

Pioneering Green Anaesthesia Practices in the Operation Theatre

Sailaja K*

Care Hospital, India

*Corresponding author: Kamabathula Sailaja, Care Hospital, Hyderabad, Telangana State, India, Tel: +91 7093322303; Email: sailu_k_78@yahoo.co.in

Received Date: December 23, 2024; Published Date: January 10, 2025

Abstract

As climate change accelerates, every sector, including healthcare, must adopt sustainable practices to reduce environmental impact. Anaesthesiology, as a critical component of surgical care, plays a key role in this effort due to its significant contribution to greenhouse gas emissions, waste production, and energy consumption. Anaesthetic gases like desflurane and nitrous oxide, with high global warming potential (GWP), are major contributors to climate change. Additionally, the high energy demands of operation theatres and the disposal of single-use medical equipment further amplify the environmental footprint of anaesthetic practices. The production and disposal of anaesthetic drugs, such as propofol, also contribute to CO₂ emissions and aquatic pollution. Despite these challenges, there are substantial opportunities for reducing environmental harm within anaesthesiology. Practices such as low-flow anaesthesia, the use of sevoflurane (a lower-GWP volatile anaesthetic), and improved scavenging systems can significantly reduce the carbon footprint. Additionally, sustainable waste management, energy efficiency, and the adoption of reusable equipment can mitigate the sector's environmental burden. Global initiatives, like the ASA's "Greening the Operating Room" and the NHS's "Greener NHS" program, underscore the role of anaesthesiologists in driving sustainability. In India, growing awareness and efforts, such as the Green OT initiative, reflect a shift towards greener anaesthesia practices. However, barriers such as resistance to change and lack of infrastructure remain significant challenges. Overcoming these requires continuous education, research into low-impact technologies, and systematic implementation strategies. Ultimately, anaesthesiologists, by adopting sustainable practices, can lead the way in reducing the environmental impact of healthcare, contributing to the broader goal of mitigating climate change while maintaining high standards of patient care. Through collective efforts, the cumulative impact of small changes can drive meaningful progress toward a more sustainable future for healthcare.

Keywords: Sustainability; Green Operation Theatre; Global Warming Potential; Green Anaesthesia

Abbreviations

GWP: Global Warming Potential; CO₂: Carbon Dioxide; PBT: Persistence, Bioaccumulation, and Toxicity; OT: Operation Theatre; ASA: American Society of Anesthesiologists; NHS: National Health Services; FGF: Fresh Gas Flow.

Introduction

As the world grapples with the urgent and escalating climate change crisis, every profession, including anaesthesiology, is called to action. Operation theatres (OT), as resource-intensive environments, present significant opportunities

for sustainability. As anaesthesiologists, we have the power to make a significant difference.

Let us explore how anaesthesiologists impact the environment and can play a significant role in mitigating these effects.

The Environmental Impact of Anaesthetic Practices

Anaesthesiology plays a critical role in surgical care and contributes to healthcare's environmental impact. Using anaesthetic gases, such as desflurane and nitrous oxide, is a significant contributor. These are potent greenhouse gases with a high global warming potential (GWP). Desflurane, for instance, has a GWP approximately 2,540 times greater than carbon dioxide over a 100-year period. Sevoflurane is considered to have a lower GWP among volatile anaesthetics, with a value of 130 over the same time span. While also an effective anaesthetic, nitrous oxide contributes to global warming and ozone depletion. It is widely used for anaesthesia and analgesia in dental procedures and labour and has the potential for abuse, making it a major contributor to environmental deterioration.

Beyond the direct emissions of greenhouse gases from anaesthetic gases, several other anaesthetic practices contribute to global warming. Energy consumption also forms a considerable part of an anaesthesiologist's workspace environmental impact. Using energy for lighting, heating, ventilation, air conditioning, and operating medical equipment such as monitors, anaesthesia machines, and surgical tools contributes significantly to the carbon footprint of operation theatre facilities. Maintaining energy efficiency by proper use and care of equipment and turning them off when not in use is a doable task for any setup.

Anaesthesiology involves producing substantial amounts of waste. The carbon footprint of production, transport, disposal and sometimes incineration of single-use anaesthetic equipment such as masks, tubes, syringes, and unused medications further adds to the environmental load, exacerbating the carbon footprint of our field. Reducing waste and opting for safe and feasible reusable options can help mitigate these effects to an extent.

The production and disposal of anaesthetic drugs also contribute to greenhouse gas emissions. For example, the production of propofol and other intravenous anaesthetics involves chemical processes that emit carbon dioxide (CO₂) and other pollutants. Additionally, pharmaceutical waste can contribute to environmental pollution if disposed of incorrectly. Medications are classified based on 1) environmental risk (ratio of predicted concentration to safe environmental drug concentration) and 2) environmental

hazard (nine-point index based on persistence, bioaccumulation, and toxicity - PBT index). Further, as the use of one medication often influences other decisions, the total environmental impact of medications administered during an anaesthetic should be considered and not simply the PBT index of any single medication [1].

Practices like sterilising equipment or high-flow oxygen and volatile agent usage can significantly increase energy usage, contributing to higher emissions. Addressing these issues involves change of practice and implementing more energy-efficient technologies, reducing waste, optimising resource use, and adopting other practices that lower the overall environmental impact of anaesthesia care. Each step towards greener practices by us can reduce our carbon footprint. The shift from reusable to disposable items in medical practice has inevitably led to increased waste and emissions.

Opting for alternatives with lower environmental impact and promoting practices like low-flow anaesthesia using anaesthetic agents with lower global warming potential, equipment with leak-proof systems, and good scavenging can significantly impact the environment. By making conscious choices, we can contribute to a greener future.

My Journey Towards Environmental Stewardship in Anaesthesiology

My commitment to environmental sustainability began with a growing awareness of the broader implications of my everyday practices. It was a realisation that each choice I made, from selecting anaesthetic agents to managing resources, contributed to a larger environmental context. Embracing this perspective, I advocated for change within my department, promoting practices that support sustainability.

Our hospital launched the Green Operation Theatre certification initiative, aiming to transform our surgical theatres into models of sustainability. This program focuses on reducing emissions from anaesthetic gases by using sevoflurane low-flow anaesthesia, improving energy efficiency, and minimising waste. The progress and success of this initiative needs to be measured and evaluated over time.

Overcoming Challenges

The path to sustainability is not without its challenges. Initial costs and resistance to change are significant hurdles. However, we can gradually overcome scepticism by demonstrating the long-term savings and environmental benefits of these practices. Barriers to implementing sustainable practices often include a lack of knowledge about sustainable alternatives, infrastructural challenges, and resistance to changing established norms. It is essential to acknowledge these challenges but remember that they are

not insurmountable.

There is a growing need for education and training on the environmental impacts of anaesthetic practices and the benefits of sustainable alternatives. This knowledge plays a crucial role in raising awareness and showcasing successful modifications in the system, fostering a culture of sustainability within our community. Anaesthesiologists, other healthcare professionals, and policymakers should actively seek out such education and training opportunities to stay updated with the latest sustainable practices and to contribute to global efforts to reduce the environmental impact of healthcare.

The Present Progress

Global: Initiatives like the American Society of Anaesthesiologist's "Greening the Operating Room" emphasise reducing the use of high-GWP anaesthetics and serve as guidelines for managing sustainability in operating rooms.

The NHS(National Health Service) launched the "Greener NHS" in 2020 and delivered a report to achieve their net zero for emissions by 2040. A Green Checklist was developed to guide how operation theatres can be more sustainable [2].

The NHS has integrated sustainability into its operations, underscoring the pivotal role of anaesthesiologists in leading efforts to make surgical practices more sustainable. This includes everything from managing anaesthetic gases to waste disposal and energy use in operation theatres. Anaesthesiologists are at the forefront of this movement, driving change and inspiring others to follow suit [3].

These examples highlight a growing global commitment to reducing the environmental impact of anaesthesiology. Each country's approach is tailored to its specific healthcare infrastructure and environmental policies, but the overall direction is clear: a shift towards more sustainable and less environmentally damaging medical practices.

Globally, efforts are being made to optimise the use of anaesthetic gases to minimise their environmental impact by developing anaesthesia workstations capable of low-flow anaesthesia. Reducing the flow rates of inhaled anaesthetics and increasing intravenous anaesthesia and regional anaesthesia, where possible, are among the strategies adopted to reduce greenhouse gas emissions associated with anaesthetic practices. Propofol, however, is not without its environmental issues and has been shown to bioaccumulate in aquatic environments and is toxic to marine life. For this reason, it is strongly advised to ensure appropriate propofol usage and disposal infrastructure availability.

Lowering the fresh gas flow (FGF) rate and utilising portable N₂O(Nitrous oxide) cylinders, as opposed to central piping, which suffers from substantial loss/leakage, may reduce the impact of volatile anaesthetic agents.

There are several high-impact articles on our role in environmental sustainability and guidance regarding the solutions that can be looked into to improve individual practices. Six core climate-smart actions -waste segregation, waste reduction and recycling, reuse and reprocessing, sterilisation, anaesthesia gas changes, and improvement of energy use in the operation theatre were found to be the main areas of research. There is still a long way to go to improve the quality of our climate-smart actions [4].

Many studies have focused on various phases of behaviour change intervention, implementation methods, or dedicated implementation strategies. These include audits, education, opinion leader promotion, behaviour change intervention, policy or guidelines, consensus statements, and exploration of barriers and enablers. Behaviour change in context to sustainability is a novel set of behaviours, routines, and working methods directed at sustainability while maintaining or improving health outcomes, efficiency, cost-effectiveness, or users' experiences. These must be implemented with planned and coordinated actions to achieve the desired outcomes [5].

India: India is a diverse country with vast diversity in its healthcare infrastructure and practices. In India, sustainability in anaesthesiology is gaining attention, particularly focusing on reducing environmental impacts such as waste management and the use of disposable materials. Several initiatives and studies highlight the challenges and actions taken by anaesthesia providers in this regard.

In some studies, anaesthesia providers have expressed concerns about the large amounts of waste produced, including non-recyclable plastics and metals, and the disposal of excess medicines. There is a need for better recycling practices and a reduction in disposable items that contribute to significant environmental burdens.

Moreover, we are taking steps towards sustainable practices by consciously planning the use of anaesthetic supplies, promoting recycling and reuse where feasible, and encouraging colleagues to adopt more environmentally friendly practices.

The Green OT initiative is being implemented across major hospitals in India to bring sustainability into regular practice.

These findings and initiatives reflect a growing awareness and effort within the Indian anaesthesia community to address the environmental impacts of our practices and align

with global movements towards sustainability in healthcare.

Future - The Way Forward

Utilising alternative anaesthetic gas agents with a more favourable environmental profile, such as xenon, may be more attractive in time; however, currently, xenon-based anaesthesia requires an energy-intensive manufacturing process. Alternatively, novel gas scavenging and destruction technologies have been investigated as a possible means to reduce the impact of volatile anaesthetic induction. While it is frequently acknowledged that these methods are still in their infancy, they have the potential to reduce losses of volatile anaesthetic gases to the environment significantly [6].

Concrete efforts at various levels are necessary to raise awareness about the environmental impacts of anaesthetic practices. This can be achieved through regular training programs and integrating sustainability into medical education. Encouraging research into new technologies and practices that reduce environmental impact without compromising patient care will lead to further environmental sustainability in our field. One significant aspect of the research has centred on the environmental impact of inhaled anaesthetics, which are potent greenhouse gases. Developing guidelines that promote environmentally friendly practices and providing incentives for hospitals that implement these practices can be taken up by the higher offices. Several articles on the environmental effects of our practice and guidance have been published, which can be looked into to establish possible sustainable practices at every infrastructure level to bring possible changes in our respective setups.

It is a herculean task to bring about change in any setup as there are several barriers to implementing new measures to operation theatres despite our best intentions. To reduce the time lag from research to practice and to improve both patient care and returns on research investment, implementation science emerged as a field of investigation, with a focus on improving the systematic uptake of evidence-based care into routine practice. Implementation can be categorised into four phases: exploration, installation, initial implementation, and full implementation. The sustainability of the environment friendly operation theatres is one area which would benefit hugely from a systematic implementation approach to establishing and maintaining the changes. The '6 Rs'—rethink, refuse, reduce, reuse, recycle, and research—are the basis of sustainable practice and can be applied to an operation theatre setting [7].

Conclusion

Anesthesiologists play a critical role in the healthcare system, and this role extends to their potential impact on environmental sustainability. By adopting more sustainable practices, anesthesiologists can lead by example and significantly contribute to the global effort to mitigate climate change. This is not only a professional obligation but also a moral one. While minuscule in the global scheme, our efforts underscore the significant cumulative impact of many small changes.

Conflicts of interest

There are no conflicts of interest.

References

1. Cindy B Yeoh, Kathleen J Lee, Shalini Mathias, Luis E Tolinche (2020) Challenges of Going Green in the Operating Room. *Anaest & Sur Open Access J* 2(1): 2020.
2. Lodhia S, Venton A, Rockall T (2024) Implementing a green sustainable operating theatre. *European Journal of Surgical Oncology*.
3. National Green Theatres Programme-reflecting on progress-NHS Sustainability Actioz: NHS Sustainability Action.
4. Pradere B, Mallet R, de La Taille A (2023) The Sustainability Task Force of the French Association of Urology. Climate-smart Actions in the Operating Theatre for Improving Sustainability Practices: A Systematic Review, *European Urology* 83(4): 331-342.
5. Davies, Jessica F (2023) Implementation approaches to improve environmental sustainability in operating theatres: a systematic review; *British Journal of Anaesthesia* 133(6): 1383-1396.
6. Roscioli R, Wyllie T, Neophytou K (2023) How we can reduce the environmental impact of our operating theatres: a narrative review. *ANZ Journal of surgery*.
7. Lam S, Wong D, Gandhi S (203) Moving Towards Green Anaesthesia-Strategies for Environmental Sustainability: Virtual Library.