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EDITORIAL VIEW

Dexmedetomidine in cardiac anesthesia

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ABSTRACT

There is an ever increasing number of invasive cardiovascular procedures performed annually all over the world. Most of these procedures are known to have a high complication rate; the most common cause of these complications being the surgical stress response with resultant impaired myocardial oxygen supply and demand ratio. The use of dexmedetomidine in cardiac anesthesia has shown promising results in decreasing the complication rates in these patients. It is shorter acting, highly selective alpha-2 adrenoceptor agonist and has analgesic, sedative, anxiolytic and sympatholytic properties. Published studies and meta-analyses have demonstrated beneficial role of perioperative use of dexmedetomidine in cardiac anesthesia. It is relatively a new drug and in order to further confirm its beneficial effects during cardiac anesthesia, more well designed, clinical trials are needed to make evidence based recommendations for its use in specific circumstances and establish its permanent place in cardiac anesthesia.

Key words: Research; South Asia; Statistics; Epidemiology; Demographic data

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There has been a global increase in the invasive cardiovascular procedures in the recent years. It is estimated that approximately 7 million such procedures are performed annually.[1] The Society of Thoracic Surgeons reports major complications following valve and coronary artery bypass surgical procedures to be as high as 30.1%.[2] The most common factor contributing to these major complications is the surgical stress response causing imbalance between myocardial oxygen supply and demand.[3] Advancement in surgical techniques, anesthesia drugs, better understanding of cardiopulmonary bypass and improved post-operative care have remarkably improved outcomes following cardiac surgery.

Dexmedetomidine is considered as a pure alpha-2 agonist as it has a high selectivity for alpha-2 receptors. It is 1600 times more specific for alpha-2 compared to alpha-1 receptors. It produces analgesia, anxiolysis and reduction of systemic norepinephrine release. It affects the regulation of wakefulness and nociceptive transmission by acting on the locus ceruleus in the brain stem and causes analgesia by acting on the dorsal horn of the spinal cord.[4]

It has an α half-life of six minutes which makes it suitable for use as an intravenous agent. It was initially approved by US Food and Drug Administration (FDA) for 24 hours use as a sedative for adult mechanically ventilated patients. FDA subsequently gave approval in 2008 for it to be used in adult patients undergoing monitored anesthesia care. In 2008, it got the FDA approval for use in monitored anesthesia care in adults. Later on, it got the approval for use as a mild sedative in adult ICU patients in Europe.[5]

The drug has recently gained wide spread recognition with improved availability, and is currently being used as a drug of preference in the intensive care unit (ICU), neuro- anesthesia and cardiac anesthesia.[6] Meta-analysis conducted on the use of dexmedetomidine in non-cardiac surgery patients has shown that it increases the incidence of bradycardia, shortens the duration of mechanical ventilation and decreases the length of stay in ICU.[7]

The use of dexmedetomidine in cardiac anesthesia is on the rise as several recently published studies have demonstrated cardiovascular stability in cardiac surgery due to its use. The properties of being a good analgesic, sedative, anxiolytic and sympatholytic agent made it a useful agent to be used with routine anesthetic intravenous induction drugs. It attenuates the hypertensive response to endo tracheal intubation in cardiac surgery patients,[8] and produces stable hemodynamics at the time of incision and sternotomy, considerably reducing the requirement of other intravenous anesthetic agents.[9] It was once believed that perioperative use of dexmedetomidine provides cardiac protection; however, this was not supported by a study conducted by Tosun Z et al.[10]

Very few meta-analyses are available in the literature addressing the use of dexmedetomidine in cardiac surgery patients. One such study demonstrated a reduction in the incidence of delirium, ventricular tachycardia and duration of mechanical ventilation in cardiac surgery patients by the use of dexmedetomidine.[11] Another meta-analysis[12] evaluated the outcome of cardiac surgery patients with the use of dexmedetomidine. The authors showed that dexmedetomidine use reduces the risk of atrial fibrillation, ventricular tachycardia and postoperative delirium. It caused hypotension and bradycardia specifically in adult patients and these side effects were of concern to the cardiac anesthesiologist. These side effects have been described and evaluated in many studies conducted on adult patients.[13] However, these known side effects of dexmedetomidine i.e. hypotension and bradycardia are now being explored peri-operatively in cardiac surgery patients as a treatment for blunting the pressor responses and tachyarrhythmia's. In other words once considered harmful to the cardiac patients, these effects are being considered beneficial.

Dexmedetomidine is also found to benefit patients with pulmonary hypertension undergoing mitral valve replacement. It does this by attenuating the rise in systemic and pulmonary vascular resistances following sternotomy, decreasing fentanyl requirements and not allowing the mean arterial and pulmonary artery pressures to rise in these patients.[14]

It lacks cholinergic effects and causes improved sleep architecture.[15] These effects are considered to be of benefit in the prevention of emergence delirium. It is currently being considered as the drug of choice for the prevention of delirium in the critically ill patients and is included in the 2012 guidelines for providing analgesia and sedation in the ICU. In spite of some favorable studies suggesting it as a drug of choice for preventing delirium, the available literature does not support this in cardiac surgery patients.

The sedative, anxiolytic and minimal hemodynamic effects of the drug in the peri-operative period have resulted in its increased use in cardiac surgery. Cardiac anesthesiologists are now using it frequently based on the available evidence as an agent to suppress the hemodynamic response, as a therapeutic option for tachyarrhythmia, as sedation during mechanical ventilation and to decrease delirium especially in old age patients. However, it being a relatively new drug, in order to further confirm its beneficial effects during cardiac anesthesia, more well designed clinical trials are needed to explore its claimed benefits and make evidence based recommendations for its use in specific circumstances and establish its permanent place in cardiac anesthesia.

Conflict of interest: Nil

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