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Block 2
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Reference article: Diez-Parra, Sandra, MD et al. "Use of Adenosine in the Treatment of Supraventricular Tachycardia in a Pediatric Emergency Department. *Pediatric Emergency Care*. 6/2014; 30 (6).

Question:

Are doses of adenosine higher than previously described needed to successfully revert SVT in children?

Background:

SVT is a fast rhythm that originates above the bundle of His. Reentrant SVT is the most frequent arrhythmia requiring treatment in childhood with an incidence of 1 in 1000 to 1 in 250 children. In infants and children, it is most commonly the result of an accessory pathway between the atria and ventricles. In adolescents and adults it is most commonly due to intranodal reentry at the AV node. Most patients with SVT do not have structural heart disease. Adenosine is the drug of choice for treatment.

Methods:

This was a retrospective study of all pediatric patients under age 14 with SVT diagnosed in the ED in a tertiary hospital in Spain between 2007 and 2011. Vagal maneuvers were attempted while IV access was obtained and if unsuccessful, incremental doses of Adenosine were given at 100, 200, and 300 mcg/kg. Data was also collected regarding age, sex, presenting symptoms, history of prior heart disease, disposition, as well as whether the episode resolved spontaneously, with vagal maneuvers, adenosine and if so number of doses, as well as other drugs used.

Results:

44 episodes of SVT were treated in 26 patients. Median age was 3.1 years. Only 2 patients had associated structural heart disease, one had an unbalanced AV canal, the second had mild mitral insufficiency. In 78% of patients treated, it was for a 2nd or further episode. 5 patients did not receive Adenosine because they either converted spontaneously (3), converted with Vagal maneuvers (1), and one with prior diagnosis of Coumel tachycardia treated with propranolol. In patients who received Adenosine, 75% converted and 10 did not respond. 4 of these were given B-blockers, 3 Amiodarone, 1 Amiodarone plus cardioversion. One died, a 7 day old infant with SVT and severe biventricular dysfunction. 12 patients (30%) received 1 dose, 16 two doses, and 9 received 3 doses.

Of the 40 treated with adenosine in the ER, 29 were discharged home (66%), 11 were admitted to the PICU, 4 to the Pediatric ward. Criteria for admission included unresponsive to Adenosine, heart failure and hemodynamic instability and very young (1 month). 7 of the patients admitted to the PICU had additional episodes of SVT requiring additional Adenosine, Amiodarone or beta blockers.

Final diagnosis of the 44 episodes showed 31 accessory pathway reentries, 6 WPW, 3 permanent reciprocating tachycardia of the union (Coumel tachycardia), 2 atrial flutter, 1 intranodal reentry and 1 junctional ectopic tachycardia.

Discussion:

Adenosine is successful in cardioverting 70-85% of Pediatric cases of SVT. Patients who did not respond to Adenosine in this study had signs of severe heart failure on presentations. In these cases, Adenosine may not have been effective because of the slowing of venous circulation. The initial dose recommended is 100 mcg/kg, but only 24% of patients in this study converted with this dose and the overall average cumulative dose received by patients in this study was 275 mcg/kg with a maximum of 900 mcg/kg without undesirable side effects, suggesting the dose recommended by PALS is insufficient and the starting dose should be closer to 200 mcg/kg.

Most pediatric patients with SVT do have structurally normal hearts. SVT is most common in children younger than 1 year, usually under 4 months. When the first onset of SVT occurs after 1 year of age, the prognosis is less favorable with spontaneous remission rates of 15-20% at 12 years. Patients in this young age group also tend to present with more nonspecific symptoms, cyanosis, difficulty feeding, tachypnea, sweating which often results in delays in diagnosis which may be the reason more of these children present in CHF or with some evidence of cardiovascular collapse. In the ER, patients should have an EKG and if successfully cardioverted and stable, should follow up with a pediatric cardiologist as an outpatient. As with adults, if the patient is unstable, cardioversion is recommended. Admission is recommended if Adenosine is unsuccessful, the patient is unstable with signs of CHF on arrival, or if there is a history of structural heart disease.

Limitations:

Although SVT is a common dysrhythmia in Pediatrics, it is overall uncommon, making the sample size small. It was also a retrospective study which did not directly compare a lower initial dose of Adenosine to a higher dose. Other factors such as location of IV were also not taken into account and could be a factor given Adenosine's short half life.

Bottom Line:

Adenosine is a very effective drug for treating SVT in Pediatrics and Adults and while its ineffectiveness is a reason for admission, ineffectiveness of the first dose is not at all uncommon and should not be seen a sign that additional higher doses will be ineffective. This was a study done in Spain; the U.S. recommendation is 100 mcg/kg and then additional doses of 200 mcg/kg.
