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Commentary

An Explanation about Ketamine, Etomidate and Their Combination for Induction of Anesthesia in Congenital Heart Disease

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Some of the researchers Citing appearances and their observations on Tetralogy of Fallot, recommended Ketamine and Etomidate or their combination as ideal agents or cocktail for induction of anesthesia in cyanotic heart diseases to prevent a decrease in the systemic vascular resistance while preserving the pulmonary blood flow in order to maintain systemic oxygen saturation [1].

Cyanotic heart disease involves a variety of congenital heart diseases with different pathophysiology affecting on systemic and pulmonary circulation. Tetralogy of Fallot is a heart birth defect that affects how to get blood out of the heart based on the compression gradients of the internal cavities and Aorta and pulmonary artery. It is a combination of four heterogeneous defects that affect each other including, ventricular septal defect, pulmonary valve stenosis, right ventricular hypertrophy and, deviation of the aortic entrance pathway. In some cases, the patients have an extra defect like atrial septal defect (pentalogy).

In penta/ Tetra logy of Fallot, there is a pulmonary stenosis that restricts pulmonary artery circulation. Unlike Tetralogy of Fallo; there are cyanotic congenital heart diseases that have pulmonary over circulation like Truncus Arteriosus, Transposition of the great vessels, Partial/total anomalous pulmonary Venous Return et cetera.

These congenital heart lesions are very responsive to changes in the ratio of pulmonary to systemic vascular resistance. Occasionally, these patients need early diagnosis and treatment because late therapeutic intervention will stick structural remodeling and undesired outcome. These patients refer to catheterization laboratory or computed tomography scan room for diagnostic purpose under sedation or general anesthesia. The key element in managing these patients is lowering pulmonary resistance while supporting right ventricular function.

Ketamine is a non-competitive NMDA receptor antagonist with dissociative anesthetic effect and pain management potency [2-3] while, Etomidate is a nonbarbiturate, imidazole like structure, hypnotic drug without analgesic properties [4]. When used in combination, they additively induce a central nervous system depressive effect. Their combination will accelerate the onset of anesthesia induction. Ketamine increases pulmonary vascular resistance and some researchers recommended it should be restricted [2] but recent studies under high sympathetic tone conditions have reported increase in pulmonary circulation but, a

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safe margin was seen in patients with pulmonary hypertension, reversally [3]. Although, we believe considering the pure role for Ketamine as an augmenting agent on pulmonary hypertension is an overly negative and simplistic assessment; liberal prescription of Ketamine in these patients could be limited.

Etomidate is used for induction of anesthesia in patients who have limited hemodynamic reserve. Clinically hemodynamic changes after Etomidate administration are not seen in pediatrics but it could influence the body's corticosteroid profile. Relative adrenal insufficiency in pediatrics with congenital heart abnormality surgery may induce postoperative vasopressor dependency and influence the outcome of operation. Researchers believe further research is needed to determine safety of Etomidate in neonates and pediatric with congenital heart disease and pulmonary hypertension [4].

Balanced anesthesia is based on combination of different drugs with antagonist adverse effects in order to obtain logical physiologic adjustment. For this purpose, anesthesiologists combine anesthetic drugs like Ketamine, Propofol, opioids and benzodiazepines. Combination of Etomidate and Ketamine do not provide more preference besides; both Etomidate and Ketamine attenuated pulmonary vasorelaxation by inhibiting the Nitric oxide and endothelium-derived hyperpolarizing factors components [5].

The anesthetic management of patients with congenital heart problems and eventually aggravation of right to left shunting; varies based on pathophysiology and severity of the lesions. The ratio between pulmonary to systemic circulations (Qp: Qs ratio) will be determinative. Congenital heart disease with a small shunting component (Qp: Qs ratio less than 1.5: 1) will require only minor anesthetic changes and adjustment [2-4]. However, for all patients with a significant shunting lesion, anesthetic prescription should be given to maintaining the adequate pulmonary to systemic circulation ratio and one of the best choices will be anesthesia based on opioids and low dose benzodiazepine.

In summary, we would not be considering Ketamine, Etomidate or their combination for induction of anesthesia in all congenital heart diseases.

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