Sugammadex Reversal in the Anesthetic Management of Wolff-Parkinson-White

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Case Presentation

A 16 year old, 52 kg male with no past medical history, no medications, and an ASA class of I, initially presented for seven dental extractions. He was determined to be a Mallampati II, with mouth opening and thyromental distance of 2cm each. His anesthetic perioperative management is detailed in the table below. Five minutes after the start of the procedure, the patient was noted to be in a sinus bradycardia rhythm of 50 BPM and was provided ephedrine. Shortly thereafter, his ECG monitor began displaying delta waves and shortened PR intervals. He became tachycardic up to the 110's and the decision was made to cancel the surgery. He had a 4/4 train of four following Sugammadex reversal. His heart rate ranged from 50 - 110, and his blood pressure ranged from 95/40 to 130/90. He was referred to a pediatric cardiologist and electrophysiologist for further evaluation. See figures 1, 2.

Upon re-presentation 5 months later, the patient now had a past medical history of confirmed WPW, ASA class II, presenting for the same procedure. A crash cart and emergency antiarrhythmic Amiodarone were kept nearby. His anesthetic perioperative management is detailed in the table below. He had a 4/4 train of four after Sugammadex reversal. His heart rate increased to 110 at induction, returning to baseline within 30 seconds, and the rest of his perioperative course was uneventful. His heart rate ranged from 50-110, and his blood pressure ranged from 90/50 to 130/80. No WPW morphologies were seen on ECG during the second operative course.

Perioperative Management

The following anesthetic agents were used during each surgical case. Both encounters commenced and concluded without complication, discounting the initial unmasking of Wolff-Parkinson-White syndrome. See table below.

	Premedication	Induction	NM Blockade	Maintenance	Analgesia	Reversal	Complications	ETT
Surgery 1	Midazolam	Fentanyl	Rocuronium	Sevoflurane	none	Sugammadex	No	Nasal
		Lidocaine						
		Propofol						
Surgery 2	Midazolam	Fentanyl	Vecuronium	Sevoflurane	Remifentanil	Sugammadex	No	Nasal
		Lidocaine		Dexmedetomidine				
		Propofol		Propofol drip				

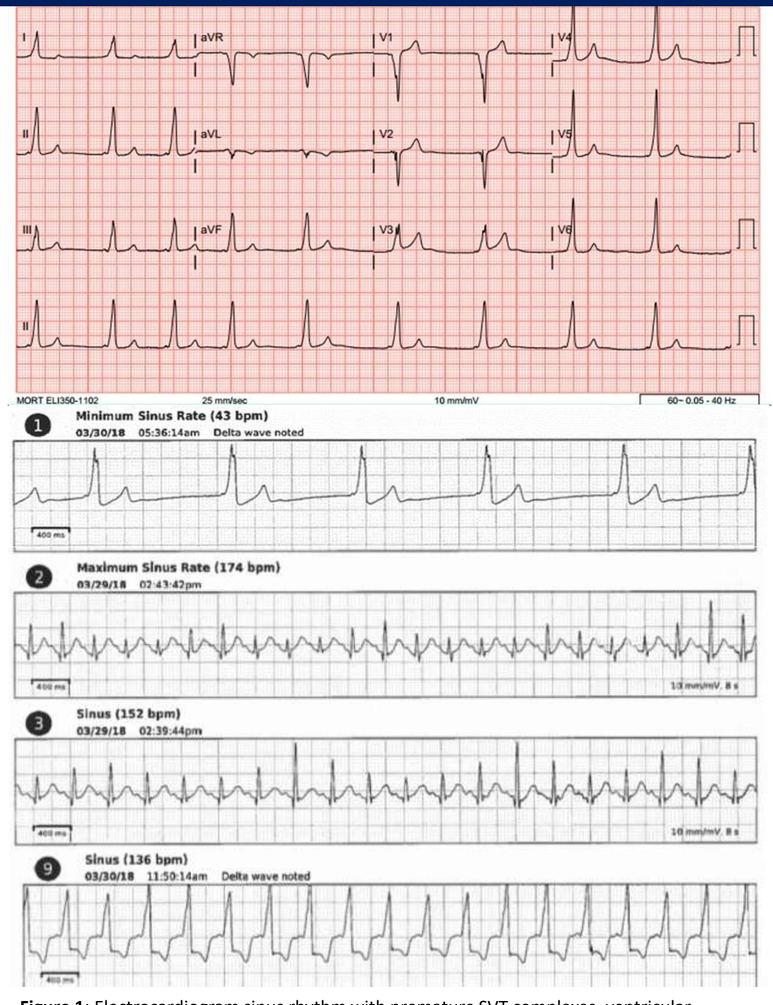

Figure 1: Electrocardiogram sinus rhythm with premature SVT complexes, ventricular preexcitation, WPW pattern type B. Rate 55, QTc 457, QRS 171, T 86.
Figure 2: 1 month Holter monitor displaying minimum sinus rate of 43, maximum sinus rate of 174, with delta waves, shortened PR intervals, pseudo-ischemic morphology

Discussion

Wolff-Parkinson-White syndrome (WPW) is a congenital condition characterized by reentrant accessory pathways that bypass the normally rate-decremental AV nodal conduction system. The cause is thought to be due to aberrant conductive tissues remaining outside the fibrous annulus after embryologic development, epitomized by the bundle of Kent and Mahaim tissues.[1] WPW manifests as a pre-excitation of the ventricles, usually triggered by premature atrial contractions. Stereotypical electrocardiogram findings may include a delta wave, a wide QRS complex (>110ms), a shortened PR interval (<120ms), and the occasional presence of a pseudo-infarction pattern, which can present a diagnostic challenge for the anesthesiologist. Wolff-Parkinson-White syndrome has an estimated prevalence of 0.13-0.25% within the general population. Sudden cardiac death within these patients occurs at a rate of 0.15% - 0.39% per patient per year. Coexisting atrial fibrillation or atrial flutter may cause rapid deterioration if irregular impulses are conducted through the accessory pathways, leading to ventricular fibrillation. Advanced cardiac life support measures must be immediately accessible, should the patient deteriorate perioperatively.[2-4]

The anesthetic considerations for a patient with WPW syndrome may be challenging, as many standard use agents can modulate the autonomic nervous system, resulting in dysrhythmia. Furthermore, patients who are in pain, anxious, pregnant, hypothermic, hyperventilated, gagging, or nauseous will be at increased risk. Laryngoscopy, and laparoscopic insufflation are known triggers. The use of light planes of anesthesia, regional anesthesia and certain cholinergic medications can be permissive to accessory pathway conduction. Dysrhythmias may be initially discovered upon induction, or during the perioperative course. [4-6]

The goals of anesthetic management of the patient with WPW is to avoid sympathetic, vagal, and medicinal excitation of the accessory pathways. Thus, appropriate anesthetic agents must be chosen to ensure safety. Succinylcholine, although valuable for its short paralytic course, has been found to have proarrhythmic properties—whereas Rocuronium, Vecuronium, and Cisatracurium have been found to be safe.[4,7] Neostigmine and Glycopyrrolate reversal have known cholinergic and antimuscarinic effects, which can lead to dysrhythmia. Sugammadex was approved for clinical use in 2016, and is considered a relatively inert agent. Our case demonstrates its advantageous use for neuromuscular blockade reversal in WPW patients that require careful attention to autonomic control.[8]

References:

1. Mirzoyev S, McLeod C, Asirvatham S. Embryology of the Conduction System for the Electrophysiologist. Indian Pacing Electrophysiol J. 2010; 10(8): 329–338.
2. Keating L, Morris FP, Brady WJ. Electrocardiographic features of Wolff-Parkinson-White syndrome. Emerg Med J 2003;20:491–493
3. Lustik SJ, Wojtczak J, Chhibber AK: Wolff-Parkinson-White syndrome simulating inferior myocardial infarction in a cocaine abuser for urgent dilation and evacuation of the uterus. Anesth Analg 89:609-612, 1999
4. Hines RL, Marschall KE. Abnormalities of Cardiac Conduction and Cardiac Rhythm. In: Stoelting's Anesthesia. Elsevier: 7th ed. Philadelphia. 2017. Pp.160
5. Lubarsky D, Kaufman B, Turndorf H: Anesthesia unmasking benign Wolff-Parkinson-White Syndrome. Anesth Analg 68:172-174, 1989
6. Schoenstadt DA, Whitcher CE: Observations on the mechanism of succinylcholine-induced cardiac arrhythmias. Anesthesiology 24:358-362, 1963
7. Bengali R, Wellens HJJ, Jiang Y. Perioperative Management of the Wolff-Parkinson-White Syndrome. J Cardiothorac Vasc Anesth. 2014 Oct;28(5):1375-86
8. Nag, K. et al. Sugammadex: A revolutionary drug in neuromuscular pharmacology Anesth Essays Res. 2013 Sep-Dec; 7(3): 302–306.