reaches its peak effect quickly. The power of remifentanil is slightly less than fentanyl. Remifentanil has important role in modern anesthesia and safe therapy for continuous infusion. The most common application of this drug is infusion with propofol in the prescribed intravenous anesthesia [TIVA]. Also for cases where short term analgesia is needed it is useful as single dose [11]. In a study titled [comparison the effects of fentanyl, sufentanil and alfentanil as premedication on the incidence of nausea and vomiting after gynecological laparoscopy surgery], it was found that in the first 24 hours after surgery no differences between the three drugs alfentanil, fentanyl and sufentanil in the incidence of vomiting were observed, while the beneficial effects of alfentanil than two other drugs in reducing the incidence of nausea and vomiting during periods after surgery could be considered as premedication [13]. In a study that compared the effect of fentanyl and alfentanil on waking, nausea and vomiting

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in the elderly cataract surgery, it was found that the incidence of nausea and vomiting in the fentanyl group was more than alfentanil [14]. Nausea and vomiting is a common problem in patients after general anesthesia that can cause delay in unforeseen and unplanned discharge and admission. Since each drug in addition to the benefits can provide side effects, opioids are no exception. The use of opioids (alfentanil and remifentanil and fentanyl and sufentanil) as analgesic drug before, during and after surgery usually increases nausea and vomiting that this nausea and vomiting in patients undergoing many significant problems in recovery, especially in the elderly patients with pharyngeal and laryngeal reflexes is weak and it has caused complications such as pulmonary aspiration. A major goal in the care of patients undergoing cataract surgery is to prevent increased pressure inside the eye. In order to achieve that, the patient should refrain from actions that led to its elevation like the coughing, sneezing, nausea, vomiting and sudden movements. Therefore, any attempt to reduce or minimize its occurrence is important. This study aimed to determine the best drug to reduce nausea and vomiting in cataract surgery with general anesthesia.

## METHOD

The present study was cross-sectional. Sampling was gradual random. Calculations and sample size. In this study, 104 patients in each group of fentanyl, alfentanil, sufentanil and remifentanil have been studied. A total of 416 patients were studied. Inclusion criteria: All patients were in the 18 to 70 age group and in ASA I Group classification (American Society of Anesthesiologists) (without sick and healthy) and ASA II (with mild systemic disease), undergone general anesthesia with a laryngeal mask. Exclusion criteria: record of chronic abdominal pain, gastroesophageal reflux, lung aspiration, gastrectomy, diabetes, record of extensive abdominal surgery, gastric ulcer and duodenal, and any changes in the hemodynamic status of patients that need to be injected other drugs. Before the implementation of project, the research after the adoption of project and licensing of research and permission from the ethics committee and after coordination with the authorities of operation room and Motahari hospital administration will be done. Patients undergoing eye surgery (cataract) that laryngeal mask is used for their anesthesia after recovery and gain full consciousness are going to be examined and questioned about the presence or absence of nausea and vomiting (no, low, medium, high). The minimum period that the patient will stay in the recovery room if hemodynamic status is good is 30 minutes. Generally three groups of drugs are used in this study in order to induce patients' anesthesia: 1- Opioids, 2- Sleep aids, 3- Muscle relaxants. Drug dose used in this study will be (fentanyl, sufenta and alfenta=cc1), (remifentanil 1-2 microgram/kg stat) that we use one of the drug for each patient. Of the hypnotic drugs 1/5 mg / kg propofol was used for induction. Propofol maintenance dose will be (dose maintenance = 50-150 micrograms per kilogram per minute). Then of neuromuscular muscle relaxant drugs 0/6mg/kg of Atracurium will be injected to keep the muscle relaxation. After that, the lungs of patients will ventilated with N2O, and oxygen with the ratio of 50% and during anesthesia all the patients will be undergone monitoring and pulse oximetry, heart rate, blood pressure and ECG. The results of the information obtained by the questionnaire were analyzed statistically by SPSS version 22 software and Pearson Chi-Square test was used for analysis.

## Findings

In this study, 416 patients who had cataract surgery were enrolled. 53.1 percent were male and 46.9% were female. 23.6% were between 50-55, 19.0% 56-60, 18.8% 61-65, 16.1% 66-70 and 22.6% 71-75. 9.9% of patients had nausea. 46.9% have a diameter of laryngeal mask 3 and 51.1% have a diameter of laryngeal mask 4. 98.3% of patients had duration of 30-39 minutes mask usage and 1.7% of the patients had duration of 40-50 minutes mask usage. 18.5 percent were in the range of 60-69 Kg, 54.3% 70-79 Kg, 21.9% 80-89 Kg and 5.3% 90-100 Kg. The patients were divided into four 104-member groups of remifentanil, alfentanil, sufentanil and fentanyl. Chi-square test results show that among the four drugs remifentanil, alfentanil, sufentanil and fentanyl on the incidence of nausea after anesthesia with laryngeal mask exist significant differences in cataract surgery ( $p$ -value < 0.05), [Table1].

Fentanyl and Sufentanil respectively had the highest and lowest incidence of nausea in patients. It is worth noting that nausea of remifentanil and alfentanil were not in extreme levels.

The incidence of nausea in patients using fentanyl was 14.4 percent. Nausea of 4.8% of patients was in the mild level, 5.8% moderate and 3.8% were severe.

The incidence of nausea in patients using alfentanil was 13.5 percent. The level of nausea of 10.6% of patients was in the mild level, 2.9% were intermediate.

The incidence of nausea in patients using Sufentanil was 2 percent. The level of nausea of 1 percent of patients was in mild level, and 1% was severe.

The incidence of nausea in patients using the drug remifentanil was 9.6 percent. Only 9.6% of the patients' nausea was mild.

**Table 1:** Comparison the effects of four drugs remifentanyl, alfentanil, sufentanil and fentanyl on the incidence of nausea by using Chi-square test

		Nausea				Pearson Chi-Square	p-value
		no n (%)	mild n (%)	moderate n (%)	severe n (%)		
opioid	fentanyl(N=104)	89(85.6)	5(4.8)	6(5.8)	4(3.8)	30.31	0.00
	alfentanil(N=104)	90(86.5)	11(10.6)	3(2.9)	0 (0.0)		
	sufentanil(N=104)	102(98.1)	1(1.0)	0 (0.0)	1(1.0)		

Chi-square test results show that there is a significant difference among four remifentanyl, alfentanil, sufentanil, fentanyl and the duration of the mask use, weight and age of the patient after anesthesia with laryngeal mask in cataract surgery (p-value <0.05), [Table 2]. But there is no significant difference among the four drugs and diameter of the laryngeal mask and gender (p-value <0.05), [Table 2].

**Table 2:** Comparison the effects of four drugs remifentanyl, alfentanil, sufentanil and fentanyl based on micro factors by using Chi-square test

		opioid			
		fentanyl n (%)	alfentanil n (%)	sufentanil n (%)	remifentanyl n (%)
laryngealdiameter	3	58(55.8)	44(42.3)	50(48.1)	43(41.3)
	4	46(44.2)	60(57.7)	54(51.9)	61(58.7)
	p-value	0.138			
time	30-39	97(93.3)	104(100)	104(100)	104(100)
	40-50	7(6.7)	0(0.0)	0(0.0)	0(0.0)
	p-value	0.00			
gender	male	46(44.2)	61(58.7)	54(51.9)	60(57.7)
	female	58(55.8)	43(41.3)	50(48.1)	44(42.3)
	p-value	0.138			
weight	60-69	31(29.8)	19(18.3)	19(18.3)	8(7.7)
	70-79	54(51.9)	37(35.6)	49(47.1)	86(82.7)
	80-89	15(14.4)	36(34.6)	30(28.8)	10(9.6)
	90-100	4(3.8)	12(11.5)	6(5.8)	0(0.0)
	p-value	0.00			
age	50-55	27(26.0)	12(11.5)	19(18.3)	40(38.5)
	56-60	38(36.5)	14(13.5)	12(11.5)	15(14.4)
	61-65	9 (8.7)	16(15.4)	27(26.0)	26(25.0)
	66-70	12 (11.5)	21(20.2)	20(19.2)	14(13.5)
	71-75	18(17.3)	41(39.4)	26(25.0)	9(8.7)
	p-value	0.00			

## DISCUSSION

The incidence of nausea in patients using fentanyl was 14.4 percent. The incidence of nausea in patients using alfentanil was 13.5 percent. The incidence of nausea in patients using Sufentanil was 2 percent.

The incidence of nausea in patients using remifentanyl was 9.6 percent. In this study, fentanyl and sufentanil have the highest and lowest incidence of nausea in patients. All studies that used opioids do not show the increased incidence of nausea with opioids but PONV is a dose-dependent characteristic that is related to opioids, so that even short-acting opioids also in order to maintain PONV must maintain concentrations high enough to bind to receptor [15]. Today, with ever increasing outpatient surgery, there is a tendency to earlier discharge of patients from recovery. Reduction in the incidence of PONV promotes discharge of patients, costs related to antiemetic drugs, duration of stay of patients in hospitals or reduce readmission and leads to patients' satisfaction, because PONY is recommended by patients as an unpleasant feeling that is even worse than pain [16-17]. And still is a major problem after surgery under general anesthesia.

In a study comparing the incidence of nausea and vomiting associated with fentanyl and propofol with remifentanyl and propofol infusion it was shown that the incidence of nausea and need to anti-nausea drugs during the period 2-12 hours after surgery in patients receiving Fentanyl and Propofol was more [18]. However, in this study we did not examine the plasma concentrations of these drugs during and after operation, but it does not seem that it is the plasma concentrations of these drugsthat the determining factor is postoperative nausea after taking opioids, because other studies have shown that the sufentanil in two equal doses of alfentanil required for analgesia after surgery has had less plasma concentrationbut caused a greater increase in the incidence of nausea, this results are against the results of this study. In this study sufentanil group has the lowest nausea and vomiting. In a study Langevinis and colleagues used alfentanil, fentanyl and fentanyl as a part of

balanced anesthesia technique and anesthesia protocols were planned in such a way that the at the start of the post-anesthesia care concentrations of each drug were nearly identical plasma. After a recovery period, incidence of PONV in the fentanyl and sufentanil three times more than alfentanil group, these results were contrary to the present study [19]. In some studies contrary to this study, no difference in the incidence of PONV has been seen between equivalent doses of morphine, hydromorphone, meperidine, fentanyl, sufentanil and remifentanyl. These studies were contrary to this study [20].

## CONCLUSION

The results showed that compared to other opioids sufentanil had the least side effects of nausea and vomiting. Therefore, it is suggested that the Sufentanil be used for cataract eye surgery.

## CONFLICT OF INTEREST

None

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## FINANCIAL DISCLOSURE

None

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