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Review Paper

Sedation and analgesia during ablation procedures for atrial arrhythmias: A narrative review

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ABSTRACT:

Sedation and anesthesia play a major role in cardiac Cath lab. Many procedures are done in the Cath lab which were done in the operation theater. Sedation is challenging in these high-risk procedures. Appropriate sedation, analgesia and anesthesia should be used considering the patient profile, procedural difficulty and time. There must be a thorough understanding of the nature of the drugs used with respect to onset, duration of action and side effects. Patients should be monitored vigilantly especially for respiratory and cardiovascular issues. These would result in better outcomes for the patients undergoing sedation in these procedures.

Keywords: ablation; analgesia; arrhythmia; sedation

INTRODUCTION:

Interventional cardiology procedures have been steeply increasing over time. [1] Catheter ablation procedures for atrial arrhythmias atrial fibrillation and flutter are frequently being done under sedation and analgesia. [2] Though sedation is extremely challenging, it has several potential advantages over general anesthesia in terms of faster recovery, lesser local side effects such as sore throat, lesser ICU stay, lesser costs and lesser time to discharge from the hospital. [3] Nevertheless, sedation brings challenges including hypotension and bradycardia, lesser airway control, risk of hypoventilation, respiratory depression and apnea. [4]

Depth of sedation:

The depth of sedation occurs on a continuum from minimal to deep sedation based on the parameters of responsiveness, airway (need for intervention), spontaneous ventilation and cardiovascular function. [5] Minimal sedation is also referred to as ‘anxiolysis’ wherein there is normal response to verbal stimuli and the other three parameters remain unaffected. This is usually after a single dose of a sedative or analgesic administered before the procedure. With moderate sedation/analgesia (also termed as ‘conscious sedation’), the patient gives purposeful responses to either verbal or tactile stimulation, such as being gently touched or spoken to. No intervention is necessary to maintain their airway, and their breathing remains adequate on its own. Cardiovascular function is usually maintained during moderate sedation. Moderate sedation is achieved by titration of IV sedation and/or analgesics during the procedure. Deep sedation/analgesia is a drug induced loss of consciousness wherein the patient cannot be aroused easily but responds purposefully only after repeated or painful stimulation. The ability to independently maintain ventilatory function may be compromised, and patients may need assistance to keep their airway open. Spontaneous ventilation may also be insufficient. However, cardiovascular function is generally stable. This is usually achieved through the careful adjustment of IV sedatives, analgesics, and/or anaesthetics during the procedure.

Medications:

A. **Propofol**:

It is a short acting intravenous agent that is used for both induction and maintenance because of which the recovery is smooth and quick even after a prolonged infusion. [6,7] Propofol used for Target controlled infusion has very good results. The pharmacokinetic model of propofol is a 3 compartment model consisting of central, peripheral and deep compartment. The faster offset is because of its peripheral redistribution. The deep (fat) compartment acts as a storage which may delay the delay the offset in in obese patients Propofol is mainly metabolized through the liver, and the metabolites are excreted via the kidney. Propofol is a potent respiratory and cardiovascular depressant because of which the doses have to be carefully titrated. When given along with the opioids it may induce apnea. Its infusion at 100ug/kg/min induces a 40% decrease in tidal volume and 20% increase in respiratory rate. [8] Propofol also causes greater hemodynamic impairment compared to other sedative agents. There is a decrease in cardiac output and stroke volume causing hypotension. Patients mostly complain of pain on injection which can be mitigated by concomitant use of lignocaine. [9]

B. **Dexmedetomidine**:

It is a alpha 2 adrenergic receptor agonist which has anxiolytic, sedative and analgesic effects. [10] The sedative effect is due to the binding to the alpha 2 receptors in locus coeruleus and the analgesic effect is due to the binding of the alpha2 receptors in spinal cord and locus coeruleus. Dexmedetomidine produces a natural sleep-like pattern of the electroencephalogram because it acts on the endogenous sleep promoting pathway. The advantage of dexmedetomidine is its minimal respiratory depressive effect. It reduces the release of norepinephrine and sympathetic tone in the central nervous system causing severe bradycardia Hypotension can occur in old patients and patients with history of diabetes and history of hypertension or with a large loading dose. Because of its low respiratory depression potential, [11] combined administration with other sedatives /analgesics provides good results without the risk of respiratory complications.

C. **Opioids**:

Opioids have strong analgesic effects but not hypnotic effects, but these can decrease the need for other sedatives when used together. [12] The risk of respiratory and cardiovascular side effects increases when opioids are used together with sedatives so special acre needs to be taken in the patients receiving both. Remifentanil is short duration opioid used for conscious sedation during painful procedures. Onset is rapid regardless of the duration of infusion. recovery is rapid and unaffected by hepatic or renal dysfunction.

D. **Midazolam**:

Midazolam is a short acting benzodiazepine causing anxiolysis and antegrade amnesia without any analgesic effect.it decreases the central respiratory drive response to hypercapnia and hypoxia. [13,14] This is dose dependent. It has minimal depressive effects on the cardiovascular system when used alone but can be increased when used in conjunction with other sedatives or hypnotics' doses should be decreased in older patients and patients with reduced cardiovascular function. Since it is metabolized in the liver, it can cause severe sedation for longer duration in patients with hepatic dysfunction. The side effects of midazolam include agitation, aggressiveness, restlessness and hallucinations. Patients with a history of alcohol intake or mental health problems are at an increased risk of paradoxical reaction. These reactions can be controlled using haloperidol and flumazenil.

Pre anesthetic assessment and preparation:

Anesthetists should be aware of preexisting diseases or comorbidities that might increase the chances of complications, including a difficult airway, any systemic disease, obstructive sleep apnea or allergies. The evaluation of airway to check for neck mobility, neck mass, facial anomaly, dental status is vital. Primarily, the focus should be on respiratory and cardiovascular system. [12, 14-16]

The fasting requirements are the same as general anaesthesia [16] since pulmonary aspiration can be a rare but frequently fatal complication, as sometimes the moderate sedation needs to be converted to deep sedation or general anaesthesia.

During the procedure:

A. Respiratory and hemodynamic monitoring: Respiratory depression leading to hypoxemia is the most common adverse event during sedation, hence pulse oximetry is mandatory for monitoring. Capnography monitoring gives an earlier indicator of hypoxemia than pulse oximetry for hypoventilation so that rapid interventions can be made to reduce the respiratory depression, including depth of sedation, patient stimulations and assisted ventilation. [17, 18] Also, the anesthetist should be very vigilant for qualitative clinical signs such as chest wall movement retractions, gasping and stridor. The use of electrocardiography, noninvasive blood pressure and heart rate monitoring are mandatory in all cases. [12] Rarely invasive blood pressure monitoring might be needed.

B. **Monitoring depth of sedation:** The depth of sedation should be monitored throughout the procedure. [5] The margin of safety for deep sedation can be vary narrow with regards to respiration and cardiovascular function. The depth can be assessed by verbal interactions with the patient as well as with the other clinical parameters. Some structured assessment methods that can be used clinically to assess depth of sedation are the ASA Continuum of Sedation, the Modified Observer's Assessment of Alertness/Sedation Scale (MOASS), and the Ramsay Sedation Scale (RSS). [19] The Bispectral index (BIS) can be used to assess the depth of sedation but its correlation with sedation depth is more useful in cases of longer duration ablation for arrhythmias. [20, 21]

Procedural considerations for Catheter Ablation for arrhythmias:

Moderate sedation is usually sufficient for most of the cases either with benzodiazepine, propofol, opioids or dexmedetomidine. [12,22] In some complicated cases there might be a need for deep sedation or general anesthesia especially in cases of longer duration needing patient immobilization. General anesthesia had better results compared to sedation in terms of shorter procedure times and higher arrhythmia free rate. [23] The benefits of deep sedation over general anesthesia are lesser throat discomfort, faster recovery times, lesser Intensive care stay and lesser financial costs.

The sedative /anesthetics might have a deleterious effect on the successful ablation of the supraventricular tachyarrhythmias. Many of the drugs might slow cardiac conduction and reduce the ability to elicit arrythmias. The combination of benzodiazepine and fentanyl is less likely to interfere with the arrhythmia inducibility. [14, 24]

Studies are still needed to demonstrate the superiority of any sedative /anesthetic agent on the outcomes of the procedure. So, as of now the approach is based on patient comfort, preference of the cardiologist and the anesthetist and the arrhythmia inducibility.

CONCLUSION:

Sedation for cardiovascular procedures such as ablation procedures for arrhythmias presents unique challenges, as well as unique advantages. Achieving a successful outcome while improving patient safety and comfort requires carefully balancing sedation and analgesia levels, taking into account the patient's condition, the specifics of the procedure, and the resources available at the institution, as well as knowledge and skills of the competent anaesthetist.

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