Medical Research Archives

ESMED
European Society of Medicine

OPEN ACCESS

Published: June 30, 2023

Citation: Krishnamurti C, Mehdi Z, et al., 2023. Newer Perspectives in Anesthesiology: A Philatelic Based Review, Medical Research Archives, [online] 11(6). https://doi.org/10.18103/mra.v11i6.3920

DOI
https://doi.org/10.18103/mra.v11i6.3920

ISSN: 2375-1924

REVIEW ARTICLE

Newer Perspectives in Anesthesiology: A Philatelic Based Review

Dr Chandrasekhar Krishnamurti, M.D.*
Emeritus Professor Anesthesiology, NRIIMS, Visakhapatnam-531162, A.P., India
*Corresponding email: globeshaker@gmail.com

®Dr Zohra Mehdi, M.D.
Associate Professor Anesthesiology, NRIIMS, Visakhapatnam – 531 162, A.P., India

®Dr Vijayalakshmi Chandrasekhar, MD, DGO, MBA
Associate Professor (OBGY), GITAM Institute of Medical Sciences and Research, Rushikonda, Visakhapatnam – 530 045, A.P., India

ABSTRACT

Over the past decade, the practice of anesthesiology had become inextricably dependent upon technology. Anesthetics were first discovered, then made increasingly safe, and now, more precise and efficient, all due to tremendous advances in monitoring and delivery technology. Telemedicine has revolutionized medicine and preoperative evaluations and teaching are being done via teleconference and zoom meetings. Patient monitoring has become noninvasive, and closed-loop anesthesia delivery systems are making anesthetic administration very precise and safe. Next-generation technology and innovations will eliminate human errors entirely.

Keywords: Anesthesiology; precision medicine; artificial intelligence; closed loop technology

INTRODUCTION

The scope of anesthesia practice has seen a considerable expansion over the past two decades and it has become inextricably dependent upon monitoring and delivery technology. The scope of anesthesia practice has expanded globally, providing anesthesiologists with unique new technological tools to ensure a precise and safer care of surgical patients.

IMPROVED PATIENT CARE

In the 1960s and 1970s, the death related to anesthesia was one in every 10,000 to 20,000 patients. Now, with technological advances, it is in the range of one in every 200,000 patients. Deaths and adverse outcomes continue to decrease significantly due to comprehensive and continuous monitoring and improved vigilance, education, and training. [1,2]

IMAGING & POINT OF CARE

Improved image quality as well a significant reduction in price, with handheld devices with intuitive interfaces and AI integration has led to the point-of-care use of ultrasonography to acquire and interpret all images in real time. (Fig 1) This has enabled better and early diagnosis of patient status and rapid, and goal-oriented therapy for better outcome. Bedside lung ultrasound in emergency protocol, fluid administration limited by lung sonography, fast focused assessment with sonography for trauma have facilitated precise and evidence-based patient treatment. [3,4,5,6]

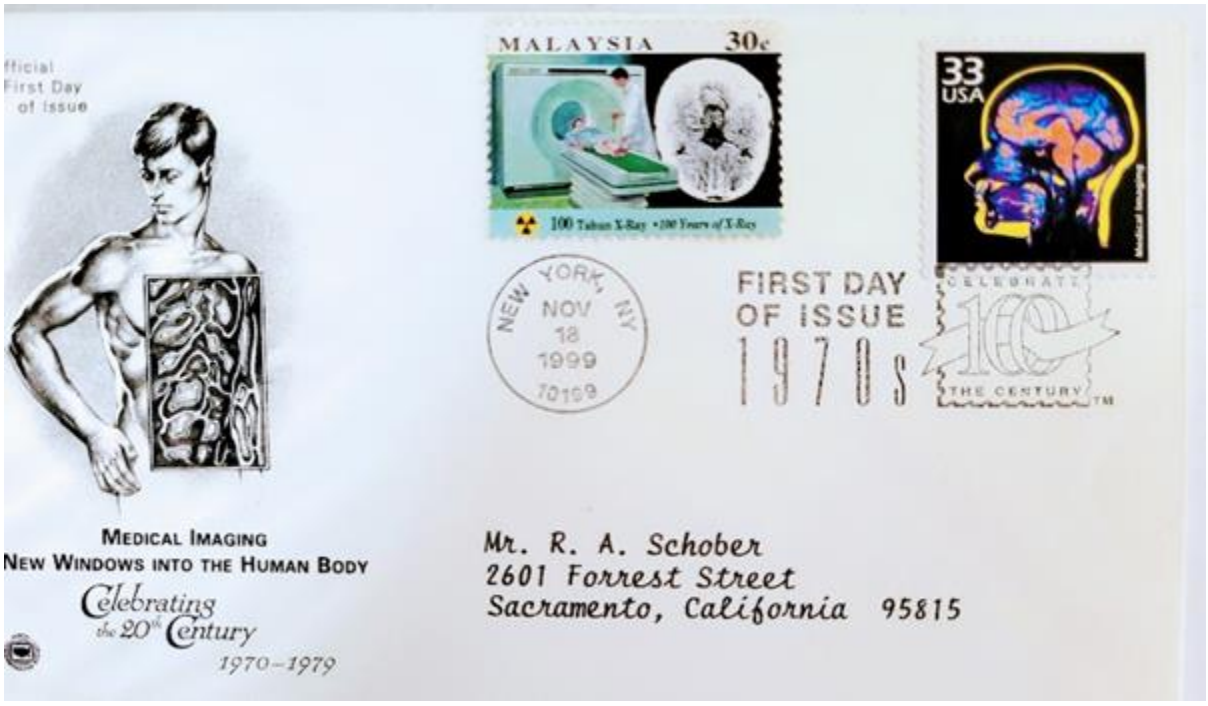

Fig 1: *Imaging and Point of Care Diagnosis and Treatment*

TELEMEDICINE:

Telemedicine has resulted in a sea change in outpatient medicine and perioperative management. (Fig 2) Preoperative evaluations are now done via teleconferencing and comprehensive patient health data is available at the click of a mouse. [7,8,9]

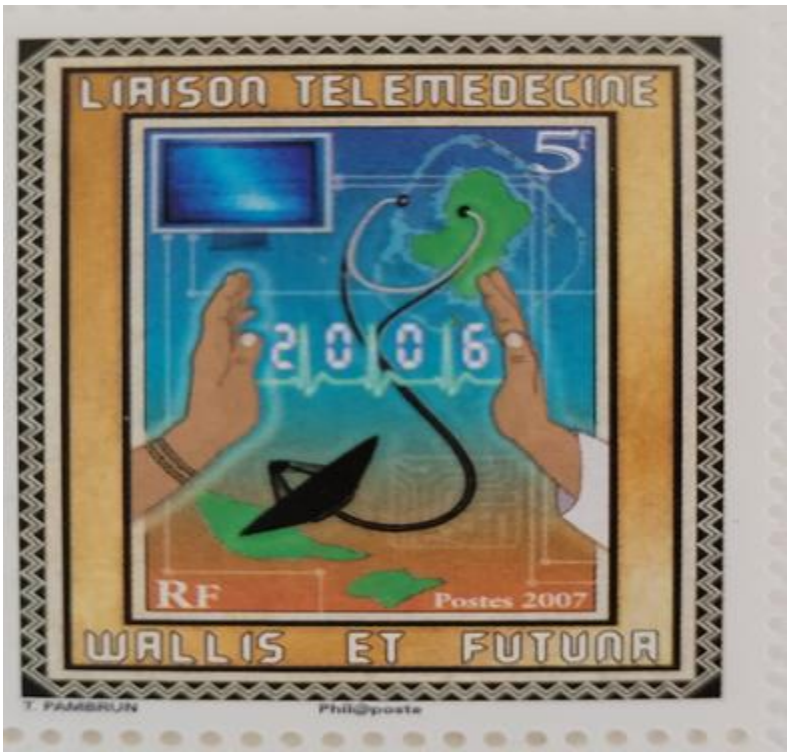

Fig 2: *Telemedicine : Remote global medicare*

AUTOMATION & ARTIFICIAL INTELLIGENCE

Automation applied to the administration of closed-loop anesthesia delivery, artificial intelligence (AI) and machine learning (ML) have transformed the future of health care. All phases of perioperative care from accurate risk prediction to operating room organization has been impacted to improve cost-effectivity, quality care and better outcomes. (Fig 3, 4) Drug designing and development was hampered by complex and huge data from genomics, proteomics, microarray data, and clinical trials. Deep learning (DL) algorithms based on deep, convolutional (CNN), recurrent (RNN) neural and deep auto-encoder (DAEN) networks has facilitated newer drug discovery. Artificial intelligence applied to monitoring drug release, pre-clinical and clinical development, primary and secondary drug screening, biomarker development, pharmaceutical manufacturing, bioactivity identification and physiochemical properties, prediction of toxicity, and identification of mode of action will result in newer, more efficacious and less toxic drugs in the near future. [10,11,12,13,14]

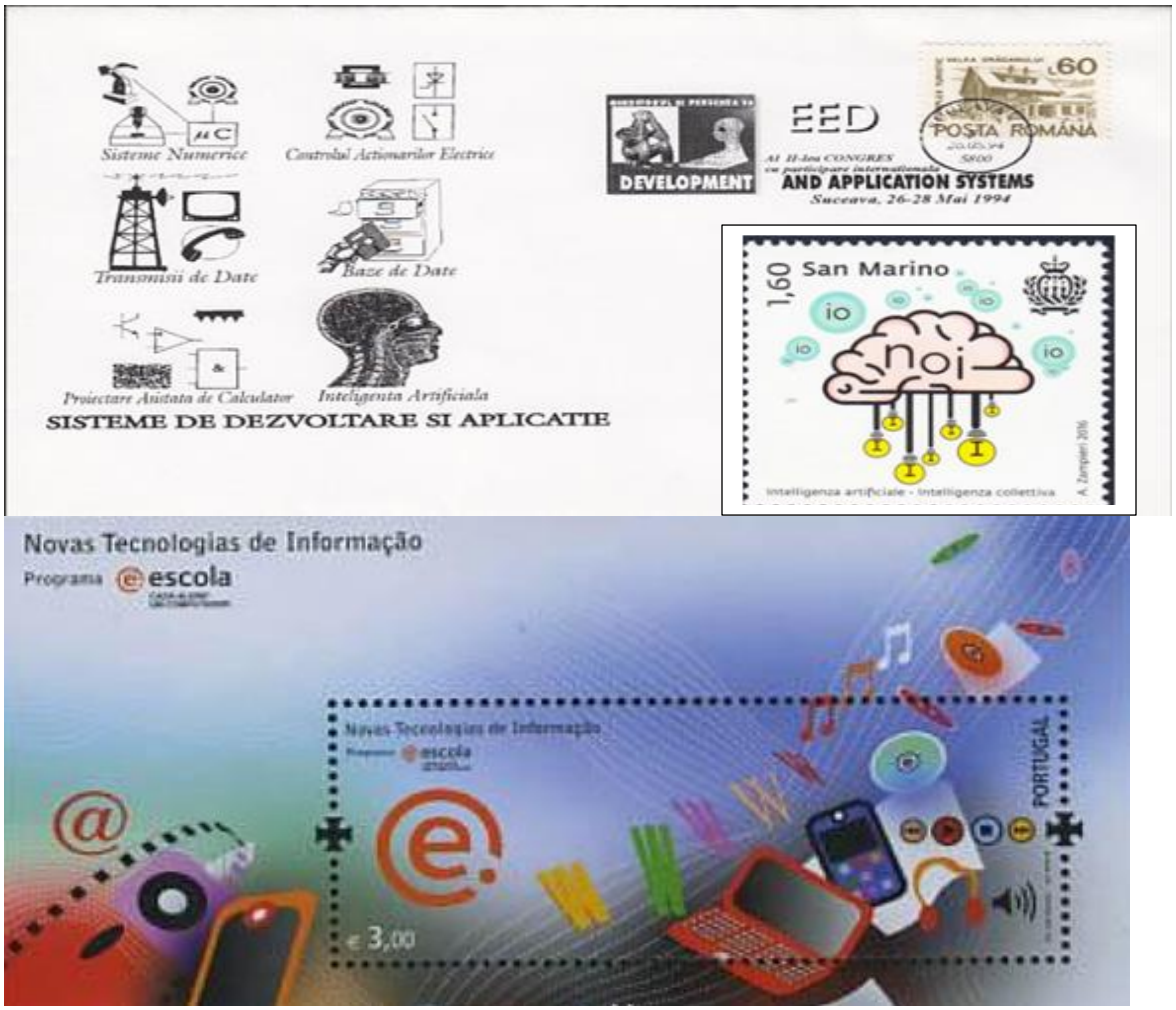

Fig 3 & 4: *Automation and Artificial Intelligence Application in Medicare*

"ZOOM" LEARNING

Zoom video conferencing has made person-to-person communication involving anesthesiologists possible through the Covid-19 pandemic. (Fig 5, 6) Almost all anesthesiology related continuing medical education (CME) is being effectively conducted through these newer portals. [15,16]

Fig 5 & 6: *"Zoom" learning – the revolution in knowledge updates*

ANESTHESIA IN ADVERSE ENVIRONMENTS

Target-controlled infusion (TCI) pumps and depth of anaesthesia monitors have made total intravenous anesthesia (TIVA) easy, safe, and precise. The rapid pharmacokinetics and pharmacodynamics characteristics of newer short acting intravenous designer drugs like ciprofol, remimazolam, remifentanil, dexmedetomidine, and cisatracurium has resulted in good quality of recovery and discharge. These drugs are painless on intravenous injection, and provide better haemodynamic stability and good quality of recovery and early discharge from hospital. [17,18,19] These newer techniques will make anesthesia administration in adverse environments like at depths, high altitude and aerospace precise and safe. (Fig 7)

Fig 7: *Underwater, High Altitude And Aerospace Anesthetic challenges*

GENETICS

Preliminary candidate gene studies suggest that susceptibility to adverse perioperative events is genetically determined. Biomarkers in perioperative medicine and critical care include prognosis, diagnosis, and monitoring of adverse outcomes, as well as informing and refining therapeutic decisions. (Fig 8)

Patterns of human genome variation, gene regulation, basic population genetic methodology, gene and protein expression analysis, and evaluating dynamic genomic markers can evaluate and catalog organ-specific responses to surgical stress. This can assist with organ-protective strategies by better understanding of genetic control of anesthetic mechanisms and responses. Mutations in the ryanodine receptor gene, *RYR1*, are found in 50–70% of cases susceptible to malignant hyperthermia and statin induced myopathy. Genetic profiling of drug metabolizing enzymes, carrier proteins, and receptors, using molecular technologies will enable personalized choice of drugs and dosage regimens tailored to suit a patient's pharmacogenetic profile. In the future, an individual's pharmacological needs will be based on age, sex, and genomics. [20,21,22]

Fig 8: Pharmacogenetics and Precision Medicine

CONCLUSION

Anesthesiology is at a crossroad with new models of care with increased utilization of technology. Expansion in telemedicine has enabled care for more patients in diverse settings and to better monitor patients remotely while ensuring immediate intervention as needed. Resident training needs constant upgrading to ensure continued competency and core training in the evolving technology to support patient and health system needs. 23

REFERENCES

1. Methangkool E, Cole DJ, Cannesson M. Progress in Patient Safety in Anesthesia. *JAMA* 2020;324(24):2485–2486
2. Prielipp RC, Cohen NH. The future of anesthesiology: implications of the changing healthcare environment. *Current Opinion in Anaesthesiology* 2016; 29(2): 198-205
3. Ramsingh D, Yuriy S, Bronshteyn SH, Zimmerman J. Perioperative Point-of-Care Ultrasound: From Concept to Application. *Anesthesiology* 2020; 132: 908–916
4. Moore CL, Copel JA. Point-of-care ultrasonography. *N Engl J Med* 2011; 364: *749–57*
5. Li L, Yong RJ, Kaye AD, Urman RD. Perioperative Point of Care Ultrasound (POCUS) for Anesthesiologists: an Overview. *Curr Pain Headache Rep* 2020 Mar 21;24(5):20
6. Heinz, E.R., Vincent, A. Point-of-Care Ultrasound for the Trauma Anesthesiologist. Curr Anesthesiol Rep 2022;12:217–225.
7. Kamdar N, Jalilian L. Telemedicine: A Digital Interface for Perioperative Anesthetic Care. *Anesth Analg* 2020;130(2):272-275
8. Jacob AK, Belch LM, Pai SL. Telehealth in Anesthesia. *Adv Anesth* 2021 39:259-268.
9. Schoen DC, Prater K. Role of Telehealth in Pre-anesthetic Evaluations. *AANA J* 2019;87(1):43-49
10. Hashimoto DA, Witkowski E, Gao L, Meireles O, Rosman G. Artificial Intelligence in Anesthesiology: Current Techniques, Clinical Applications, and Limitations. *Anesthesiology* 2020;132(2):379-394
11. Gupta R, Srivastava D, Sahu M, Tiwari S, Ambasta RK, Kumar P. Artificial intelligence to deep learning: machine intelligence approach for drug discovery. *Mol Divers* 2021;25(3):1315-1360
12. Jiménez-Luna J, Grisoni F, Weskamp N, Schneider G. Artificial intelligence in drug discovery: recent advances and future perspectives. *Expert Opin Drug Discov* 2021;16(9):949-959
13. Jing Y, Bian Y, Hu Z, Wang L, Xie XQ. Deep Learning for Drug Design: an Artificial Intelligence Paradigm for Drug Discovery in the Big Data Era. *AAPS J* 2018; 20(3):58.
14. Nag S, Baidya ATK, Mandal A, Mathew AT, Das B, Devi B, Kumar R. Deep learning tools for advancing drug discovery and development. 3 *Biotech*. 2022;12(5):110.
15. Swerdlow B, Soelberg J, Osborne-Smith L. Distance Education in Anesthesia Using Screen-Based Simulation – A Brief Integrative Review. *Adv Med Educ Pract* 2020;11:563-567
16. Bergmans E, Metelmann C, Metelmann B, Rübsam ML, von Au F, Thies KC. Technology-enhanced learning in anesthesiology and emergency medicine: A new approach to medical school teaching in the wake of the pandemic. *Anaesthesiologie* 2022;71(6):444-451.
17. Anderson BJ,Bagshaw O. Practicalities of total intravenous anesthesia and target controlled infusion in children. *Anesthesiology* 2019; 131(1):164-185
18. Wingert T, Lee C, Cannesson M. Machine Learning, Deep learning and Closed Loop Devices-Anesthesia Delivery. *Anesthesiol Clin* 2021;39(3):565-581
19. Bajwa SJS, Stalin V, Surekha S et al. Recent advancements in total intravenous an aesthesia and anaesthetic pharmacology. *Indian Journal of Anaesthesia* 2023; 67(1): 56-62
20. Booij Leo HDJ. Sex, age, and genetics in anesthesia. *Current Opinion in Anaesthesiology* 2008; 21(4): 462-466
21. Ashley EA, Butte AJ, Wheeler MT, et al. Clinical assessment incorporating a personal genome. *Lancet* 2010; 375:1525-1535.
22. Feero WG, Guttmacher AE, Collins FS. Genomic medicine—an updated primer. *N Engl J Med* 2010;362:2001-2011
23. Bridges KH, McSwain JR, Wilson PR. To Infinity and Beyond: The Past, Present, and Future of Tele-Anesthesia. *Anesth Analg* 2020 ;130(2):276-284.