EM CASE OF THE WEEK.

BROWARD HEALTH MEDICAL CENTER
DEPARTMENT OF EMERGENCY MEDICINE

BROWARD HEALTH
Care Warriors

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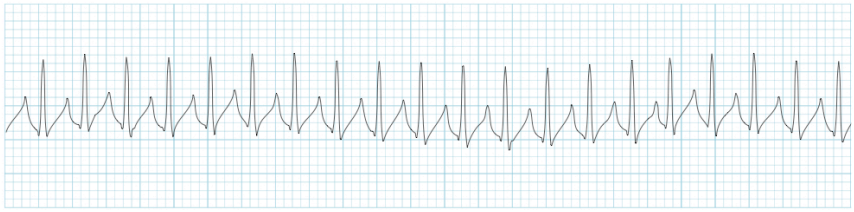
Paroxysmal Supraventricular Tachycardia

A 31-year-old male with no past medical history presents to the ED with a racing heartbeat, lightheadedness, and shortness of breath persisting for the past 2 hours. He has experienced these symptoms roughly a dozen times spaced over the last decade. He describes the episode as waking him up from his sleep early this morning after a night of binge drinking. He denies chest pain, syncope, or diaphoresis. Patient presents with a heart rate of 182 with all other vitals within normal limits. On physical exam, patient is tachycardic and appears to be anxious about the condition. His rhythm strip is shown below:



Which of the following is the most appropriate initial treatment for this patient's condition?

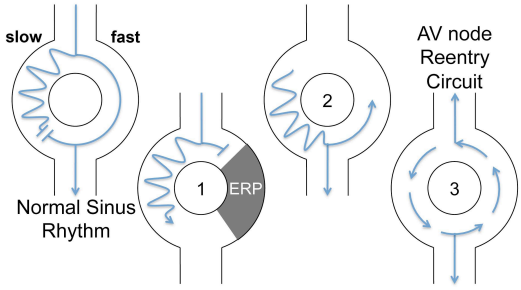
A. 0.1 mg/kg Digoxin IV

B. 6mg Adenosine IV

C. Vagal maneuvers such as Valsalva maneuver, immersing the face in ice water, or carotid massage

D. Electrical cardioversion

E. metoprolol 25 mg ablet PO



Via: https://lifeinthefastlane.com/ecg-library/svt/

Paroxysmal Supraventricular Tachycardia, defined as a regular, narrow-complex tachyarrhythmia caused by dysfunctional conduction pathways that originate above the Bundle of His.

The image above shows the mechanism of the normal electrical pathway on the left, where only one impulse progresses because the faster path (clockwise) loops back around and terminates the slower pathway (counter-clockwise). The AV Node Re-entrant circuit on the right shows how the slow pathway conducts through, while also travelling retrograde along the fast pathway. If the slow pathway has repolarized in time, the retrograde impulse can then once again excite the slow pathway and loop back through to continue to depolarize in the counter-clockwise direction.

EM Case of the Week is a weekly "pop quiz" for ED staff.

The goal is to educate all ED personnel by sharing common pearls and pitfalls involving the care of ED patients. We intend on providing better patient care through better education for our nurses and staff.

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Answer: The correct answer is C. Vagal maneuvers are a safe and effective way to terminate paroxysmal supraventricular tachyarrhythmias.

Description

Supraventricular tachycardia is a general term to describe an increased heart rate with rapid onset that often resolves without intervention. Roughly 2.3 per 1000 people have paroxysmal supraventricular tachycardia, with women more often affected than men. Patients are usually over 20 years old. Known risk factors are alcohol, nicotine, stress, hyperthyroidism, or an inherited conduction anomaly known as Wolff-Parkinson-White syndrome.

Diagnosis

The symptoms of paroxysmal supraventricular tachycardia are sudden onset of palpitations that are associated with lightheadedness, sweating, chest pain, and shortness of breath.

The patient often appears anxious on presentation. The first step in diagnosis is to assure the patient has a pulse. An EKG is the next step when adequate circulation is confirmed.

Via: Via: https://lifeinthefastlane.com/ecg-library/svt/

The image above shows normal sinus rhythm on the top and paroxysmal supraventricular tachycardia on the bottom. The p-waves are often hidden, but can be noted as a pseudo-R-wave, as can be seen in the circle.

Treatment

The goal of therapy is to restore normal sinus rhythm by blocking the re-entrant AV node. This can be done by several means.

Vagal Maneuvers – The easiest and safest treatment. Valsalva maneuver is a commonly used method where the patient bears down as if they are having a bowel movement. Breath holding, carotid massage, and splashing ice water on the face can also help. These techniques slow down AV conduction by increasing vagal output.

Adenosine – If vagal maneuvers are unsuccessful, adenosine can be started at 6mg IV. If that does not work, 12 mg can be tried next. Adenosine is an ultra-short acting drug that works by blocking the AV node.

Calcium Channel Blockers – Verapamil and diltiazem can also work by blocking the AV node. These should be used when adenosine has already been tried and failed or if the tachycardia recurs.

Cardioversion – If the patient becomes hemodynamically unstable at any point, electrical cardioversion is the best life-saving treatment. Prepare to cardiovert if the patient is hypotensive, has pulmonary edema, or has ischemia. It is recommended to use 50 J/Kg immediately upon recognition of such symptoms.

Radiofrequency catheter ablation – when a patient suffers from recurrent episodes of paroxysmal supraventricular tachycardia, long-term treatment should be considered. Radiofrequency catheter ablation is a very effective method for long-term treatment that is preferable to pharmacologic control. This is done by mapping out electrical circuits in the heart. Ablation is performed on the slow pathway for AV Nodal re-entrant tachycardia or the accessory pathway in AV re-entrant tachycardia.

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Types of paroxysmal supraventricular tachycardia

Type	Incidence	Description
AV Nodal Re-entrant Tachycardia	56%	A re-entrant circuit forms within or adjacent to the AV node, which is composed of a fast and a slow pathway. These pathways are composed of tissue that behaves similarly to nodal tissue. The slow pathway has a short refractory period, and the fast has a long refractory period. A premature atrial impulse reaches the AV node when the fast pathway is refractory. The impulse travels down the slow pathway and is able to loop back up the fast pathway if it is now repolarized. It then reaches the entry point for the slow pathway once again, just as it has now repolarized. This allows for the circuit to continue, sending impulses to the ventricles at a tachycardic rate. This type is rarely life threatening.
AV Re-entrant Tachycardia	27%	This form results when there are multiple conduction pathways. Therefore, there are multiple pathways between the atria and ventricles for a circuit to form. The re-entrant circuit forms when an impulse travels anterograde down the AV node and retrograde via the accessory pathway. Ventricular pre-excitation can occur causing Wolff-Parkinson-White Syndrome, as noted on EKG by a delta wave. This is dangerous and can lead to extremely rapid rates and V-fib. It is important to note that these patients cannot be treated with AV nodal blocking agents because this risks degeneration to dangerous arrhythmias. Classically these patients are treated with procainamide.
Paroxysmal Atrial Tachycardia	17%	An ectopic pacemaker in the atria leads to tachycardia due to increased automaticity. This can degenerate into A-fib.

Take Home Points

- Paroxysmal supraventricular tachycardia is a tachycardia that can occur in patients with healthy hearts.
- It presents as a rapid heart rate with sudden onset.
- Patients may have associated diaphoresis, chest pain, shortness of breath, and anxiety.
- It should be treated first with vagal maneuvers.
- Other treatments include adenosine, calcium channel blockers, or synchronized electrical cardioversion.
- The most common type of paroxysmal supraventricular tachycardia is due to AV Nodal re-entrant Tachycardia. Other common causes are AV re-entrant Tachycardia and Paroxysmal Atrial Tachycardia.

ABOUT THE AUTHOR

This month's case was written by Christopher Kinter. Christopher is a 4th year medical student from FIU HWCOM. He did his emergency medicine rotation at BHMC in December 2017. Rochelle plans on pursuing a career in Orthopedic Surgery after graduation.

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