ISSN: 1607-8322, e-ISSN: 2220-5799 **Anaesthesia, Pain & Intensive Care**
Vol 27(6); December 2023 DOI: 10.35975/apic.v27i6.2344

EDITORIAL VIEW **PERIOPERATIVE MEDICINE**

Monitoring in anesthesiology

Tariq Hayat Khan, DA, MCPS, FCPS

Consultant Anesthesiologist & Pain Specialist, APICAREHQ, 25-E, G-10-3, Ibn-e-Sina Road, Islamabad, Pakistan; E-mail: apicare@yahoo.com; Phone: +92 321 5149 709

ABSTRACT

Near infrared spectroscopy (NIRS) is a non-invasive monitoring modality, which is still not very commonly available, so most of the anesthesiologist in this part of the world might not have heard it. A case series by Purwoko et al. is being published in this issue of Anaesthesia, Pain & Intensive Care under the title of, 'How NIRS can predict the outcome of patient in low systemic pressure: a case series'. This editorial is just a complement to that case series, and highlights the importance for the anesthesiologists to keep themselves abridged with the on-going developments. It also emphasizes on provision of training facilities in the centers of postgraduate training. The journey of monitoring during anesthesia has not reached its end point. More and more complex modalities are being introduced. Perhaps, we need to formulate category-wise guidelines for monitoring from basic to more complex monitoring.

Key words: Anesthesia; Guidelines; Monitoring; Near infrared spectroscopy

Citation: Khan TH. Monitoring in anesthesiology. Anaesth. pain intensive care 2023;27(6):622−624; **DOI:** 10.35975/apic.v27i6.2344

Every patient undergoing anesthesia, whether general or regional anesthesia for some surgical procedure deserves to be safe and the operators need to adhere to the golden principle of 'Primum non nocere' (First of all, do no harm), which is thought to be a part of the original Hippocratic oath. The anesthesia as well as the surgery may have profound effects on the normal physiological processes and systems of the patient, which need to be promptly corrected to avoid serious harm, and adequate monitoring of the physiological parameters is the only sure method to identify and speedy rectification of any adverse event.

Not very long ago, in the third world countries like Pakistan, the anesthetists depended upon continuous palpation of a peripheral pulse of the patient, and periodic manual measurement of the blood pressure. Close coordination between the operating surgeon and the anesthetist was (and it is still) paramount. On occasions, the surgeon would caution the anesthetist that the patient was bleeding, or at other times, the patient wasn't bleeding. Both of these warning demanded for the anesthetist to take immediate action to save the life of the patient.

The times have changed very fast, and most of the operating rooms in the world are now equipped with at least the basic monitoring facility outlined by Standards for Basic Anesthetic Monitoring, developed by Committee on Standards and Practice Parameters (CSPP) and originally approved by American Society of Anesthesiologists (ASA) on October 21, 1986, and last amended October 20, 2010. This set of standards addresses only the issue of basic anesthetic monitoring, which is one component of anesthesia care. In certain rare or unusual circumstances, 1) some of these methods of monitoring may be clinically impractical. The main emphasis has been laid upon the continued presence of a qualified anesthesia personnel in the operating room throughout the conduct of all general or, regional anesthesia and even monitored anesthesia care. In majority of the cases, the anesthesiologists have been relying upon basic mechanical monitoring of pulse oximetery, non-invasive blood pressure and electrocardiographic trace. A single monitoring device would suffice to show us all of these parameters. It may be pertinent to mention here that even the original basic monitoring advocated by ASA committee have not all been implemented. The 'Standards for Basic Anesthetic Monitoring' advocated continual evaluation of the patient's oxygenation, *ventilation*, circulation and *temperature* during all anesthetics. In practice the second and fourth elements (*ventilation* and *temperature)* are rarely monitored. The former of the two requires capnograph to indicate correct placement of endotracheal tube, and the adequacy of the ventilation,

and the second one needs a temperature probe. A large-scale survey-based research is required to document the extent of the use of capnography and temperature measurement in operating rooms of our country. The results would be disappointing. Surprisingly most of multiparameter monitors used in our country are devoid of capnography. Even the use of the available facility may not be routinely used.

Not every patient, and not every procedure, will require only the basic monitoring mentioned above. The extensive surgical procedures or the deleterious patients might need invasive monitoring, including peripheral arterial pressure and central venous pressure monitoring. The cardiothoracic surgery, neuro surgery and transplant surgery have their own sets of requirements. The best decisions are made with mutual coordination by the anesthesiologists as well as the surgeon, and the availability of the facilities. Some of the developments in the past few decades include percutaneous oxygen saturation, and end-tidal concentrations of oxygen, carbon dioxide, and inhalation anesthetics as routine monitors. Another very important development is in the monitoring of hypnosis or the depth of anesthesia with the use of electroencephalogram (EEG) and then low- or non-invasive cardiac output measurement.

Although the final decision has to be made by the anesthetist and the surgeon, keeping in view the operative requirements, the administration has the responsibility to make most, if not all, of the current monitoring facilities available regardless the cost. Really, nothing is costlier than a human life.

The high emphasis on the safety of the patient has compelled the clinicians and the scientists to develop more advanced and more sophisticated parameter monitors. Near infrared spectroscopy (NIRS) is one of the latest innovations. It was first described by Frans Jöbsis1 for use in living tissues in the human brain in 1977. INR is based on the concept that light of wavelengths 680 to 1000 nm, is able to penetrate human tissue and is absorbed by the chromophores oxyhemoglobin (HbO_2) and deoxyhemoglobin (HHb) and the cytochrome oxidase. it has also been developed into a useful tool in neuroimaging studies, with the so-called functional NIRS (fNIRS). Any change in the detected light levels can represent changes in concentrations of these chromophores. The clinical use of NIRS for monitoring the brain is now well established in neonates and small children, in whom transillumination is possible because of the thin skull and small dimensions; but use in adults has been hampered by various setbacks including varying thickness of the tissues over the skull. Despite the difficulties, the clinicians have used it evaluate cerebral hemodynamic changes has been reported in a variety of medical and neurosurgical conditions, including those associated with disturbed cerebral circulation. It has been shown that in patients with head injury, changes in oxyhemoglobin correlate well with changes in jugular venous oxygen saturation (SjvO2), transcranial Doppler (TCD), and laser Doppler. It can particularly be useful in resuscitation from shock or sepsis. With the more advancement, the monitor size is expected to be more compact and of lesser dimensions, so as to be used in the field as well as on the bedside to measure the cerebral blood flow, and to image the brain.

The healthcare regulating authorities must ensure that the required monitoring facilities are available in every operating room of every hospital, in which surgery is allowed, and that the anesthesiologist and the surgeon involved are competent enough to undertake the surgery with adequate monitoring. NIRS as an easy-to-use, noninvasive technique to measure tissue oxygenation in the adult brain. In addition, NIRS use has expanded to examine oxygenation in other tissues and to estimate the adequacy of systemic circulation; this can be particularly useful in resuscitation from shock or sepsis.

As more and more new monitoring modalities are being introduced in clinical practice, the regulatory authorities need to formulate guidelines specifying a set of monitoring modalities for the simplest procedure in an ASA-I patient to the most complex procedures in ASA-IV to V patient, keeping in view the requirements of the procedure being planned.

It must be noted that the availability of these costly sophisticated gadgets is only one side of the coin. The anesthetists responsible for training of young postgraduates must ensure that their trainees are fully trained and well-versed with every possible monitoring option before they complete their training period.[6] The supervisory and regulatory bodies have the main responsibility to make sure that every center recognized for training has the required capability to train in every current monitoring modality, including the expertise of the supervisors and the availability of the gadgets. This is the only way if we wish to compete with the competitors from the developed and not-so-developed world.

Conflict of interest

None declared by the author.

Authors contribution

THK is the sole author of this editorial. Help was obtained from the published sources to construct this editorial.

BIBLIOGRAPHY

1. American Society of Anesthesiologists. Standards for Basic Anesthetic Monitoring. (Accessed on November 28, 2023) Available at: https://www.asahq.org/standards-and-practice-parameters/standards-for-basic-anesthetic-monitoring

2. Pippa G. Al-Rawi, Peter J. Kirkpatrick, Chapter 33 - Near Infrared Spectroscopy, Editor(s): Peter D. Le Roux, Joshua M. Levine, W. Andrew Kofke, Monitoring in Neurocritical Care, W.B. Saunders, 2013, Pages 327-335.e3, ISBN 9781437701678, DOI: 10.1016/B978-1-4377-0167-8.00033-9. (Accessed on November 28, 2023) Available at: https://www.sciencedirect.com/science/article/pii/B9781437701678000339

3. Ali J, Cody J, Maldonado Y, Ramakrishna H. Near-Infrared Spectroscopy (NIRS) for Cerebral and Tissue Oximetry: Analysis of Evolving Applications. J Cardiothorac Vasc Anesth. 2022 Aug;36(8 Pt A):2758-2766. [PubMed] DOI: 10.1053/j.jvca.2021.07.015; . Epub 2021 Jul 10.

4. Sood BG, McLaughlin K, Cortez J. Near-infrared spectroscopy: applications in neonates. Semin Fetal Neonatal Med. 2015 Jun;20(3):164-72. [PubMed] DOI: 10.1016/j.siny.2015.03.008; Epub 2015 Apr 29.

5. Nishiyama T.Recent advance in patient monitoring. Korean J Anesthesiol. 2010 Sep;59(3):144-59. DOI: 10.4097/kjae.2010.59.3.144. Epub 2010 Sep 20. PMID: 20877698; PMCID: PMC2946031.

6. Riaz N, Khan TH. Monitoring at what price (Editorial). 2002;6(1):5-6 (Free Full Text)

