

Nitrous Oxide in Oxygen and Air in Oxygen for Perioperative Analgesia : A Comparative study

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Abstract

Background: To determine that additional dose of nalbuphine is required while using medical air instead of nitrous oxide in oxygen to maintain anaesthesia so that inadequate intra-operative analgesia could be avoided.

Methods: This quasi experimental study was carried out in the Department of Anaesthesia, Holy Family Hospital, Rawalpindi, from October 2007 to March 2008. One hundred patients were selected by non probability convenient sampling. Patients between 20 to 40 years of age were included, belonging to ASA Class-I and II. They were divided into two groups (A and B) scheduled for different elective surgical procedures under general anaesthesia. Group A comprised of fifty patients who received medical air in oxygen. Group B comprised of fifty patients who received nitrous oxide in oxygen. The conduct of anaesthesia was kept same in both the groups. Patients heart rate, mean arterial pressure, pulse oximetry, ECG were monitored and requirement of additional dose of nalbuphine in both the groups was noted. Intra-operative tachycardia and hypertension indicated additional dose of nalbuphine. Average value of heart rate and blood pressure of each case was determined and the data compared and analyzed by SPSS-10.

Results: Forty patients in group A did not require intra-operative additional nalbuphine while the remaining ten patients required it. Forty eight patients in group B did not require additional intra-operative nalbuphine and only two patients required it.

Conclusion: The use of nitrous oxide significantly reduces the intra-operative narcotic analgesia requirement.

Key Words: Nitrous oxide, Nalbuphine, Analgesia

Introduction

Nitrous oxide is still commonly used in combination with volatile agents to maintain anaesthesia¹. It is said to be a good analgesic but a weak anaesthetic.² Nitrous oxide alone is insufficient to produce an adequate depth of anaesthesia.³ However, there is a growing concern regarding its toxic effects and cost.⁴ Concerns regarding its safety have led to

continued interest in alternatives.⁵

Consequently, medical air is being used more frequently in combination with oxygen during anaesthesia because it is readily available, economical and non toxic.⁶ Inadequate analgesia however, remains a high concern for the patients during surgery.⁷ Numerous techniques and number of analgesics have been used for this purpose with variable results.⁸ It is difficult to judge or measure intra-operative pain as anaesthetist has to rely on different clinical signs e.g. tachycardia, raised blood pressure and sweating which are effected by other factors such as surgical stimulation, type of surgery and surgical incision.^{9,10}

Many studies have been conducted to compare medical air with nitrous oxide in oxygen for general anaesthesia but none shows marked difference with respect to analgesia.¹¹ A lot of work has been done in the past in the management of intra operative pain. The use of air in oxygen for general anaesthesia is devoid of serious side effects like diffusion hypoxia and expansion of air embolism as caused by nitrous oxide.¹⁰

We are presenting a randomized, single blind standardized trial, conducted in the Department of Anaesthesiology, Holy Family Hospital, Rawalpindi. The purpose of the study was to compare medical air with nitrous oxide in oxygen during anaesthesia so that inadequate intra-operative analgesia could be avoided.

Patients and Methods

This quasi experimental study was conducted in the Department of Anaesthesiology, Holy Family Hospital, Rawalpindi from October 2007 to March 2008. Patients between the ages 20 to 40 years, having physical status ASA grade I or II, under going elective surgical procedures and planned for general anaesthesia were included in the study. Cases with pneumothorax, acute intestinal obstruction, air

embolism, tympanic membrane grafting and surgery of closed spaces were excluded. Patients aged less than 20 years or more than 40 years were also excluded. Patients were divided into two groups. Group A and group B. Each comprised of fifty patients. Group A received medical air in oxygen and Group B received nitrous oxide in oxygen.

Regarding group description and sampling technique, the technique devised was non probability convenience sampling. Patients were divided into two groups on the basis of even and odd numbers i.e., from number 1 to 100, all the odd numbers were taken as group A and all the even numbers were taken as group B. The procedures were carried out after routine pre-anaesthesia evaluation and obtaining written informed consent from the patients. On arrival in operation theatre venous access was secured and basic monitoring parameters including pulse oximetry, non-invasive blood pressure, mean arterial pressure, heart rate and ECG were started. Group B patients received nitrous oxide in oxygen. Conduct of anaesthesia in both groups included injection nalbuphine, 5mg, thiopentone sodium 5mg/kg, atracurium 0.5mg/kg, followed by endotracheal intubation, intermittent positive pressure ventilation and isoflurane 1%.

Tachycardia and hypertension were taken as indicators for the requirement of nalbuphine 0.1mg/kg in the maintenance phase. Additional nalbuphine was given when heart rate increased more than 20 beats/min or mean arterial pressure increased more than 20 mm of Hg from the base line. Average value of each indicator was determined and the data compared and analyzed by SPSS-10.

Results

It was observed that 80% i.e. forty patients of group A did not require additional nalbuphine while 20% i.e. 10 patients required it.

Table 1: Nalbuphine Cross tabulation Count

		Nalbuphine		Total
		No	Yes	
GROUP	A	40	10	50
	B	48	2	50
Total		88	12	100

However forty-eight patients (96%) of group B did not require nalbuphine and only 2(4%) required it. Group statistics, independent sample tests, case processing and cross tabulation of the two groups are summarized in Tables 1 and 2.

Table 2: Statistical analysis

	Statistical analysis				
	Value	Df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	6.061 (b)	1	.014		
Continuity Correction(a)	4.640	1	.031		
Likelihood Ratio	6.550	1	.010		
Fisher's Exact Test				.028	.014
Linear-by-Linear Association	6.000	1	.014		
N of Valid Cases	100				

(a) Computed only for a 2x2 table

(b) 0 cells (.0%) have expected count less than 5. The minimum expected count is 6.00.

Discussion

Inadequate analgesia remains a high concern for the patients during surgery. Numerous methods, techniques and number of analgesics have so far been used for this purpose with variable results. Intra operative pain remains under-treated due to fear of side effects of commonly used drugs like narcotic analgesics.

Apart from untoward effects of nitrous oxide like diffusion hypoxia and bone marrow depression, it is also expensive as compared to medical air. On the other hand it has good analgesic properties, weak anesthetic, concentrating and second gas effect (carrier gas).¹² It also reduces the minimum alveolar concentration of inhalational agents¹³. Having these properties, it is considered superior to medical air during maintenance of anaesthesia.¹⁴

Intra-operative pain may lead to catecholamine release which may result into life threatening arrhythmias in susceptible individuals.¹⁵

Although nitrous oxide has toxic effects but its benefits are more than its risks. However its risks are minimized or ameliorated by modifications in the modern anaesthetic machines¹⁶.

The study showed that 20% i.e. ten patients of group A in which medical air in oxygen was used required additional nalbuphine whereas only 4% i.e. two patients of group B(in which nitrous oxide in oxygen was used) required nalbuphine. Thus nitrous oxide plays an important role to prevent intra-operative pain during anaesthesia .

Conclusion

There is a significant difference regarding additional dose of nalbuphine between the groups in which air instead of nitrous oxide in oxygen was used for the maintenance of anaesthesia. Thus nitrous oxide in oxygen is proved to be superior to medical air in oxygen for maintenance of anaesthesia with the volatile agent as less or no analgesia is required compared with the latter. It is recommended that nitrous oxide in oxygen should be used instead of medical air in oxygen for maintenance of anaesthesia to avoid inadequate analgesia or excessive use of opioids.

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