Rev Bras Anestesiol. 2014;64(3):164–168

REVISTA BRASILEIRA DE ANESTESIOLOGIA
Official Publication of the Brazilian Society of Anesthesiology
www.sba.com.br

SCIENTIFIC ARTICLE

Oxygen concentrators performance with nitrous oxide at 50:50 volume

Jorge Ronaldo Moll[a], **Joaquim Edson Vieira**[b,*], **Judymara Lauzi Gozzani**[c], **Lígia Andrade Silva Telles Mathias**[c]

[a] *Hospital Geral de Bonsucesso do Ministério da Saúde, Rio de Janeiro, RJ, Brazil*
[b] *Departament of Surgery, Faculdade de Medicina, Universidade de São Paulo, São Paulo, SP, Brazil*
[c] *Faculdade de Ciências Médicas da Santa Casa de São Paulo, São Paulo, SP, Brazil*

Received 18 March 2013; accepted 10 June 2013
Available online 11 October 2013

KEYWORDS
Oxygen inhalation therapy;
Nitrous oxide;
Equipment and supplies;
Anesthesia;
Inhalation;
Developing countries

Abstract
Background and objectives: Few investigations have addressed the safety of oxygen from concentrators for use in anesthesia in association with nitrous oxide. This study evaluated the percent of oxygen from a concentrator in association with nitrous oxide in a semi-closed rebreathing circuit.
Methods: Adult patients undergoing low risk surgery were randomly allocated into two groups, receiving a fresh gas flow of oxygen from concentrators (O293) or of oxygen from concentrators and nitrous oxide (O293N2O). The fraction of inspired oxygen and the percentage of oxygen from fresh gas flow were measured every 10 min. The ratio of FiO_2/oxygen concentration delivered was compared at various time intervals and between the groups.
Results: Thirty patients were studied in each group. There was no difference in oxygen from concentrators over time for both groups, but there was a significant improvement in the FiO_2 ($p < 0.001$) for O293 group while a significant decline ($p < 0.001$) for O293N2O. The FiO_2/oxygen ratio varied in both groups, reaching a plateau in the O293 group. Pulse oximetry did not fall below 98.5% in either group.
Conclusion: The FiO_2 in the mixture of O293 and nitrous oxide fell during the observation period although oxygen saturation was higher than 98.5% throughout the study. Concentrators can be considered a stable source of oxygen for use during short anesthetic procedures, either pure or in association with nitrous oxide at 50:50 volume.
© 2013 Sociedade Brasileira de Anestesiologia. Published by Elsevier Editora Ltda.
Este é um artigo Open Access sob a licença de CC BY-NC-ND

* Corresponding author.
E-mail: joaquimev@usp.br (J.E. Vieira).

0104-0014 © 2013 Sociedade Brasileira de Anestesiologia. Published by Elsevier Editora Ltda. Este é um artigo Open Access sob a licença de CC BY-NC-ND
http://dx.doi.org/10.1016/j.bjane.2013.06.011

Introduction

The high price of oxygen can encourage the installation of oxygen concentrators.[1,2] In Brazil a previous investigation suggested that savings related to the use of a concentrator over 10 years in a non-profit hospital reached 19.5 million dollars.[3] The oxygen from concentrators represents a cost of US$ 0.0015 mL^{-1}. It is worth to notice the offering of this system as an oxygen source set up a perfect competition in this market in Brazil and reduced its final price nationwide.

A number of studies using oxygen concentrators with open ventilation systems concluded that the efficacy and reliability of such devices make them a suitable alternative to oxygen cylinders in the developing world.[4–6]

Oxygen concentrators use zeolite molecular sieve technology, which can produce up to 95% pure O_2. Briefly, room air is drawn into the oxygen concentrator through a series of filters to remove dust and bacteria. The concentrator contains two columns of the zeolite molecular sieve within a canister. The sieve adsorbs nitrogen from the air as it is forced through under pressure. The sieve allows O_2 to pass through along with the 0.93% argon present in the air. Synthetic zeolite is used for the production of oxygen. The concentrator has been shown to be reliable and cost effective for providing oxygen in locations where cylinders may not always be available.[7] However, little is known about the association of oxygen from concentrators with nitrous oxide during mechanical ventilation in anesthesia.

This study evaluated the percent of oxygen from a concentrator in association with nitrous oxide for procedures lasting at least 100 min in a semi-closed rebreathing circuit.

Methods

After approval by the Ethics Research Committee of Hospital Geral de Bonsucesso do Ministério da Saúde, city of Rio de Janeiro, adult patients undergoing low risk surgery were invited to participate, gave written informed consent and were randomly allocated into two groups, either receiving a fresh gas flow (FGF) of 1000 mL min^{-1} oxygen from concentrator (O293) or a FGF of 500 mL min^{-1} of oxygen from concentrator plus 500 mL min^{-1} nitrous oxide (O293NO). The only exclusion criterion was the presence of any lung disease. The oxygen used in this investigation was provided by oxygen concentrator connected to medical gas pipeline systems, providing an output pressure of 4.08–5.09 kg cm^{-2} (Eniplan Ferri – Engenheiros Associados Ferri Lt., COE 2x20 model, Rio Grande do Sul, Brazil). Nitrous oxide was provided from gas pipeline system originated from standard tanks.

Patients breathed under a mask with oxygen from concentrator at a flow of 8.0 L min^{-1} for 3 min in a semi-closed rebreathing circuit. Following this period, anesthesia was induced with sequential intravenous administration of Fentanyl 5.0 mcg kg^{-1}, propofol 1.5 mg kg^{-1} and atracurium 0.5 mg kg^{-1}. After tracheal intubation, a controlled mechanical ventilation system with a CO_2 absorber was used to provide a tidal volume sufficient to maintain exhaled CO_2 between 30 and 35 mmHg. Maintenance of anesthesia was achieved with isoflurane and the FGF of 1 L min^{-1}. One side-stream valve (CardioCap5 – GE Datex-Ohmeda Helsinki, Finlandia) between the inspiratory unidirectional valve and the Y-piece to connect with the patient allowed the inspired and expired fractions of volatile anesthetics, carbon dioxide ($ETCO_2$), oxygen (FiO_2) and nitrous oxide (FiN_2O) to be monitored, and another side-stream valve (Capnomac – GE Datex-Ohmeda Helsinki, Finlandia), located at the delivery port through which the gases are delivered from the machine to the systems, monitored the percentage of oxygen delivered from concentrator by means of paramagnetic oxygen analysis. The samples derived from these sidestream valves were vented to atmosphere (Fig. 1). The measurements of oxygen ratios in either group were expected to reach stability, considering the consumption of oxygen should be at least 200 mL min^{-1} throughout the intraoperative period.

The variables studied were the concentration of inspired oxygen, as well as the fraction of inspired oxygen measured every 10 min after intubation until the end of anesthesia. Arterial pressure, heart rate and pulse oximetry values were obtained at the beginning of anesthesia as well as every 10 min until the end of the procedure. The ratio of FiO_2 to oxygen concentration delivered by the concentrator (O293) was compared at intervals between the groups. The results are presented as median and 25–75 percentiles or mean and standard deviation when normality was achieved. Analysis of variance for repeated measures was used to compare data from the different time intervals within groups. Student's *t* test was used to compare the age, weight, height and body mass index. Chi-square was used to compare the gender ratio. The hypothesis considered a previous investigation with oxygen concentrator as the sole source and where the mean FiO_2 difference was considered the target difference and the use of a nomogram for calculating sample size give a sample of 25–30 patients.[3,7] All comparisons were considered statistically significant when $p < 0.05$. The statistical package Sigma Stat for Windows, version 2.03, SPPS Inc. was used.

Results

Sixty patients of both sexes formed the sample, with 30 in each group, including ASA physical status one and two. There was no statistically significant difference between the two groups for gender, age, weight, height or body mass index (Table 1).

The mean values and standard deviations of delivered oxygen concentration and inspired oxygen percent were registered for both groups (Fig. 2). There was no difference in the delivered oxygen concentration from concentrator over time (Friedman repeated measures ANOVA, $p = 0.084$). There was a significant improvement in the FiO_2 ($p < 0.001$), which was lower at 10 min compared to 40 min and up, and from

Table 1 Patients' characteristics.

	O293Mean ± SD	O293NOMean ± SD
Age in years	39.5 ± 18.3	32.9 ± 13.7
Weight (kg)	67.5 ± 12.9	70.2 ± 14.6
Height (m)	1.67 ± 0.07	1.70 ± 0.09
BMI (kg cm^{-2})	23.45 ± 3.71	24.16 ± 3.74
Gender (M/F)	16/14	16/14

Download English Version:

https://daneshyari.com/en/article/2750366

Download Persian Version:

https://daneshyari.com/article/2750366

Daneshyari.com