Coexistence of Passive and Active Junctional Rhythms with Rates up to 300 Per Minute in a Child with Atrial Parasystole

Barry J. Maron, M.D., Barbara B. Bell, M.D., and M. Mirowski, M.D., F.C.C.P.

An 11-year-old boy, without evidence of structural cardiac disease, presented refractory passive and active junctional rhythms varying in rate from 60 to 300 per minute associated with atrial parasystole. The clinical course was complicated by heart failure and syncope. The arrhythmias responded poorly to therapy, although the ventricular rate could be adequately controlled with digitalis and propranolol.

Paroxysmal supraventricular arrhythmias are frequently encountered in children and usually respond well to therapy. Recently, however, we observed an 11-year-old child who demonstrated an unusually broad spectrum of junctional rhythms, associated with an atrial parasystole. The exceptional nature of these arrhythmias and their clinical and electrophysiologic implications prompted the reporting of this case.

CASE REPORT

An 11-year-old Negro boy, referred to The Johns Hopkins Hospital Outpatient Clinic for an infected toe, was found to have tachycardia of 275 per minute which terminated spontaneously. No congestive heart failure was noted. Digoxin was prescribed on an outpatient basis.

Two months later, the patient was hospitalized because of faintness and dizziness. Tachycardia of 240 per minute was present which did not respond to carotid sinus massage. During this and following admissions, junctional rhythms with rates varying between 50 and 300 per minute were recorded (Fig 1, 2, 3). Occasionally, brief bouts of sinus rhythm were noted. Physical examination, chest x-ray examination, and laboratory tests which included thyroid and virologic studies, gave normal findings. Cardiac catheterization and selective right atrial angiography demonstrated no abnormalities. Because the patient was in sinus rhythm at the time of cardiac catheterization, His bundle recordings were not performed. Digoxin was withdrawn for five days without change in rhythm and resumed thereafter.

When readmitted to the hospital three months later, heart failure with moderate cardiomegaly and tachycardia of 275 per minute were present. Digoxin dose was increased and diuretics were added resulting in a temporary resumption of sinus rhythm.

During the next year, three additional hospitalizations

*From the Department of Pediatrics, The Johns Hopkins Hospital, Baltimore, and the Department of Medicine, Sinai Hospital of Baltimore. This work was supported in part by General Research Support Grant 550-4P1-05478-08 and by Maternal and Child Health Project Service 12H 201 from the U.S. Public Health Service, National Institutes of Health. Reprint requests: Dr. Mirowski, Sinai Hospital of Baltimore, Inc., Baltimore 21215

References

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were required: twice for episodes of syncope on exertion and once for heart failure with tachycardia. When propranolol was added to digoxin, the patient became free of symptoms, his heart rates varying between 50 and 110 per minute. However, the junctional origin of the rhythm persisted.

Electrocardiographic Data

Junctional rhythms varying in rate between 50 and 300 per minute characterized this patient's electrocardiographic picture. Among the large number of tracings available, the following representative rhythm strips were selected for analysis.

Figure 1A begins with two conducted sinus beats (arrows). The second beat is followed by marked slowing of the sinus rhythm, an increase of the P-P interval to 0.96 sec as compared to 0.88 sec in the initial two beats. Consequently, a junctional escape rhythm at a rate of 70 beats per minute emerges with atrioventricular (A-V) dissociation. The junctional origin of this rhythm is indicated by the configuration of the QRS complexes which are not preceded by P waves. Although the QRS configuration is normal, it is distinctly different from the conducted sinus beats.

Figure 1B shows the same junctional rhythm, but with a rate of 115 per minute. Incomplete A-V dissociation is present with a few sinus capture beats (arrows). The relative prolongation of the PR interval of the sinus capture beats (0.18 sec) is most probably due to concealed conduction in the A-V junctional tissue, made partially refractory by the preceding junctional beat.

Figure 2 displays a rhythm strip recorded during a paroxysm of rapid junctional tachycardia. The rate is 275 per minute. The similarity of the QRS configuration to those observed when the junctional rhythms were slower is evident. Occasionally, peaked and tall P waves, clearly of ectopic origin, are noted (arrows). The interectopic intervals are multiples of the basic P-P interval, varying between 0.28 and 0.29 sec. This indicates an atrial parasystolic focus firing at a rate of 250 per minute.

Figure 3 shows an example of junctional tachycardia of 300 per minute. Again, the similarities of the QRS configuration to that of previously described junctional rhythms are obvious and document the nature of the arrhythmia. The possibility of an atrial flutter with 1:1 conduction might be considered, but can be excluded by reference to other electrocardiograms.

DISCUSSION

Junctional rhythms are conveniently classified as passive or active.1 Passive (escape) rhythms result from slowing or failure of the dominant atrial pacemaker, the subsidiary A-V junctional center taking over control of the heart with its inherent discharge rate of 50 to 60 beats per minute.2,3 Active junctional rhythms, on the other hand, are more rapid and reflect enhanced automaticity of the A-V junctional area or a reentry mechanism. The junctional tachycardias are either paroxysmal, with an abrupt onset and termination of the arrhythmia, or nonparoxysmal, as described by Pick and Dominguez.1 While the paroxysmal forms often occur in otherwise normal individuals and generally have rates of 160 to 220 beats per minute, the nonparoxysmal junctional tachycardias are usually associated with organic heart disease or with digitalis intoxication and their rates are slower, ranging between 60 and 150 per minute.

Several facets of the present case deserve special comment. Probably its most intriguing feature is the coexistence of passive and active junctional rhythms in the same patient. This finding is quite unexpected in view of the totally different underlying mechanisms of these two variants. While the passive form indicates
depression of the sinus node and of other automatic atrial centers, the presence of active rhythms points toward functional or structural changes in the A-V junction. It is difficult to suggest a specific etiologic factor or pathologic state which would serve as a common denominator for the association of these conceptually different disorders. Scattered reports of focal myocardial disease associated with rapid tachycardias of 300 or more beats per minute in children have been reported, but their relevance to this case is only speculative.

The fact that the junctional tachycardias exhibited by our patient were occasionally as rapid as 300 per minute is also significant from another point of view. While rates of 250 per minute are mentioned in the literature, this case is the first, as far as we were able to ascertain, documenting the capability of the A-V junction to drive the heart at such an exceptionally rapid rhythm.

The nature of atrial activity during the junctional rhythms in our case cannot be clarified from the available data. Occasionally, however, the existence of an atrial parasystolic focus was evident. Parasystole is generally found in adults with serious heart disease, but does occur in normal subjects. The most common site is ventricular, and atrial parasystole is much less frequent. A review of the literature did not reveal previously reported cases of atrial parasystole in childhood.

REFERENCES

ANNOUNCEMENTS

Third International Congress, International Radiation Protection Association

The Third International Congress of the International Radiation Protection Association has been scheduled to take place at the Washington-Hilton Hotel, Washington, D.C., September 9-14. Sessions will be conducted simultaneously in English, French and Russian. Direct inquiries to Mr. Robert A. Catlin, Congress Secretary-General, U.S. Atomic Energy Commission, Washington, D.C. 20545.

Symposium on Sero-Diagnosis of Cancer

The First invitational Symposium on the Sero-diagnosis of Cancer, cosponsored by the Laboratory Service, Naval Hospital (Bethesda), the College of American Pathologists, the American Society of Clinical Pathologists, and the Armed Forces Radiobiology Research Institute will be held September 29 at the Naval Hospital Auditorium, National Naval Medical Center, Bethesda. For information, write the College of American Pathologists, 1775 K Street NW, Washington, D.C. 20006.

Courses in Clinical Management and Control of Tuberculosis

Postgraduate courses in clinical management and control of tuberculosis, presented by the National Jewish Hospital with the cooperation of the University of Colorado Medical School, Denver Health Department, Colorado State Health Department, Fitzsimons Army Medical Center, Colorado Tuberculosis and Respiratory Disease Association and the American Thoracic Society will be held at the National Jewish Hospital, Denver, August 20-31 and November 5-16, 1973. For further information, please write Paul T. Davidson, M.D., chief, Tuberculosis Section, Department of Medicine, NJH, 3800 East Colfax Avenue, Denver 80206.

Symposium on Pulmonary Disease

The 26th Annual Symposium on Pulmonary Disease will be held at Fitzsimons Army Medical Center, Denver, September 10-14. The symposium is sponsored jointly by Fitzsimons Army Medical Center and the University of Colorado School of Medicine. Information may be obtained from the Program Director, Pulmonary Disease Symposium, Fitzsimons Army Medical Center, Denver 80240.

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