Asymptomatic patient with WPW

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Preexcitation syndrome

1930 Wolff, Parkinson and White: 12 young patients with “functional bundle branch block, short PR and episodes of tachycardia”

1943 F. Wood: First pathologic description of accessory pathway

1943 RF Ohnell: First use of the term: ventricular preexcitation”

1968 W. Sealy: First surgical treatment of WPW

1984 Morady and Scheinmann: Development of catheter ablation

1988-now: Multiple authors reporting progressively better results with RF ablation, cryoablation, newer mapping methods, Pediatric RF Ablation Registry, PAPCA study
In recent years, the use of electrocardiograms (ECGs) for:

1. Screening prior to sports participation
2. Medical and surgical procedures
3. Initiation of some medications

Has identified increasing numbers of asymptomatic individuals with a WPW ECG pattern
Preexcitation syndrome ECG

A shortened PR interval (typically <120 ms in a teenager or adult)

A slurring and slow rise of the initial upstroke of the QRS complex (delta wave)

A widened QRS complex (total duration >0.12 seconds)

ST segment–T wave (repolarization) changes, generally directed opposite the major delta wave and QRS complex, reflecting altered depolarization
Etiology

- Failure of insulating tissue maturation within the atrioventricular (AV) ring
- "acquired"
- Pompe disease (GAA), Danon disease, and other glycogen-storage diseases
- Ebstein multiple accessory bypass tracts, mostly on the right. The orthodromic reciprocating tachycardia in such patients often exhibits right bundle-branch block (RBBB) and a long ventriculoatrial (VA) interval.
- Rhabdomyomas
- Hypertrophic cardiomyopathy
Natural history and presentation of WPW

1–3 in 1000 individuals

5.5 in 1000 among first-degree relatives

3.4% of those with WPW syndrome have first-degree relatives with preexcitation

65% of adolescents and 40% of individuals over 30 years are asymptomatic

4 newly diagnosed cases of Wolff-Parkinson-White (WPW) syndrome per 100,000 population occur each year
Ventricular pre-excitation in the general population: a study on the mode of presentation and clinical course

J A Goudevenos, C S Katsouras, G Graekas, O Argiri, V Giogiakas, D A Sideris

<table>
<thead>
<tr>
<th></th>
<th>Male</th>
<th>Female</th>
<th>p Value</th>
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<tr>
<td>n (%)</td>
<td>108 (69)</td>
<td>49 (31)</td>
<td>&lt; 0.001</td>
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<td>Age at diagnosis (years)</td>
<td>0 to 84</td>
<td>6 to 83</td>
<td>–</td>
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<tr>
<td>Range</td>
<td>39.6 (20.6)</td>
<td>49.1 (21.0)</td>
<td>&lt; 0.01</td>
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Conclusions—WPW pattern is more common, and diagnosed at a younger age, in men than in women. About half the patients with WPW pattern on ECG are asymptomatic at diagnosis and tend to remain so thereafter. No sudden cardiac death occurred during the study period. (Heart 2000;83:29–34)
Bimodal Age Distribution

In the 1\textsuperscript{st} year of life the accessory pathway loses anterograde conduction in as many as 40\% of patients.

If WPW and tachycardia coexist in an individual beyond 5 years of age, they continue to be present more than a decade later in more than 75\% of individuals.

The loss of preexcitation in children and adolescents over a 5 year period is variable (0\%–26\%).
Rarely patients present with WPW due to the hemodynamic effects of preexcitation alone.
WPW syndrome: A Wolf(f) in sheep’s clothing?

Most worrisome are the uncommon presentations of syncope or aborted sudden cardiac arrest as the first manifestation of WPW syndrome.
AF with preexcitation in previously asymptomatic 12 yr old presenting with syncope
Ventricular fibrillation during AVRT
<table>
<thead>
<tr>
<th>Author</th>
<th>Patients</th>
<th>Years studied</th>
<th>Age</th>
<th>Follow-up (y)</th>
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<th>SCD per patient-year</th>
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<td>21</td>
<td>20</td>
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<td>Leitch (1990)</td>
<td>75</td>
<td>1980–1988</td>
<td>34 ± 13</td>
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<td>Klein (1989)</td>
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<td>1981–1989</td>
<td>45</td>
<td>4.5</td>
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<td>Munger (1993)</td>
<td>113*</td>
<td>1953–1989</td>
<td>33 ± 16</td>
<td>12</td>
<td>2</td>
<td>0.0015</td>
<td>Both SCD patients were symptomatic</td>
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<td>Inoue (2000)</td>
<td>57</td>
<td>1985–1993</td>
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<td>8</td>
<td>0</td>
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<td>Goudevenos (2000)</td>
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<td>1990–1997</td>
<td>20</td>
<td>4.6</td>
<td>0</td>
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<td>Fitzsimmons (2001)</td>
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<td>1955–1999</td>
<td>34.3</td>
<td>21.8</td>
<td>1</td>
<td>0.0002</td>
<td>SCD patient had SVT and atrial fibrillation</td>
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<td>Sarubbi (2003)</td>
<td>98</td>
<td>1985–2001</td>
<td>5.4</td>
<td>4</td>
<td>1</td>
<td>0.0019</td>
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<td>Pappone (2003)</td>
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<td>1993–1996</td>
<td>36 ± 21</td>
<td>3.2</td>
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<td>0.0150</td>
<td>2 patients had VF and were resuscitated</td>
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<td>Santinelli (2009)</td>
<td>184</td>
<td>1995–2005</td>
<td>10</td>
<td>4.6</td>
<td>0</td>
<td>0.0000</td>
<td>3 patients had VF and were resuscitated</td>
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</table>
Radiofrequency Ablation in Children with Asymptomatic Wolff–Parkinson–White Syndrome

Carlo Pappone, M.D., Ph.D., Francesco Manguso, M.D., Ph.D., Raffaele Santinelli, M.D., Gabriele Vicedomini, M.D., Simone Sala, M.D., Gabriele Paglino, M.D., Patrizio Mazzone, M.D., Christopher C. Lang, M.B., Ch.B., Simone Gulletta, M.D., Giuseppe Augello, M.D., Ornella Santinelli, M.D., and Vincenzo Santinelli, M.D.

**Figure 2.** Survival Free of Arrhythmic Events among Children with Asymptomatic Wolff–Parkinson–White Syndrome at High Risk for Arrhythmias, According to Whether They Underwent Prophylactic Accessory-Pathway Ablation or No Ablation (Control).

P < 0.001 for the comparison between the ablation group and the control group (by the two-sample log-rank test).

**Figure 3.** Survival Free of Arrhythmic Events among Children with Asymptomatic Wolff–Parkinson–White Syndrome at High Risk for Arrhythmias Who Did Not Undergo Ablation, According to Whether They Had Single or Multiple Accessory Pathways.

P = 0.004 for the comparison between the two groups (by the two-sample log-rank test).
Usefulness of Invasive Electrophysiologic Testing to Stratify the Risk of Arrhythmic Events in Asymptomatic Patients With Wolff-Parkinson-White Pattern

Results From a Large Prospective Long-Term Follow-Up Study

Carlo Pappone, MD, PhD, Vincenzo Santinelli, MD, Salvatore Rosanio, MD, PhD, Gabriele Vicedomini, MD, Stefano Nardi, MD, Alessia Pappone, MD, Valter Tortoriello, MD, Francesco Manguso, MD, PhD, Patrizio Mazzone, MD, Simone Gulletta, MD, Giuseppe Oreto, MD, Ottavio Alfieri, MD
Asymptomatic Ventricular Preexcitation
A Long-Term Prospective Follow-Up Study of Adult Patients

343 adult subjects screened

50 refused to enter into the study

Electrophysiologic Testing

293 completed study

262 no arrhythmic events

31 total arrhythmic events
14 AVRT
17 potentially life-threatening
  4 AVRT + AF
  13 AF

Santinelli V et al. Circ Arrhythm Electrophysiol
2009;2:102-107
Asymptomatic Ventricular Preexcitation
A Long-Term Prospective Follow-Up Study of Adult Patients

79 patients (27%; mean age, 48±5 years): spontaneous disappearance of the δ wave

31 patients (10%) (median age, 25 years; IQR, 22 to 29) had a first arrhythmic event, potentially life-threatening in 17 (5,8%) (resuscitated cardiac arrest [1], presyncope [7] syncope [4], or dizziness [5]

Multivariate analysis: age ($P=0.004$), inducibility ($P=0.001$) and APERP ≤250 ms ($P=0.001$) predicted potentially life-threatening arrhythmias.

SPRR during AF not predictive of future events

Natural history of asymptomatic ventricular pre-excitation a long-term prospective follow-up study of 184 asymptomatic children

Median follow-up of 57 months (32-90 months)
133 children (mean age 10 years; 8 to 12 years) asymptomatic
51 children (27%) (mean f/u 20 months; 8-60 months) a first arrhythmic event
Potentially life-threatening in 19 (10%) (mean age 10 years; 10 to 14 years)
Cardiac arrest (3 patients), syncope (3 patients), atypical symptoms (8 patients), or minimal symptoms (5 patients)

Independent predictors by multivariate analysis were APERP ≤240 msec (p = 0.001) and multiple accessory pathways (p = 0.001)

Risk stratification in WPW
Determining which WPW patients are at highest risk for life-threatening arrhythmia by history alone remains a dilemma, but in the absence of noninvasive and invasive testing the reported warning flags appear to be younger age (<30 years), male gender, history of AF, prior syncope, associated congenital or other heart disease, and familial WPW.
Risk stratification in WPW

ECG during preexcited AF affords a “true” assessment of the anterograde characteristics of the accessory pathway **Shortest Pre-Excited R-R Interval (SPERRI)**. A SPERRI of 220–250 ms and especially less than 220 ms is more commonly seen in patients with WPW who have experienced cardiac arrest.
Exercise testing

Only abrupt and complete loss of preexcitation during exercise confirmed a long anterograde APERP

15%

Interobserver reliability difficulties in discerning subtle preexcitation when partially masked by rapid AV nodal conduction

APERP did not correlate well with the SPERRI during AF, except under the influence of isoproterenol.
Exercise testing
Serial ambulatory ECG monitoring may be used to screen for paroxysmal AF, especially in asymptomatic patients with a WPW.

In a prospective study of 184 asymptomatic children with WPW followed for 5 years, biannual Holter monitors identified paroxysmal AF in 22 patients (12%).
Rapid anterograde conduction, vulnerability to AF, and retrograde conduction of the accessory pathway was found in a significantly higher percentage of patients <25 years of age compared to those >25 years of age.

Use of isoproterenol during EP testing in children has been advocated as a possible surrogate of adrenergic stimulation for testing done under anesthetic conditions.
## Invasive electrophysiologic parameters in asymptomatic children and young adults with WPW pattern

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<th>Author</th>
<th>Pts</th>
<th>Age (y)</th>
<th>F/U (y)</th>
<th>APERP</th>
<th>APERP ≤240</th>
<th>SPERRI ≤250</th>
<th>Inducible SVT</th>
<th>PPV of SCD (SPERRI ≤250)</th>
<th>NPV of SCD (SPERRI ≤250)</th>
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<th>Actual death</th>
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<td>Pappone</td>
<td>212</td>
<td>36</td>
<td>3</td>
<td>275 ± 34</td>
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<td>47 (22%)</td>
<td>77 (42%)</td>
<td>3/48**</td>
<td>136/136**</td>
<td>3*</td>
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<td>Santinelli</td>
<td>184</td>
<td>10</td>
<td>4.7</td>
<td>270 (240–290)</td>
<td>48 (26%)</td>
<td></td>
<td>14 (61%)</td>
<td>0/23</td>
<td>49/49</td>
<td>0</td>
<td>0</td>
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<td>Dubin</td>
<td>23</td>
<td>12</td>
<td>2.5</td>
<td>2 (9%)</td>
<td>274 (240–325)</td>
<td>23 (31%)</td>
<td>22 (29%)</td>
<td>0/2</td>
<td>13/13</td>
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<tr>
<td>Leitch</td>
<td>72</td>
<td>34</td>
<td>4.3</td>
<td>293 (280–310)</td>
<td></td>
<td>438 ± 106</td>
<td>2 (13%)</td>
<td>3 (20%)</td>
<td>13/13</td>
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<td>Beckman</td>
<td>15</td>
<td>33</td>
<td>7.5</td>
<td>356 ± 194</td>
<td></td>
<td>277 ± 48</td>
<td>7 (17%)</td>
<td>16 (38%)</td>
<td>35/35</td>
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<td>Milstehn</td>
<td>42</td>
<td>36</td>
<td>2.4</td>
<td>333 ± 106</td>
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<td></td>
<td>5 (15%)</td>
<td>12 (55%)</td>
<td>0/3</td>
<td>31/31</td>
<td>0</td>
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<td>Satoh</td>
<td>34</td>
<td>36</td>
<td>1.3</td>
<td>252 ± 23</td>
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<td>12 (55%)</td>
<td>0/3</td>
<td>31/31</td>
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<td>Bremilla</td>
<td>40</td>
<td>35</td>
<td>1.8</td>
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<td>341 (150–650)</td>
<td>7 (18%)</td>
<td>7 (18%)</td>
<td>0/7</td>
<td>33/33</td>
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<td>10</td>
<td>1.6</td>
<td>240 (230–270)</td>
<td>230 (215–230)</td>
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<td>12 (44%)</td>
<td>14 (40%)</td>
<td>1*</td>
<td>3</td>
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<td>Pappone</td>
<td>35</td>
<td>22</td>
<td>5</td>
<td>240 (230–260)</td>
<td>240 (225–250)</td>
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<td>14 (40%)</td>
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<td>3</td>
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<td>Bertaglia</td>
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<td>20</td>
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<td>2 (25%)</td>
<td>27 (30%)</td>
<td></td>
<td>0/27</td>
<td>61/61</td>
<td>0</td>
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<td>Fazio</td>
<td>8</td>
<td>7.8</td>
<td>4.2</td>
<td>2 (25%)</td>
<td>2 (25%)</td>
<td></td>
<td>0 (0%)</td>
<td>0/2</td>
<td>1</td>
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<td>Sarubbi</td>
<td>35</td>
<td>10</td>
<td>4</td>
<td>276 ± 39</td>
<td></td>
<td>238 ± 9</td>
<td>5 (14%)</td>
<td>17 (48%)</td>
<td>30/30</td>
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Prosp ective Assessment after Pediatric Cardiac Ablation: 
Demographics, Medical Profiles, and Initial Outcomes

GEORGE F. VAN HARE, M.D.,1 HAROLD JAVITZ, PH.D., M.D.,2 DORIT CARMELLI, PH.D.,2
J. PHILIP SAUL, M.D.,3 RRONN E. TANEL, M.D.,4 PETER S. FISCHBACH, M.D.,5
RONALD J. KANTER, M.D.,6 MICHAEL SCHAFFER, M.D.,7 ANN DUNNIGAN, M.D.,8
STEVEN COLAN, M.D.,9 GERALD SERWER, M.D.,5 and Participating Members of the Pediatric
Electrophysiology Society

<table>
<thead>
<tr>
<th>TABLE 2</th>
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<td>Immediate Results of Ablation Procedures</td>
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<th>Cohort</th>
<th>CE Registry</th>
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<th>All Participants</th>
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<td>Total substrates</td>
<td>517/540 (96%)</td>
<td>508/537 (95%)</td>
<td>1,761/1,906 (92%)</td>
<td>2,786/2,983 (93%)</td>
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<tr>
<td>Substrate/pathway location</td>
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<td>Manifest accessory pathway</td>
<td>223/234 (93%)</td>
<td>192/204 (94%)</td>
<td>579/629 (92%)</td>
<td>994/1,067 (93%)</td>
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<td>Concealed accessory pathway</td>
<td>141/145 (97%)</td>
<td>145/152 (95%)</td>
<td>416/437 (95%)</td>
<td>702/734 (96%)</td>
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<td>Paroxysmal junctional reciprocating tachycardia</td>
<td>10/14 (71%)</td>
<td>19/20 (95%)</td>
<td>28/34 (82%)</td>
<td>57/68 (83%)</td>
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<td>Pathway location</td>
<td></td>
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<tr>
<td>Right free wall</td>
<td>59/65 (91%)</td>
<td>49/53 (93%)</td>
<td>186/208 (89%)</td>
<td>294/326 (90%)</td>
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<td>Right septal</td>
<td>74/81 (91%)</td>
<td>80/91 (88%)</td>
<td>238/267 (89%)</td>
<td>392/439 (89%)</td>
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<td>Left septal</td>
<td>21/22 (96%)</td>
<td>20/20 (100%)</td>
<td>54/66 (82%)</td>
<td>95/108 (88%)</td>
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<td>Left free wall</td>
<td>221/226 (98%)</td>
<td>202/206 (98%)</td>
<td>547/559 (98%)</td>
<td>970/991 (98%)</td>
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<td>AV nodal reentrant tachycardia</td>
<td>140/142 (99%)</td>
<td>148/153 (97%)</td>
<td>488/505 (97%)</td>
<td>776/800 (97%)</td>
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<td>Atrial fibrillation</td>
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<td>0/0 (N/A)</td>
<td>4/4 (100%)</td>
<td>4/4 (100%)</td>
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<td>Atrial flutter/infraatrial reentry</td>
<td>1/1 (100%)</td>
<td>2/3 (67%)</td>
<td>74/87 (85%)</td>
<td>77/91 (85%)</td>
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<td>Ectopic atrial tachycardia</td>
<td>1/2 (50%)</td>
<td>0/0 (N/A)</td>
<td>100/108 (93%)</td>
<td>101/110 (92%)</td>
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<td>Junctional ectopic tachycardia</td>
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<td>0/0 (N/A)</td>
<td>9/9 (100%)</td>
<td>9/9 (100%)</td>
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<td>Ventricular tachycardia</td>
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<td>1/1 (100%)</td>
<td>42/54 (78%)</td>
<td>43/55 (78%)</td>
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<td>Other</td>
<td>1/2 (50%)</td>
<td>1/1 (100%)</td>
<td>21/28 (75%)</td>
<td>23/31 (74%)</td>
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<td>Missing</td>
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<td>0/3 (0%)</td>
<td>0/11 (0%)</td>
<td>0/14 (0%)</td>
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</table>
Patients 0 to 16 years with SVT due to accessory pathways or AV nodal reentrant tachycardia (AVNRT) (n = 481)

Overall success rates for RF ablation: 95.7%

Higher success rates for left free-wall pathways (97.8%) than right free-wall pathways (90.8%)

Complications 4%, no deaths

AV block limited to AVNRT (2.1%) and septal AP (3.0%)

Recurrence: 10.7% at 12 months

Van Hare et al, J Cardiovasc Electrophysiol. 2004: 759-70

Risks of invasive EP study

- Venous Occlusion
- Arteriovenous Fistula
- Pulmonary Emboli
- Thrombophlebitis
- Infection
- Catheter induced Permanent Complete AV Block Induction
- Vf
- Radiation Exposure

Radiation exposure generally is avoided by the use of transesophageal Pacing or electromagnetic navigation systems
Cryoablation

With septal accessory pathways or in close proximity to the coronary sinus

Cryoablation for accessory pathways located near normal conduction tissues or within the coronary venous system in children and young adults

Yaniv Bar-Cohen, MD, Frank Cecchin, MD, Mark E. Alexander, MD, Charles I. Berul, MD, John K. Friedman, MD, Edward P. Walsh, MD

From the Electrophysiology Division, Department of Cardiology, Children's Hospital Boston, Boston, Massachusetts, and Department of Pediatrics, Harvard Medical School, Boston, Massachusetts.

<table>
<thead>
<tr>
<th></th>
<th>Anteroseptal location</th>
<th>Midseptal location</th>
<th>Mouth of coronary sinus/middle cardiac vein location</th>
<th>Total APs</th>
<th>Recurrence</th>
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<td></td>
<td>Success</td>
<td>Recurrence</td>
<td>Success</td>
<td>Recurrence</td>
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<td>Cryoablation study group</td>
<td>15/19 (79%)</td>
<td>4/15 (27%)</td>
<td>9/12 (75%)</td>
<td>5/6 (83%)</td>
<td>2/5 (40%)</td>
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<tr>
<td>(n = 37)</td>
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<td>29/37 (78%)</td>
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<tr>
<td>Institutional RF*</td>
<td>28/36 (78%)</td>
<td>4/28(14%)</td>
<td>16/20(80%)</td>
<td>41/46(89%)</td>
<td>1/41(2%)</td>
</tr>
<tr>
<td>(n = 102)</td>
<td></td>
<td></td>
<td></td>
<td>85/102(83%)</td>
<td></td>
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<tr>
<td>*P value cryoablation vs RF</td>
<td>.9</td>
<td>.3</td>
<td>.7</td>
<td>.002</td>
<td>.5</td>
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<td></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

Death as a complication of pediatric RFA

Mortality more frequent in patients with structural heart disease, smaller patients, those who received a greater number of RF energy applications, and those undergoing left-sided procedures.
Athletes recommendations

36th Bethesda Conference, risk stratification with an EP study is advisable in asymptomatic athletes engaged in moderate- to high-level competitive sports.

Slightly more aggressive statement from the European Society of Cardiology, which mandates that all athletes with WPW undergo comprehensive risk assessment including an EP study.
Current strategy for treatment of patients with Wolff–Parkinson–White syndrome and asymptomatic preexcitation in Europe: European Heart Rhythm Association survey

Jesper Hastrup Svendsen¹,², Nikolaos Dagres³, Dan Dobreanu⁴, Maria Grazia Bongiorni⁵, Germanas Marinskis⁶, and Carina Blomström-Lundqvist conducted by the Scientific Initiatives Committee, European Heart Rhythm Association

Table 1  Anticipated treatment strategy for a child presenting at your emergency department with overt WPW (pre-excitation) and symptomatic orthodromic AV-reentry tachycardia

<table>
<thead>
<tr>
<th>Treatment Strategy</th>
<th>Score 1 (fully disagree)</th>
<th>Score 2</th>
<th>Score 3</th>
<th>Score 4</th>
<th>Score 5 (fully agree)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Only ablation if severely symptomatic (%)</td>
<td>15.7</td>
<td>13.7</td>
<td>17.6</td>
<td>27.5</td>
<td>25.5</td>
</tr>
<tr>
<td>Only ablation if severely symptomatic despite medical therapy (%)</td>
<td>18.0</td>
<td>20.0</td>
<td>8.0</td>
<td>22.0</td>
<td>32.0</td>
</tr>
<tr>
<td>Only ablation if patient weighs &gt;15 kg (%)</td>
<td>14.0</td>
<td>10.0</td>
<td>14.0</td>
<td>38.0</td>
<td>24.0</td>
</tr>
<tr>
<td>Only ablation if parents have a strong wish for cure (%)</td>
<td>16.0</td>
<td>14.0</td>
<td>24.0</td>
<td>32.0</td>
<td>14.0</td>
</tr>
<tr>
<td>I will wait with ablation until the child can make its own decision (ideally &gt;18 years) (%)</td>
<td>37.4</td>
<td>17.6</td>
<td>13.7</td>
<td>13.7</td>
<td>17.6</td>
</tr>
</tbody>
</table>

In their answer to the question the responders should indicate to what degree they would agree with a statement. Score 1 indicates that the responder fully disagree with the statement, whereas score 5 indicates that the responder fully agrees with the statement.
Recommendations

An exercise stress test, when the child is old enough to comply, is a reasonable component of the evaluation if the ambulatory ECG exhibits persistent preexcitation

(Class IIA, Levels of Evidence B/C).
Recommendations

Utilization of invasive risk stratification (transesophageal or intracardiac) to assess the shortest preexcited R-R interval in atrial fibrillation is reasonable in individual whose noninvasive testing does not demonstrate clear and abrupt loss of preexcitation

(Class IIA, Levels of Evidence B/C)
Recommendations

Young patients with a <SPERRI 250 ms in atrial fibrillation are at increased risk for SCD. It is reasonable to consider catheter ablation in this group, taking into account the procedural risk factors based on the anatomical location of the pathway (Class IIA, Levels of Evidence B/C).
Recommendations

Young patients with a SPERRI >250 ms in atrial fibrillation are at lower risk for SCD, and it is reasonable to defer ablation (Class IIA, Level of Evidence C).

Ablation may be considered in these patients at the time of diagnostic study if the location of the pathway and/or patient characteristics do not suggest that ablation may incur an increased risk of adverse events, such as AV block or coronary artery injury (Class IIB, Level of Evidence C).
Recommendations

Young patients deemed to be at low risk might subsequently develop cardiovascular symptoms such as syncope or palpitations. These patients should then be considered symptomatic and may be eligible for catheter ablation procedures regardless of the prior assessment.

Military aviators followed over 2 decades, 23% with constant preexcitation developed reentrant SVT in comparison to the 8.3% who only exhibited intermittent preexcitation.

Recommendations

Asymptomatic patients with a WPW ECG pattern and structural heart disease are at risk for both atrial tachycardia and AV reciprocating tachycardia, which may result in unfavorable hemodynamics. Ablation may be considered regardless of the anterograde characteristics of the accessory pathway (Class IIB, Level of Evidence C).
Recommendations

Asymptomatic patients with a WPW ECG pattern and ventricular dysfunction secondary to dyssynchronous contractions may be considered for ablation, regardless of anterograde characteristics of the bypass tract

(Class IIB, Level of Evidence C).
Baseline Electrocardiogram

- Persistent manifest pre excitation
  - Exercise Stress Test
    - Persistent or uncertain loss of manifest pre excitation
    - Abrupt and clear loss of manifest pre excitation
      - Diagnostic transesophageal or intracardiac electrophysiology study
        - SPERRI in atrial fibrillation > 250 msec and absence of inducible SVT
          - Follow in cardiology with counseling regarding symptom awareness (Class IIA)
        - SPERRI in atrial fibrillation ≤ 250
          - May consider ablation based on pathway location and/or patient characteristics (Class IIB)
        - Inducible SVT
          - Discuss risk/benefits of ablation (Class IIA)

- Intermittent pre excitation
  - Follow in cardiology with counseling regarding symptom awareness
PACES/HRS expert consensus statement on the use of catheter ablation in children and patients with congenital heart disease

Developed in partnership with the Pediatric and Congenital Electrophysiology Society (PACES) and the Heart Rhythm Society (HRS). Endorsed by the governing bodies of PACES, HRS, the American Academy of Pediatrics (AAP), the American Heart Association (AHA), and the Association for European Pediatric and Congenital Cardiology (AEPC)

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Class I Ablation is recommended for the following:

1. WPW pattern following resuscitated cardiac arrest (LOE: B).
2. WPW pattern with syncope when there are predictors of high risk for cardiac arrest (LOE: B).

Class IIa Ablation can be useful for the following:

1. WPW pattern with ventricular dysfunction presumed due to dyssynchrony in larger patients, or when medical therapy is either not effective or associated with intolerable adverse effects in smaller patients (LOE: B). (Note: This indication was Class IIb in the prior guidelines for asymptomatic WPW).
2. WPW pattern without symptoms, in which there are predictors of high risk for cardiac arrest in larger patients (LOE: C).

Class IIb Ablation can be reasonable for the following:

1. WPW pattern without symptoms in larger patients with predictors of low risk for cardiac arrest, as a patient or family choice (LOE: E).
2. WPW pattern without symptoms in smaller patients (LOE: C).
3. WPW pattern with syncope, without predictors of high risk for cardiac arrest in larger patients (LOE: C).
4. WPW pattern without symptoms in larger patients when the absence of WPW pattern is a prerequisite for participation in personal or professional activities (LOE: E).

Class III Ablation is not recommended for the following:

1. WPW pattern caused by a fasciculoventricular accessory pathway (LOE: C).
2. WPW pattern without symptoms in smaller patients (LOE: C).
1. In asymptomatic patients with pre-excitation, the findings of abrupt loss of conduction over a manifest pathway during exercise testing in sinus rhythm (294–297) (Level of Evidence: B-NR) SR or intermittent loss of pre-excitation during ECG or ambulatory monitoring (297) (Level of Evidence: C-LD) SR are useful to identify patients at low risk of rapid conduction over the pathway.
2015 ACC/AHA/HRS Guideline for the Management of Adult Patients With Supraventricular Tachycardia

A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines and the Heart Rhythm Society

1. An EP study is reasonable in asymptomatic patients with pre-excitation to risk-stratify for arrhythmic events (254,256,298–301).

2. Catheter ablation of the accessory pathway is reasonable in asymptomatic patients with pre-excitation if an EP study identifies a high risk of arrhythmic events, including rapidly conducting pre-excited AF (254,302,303).

3. Catheter ablation of the accessory pathway is reasonable in asymptomatic patients if the presence of pre-excitation precludes specific employment (such as with pilots) (103,254,276–282,302-304).
4. Observation, without further evaluation or treatment, is reasonable in asymptomatic patients with pre-excitation (301,306-309).

Most observational cohort studies suggest that the great majority of adult patients with asymptomatic pre-excitation who do not undergo an ablation of the accessory pathway have a benign course with few clinically significant arrhythmic events occurring over time. This supports the recommendation that observation without medical therapy or ablation is a reasonable alternative because the risk of SCD is small and is seen mainly in children (254,301,306-309). The choice to observe asymptomatic patients should be preceded by the patient being informed of the small risk of life-threatening arrhythmias developing in the absence of treatment, along with the success rate and complications associated with catheter ablation of the accessory pathway.
Catheter navigation using the NavX system

Papagiannis et al, PACE 2006;29:971-8
What to do with asymptomatic WPW

Inform the parents/pt that the risk is quite low, but not 0, higher in young individuals

Risk of EP testing is very low but not 0 (2-3% for adverse events, less than 0.1% mortality and mostly in small pts <15 kg)

None of the non-invasive criteria is 100% sensitive (although spontaneous loss of delta usually reassuring)

Invasive EP testing is our preference after age 5-6, wt >25 kg if parents understand the above

If APERP under anesthesia <300, or if inducible AVRT usually ablate, unless location very unsafe