ARRHYTHMIA OF THE MONTH

Section Editor: Fred Morady, M.D.

Wide QRS Complex Tachycardia in a Patient with Wolff-Parkinson-White Syndrome and Cardiomyopathy: What is the Mechanism?

GREGORY F. MICHAUD, M.D., and BRADLEY P. KNIGHT, M.D.

From the Department of Internal Medicine, Division of Cardiology, University of Michigan, Ann Arbor, Michigan

Case Presentation

A 32-year old woman with severe mitral regurgitation, congestive heart failure, and Wolff-Parkinson-White syndrome developed frequent, nonsustained episodes of a wide QRS complex tachycardia several days postpartum. Figure 1 shows an ECG with telemetry lead I and modified chest lead (MCL) recorded while the patient complained of palpitations. The same pattern of initiation and termination of the wide QRS complex tachycardia was seen repeatedly. An example of ventricular preexcitation during sinus rhythm is shown in an ECG with identical leads in Figure 2. What is the mechanism of the wide QRS complex tachycardia?

Commentary

The ECG in Figure 1 shows a wide QRS complex tachycardia at a cycle length of 240 msec with an apparent 1:1 AV relationship. The differential diagnosis of a wide QRS complex tachycardia with a 1:1 AV relationship includes ventricular tachycardia, antidromic reentrant tachycardia, and paroxysmal supraventricular tachycardia with aberrant conduction.

Inspection of the first three QRS complexes in Figure 1 shows sinus rhythm at a cycle length of 640 msec followed by a slightly premature atrial depolarization with a different P wave morphology and shorter PR interval. The first three QRS complexes are not preexcited. It is not possible to discern whether the wide QRS complex depolarization at the onset of the tachycardia is preceded by a premature atrial depolarization. Therefore, inspection of the initiation of the tachycardia is not useful in differentiating ventricular tachycardia from antidromic reentrant tachycardia or supraventricular tachycardia with aberrant AV conduction.

The open arrow following the first wide QRS complex in Figure 3 shows an atrial depolarization that is seen with a fixed AV relationship during the tachycardia. At the termination of the tachycardia, the closed arrow shows an atrial depolarization with a longer ventriculoatrial interval that is followed by a narrow QRS complex. Termination of ventricular tachycardia should be independent of events arising in the atrium or AV node. Therefore, ventricular tachycardia is exceedingly unlikely to terminate simultaneous with a change in the AV relationship unless the tachycardia cycle length changes as well. Termination of supraventricular tachycardia, however, frequently occurs with a simultaneous change in the AV relationship. Additionally, there is no reason for termination of ventricular tachycardia to be linked with a narrow QRS complex unless a supraventricular depolarization captures the ventricle prematurely, which is not seen in this case. Conversely, termination of a supraventricular tachycardia with aberrant AV conduc-

J Cardiovasc Electrophysiol, Vol. 11, pp. 1179-1180, October 2000

Address for correspondence: Gregory F. Michaud, M.D., 2 Dudley Street, Suite 360, Providence, RI 02905. Fax: 401-444-3328; E-mail: gmichaud@lifespan.org

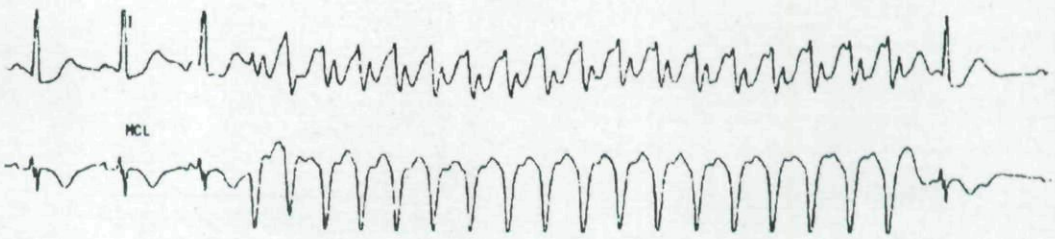


Figure 1.

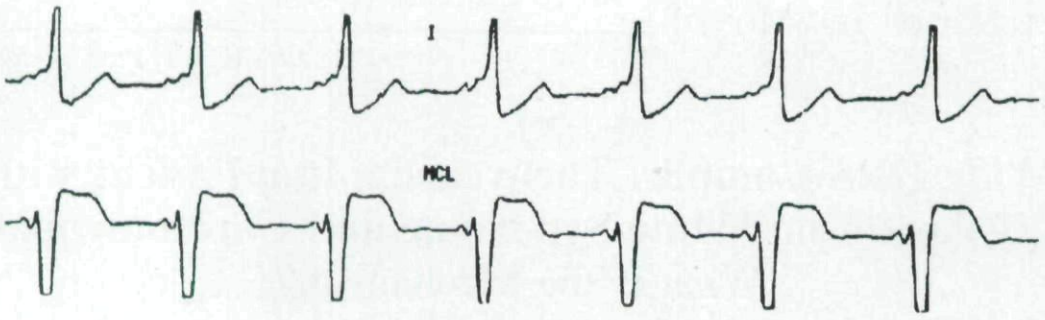


Figure 2.

tion may be preceded by a longer cycle length and subsequent loss of bundle branch block, as is seen in this case.

The remaining differential diagnosis of the supraventricular tachycardia mechanism includes antidromic or orthodromic reentrant tachycardia, AV nodal reentrant tachycardia, and atrial tachycardia. Antidromic reentrant tachycardia is unlikely given the morphology difference seen in lead I between the QRS complexes in the tachycardia (Fig. 1) and preexcited sinus rhythm (Fig. 2). Further evidence against antidromic reentrant tachycardia lies in the observation that the RP interval is shorter than the PR interval during the tachycardia. Atrial tachycardia is less likely than orthodromic reentrant tachycardia or AV nodal reentrant tachycardia because the AV relationship appears to be critically linked to the termination of the tachycardia. Between orthodromic reentrant tachycardia and atypical AV nodal reentrant tachycardia as the underlying supraventricular tachycardia mechanism, the observed intermittent preexcitation during sinus rhythm and the RP-PR relationship during tachycardia weigh heavily in favor of orthodromic reentrant tachycardia.

An electrophysiology study reproduced the wide QRS complex tachycardia and its characteristic termination with a narrow QRS complex. The patient was found to have a single, right posterolateral accessory pathway and dual AV nodal pathways. The mechanism of the wide QRS complex tachycardia was orthodromic reentrant tachycardia with aberrant conduction that terminated with retrograde block in the accessory pathway and a single (retrograde slow-anterograde fast) AV nodal reentrant beat with loss of aberrant conduction.

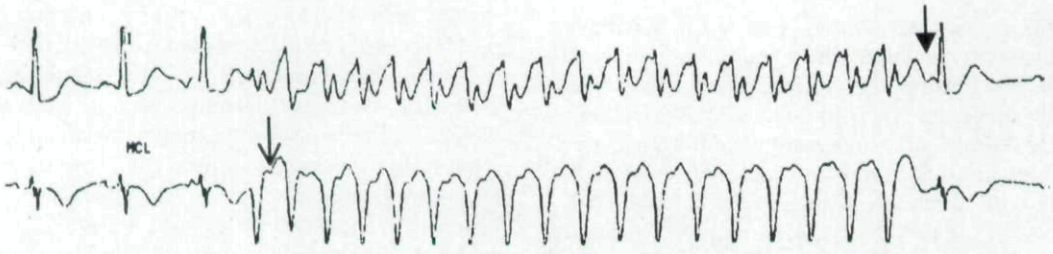
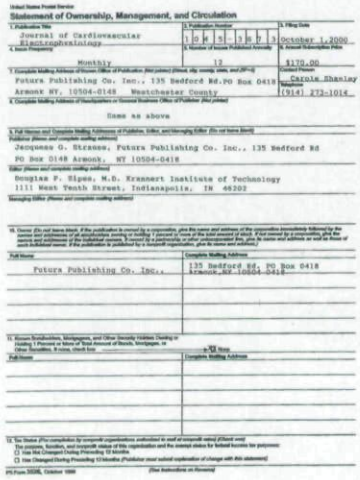


Figure 3.



Statement of Ownership, Management, and Circulation

1. Publication Title	2. Publication Number	3. Filing Date
Journal of Cardiovascular Electrophysiology	1 0 4 5 - 3 8 7 3	October 1,2000

4. Issue Frequency	5. Number of Issues Published Annually	6. Annual Subscription Price
Monthly	12	$170.00

7. Complete Mailing Address of Known Office of Publication (Not printer) (Street, city, county, state, and ZIP+4): Futura Publishing Co. Inc., 135 Bedford Rd.PO Box 0418 Armonk NY, 10504-0148 Westchester County — Contact Person: Carole Shanley; Telephone: (914) 273-1014

8. Complete Mailing Address of Headquarters or General Business Office of Publisher (Not printer): Same as above

9. Full Names and Complete Mailing Addresses of Publisher, Editor, and Managing Editor (Do not leave blank)
Publisher (Name and complete mailing address): Jacqueen G. Strauss, Futura Publishing Co. Inc., 135 Bedford Rd PO Box 0148 Armonk, NY 10504-0418
Editor (Name and complete mailing address): Douglas P. Zipes, M.D. Krannert Institute of Technology 1111 West Tenth Street, Indianapolis, IN 46202
Managing Editor (Name and complete mailing address):

10. Owner (Do not leave blank. If the publication is owned by a corporation, give the name and address of the corporation immediately followed by the names and addresses of all stockholders owning or holding 1 percent or more of the total amount of stock. If not owned by a corporation, give the names and addresses of the individual owners. If owned by a partnership or other unincorporated firm, give its name and address as well as those of each individual owner. If the publication is published by a nonprofit organization, give its name and address.)

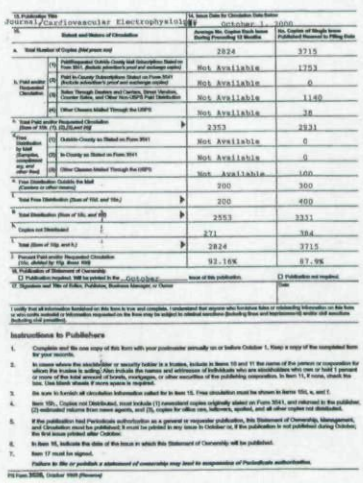
Full Name	Complete Mailing Address
Futura Publishing Co. Inc.,	135 Bedford Rd, PO Box 0418 Armonk,NY 10504-0418

11. Known Bondholders, Mortgagees, and Other Security Holders Owning or Holding 1 Percent or More of Total Amount of Bonds, Mortgages, or Other Securities. If none, check box → ☒ None

Full Name	Complete Mailing Address

12. Tax Status (For completion by nonprofit organizations authorized to mail at nonprofit rates) (Check one)
The purpose, function, and nonprofit status of this organization and the exempt status for federal income tax purposes:
☐ Has Not Changed During Preceding 12 Months
☐ Has Changed During Preceding 12 Months (Publisher must submit explanation of change with this statement)

PS Form 3526, October 1999 (See Instructions on Reverse)



13. Publication Title: Journal/Cardiovascular Electrophysiology	14. Issue Date for Circulation Data Below: October 1, 2000	
15. Extent and Nature of Circulation	Average No. Copies Each Issue During Preceding 12 Months	No. Copies of Single Issue Published Nearest to Filing Date
a. Total Number of Copies (Net press run)	2824	3715
b. Paid and/or Requested Circulation (1) Paid/Requested Outside-County Mail Subscriptions Stated on Form 3541. (Include advertiser's proof and exchange copies)	Not Available	1753
(2) Paid In-County Subscriptions Stated on Form 3541 (Include advertiser's proof and exchange copies)	Not Available	0
(3) Sales Through Dealers and Carriers, Street Vendors, Counter Sales, and Other Paid Distribution	Not Available	1140
(4) Other Classes Mailed Through the USPS	Not Available	38
c. Total Paid and/or Requested Circulation (Sum of 15b. (1), (2),(3),and (4))	2353	2931
d. Free Distribution by Mail (Samples, complimentary, and other free) (1) Outside-County as Stated on Form 3541	Not Available	0
(2) In-County as Stated on Form 3541	Not Available	0
(3) Other Classes Mailed Through the USPS	Not Available	100
e. Free Distribution Outside the Mail (Carriers or other means)	200	300
f. Total Free Distribution (Sum of 15d. and 15e.)	200	400
g. Total Distribution (Sum of 15c. and 15f)	2553	3331
h. Copies not Distributed	271	384
i. Total (Sum of 15g. and h.)	2824	3715
j. Percent Paid and/or Requested Circulation (15c. divided by 15g. times 100)	92.16%	87.9%

16. Publication of Statement of Ownership
☐ Publication required. Will be printed in the October issue of this publication. ☐ Publication not required.

17. Signature and Title of Editor, Publisher, Business Manager, or Owner — Date

I certify that all information furnished on this form is true and complete. I understand that anyone who furnishes false or misleading information on this form or who omits material or information requested on the form may be subject to criminal sanctions (including fines and imprisonment) and/or civil sanctions (including civil penalties).

Instructions to Publishers

1. Complete and file one copy of this form with your postmaster annually on or before October 1. Keep a copy of the completed form for your records.
2. In cases where the stockholder or security holder is a trustee, include in items 10 and 11 the name of the person or corporation for whom the trustee is acting. Also include the names and addresses of individuals who are stockholders who own or hold 1 percent or more of the total amount of bonds, mortgages, or other securities of the publishing corporation. In item 11, if none, check the box. Use blank sheets if more space is required.
3. Be sure to furnish all circulation information called for in item 15. Free circulation must be shown in items 15d, e, and f.
4. Item 15h., Copies not Distributed, must include (1) newsstand copies originally stated on Form 3541, and returned to the publisher, (2) estimated returns from news agents, and (3), copies for office use, leftovers, spoiled, and all other copies not distributed.
5. If the publication had Periodicals authorization as a general or requester publication, this Statement of Ownership, Management, and Circulation must be published; it must be printed in any issue in October or, if the publication is not published during October, the first issue printed after October.
6. In item 16, indicate the date of the issue in which this Statement of Ownership will be published.
7. Item 17 must be signed.

Failure to file or publish a statement of ownership may lead to suspension of Periodicals authorization.

PS Form 3526, October 1999 (Reverse)