PBLD – Table #16

Oxymetazoline-Induced Hypertension Complicated by Acute Pulmonary Edema in the PACU of an ASC

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Goals:

1) Discuss the choice of vasoconstrictors for hemostasis
2) Discuss the perioperative complications and treatment associated with vasoconstrictor
3) Discuss advanced care and transport issues in the ASC

Case History:
A 15 year old, 52 kg male with a history of traumatic injury presents for closed reduction of a nasal fracture. He denies loss of consciousness, headache, nausea or vomiting. His past medical history is unremarkable. Following uneventful induction of general anesthesia, oxymetazoline spray was liberally applied in both nares. At the termination of the 15-minute procedure, oxymetazoline-soaked pledgets were packed in both nares. Approximately five minutes later, the heart rate decreased to 40 bpm.

Questions:
What vasoconstrictors can be used for hemostasis in the perioperative period? What are the most common reasons for bradycardia in the pediatric patient?

Case History (continued):
The patient was given 10 mcg/kg of glycopyrrolate intravenously with prompt resolution of the bradycardia. The patient was transferred to the PACU with an endotracheal tube in situ. The first blood pressure was 180/130.

Questions:
What are the common causes of hypertension in the postoperative period? Is this an appropriate case in which to utilize a critical event checklist? What antihypertensive medications are indicated in this situation?

Case History (continued):
Within minutes, copious amounts of pink, frothy sputum were suctioned from the endotracheal tube.

Questions:

What is the medical management for acute pulmonary edema? What additional monitors should be placed for management? When should the patient be transported for ongoing care? Who should accompany the patient during transport?

Discussion:

The differential diagnosis for perioperative hypertension includes pain, light anesthesia and other patient-specific factors. Also included on this list should be medication error. In this case the medication causing the hypertensive response was administered by the surgeon, making it easier for the anesthesia team to overlook when considering potential causes of hypertension. When rapidly diagnosing the cause for acute hypertension, it may be helpful to utilize an emergency checklist, such as the one published by the Society for Pediatric Anesthesia (SPA). Simulation studies have repeatedly shown that the use of an emergency check list can improves performance in crisis situations. The SPA critical event checklist for hypertension does require the clinician to consider the possibility of medication error, and therefore may have been useful in identifying the diagnosis of oxymetazoline in this patient.

The action of oxymetazoline on specific α-adrenergic receptors ($\alpha_{1A,}$ $\alpha_{2A,}$ α_{2B}) that are highly expressed on the nasal mucosa causes vasoconstriction and defines its use as a topical hemostatic agent. Riegle et al. compared cocaine 4%, phenylephrine 0.25%, and oxymetazoline 0.05% for nasal vasoconstriction in pediatric patients undergoing FESS.(2) Children who were treated with oxymetazoline had less bleeding and improved visualization compared with the other two vasoconstrictors.

Systemic absorption of these agents can have systemic complications, most commonly hypertension related to its action on the α-adrenergic receptors of the smooth muscle of the vasculature that results in vasoconstriction. Furthermore, oxymetazoline can activate central adrenergic receptors and lead to serious adverse effects including cardiovascular instability, respiratory depression, and neurologic complications, which may be potentially life-threatening. In the operating room, reflex bradycardia may not always occur because general anesthetics, particularly volatile anesthetics, attenuate the baroreceptor response.

The key to the management of oxymetazoline induced hypertension is the diagnosis as its treatment is distinctly different from other causes of perioperative hypertension with treatment aimed at reducing the α-adrenergic receptor induced vasoconstriction. Non-specific β-adrenergic antagonists should be avoided because of the resulting unopposed α-adrenergic induced vasoconstriction. This results in profound vascular smooth muscle contraction leading to an increase in the peripheral vascular resistance and exacerbation of the hypertensive episode. The increase in the peripheral vascular resistance also shifts the blood from the systemic to the pulmonary circulation, which is less sensitive to the vasoconstricting properties of the α-adrenergic agonists, resulting in pulmonary edema and a decrease in the cardiac output. Therefore the treatment of oxymetazoline induced

hypertension, should include directly acting vasodilators, such as hydralazine, a selective α-adrenergic antagonists such as phentolamine, or titratable calcium channel blocker such as clevidipine or nicardipine.

The recommended dose of oxymetazoline in adults and children over the age of 6 years is '2 to 3 sprays in each nostril not more than every 10–12 h. The manufacturer's recommended upper limit of volume is 120–180 mcl if both nostrils are treated. Two squeezes of the bottle in the inverted position into each naris would then result in 4000–8000 mcl of oxymetazoline delivered to the nasopharynx. Up to a 75-fold increase in volume is possible when oxymetazoline is expelled from the bottle in the inverted compared with upright position. Pledgets used by surgeons to pretreat the nares can hold a significant volume of oxymetazoline, with one pledget holding a similar volume (1500 mcl) to the volume expelled with single squeeze of the bottle in the inverted position. The percentage of oxymetazoline absorbed from the pledgets across the nasal mucosa is unknown. Complicating our understanding of this issue is the paucity of pharmacologic data on oxymetazoline in children, including information regarding bioavailability, metabolism, clearance, and half-life. No guidelines or toxic thresholds exist for administration of oxymetazoline in small children.

It is essential to review the formulary and emergency medical equipment that is available when working in a free-standing ambulatory surgery center. Appropriate transfer protocols should be in place for the continued management of patients who require admission to a hospital. A careful assessment of the level of care needed for safe transfer will determine when and who should accompany the patient to the hospital.

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