International Journal of Food Science and Agriculture, 2023, 7(1), 66-69
https://www.hillpublisher.com/journals/jsfa/
ISSN Online: 2578-3475
ISSN Print: 2578-3467

Audit on the Toxicity of Anaesthetics Gases in the Operating Room

Mohamed Matouk*, Nacera Benmouhoub

Bachir Mentouri Public Establishments of Kouba, Faculty of Medicine of Algiers, Algeria.

How to cite this paper: Mohamed Matouk, Nacera Benmouhoub. (2023) Audit on the Toxicity of Anaesthetics Gases in the Operating Room. *International Journal of Food Science and Agriculture*, 7(1), 66-69.
DOI: 10.26855/ijfsa.2023.03.010

Received: January 15, 2023
Accepted: February 12, 2023
Published: March 9, 2023

***Corresponding author:** Mohamed Matouk, Bachir Mentouri Public Establishments of Kouba, Faculty of Medicine of Algiers, Algeria.

Abstract

Almost all areas of human activity influence the climate. The administration of anesthetics by inhalation is one such activity. With an increasing number of surgeries, the demand for general anesthesia by inhalation is considerable. However, widely used volatile anesthetics are greenhouse gases, ozone depleting agents, or both. In the body during clinical use eliminated unchanged by expiration, residual anesthetic gases (WAGs) in operating rooms and post-care units anesthetics can pose a challenge for overall elimination and occupational exposure. Anesthesia and care activities contribute less to greenhouse gas emissions GHGs with a significant impact estimated at 10% of emissions were related to health sector. The environmental impact generated halogenated HAs is only beginning to be taken into account. Among the most used HA desflurane and sevoflurane, a greater responsibility of desflurane sometimes associated with nitrous oxide. However, it accentuates the climatic consequences. Significant environmental impact the current trend is to reduce our GHG emissions.

Keywords

Gas, anaesthetics, audit, anesthesiologists, environment

1. Introduction

Almost all areas of human activity influence the climate. The administration of anaesthetics by inhalation is one such activity; If anaesthesia and health care activities contribute less to greenhouse gas emissions GHG with significant impact estimated at 10% of emissions were related to the health sector. With an increasing global volume of surgeries, the demand for general inhalation anaesthesia is considerable. However, widely used volatile anaesthetics such as N_2O and the highly fluorinated gases sevoflurane, desflurane and isoflurane are greenhouse gases, ozone depleting agents, or both [1-5]. Nitrous oxide and halogenated AH are only beginning to be taken into account, among the most used HAs desflurane and sevoflurane, a greater responsibility for desflurane sometimes associated with nitrous oxide However, it accentuates the climatic consequences [1-5]. The significant environmental impact , the current trend aims to reduce our GHG emissions specific measures that can help reduce occupational exposure and environmental impact from inhaled anaesthetics include effective ventilation and exhaust systems, regular monitoring of airborne waste gas concentrations to stay below limits recommended, ensuring that anaesthesia equipment is well maintained, avoiding desflurane and N_2O if possible, and minimizing fresh-gas flows (e.g., use of low-flow anaesthesia) [1-5]. An alternative to volatile anaesthetics may be intravenous anaesthesia. Overall, although their contributions are relatively small compared to those of other man-made substances, inhaled anaesthetics are inherently potent greenhouse gases and pose a risk to ward personnel. Operation if they are not properly managed and recovered [6, 7].

Carry out an audit of public and private health hospital structures in Algiers to assess measures aimed at reducing GHGs

2. Methods

- Audit of private and public hospital structures in Algiers
- Items explored
- Type of public or private structure
- Older or newer respirator model
- Type of halogens
- Presence or not Nitrous oxide
- Presence or not of closed circuit
- Titrated halogenated type AINOC safe
- Alternative HA Saving Techniques

3. Results and discussion

Number of structures 20 out of 30 questioned of which 70% public the respirators used were new and recent with less gas leaks in 80%. Sevoflurane was the only gas used 100%, halothane is no longer purchased by the Algerian state. Nitrous oxide was used in 60%, in the operating room, the use of N_2O is quite attractive to anaesthesiologists due to several advantageous properties. It serves as an important analgesic, raising the pain threshold during surgery. Additionally, when incorporated into the gas mixture administered to a patient, N_2O reduces the minimum necessary alveolar concentration of other aesthetic gases used concurrently (i.e., isoflurane, desflurane or sevoflurane). Therefore, a smaller amount of a volatile aesthetic agent is needed to achieve the same level of anaesthesia when N_2O is added than when the volatile agent is used alone.

The closed circuit available in 50% of structures, it is in particular the aesthetic gases, which are not recycled, which constitute a major source of pollution. More than 95% of the gas used during operations escapes as it is. The emission of halogenated gases and nitrous oxide is approximately 10 times greater in an open circuit than in a circuit with a low flow of fresh gas ("closed" circuit).the use of the closed circuit depending on recent respirators [8-11]. Residual anaesthetic gas levels varied widely and, depending on anaesthesiologists working practices and equipment design, significant staff exposures have been documented [12]. The chemical properties and global warming impacts of these gases vary, with atmospheric lifetimes of 1-5 years for sevoflurane, 3-6 years for isoflurane, 9-21 years for desflurane and 114 years for N_2O [12].

Factors that increase residual anesthetic gas concentrations in operating rooms can be divided into several categories, such as low temperature air conditioning systems, anesthesiologists working practices, equipment leaks including leaks high pressure nitrous oxide systems, and inadequate recovery devices. Equipment leaks are almost invariably present in low pressure anesthesia machine components because numerous gaskets and seals are required to allow disassembly for cleaning and replacement [13]. The anesthetic induction by inhalation causes a higher risk of leakage and anesthetic maintenance is done using the sevoflurane (often exclusively). In addition, the ventilation system is also an open system [14].

The reasons for the high concentrations were: insufficient ventilation of the room, faulty air conditioning installations, technical faults (leaks) and strong gas emission due to special anesthesia techniques [15]. Current evidence suggests that over 90% of these agents are eliminated from the body unchanged; this reinforces the concept of requiring a system to recover volatile anesthetics for reuse or proper disposal [16]. destruction of sevoflurane and desflurane with this photochemical anesthetic waste gas destruction system design is efficient and cost effective [17]. Specific measures that can help reduce occupational exposure and environmental impact from inhaled anesthetics include effective ventilation and exhaust systems, regular monitoring of airborne waste gas concentrations to stay below recommended limits [18]. Monitoring devices, such as oxygen analyzer with audible alarm, carbon dioxide analyzer, vapor analyzer, whenever a volatile anesthetic is delivered, have also been recommended by various anesthesia companies [19].

AINOC (Inhalational Anaesthesia with Target Concentration) was present in 5%, expensive and safe technique [20]. Participation seems to be representative of the reality of the structures and practices of Algiers. The only HA sevoflurane available on the market. The use of AINOC (safety technique) was restricted due to the cost; MP Potdar and coll [21] study have shown that target-controlled (TC) anaesthesia drug delivery system also called as end-tidal (ET) control is a good system for conserving the consumption of gases and thus is efficient as it reduces both the cost and the environmental pollution [22].

The development of alternative techniques was found in all structures; To reduce GHG emissions, studies recommend:

1. Use low fresh gas (FGF) flows (typically $\leqslant$ 1 L/min)
2. Avoid routine use of high impact agents like desflurane and nitrous oxide
3. Consider regional and intravenous techniques to reducing emissions, low FGF rates has also been established as an area where OR cost reduction can be readily achieved. Through education and increased awareness of adverse effects of

inhaled anesthetics on the environment [23]. Techniques have changed and improved: today, two thirds of operations are performed under regional anaesthesia, ultrasound allows a success rate of around 100%. The concept of rapid recovery after surgery, which can lead to outpatient hospitalization, requires postoperative analgesia of excellent quality and without nausea or vomiting. Unlike inhaled anesthetics, the GHG impacts of propofol are relatively minimal and are estimated to be four orders of magnitude lower than those of desflurane and nitrous oxide [23]. Other approaches (morphine sparing, halogen gases, analgesic drugs, local intravenous anaesthetics, etc.) associated with quality monitoring.

4. Conclusion

Due to the effects of anaesthetics gases on the environment intensive care anaesthesiologists have changed their practices in order to reduce the negative impact of their activities on the natural environment we as anaesthesiologists have the opportunity not only to contribute to these efforts, but also to direct them.As a specialty, we have to advocate for industry to continue to search for anaesthetics with minimal to no environmental footprint. By choosing anaesthetic agents with short-term impact such as sevoflurane and isoflurane over those with intermediate-term or long-term impact like desflurane and N_2O respectively, we can ensure a rapidly declining impact of our specialty on the environment until no-impact alternatives are available.

References

[1] Holdgate, Martin. "Preparing for climate change." Earthwatch, 35 (1989): 8.

[2] Ryan, Susan M., and Claus J. Nielsen. "Global warming potential of inhaled anesthetics: application to clinical use." Anesthesia & Analgesia, 111.1 (2010): 92-98.

[3] Gadani, Hina, and Arun Vyas. "Anesthetic gases and global warming: Potentials, prevention and future of anesthesia." Anesthesia, Essays and Researches, 5.1 (2011): 5.

[4] Ishizawa, Yumiko. "General anesthetic gases and the global environment." Anesthesia & Analgesia, 112.1 (2011): 213-217.

[5] Sherman, Jodi, et al. "Life cycle greenhouse gas emissions of anesthetic drugs." Anesthesia & Analgesia, 114.5 (2012): 1086-1090.

[6] Varughese, Shane, and Raza Ahmed. "Environmental and occupational considerations of anesthesia: a narrative review and update." Anesthesia and Analgesia, 133.4 (2021): 826.

[7] Andersen, Mads Peter Sulbaek, Ole John Nielsen, and Jodi D. Sherman. "The global warming potentials for anesthetic gas sevoflurane need significant corrections." Environmental Science & Technology, 55.15 (2021): 10189-10191.

[8] Brown, Donald G., Nanette Wetterstroem, and Jay Finch. "Anesthetic gas exposure: Protecting the OR environment." AORN journal, 41.3 (1985): 590-608

[9] Eckelman, Matthew J., and Jodi Sherman. "Environmental impacts of the US health care system and effects on public health." PloS one, 11.6 (2016): e0157014.

[10] Campbell, Matt, and JM Tom Pierce. "Atmospheric science, anaesthesia, and the environment." BJA Education, 15.4 (2015): 173-179.

[11] Andersen, Mads P. Sulbaek, et al. "Assessing the impact on global climate from general anesthetic gases." Anesthesia & Analgesia, 114.5 (2012): 1081-1085.

[12] Varughese, Shane, and Raza Ahmed. "Environmental and occupational considerations of anesthesia: a narrative review and update." Anesthesia and analgesia, 133.4 (2021): 826.

[13] Pothmann, W., et al. "Pollution of the workplace by anesthetic gases. Causes and prevention." Der Anaesthesist, 40.6 (1991): 339-346.

[14] Norton, Pedro, et al. "Assessment of anesthetic gases in a central hospital." Porto Biomedical Journal, 5.4 (2020)

[15] Baillot, A., et al. "Pollution of operating room air by anesthetic gases in relation to the air conditioning method and anesthesia techniques." Zentralblatt fur Hygiene und Umweltmedizin, International Journal of Hygiene and Environmental Medicine, 195.4 (1994): 299-305.

[16] Lahvic, Nick, and Mark Liu. "Waste gas scavenging system." StatPearls [Internet]. StatPearls Publishing, 2022.

[17] Rauchenwald, Verena, et al. "New method of destroying waste anesthetic gases using gas-phase photochemistry." Anesthesia & Analgesia, 131.1 (2020): 288-297.

[18] Varughese, Shane, and Raza Ahmed. "Environmental and occupational considerations of anesthesia: a narrative review and update." Anesthesia and analgesia, 133.4 (2021): 826.

[19] Garg, Rakesh, and Ramesh Chand Gupta. "Analysis of oxygen, anaesthesia agent and flows in anaesthesia machine." Indian Journal of Anaesthesia, 57.5 (2013): 481.

[20] Dupanloup-Meistelman, Danièle. "Quels risques professionnels liés à la pratique de l'anesthésie en 2018?." (2018).

[21] Potdar, Meenoti Pramod, Laxmi L. Kamat, and Manjeet P. Save. "Cost efficiency of target-controlled inhalational anesthesia." Journal of Anaesthesiology, Clinical Pharmacology, 30.2 (2014): 222.

[22] Özelsel, Timur J-P., Rakesh V. Sondekoppam, and Karen Buro. "The future is now—it's time to rethink the application of the Global Warming Potential to anesthesia." Canadian Journal of Anesthesia/Journal canadiend'anesthésie, 66 (2019): 1291-1295.

[23] Yeoh, Cindy B., et al. "Simple green changes for anesthesia practices to make a difference." EC clinical and medical case reports, 3.12 (2020): 1.