An observation into the accumulation of N\textsubscript{2}O in the pneumoperitoneum during laparoscopic surgeries

Anilkumar Narayan\textsuperscript{1}, Avinash Prakash\textsuperscript{2*}, Habib Md Rezaul Karim\textsuperscript{3}, Sanjay Kumar\textsuperscript{4}

\textsuperscript{1}Associate Professor, \textsuperscript{2,4}Assistant Professor, Dept. of Anesthesiology, \textsuperscript{1,2}Andaman and Nicobar Islands Institute of Medical Sciences, Port Blair, India. \textsuperscript{3}All India Institute of Medical Sciences, Raipur, Chhattisgarh, \textsuperscript{4}All India Institute of Medical Sciences, Bhopal, Madhya Pradesh, India

*Corresponding Author: Avinash Prakash
Email: dr.avinash04@gmail.com

Received: 8\textsuperscript{th} August, 2018
Accepted: 9\textsuperscript{th} March, 2019

Abstract

Introduction and Aim: Nitrous oxide (N\textsubscript{2}O) is one of the oldest inhalational anaesthetic agents used in modern anaesthesia practice, N\textsubscript{2}O has been on and off the list of drugs in the anaesthesiologist’s armamentarium. It is believed that diffused N\textsubscript{2}O will accumulate in the third spaces causing its expansion and pressures build up. However, much is not known about how much it diffuses. The aim of present study is to analyze the extent of N\textsubscript{2}O in peritoneal cavity following creation of pneumoperitoneum for laparoscopic surgeries as well as relationship to the duration of pneumoperitoneum.

Materials and Methods: Twenty two ASA I & II patients of both sexes aged between 18 to 65 years who underwent elective laparoscopic cholecystectomy were included with consent. N\textsubscript{2}O and O\textsubscript{2} were administered at a fixed proportion of 60:40. Volatile anaesthetic agent Sevoflurane was administered and adjusted to achieve a MAC\textsubscript{age} of 1.1 to 1.2.

Results: Entire 22 (50\% female) patients with mean ± standard deviation (SD) age and weight of 40.18 ± 8.96 years and 63.05 ± 6.09 kilogram fulfilled inclusion criteria and data were analyzed. No N\textsubscript{2}O or anaesthetic agent was detected in the aspirated sample at the end of surgery.

Conclusion: Amount of N\textsubscript{2}O accumulated in CO\textsubscript{2} pneumoperitoneum used for laparoscopic surgeries are insignificant to nil for 3 hour procedures.

Keywords: Amount of N\textsubscript{2}O accumulated in CO\textsubscript{2} pneumoperitoneum used for laparoscopic surgeries are insignificant to nil for 3 hour procedures.
syringe connected to trocar stopcock port of laparoscope via a three way and immediately fed in to the gas sampling port of anaesthesia gas analyzer attached to multipara monitor Mindray Benewiew T8 (Mindray Medical International Limited, Shenzhen, China) and the reading for CO₂ and N₂O was noted from the display. The data was finally analyzed using INSTAT (Graphpad prism Software Inc., La Jolla, CA, USA).

Results

Entire 22 (50% female) patients with mean ± standard deviation (SD) age and weight of 40.18 ± 8.96 years and 63.05 ± 6.09 kilogram fulfilled inclusion criteria and data were analyzed. The median ASA physical class was I (range I–III). The mean duration of surgery and pneumoperitoneum was 122.91 ± 13.51 and 107.5 ± 14.02 minutes respectively. No anaesthetic agent including N₂O was detected in the aspirated sample at the end of surgery. The mean CO₂ detected was 227.77 ± 2.78 mmHg. When compared, the concentration of CO₂ for the pneumoperitoneum durations less and more than 120 minutes, no statistical difference was found (mean ± SD pneumoperitoneum and respective CO₂ detected were 101.71 ± 9.25 versus 127.2 ± 7.92 minutes; p <0.0001, and 227.59 ± 3.06 versus 228.4 ± 1.52 mmHg respectively; p 0.578).

Discussions

N₂O is an important and one of the oldest used gases in the hands of the anaesthesiologists. We tried measuring the gas from peritoneal samples. N₂O was not detected from any of the samples despite being delivered for more than 2 hours. However, animal model study conducted in domestic pig showed that N₂O can reach up to 29% by two hours of pneumoperitoneum.³ Contrary to this, another study measuring the Fip N₂O in 50 laparoscopic gynecology, intraperitoneal hernia repair and cholecystectomy patients anaesthetized and managed with Fet N₂O was 65%–70% for a duration ranging 20 min to 3 h found that the Fip N₂O was 1-10%. The Fip N₂O increased with increasing duration of pneumoperitoneum.³ The present study was however unable find N₂O or the concentration was so low that the anaesthesia gas analyzer could not detect it. This probably happened because; intact peritoneal cavity does not contain nitrogen, oxygen or air to be replaced by N₂O. In CO₂ pneumoperitoneum the empty potential space is filled with pure CO₂ and the blood gas coefficient of CO₂ is… and that Nitrous oxide is 0.47. In this context it is also to be taken into consideration that nitrous oxide enters the potential space by diffusion, rather than by vascular delivery.⁵ We can therefore reasonably assume that in laparoscopic surgeries of moderate durations (<3h), there is no significant movement of N₂O into peritoneal cavity by diffusion when CO₂ pneumoperitoneum is used.

This study however gives us a research question whether the N₂O will be accumulated in air and oxygen pneumoperitoneum? If yes, how much? Will it be significant clinically or will it differ significantly than CO₂ pneumoperitoneum. The limitation of the present study is that we have studied only few samples and the duration of pneumoperitoneum studied were also relatively shorter.

Conclusion

Amount of N₂O accumulated in CO₂ pneumoperitoneum used for laparoscopic surgeries are insignificant to nil for 3hour procedures.

Conflict of Interest: None.

References


How to cite this article: Narayan A, Prakash A, Karim HMR, Kumar S. An observation into the accumulation of N₂O in the pneumoperitoneum during laparoscopic surgeries. Indian J Clin Anaesth 2019;6(2):187-8.