ELECTROCARDIOGRAM OF THE MONTH
INTRACARDIAC ELECTROGRAM

Paradoxic Slowing of Ventricular Rate with Intravenous Isoproterenol in a Patient with A-V Block*

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A recent clinical report demonstrated facilitation of conduction in both the A-V node and His-Purkinje system with intravenous isoproterenol.1 Despite this facilitation of conduction, it was anticipated that paradoxic worsening of conduction could occur in patients with bilateral bundle branch disease, due to increase in atrial rate with this agent.1

In this report, we document paradoxic worsening of heart block and slowing of ventricular rate during isoproterenol infusion in a patient with 2:1 A-V block distal to the His bundle. The implications of these findings are briefly discussed.

CASE REPORT

A 35-year-old man with known mild calcific aortic stenosis developed syncope for the first time on September 29, 1974 while strolling in a park. He was taken to a neighborhood hospital where a pulse rate of 36 was noted; he was hospitalized. A second episode of syncope occurred, and he was transferred to the West Side VA Hospital on October 4, 1974. Upon arrival, 2:1 A-V block was noted, with conducted beats showing a left bundle branch block pattern. Electrophysiological study was performed one hour after admission. The atrial rate was 80/min. There was 2:1 block distal to the His bundle with a conducted H-V interval of 100 msec (normal2 31-55 msec) (Fig 1A). These findings suggested bilateral bundle branch disease with complete left bundle branch block and 2:1 block in the right bundle branch.

Isoproterenol 0.2 mg was dissolved in 200 ml of normal saline solution and given by continuous intravenous infusion. The atrial rate rose to 140/min and concomitantly complete A-V block distal to the His bundle developed (Fig 1B). During complete heart block, ventricular escape rate was 10-30/min with five second asystolic periods (Fig 1B). Temporary ventricular pacing was instituted. With discontinuance of isoproterenol, 2:1 A-V block returned with an atrial rate of 80/min and ventricular rate of 40/min. A permanent pacemaker was implanted on October 7, 1974 and syncope has not recurred.

DISCUSSION

Schwartz and Schwartz3-5 described occasional paradoxic slowing of ventricular rates in patients with advanced A-V block during administration of isoproterenol, atropine, ephedrine, and epinephrine, as well as paradoxic speeding of ventricular rates with carotid massage. Our patient demonstrated acceleration of atrial rate from 80 to 140/min during isoproterenol infusion, with development of complete heart block at the latter rate. The worsening of block presumably reflected the inability of the diseased His-Purkinje system to conduct the increased numbers of impulses delivered. Mechanisms involved would include fixed prolonged bundle branch refractoriness (despite isoproterenol) and antegrade repetitive concealed conduction.

Our patient resembles a similar case of paradoxic worsening of block distal to the His bundle with atropine administration, previously reported by Haft and co-workers.7 Both the present and previous reports highlight the potential hazard of drugs used in the emergency management of A-V block. The therapy of choice for symptomatic advanced heart block should be pacemaker insertion.
FIGURE 1. Panel A: Control recordings showing 2:1 A-V block distal to His bundle. Shown are ECG leads I, 2, and 3, high right atrial electrogram (HRA) and two His bundle electrograms (HBE). P waves are labeled P, and His deflections H. Atrial and ventricular rates are listed, as are the A-H and H-V intervals. Paper speed is 100 mm/sec, and time lines are at 1 second. Panel B: Paradoxic slowing during isoproterenol infusion. Note complete heart block distal to H with a five-second asystolic period.

REFERENCES
2 Dhingra RC, Rosen KM, Rahimtoola SH: Normal conduction intervals and responses in 61 patients using His bundle recordings and atrial pacing. Chest 64:55-59, 1973