

## Differential Diagnosis of Paroxysmal Supraventricular Tachycardias by Administration of Adenosine during Sinus Rhythm

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### Summary

*According to recently published data, administration of adenosine-5'-triphosphate (ATP) during sinus rhythm can be used to identify dual AV node physiology. The aim of our study was to test, whether adenosine, the end-product of the ATP metabolisation cascade has the same potential in revealing slow pathway conduction. 38 patients (pts) undergoing electrophysiology study (EPS) and radiofrequency (RF) ablation for paroxysmal supraventricular tachycardia (PSVT) were enrolled. All pts had documented PSVT and either atrioventricular node re-entrant tachycardia or atrioventricular re-entrant tachycardia was confirmed at EPS. A rapid iv. bolus of adenosine was administered at 6 mg and 12 mg doses through a sheath in the femoral vein to all patients prior to atrial stimulation. Dual AV node pathway physiology was defined as an increment in AH interval of 50 msec or more between two consecutive sinus beats after adenosine or after a 10 ms decrement in coupling interval during atrial extrastimuli. The slow AV node pathway was successfully ablated in 15/20 pts verified by atrial extrastimulus tests after ablation. Atrioventricular block (AVB) for one or more beats was observed in 10/15 pts in response to adenosine post-ablation, while no significant change in AH time was found in the other five pts. In 2/20 pts who had slow AV node pathway modification (dual AV node pathways but no inducible tachycardia on Isuprel), AVB also appeared in response to adenosine after ablation. Successful ablation of the fast AV node pathway was performed in 3 pts after failure of slow pathway ablation. No post-ablation adenosine test was performed in these pts. Pts who had accessory pathways with anterograde conduction and overt pre-excitation showed no dual AV node pathway physiology at EPS or adenosine test post-ablation. According to our results, the adenosine test is reliable in revealing dual AV node pathway physiology and in identifying success after RF ablation or modification of the slow AV node pathway.*

### Key Words

AVNRT, RF ablation, adenosine-5'-triphosphate (ATP)

### Background

Atrioventricular node (AV) re-entry or atrioventricular re-entry is the arrhythmia mechanism in more than 90% of all paroxysmal supraventricular tachycardias (PSVT). Differential diagnosis of these two entities during invasive electrophysiology study (EPS) is based on standard criteria including demonstration of dual AV node pathway physiology with atrial extrastimuli. In a recent report [1-3], administration of adenosine-5'-triphosphate (ATP) during sinus rhythm was shown to be a valuable test in making dual AV node pathway physiology apparent even on the surface electrocardiogram. Adenosine, the end product of the ATP

metabolisation cascade with a very short half-life has recently been widely used to terminate supraventricular tachycardias with less adverse effects than ATP. Indeed, due to its efficacy and safety profile, adenosine of 6 or 12 mg has become the drug of choice for most physicians to terminate PSVTs.

The aim of our study was to investigate, whether adenosine can also be used in the differential diagnosis of PSVTs based on its potential in revealing dual AV node pathway physiology in a consecutive series of patients undergoing EPS and radiofrequency (RF) ablation for PSVT.

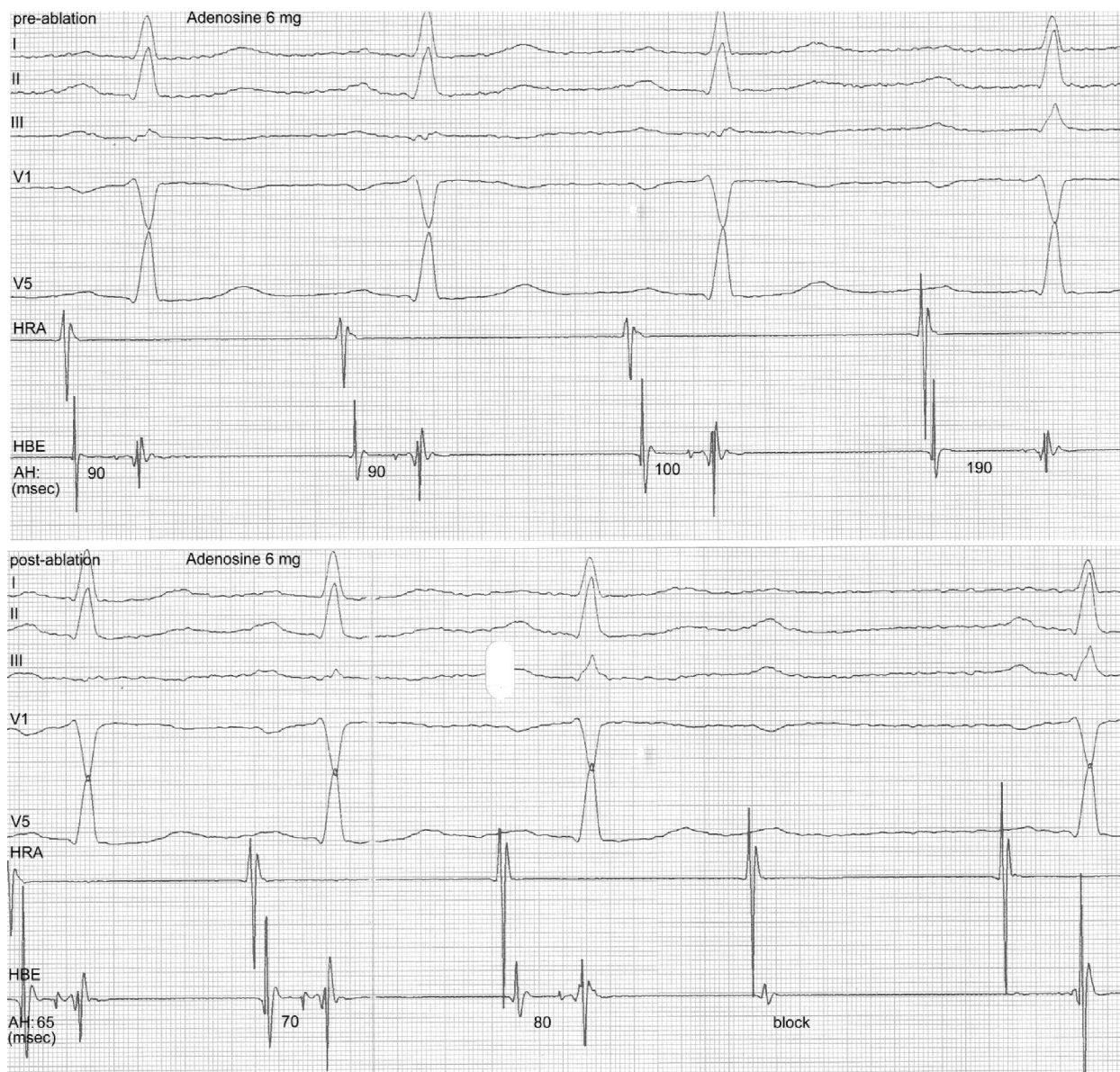


Figure 1. A typical response to Adenosine in a patient with dual AV node pathways and AV node re-entrant tachycardia before and after slow AV node pathway ablation. Pre-ablation (upper panel) a 90 ms jump was observed in the 4<sup>th</sup> beat after a 6 mg Adenosine bolus. Post-ablation (lower panel) slight prolongation in the AH interval (65-80 msec) after Adenosine is followed by atrioventricular block (4<sup>th</sup> beat). I, II, III, V1, V5: surface leads; HRA: High Right Atrium, HBE: His Bundle Electrogram.

## Methods

38 patients (23 female, age: 16-63 years) undergoing EPS and RF ablation for PSVT were enrolled. All patients had documented PSVT and either atrioventricular node re-entrant tachycardia (AVNRT) or atrioventricular re-entrant tachycardia (AVRT) was confirmed at EPS using standard criteria. Patients with atrial tachycardia or flutter were excluded.

A rapid iv. bolus of Adenosine was administered at 6 mg and 12 mg doses through a sheath in the femoral vein to all patients prior to atrial stimulation. Dual AV node pathway physiology was defined as an increment in AH interval of 50 ms or more between two consecutive sinus beats after Adenosine or after a 10 ms decrement in coupling interval during atrial extrastim-

uli. The 12 mg dose was applied, if the criterion for dual AV node pathways was not met with the 6 mg dose. After evaluation of the arrhythmia mechanism, RF ablation was performed in the same session. For AVNRT, always the slow AV node pathway was targeted initially, followed by ablation of the fast pathway if attempts at slow pathway ablation did not eliminate dual AV node pathways or tachycardia inducibility with or without Isuprel infusion. In patients with overt pre-excitation, the Adenosine and atrial extrastimulus test were repeated after RF ablation of the accessory pathway. The Adenosine test and EPS were also repeated after RF modification or ablation of the slow AV node pathway.

### Results

AVNRT was diagnosed in 20 patients based on atrial extrastimulus testing. In 14 of these 20 patients, dual AV node pathway physiology was revealed with the help of the Adenosine test pre-ablation. Single AV node echo beat was also observed after adenosine in 3 of these patients, however, AVNRT was not induced in any patient. None of the 20 patients with atrioventricular re-entrant tachycardia showed signs of dual AV node pathways with Adenosine. Therefore, the Adenosine test proved to have 70% sensitivity and 100% specificity in the diagnosis of dual AV node pathways. A positive Adenosine test was achieved using the 6 mg dose in 9 and the 12 mg dose in 5 patients.

The slow AV node pathway was successfully ablated in 15 out of 20 patients indicated by elimination of the slow AV node pathway at atrial extrastimulus test after ablation. Atrioventricular block in 1 or more beats was observed in 10 out of these 15 patients in response to Adenosine post ablation, while no significant change in AH time was found in the other five patients. In two patients out of the 20 who had slow AV node pathway modification (dual AV node pathways but no inducible tachycardia on Isuprel), atrioventricular block also appeared in response to Adenosine after the ablation. Successful ablation of the fast AV node pathway was performed in 3 patients after unsuccessful attempts at slow pathway ablation. No post ablation Adenosine test was performed in these patients. Patients who had an accessory pathway with anterograde conduction and

overt pre-excitation showed no dual AV node pathway physiology at EPS or Adenosine test post-ablation.

Atrial fibrillation episodes with spontaneous termination developed after Adenosine in two out of 38 patients, but no other complication was observed.

### Discussion

Endogenous nucleotides are known to have a strong effect on AV node conduction and ATP has been used to terminate PSVTs dependent on AV node conduction. During metabolism, ATP breaks down to Adenosine-5' diphosphate (ADP), then Adenosine-5' monophosphate (AMP) and eventually to Adenosine. These metabolites are known to also have similar effects on AV node conduction resulting in an undesirably prolonged effect of ATP in some patients. On the contrary, Adenosine, the last metabolite in this cascade has a very short half-life that makes it an ideal drug to terminate PSVT without the disadvantage of a prolonged AV conduction block.

The diagnostic use of ATP recently proposed by Belhassen's group [1-3] is based on its potential to selectively block the fast AV node pathway in patients with dual AV node pathways and AVNRT. They reported a 76% sensitivity with administration of multiple doses of ATP. In our study with 1 or 2 doses of Adenosine a similar result for sensitivity (70%) was achieved, indicating that Adenosine administration is a simple and safe test with excellent sensitivity and specificity for differentiation of the arrhythmia mechanism in patients with PSVT. The Adenosine test was also found to be reliable in identifying success after RF ablation or modification of the slow AV node pathway.

### References

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