Case Reports

Atrial Reciprocal Rhythm Following DC Conversion of Atrial Flutter

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SUMMARY

An example of atrial reciprocal rhythm and reciprocating tachycardia is presented. These arrhythmias were observed immediately after DC electrical conversion for atrial flutter. A His bundle electrogram recorded after the DC conversion demonstrated the prolonged conduction time through the A-V node, suggesting the basis of this reciprocation.

Additional Indexing Words:
Atrial flutter Atrial reciprocal rhythm Atrial reciprocating tachycardia DC electrical conversion His bundle electrogram Wenckebach period

Traditionally, reciprocal rhythms have been classified as atrial and ventricular on the basis of the site to which the impulse returns. While the ventricular reciprocal rhythm is not uncommon, the atrial rhythm is exceedingly rare, clinically.

We experienced an example of atrial reciprocal rhythm following electrical conversion for atrial flutter. To our knowledge, no case of atrial reciprocal rhythm after DC conversion has been reported so far.

Case Report

A 46-year-old man was referred to the Tokyo Medical and Dental University Hospital on October 29, 1971, for evaluation and therapy of atrial flutter, which had persisted for at least 6 years. Twenty years ago he experienced swelling of both knee joints.

Physical examination revealed a blood pressure of 138/90 mm Hg and an ir-
regular pulse. There were no murmurs. The liver was palpable 1 cm. below the
costal margin.

Laboratory examination showed no abnormalities except for the presence of
urinary albumin. A chest X-ray examination revealed an enlarged heart (cardio-
thoracic ratio: 70 percent) and normal lung fields.

**DC conversion and electrophysiologic studies:**

Informed consent was obtained for right heart catheterization. The DC con-
version (with an Electrodyne direct-current defibrillator) was performed under
transient amnesia induced by a small dose of intravenous propanidid (400 mg.). The
DC shock of 45 watt sec. was applied across the chest wall, the electrodes being
placed over the mid-sternum and the apex area.

The His bundle electrograms (HBEs) were recorded before and after DC con-
version according to the method described by Scherlag et al.3) The HBEs recorded
on the magnetic tape at a speed of 38 cm./sec. were reproduced on an electrocardio-
graphic paper at a speed of 9.5 cm./sec., resulting in HBEs recorded at a paper speed
of 100 mm./sec.

![Fig. 1. HBEs recorded before and after DC conversion. Upper strip shows a HBE during atrial flutter. Each QRS complex is preceded by the His deflection, and atrial stimuli are blocked proximal to the His bundle (probably within the A-V node), suggesting that the zone of concealment is located proximal to the His bundle. The lower strip illustrates the HBE during sinus rhythm. Although the H-V intervals (39 msec.) are the same in both strips, the A-H intervals are prolonged (155 msec.).](image-url)
Fig. 2. ECGs recorded annually. All the strips show atrial flutter with variable degree of A-V block.

Fig. 3. Wenckebach period with 3:2 A-V conduction and an atrial reciprocal beat following DC conversion (Nov. 4, 1971).

The A-H time on the HBE was measured from the first rapid deflection of the A wave to the peak deflection of the His potential (H) and the H-V time from the peak deflection of H to the earliest ventricular depolarization recorded on the HBE. In
Fig. 4. Wenckebach periods with A-V ratios varying between 3:2 and 4:3.

our case, the A-H time was 155 msec., which exceeds the normal upper limits, whereas the H-V was 39 msec. or normal. The prolonged A-H time represents probably the delay of conduction through the A-V node (Fig. 1).

Fig. 5. Reciprocating tachycardia. Note the same configuration of negative P waves.
Electrocardiograms:

Electrocardiogram (ECG) strips recorded annually before the DC conversion are shown in Fig. 2, where the atrial flutter is present with variable degrees of A-V block. Figs. 3, 4 and 5 are continuous strips. Fig. 4 shows that the atrial flutter with a 2:1 A-V ratio was electrically converted to the Wenckebach type of second degree (3:2) A-V block. Fig. 5 illustrates also the Wenckebach periods with 3:2 and 4:3 conduction ratios. The last ventricular beat of each Wenckebach period is followed by a negative P wave, suggesting retrograde conduction to the atria. These negative P waves appearing exclusively after the longest P-R interval constitute the conditions sine qua non in the diagnosis of atrial reciprocal rhythm. In addition, the diagnosis was validated by the presence of a reciprocating tachycardia in the same strip, which appeared also after the prolonged A-V conduction time (Fig. 5).

Fig. 6. ECG recorded about 3 weeks after DC conversion, showing sinus rhythm and notched P waves (Nov. 22, 1971).

Fig. 6 recorded about 3 weeks after the DC conversion shows a sinus rhythm and notched P waves. A chest X-ray film on the same day revealed a decreased cardiac shadow (cardiothoracic ratio: 45 percent).

After the DC conversion 0.6 Gm. per day of quinidine was administered to prevent relapse.

DISCUSSION

At present ventricular reciprocal rhythms are experienced not so infrequently.1) Regarding the atrial form, however, only a very few cases have been reported. Schamroth4) described that only 12 clinical examples had been reported up to 1960. Since that time there have been a few additional examples. Kistin5) reported 5 cases by means of simultaneous esophageal
and conventional electrocardiographic leads, which may have been the same kind of examples. Schuilenburg and Durrer observed atrial reciprocal beats in a patient with atrial septal defect after atrial premature beats induced by a gradually decreasing delay during the regular driving of the atrium. Roe-landt and Van der Hauwaert repeatedly recorded atrial reciprocal beats and reciprocating tachycardia in an infant with type A Wolff-Parkinson-White (WPW) syndrome. These arrhythmias in association with the WPW syndrome are likely to occur, because of the existence of two anatomically separated atrioventricular pathways in the WPW syndrome. Gettes and Yoshonis reported 7 patients with atrial reciprocating tachycardia but without WPW syndrome. Most recently, Wolff described a case of atrial reciprocal rhythm with an associated 2:1 heart block.

One of the reasons for its rarity may be due to the difficulties in diagnosis, namely, the distinction between a blocked premature beat showing a negative P wave in Leads II and III and this arrhythmia. In this connection, appearance of premature retrograde P waves and reciprocating tachycardia exclusively after the prolonged P-R interval in our case demonstrates that we are dealing with an atrial reciprocal rhythm.

Various types of arrhythmias are observed immediately following the DC conversion, although trivial in most cases. Fritz and Aberg showed in the study on a patient material consisting of 29 cases with atrial flutter that the occurrence of complication was remarkably high compared to those seen in the regularization of atrial fibrillation. The higher incidence of complication may be explained by the fact that atrial flutter is usually combined with organic heart diseases. Although post-cardioversion arrhythmias may be produced by hypoxia, electrolyte imbalance, catecholamine release or myocardial damage due to electrical discharge, the reason for the occurrence of second degree A-V block in our case is uncertain. It seems reasonable to assume, however, that the termination of repetitive concealed conduction which had persisted during the atrial flutter brought about the prolongation of the apparent refractory period of the A-V junction. This assumption may be supported by the evidence that the A-H interval which shows the conduction time through the A-V node to the His bundle was always prolonged, whereas the H-V interval showing the conduction time in the His-Purkinje system was within normal limits. Namely, there was predisposition to the A-V block in this case and this became manifest after the DC conversion.

Although the etiology of the atrial flutter in this case is unclear, joint pain present 20 years ago is suggestive of an old rheumatic myocarditis. The atrial flutter and atrial reciprocal rhythms observed in this case might not be the only coincidental association but rather they might be based on a com-
mon tendency of re-entry, if the mechanism of atrial flutter is re-entry.

In any case, the arrhythmias observed in our case disappeared on the next day. The cause seems to be mainly due to hemodynamic improvement, considering the decrease of the cardiac shadow after the DC conversion.

REFERENCES