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Editorial

Inhalational Anesthetic

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Inhalational anesthetic agents are medications primarily used in the operating room for induction and maintenance of general anesthesia for surgery. Inhalational agents are sub-classified as volatile and non-volatile. The volatile anesthetics used in the developed world today include desflurane, sevoflurane and isoflurane. Other agents widely used in the past include ether, chloroform, enflurane, halothane and methoxyflurane. The volatile anesthetics are liquids at room temperature and require the use of vaporizers for inhalational administration. On the other hand non-volatile Nitrous oxide is already gaseus under normal conditions of temperature and pressure with analgesic properties.

Diethyl ether was the first modern inhalational anesthetic to be publicly exhibited with the invention of halogenated agents in 1950s. The explosion risk was largely eliminated. Modern anesthetic practice is based mostly on inhalational anesthetic drugs.

Although exact mechanism of action remains mostly unknown, inhaled anesthetics work with the central nervous system by augmenting signals to chloride channels (GABA receptors) and potassium channels while depressing neurotransmission pathways, which includes acetylcholine (both muscarinic & nicotinic), glutamate or NMDA and serotonin (5HT) receptors[1].

Modern anesthetic practice is based mostly on inhalational anesthetic drugs. The substances that are now being used are highly efficient and have a favorable safety profile due to their chemical characteristics. Inhaled anesthetics immediately introduce a drug into arterial blood via pulmonary circulation. The importance of rapid therapeutic effect enables effective sedation induction and cessation caused by these drugs resulting in adequate amnesia, anesthesia and a quicker post-operative recovery period than intravenous drugs[2-4].

The primary mode of administration of inhalational anesthetics is by inhalation through a face mask, laryngeal mask, or a tracheal tube. They can be useful for preoperative sedation in addition to intravenous anesthetic agents such as midazolam and propofol in the perioperative and intra operative setting[5].

Halothane was first introduced as volatile anesthetics which has many advantages such as quick action, easy administration, non-explosiveness, high potency and low cost, leading to widespread use within a very short time. Unexplained hepatitis after exposure to halothane were reported years after its clinical use[6,7]. During the following years an increasing number of reports dealt with the association between halothane exposure and liver damage[8-16]. So development of further halogenated anesthetics isoflurane, desflurane and sevoflurane were introduced as alternative to halothane as optimum inhaled anesthetic agent[17]. Isoflurane, sevoflurane and desoflurane all decreases systemic blood pressure by decreasing systemic vascular resistance, so these agents preserve cardiac output but cardiac depression can be seen if combined with other I/V agents or in patients with cardiogenic shock. Isoflurane concentrations which provide surgical anesthesia cause little or no cardiac depression[18]. This aids in lowering the severity of heart injury from ischemia and reperfusion[19].

Volatile anesthetic agents are not true respiratory depressant drugs in the sense that they decrease the respiratory rate seen by other agents. Desflurane, a pungent gas causes coughing, laryngospasm and secretions has limited utility as an induction agent and is not recommended for the induction and maintenance of anesthesia in non-intubated children[20]. Sevoflurane is safe and widely used agent due to its simplicity in administration, adaptability and steady hemodynamic profile[21]. Sevoflurane's lack of airway irritation makes it preferable to isoflurane and desflurane for the induction of anesthesia in children and young patients. Although there is no difference in preparedness for discharge, sevoflurane withdrawal is slower than desflurane withdrawal[22].

Post-operative nausea and vomiting (PONV) are more frequently linked to inhaled anesthetics[23]. Intravenous anesthesia instead of inhaled agents reduces the risk of PONV. Patients with genetic alterations between their proteins and muscular cytosolic Ca^{2+} concentrations may develop malignant hyperthermia, a rare serious reaction to volatile anesthetics especially halothane[24].

There are hepatotoxicity associated with halothane and nephrotoxicity associated with sevoflurane, methoxyflurane and enflurane. So recommendations are to avoid sevoflurane who have known renal dysfunction[25,26]. Carbon monoxide toxicity may occur with desflurane as it is the largest producer of Co and hepatotoxicity may occur with prolonged exposure to nitrous oxide due to reduction in the recycling of vitamin B12[27,28]. However there is a link between post-operative cognitive impairment and high dose of inhalational anesthetic agents[29].

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Inhalational anesthetic agents are extensively used in the surgical practice and various other clinical procedures. Further clinical research is required to increase the safety index of available inhalational anesthetic agents and it can also lead to the evolution or development of newer inhalation anesthetic agents.

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