QRS Normalization of Bundle Branch Block by Ventricular Fusion

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A 61-year-old woman who suffered from acute inferior myocardial infarction with right bundle branch block developed complete atrioventricular block. QRS normalization of right bundle branch block as a result of ventricular fusion of the conducted sinus beat with right bundle branch block and idioventricular impulse originating in the ipsilateral side of the block is described.

(Key Words: Complete right bundle branch block, 2:1 atrioventricular block, idioventricular escape beat, acute inferior myocardial infarction)

Normalization of bundle branch block is seen as ventricular fusion of the conducted sinus beat with bundle branch block and ectopic ventricular impulse originating in the ipsilateral side of the block (1 ~ 4).

Presented here is the ECG of a patient with acute inferior myocardial infarction with 2:1 AV block and complete right bundle branch block associated with ventricular escape beats showing the normalization of QRS complex as a result of ventricular fusion.

Case Report
A 61-year-old woman who had complained of dizziness and oppressive sensation of the anterior chest was referred to this hospital because of implantation of a cardiac pacemaker for complete AV block. She had been a known hypertensive and diabetic for the last ten years.

Physical examination on admission showed blood pressure 130/70mmHg, pulse around 30/min, marked cardiomegaly and distension of the jugular vein.

Fig. 1 (synchronous recording of Standard leads I, II and III) taken on admission shows the following features:

A Basic Sinus Rhythm
The P waves are normal. The P-P interval ranges from 0.70 sec to 0.80 sec representing a sinus rate of 75 to 80 beats per minute.

Idioventricular Escape Beats
The first as well as the last 2 beats of the tracing are idioventricular escape beats with the escape interval of 1.44 sec representing an idioventricular rate of 41 beats per minute. The QRS complexes have a left bundle branch block pattern with QRS duration of 0.14 sec indicating that their origin is in the right ventricle.

Complete Right Bundle Branch Block
The 3rd and 4th QRS complexes are conducted sinus beats with 2:1 AV block and complete right bundle branch block. The QRS duration is 0.14 sec. These right bundle branch blocks are associated with abnormal Q waves in leads II and III with elevated ST-segment in these leads with reciprocal ST-segment depression in lead I and terminal inversion of the T waves in lead III, indicating an acute inferior myocardial infarction. PQ-interval of the 3rd and 4th beats are 0.32 sec and 0.28 sec respectively.

Normalized QRS Complexes
The QRS complexes from the 5th to the 7th...
beat are conducted sinus beats. The QRS duration is 0.10 sec in the 5th and the 7th beats and 0.08 sec in the 6th beat. The QRS configuration of the 5th beat is incomplete right bundle branch block, 7th beat incomplete left bundle branch block and 6th in between. The mechanism of these manifestations is considered below (Fig. 2).

DISCUSSION

The ventricular escape beats arise in the right bundle branch immediately distal to the region of block and conduct antegradely through the right bundle branch resulting in left bundle branch block pattern. The QRS complexes from the 5th to 7th beats are the ventricular fusion beats between the sinus beats with complete right bundle branch block and the idioventricular escape impulses originating just distal to the region of block.

In the 5th beat with R-R interval of 1.48 sec after the preceding beat, ventricles are predominantly depolarized by conducted sinus beat with PQ-interval of 0.28 sec. While in the 7th beat with R-R interval of 1.44 sec after the preceding beat, ventricles are mostly depolarized by the idioventricular escape impulse. And in the 6th beat, ventricles are just coincidentally and synchronously activated by both the conducted sinus beat and idioventricular escape impulse.

In this tracing idioventricular escape interval is measured as 1.44 sec. However, the escape interval of the 5th and 6th escape beats is to be longer than 1.44 sec probably due to the warming up phenomenon.

This electrocardiographic manifestation might simulate the normalization which occurs in tachycardia dependent and bradycardia dependent bundle branch block (1).

REFERENCES

1) Oreto G and Schamroth L: QRS normalization by ventricular fusion simulating tachycardia dependent left bundle branch block. Int J Cardiol 5: 91–95, 1984
Fig. 1  ECG (synchronous recording of leads I, II and III) showing 2:1 AV block, complete right bundle branch block, incomplete right bundle branch block, incomplete left bundle branch block, a normalizing fusion beat, and idioventricular escape beats of left bundle branch block pattern.

Fig. 2  Ladder diagram illustrating sinus rhythm conducted with 2:1 AV block, ventricular escape beats and ventricular fusion with lead I ECG