The usual site of block of premature atrial contractions (PACs) is in the atroventricular AV node proximal to the His bundle. We know of only two published cases in which the site of block of PACs was demonstrated distal to the His recording site.1,2

In this report we describe a patient who had both true sinus bradycardia due to carotid sinus syndrome and infra-His blocked PACs, which in bigeminal rhythm also simulated the presence of sinus bradycardia on the surface ECG.

CASE REPORT

A 55-year-old man with an old myocardial infarction was referred to us for electrophysiologic study because of several episodes of syncope. He had no heart failure and did not use digitalis or any other β-blocking agent. His ECG at admission showed alternating sinus bradycardia and sinus tachycardia, with heart rates of 48 beats/min and 91 beats/min, respectively (Fig 1A). Additionally, left bundle branch block (LBBB) and the sporadic occurrence of premature beats, either with right bundle branch block (RBBB) or with LBBB configuration, could be observed (Fig 1B). We identified the bradycardia as type A bradycardia. By head motion, especially by turning his head to one side, we repeatedly observed a more serious bradycardia, with a heart rate of 40 beats/min. We called this rhythm type B bradycardia; it occurred with an R-R cycle length of 1,460 to 1,500 ms, and by means of His bundle recordings (HBE) it proved to be a true sinus bradycardia. The slow sinus activation was associated with the impairment of AV nodal conduction. This bradycardia was short in duration, and when the sinus activity accelerated simultaneously, the improvement of AV nodal conduction delay could be observed. The conduction time was normal distal to the His bundle (H-V interval, 46 ms) (Fig 2). During A type bradycardia with an R-R cycle length of 1,240 ms, the HBE disclosed the presence of PACs, which occurred in bigeminal rhythm and were blocked distal to the His bundle. During this rhythm, the A-H interval was normal, and the H-V interval remained unchanged in the conducted sinus beats (Fig 3A). The premature beats with RBBB and LBBB configuration also proved to be supraventricular in origin. In PACs with RBBB configuration the conduction time was prolonged both proximal and distal to the His bundle, while in PACs with LBBB configuration the conduction time was abnormal proximal to the His bundle, and the H-V interval remained the same as in the conducted sinus beats (Fig 3B).

During carotid sinus massage, the observed longest sinus pause was 3,800 ms. Corrected sinus node recovery time and sinoatrial conduction time were abnormal, 620 ms and 125 ms, respectively. Exercise and administration of atropine did not result in a significant increase in the heart rate. A permanent pacemaker was implanted. Administration of verapamil orally abolished both conducted and blocked PACs. There was no recurrence of arrhythmia during a one-year follow-up.

![Image](https://example.com/image1)

**Figure 1A.** Alternating sinus bradycardia and sinus tachycardia with a heart rate of 48 beats and 93 beats/min, respectively. LBBB is also present. During bradycardia blocked F waves can be observed, with a constant coupling interval, superimposed on the ST-segment of preceding sinus beats. (B) Bigeminal occurrence of blocked PACs. PAC conducted after the third sinus beat with phasic aberrant ventricular conduction (RBBB configuration), after fourth beat with preexistent LBBB configuration. ECG leads 1 to 3. Paper speed is 25 mm/s. A and B are not continuous recordings.

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**Bigeminal Infra-His Blocked Premature Atrial Contractions (Veress, Bőszőrményi)**
Discussion

A blocked or nonconducted PAC is characterized by an abnormal premature P' wave that is not followed by a QRS complex. The abnormal P' wave may not be visible on the surface ECG, especially if it is superimposed on the T wave of the preceding sinus beat. If this premature P wave is not obvious, the pause may be incorrectly diagnosed as sinoatrial block. Further, blocked PACs, which occur in bigeminal rhythm, must be differentiated from 2:1 AV block. Blocked PACs can also simulate Mobitz type 2 block and cause PR prolongation in the subsequent beats as a manifestation of concealed antegrade conduction.

In our case the type A bradycardia on the surface ECG was mistakenly diagnosed as sinus bradycardia, although P' waves were apparent in leads 1 and 3. The surface ECG was misleading, because the patient also had true sinus bradycardia and LBBB in the conducted sinus beats. In the presence of LBBB with secondary ST-segment alteration, the P' waves of the very early PACs superimposed on the ST segment of the preceding sinus beats and were hardly recognizable. In addition, the sporadic, aberrantly conducted PACs mimicked the presence of premature ventricular contractions.

With the help of HBE, both type A and B bradycardias were documented. HBE showed differences not only in the heart rate between type A and type B bradycardias but also in other ECG features. The type B bradycardia was evidently a true sinus bradycardia due to hyperirritable carotid sinus syndrome. During the rhythm of type A bradycardia, the HBE disclosed the occurrence of blocked PACs in bigeminal rhythm. To our surprise these PACs were blocked distal to H recording site. The possibility that conduction delays and block of single PAC may occur within the ventricular specialized conduction system has been demonstrated in experimental studies. In man only two case reports are known in which the site of block of PACs was documented distal to the His bundle.

In our case the PACs occurred regularly with a constant coupling interval, usually blocked distal to the His bundle and rarely conducted aberrantly to the ventricles. In such cases the diagnosis of blocked PACs should be suspected when a patient presents with apparent sinus bradycardia but also shows PACs elsewhere in the ECG.

The reason for occurrence of PACs in our patient was not clear. One can speculate that the blocked PACs resulted from sinus bradycardia, since the latter predisposes to the development of ectopic impulse formation. However, this explanation is unlikely because the blocked PACs never occurred during the type B bradycardia, when the heart rate was slower. A possible explanation for the development of type A bradycardia is that the ectopic impulses of blocked PACs arose in the diastolic period of the preceding sinus.

Figure 2. His bundle electrogram (HBE) demonstrating true sinus bradycardia associated with an A-H interval of 160 ms and with a H-V interval of 46 ms in conducted sinus beats (left). Increase of heart rate resulted in decrease of A-H interval from 160 ms to 120 ms, while H-V interval remained unchanged (right). Shown are simultaneous ECG leads 1 to 3 and HBE. Paper speed is 50 mm/s.

Figure 3A. HBE demonstrates premature atrial contractions (PACs) in bigeminal rhythm. Note: PACs are blocked distal to H recording site. The P' waves of PACs are superimposed on the ST-segment of preceding sinus beats. Paper speed is 50 mm/s.
beats, and the ectopic impulses reached and discharged the sinus node prematurely. The basic rhythm of the sinoatrial node thus was disturbed and the compensatory pauses which followed the PACs resulted in a heart rate with a R-R cycle length of 1,240 ms.

The clinical importance of block distal to His bundle of PACs remains uncertain. The occurrence of block at the infra-His level of PACs in itself does not necessarily reflect a diseased conduction system. But in the light of an old myocardial infarction and the presence of LBBB, this finding can indicate a partial bilateral bundle branch disease or sclerodegenerative involvement of the main bundle of His, despite of the fact that the H-V time was normal in the conducted sinus beats. Further clinical implications of this report are as follows: (1) Blocked PACs can resemble sinus bradycardia unless one looks carefully at the surface ECG. Thus, in all cases where a long pause is apparently considered as sinoatrial block, the ST segment and the T wave of the preceding sinus beat must be compared with other T waves and critically examined for even the slightest aberration. (2) Blocked PACs can occur as the result of infra-Hisian block. The blocked PACs in our case would probably be overlooked without the study of HBE, whose usefulness is stressed. We predict that many other examples of infra-Hisian blocks will be found.

REFERENCES