CASE REPORT

A Case Report of Different Degrees of the Left Anterior, Septal and Posterior Fascicular Branch Block

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We present a rare case of various conduction defects involving the left anterior, septal, and posterior branch in one patient. The different degrees of block of anterior, septal, and posterior fascicular of the left bundle branch indicate pathological changes in left ventricle. However, the values of this electrocardiographic presentation indicating the left ventricular function still need more investigations.

Ann Noninvasive Electrocardiol 2015;20(2):189–192

dynamic changes; different degrees of block; electrocardiogram

Early in 1970, Durrer et al.¹ found that earliest activation of the human left ventricle occurred simultaneously in three endocardial regions corresponding roughly to myocardial insertion of the three fascicular of the left bundle. It has been verified that the left bundle branch are consisted of anterior, septal, and posterior fascicular branch, respectively in the dog and human heart model.^{2,3} To the best of our knowledge, the phenomena of various conduction defects involving the left anterior, septal, and posterior branch in one patient is tremendously rare. Here, we present a case of a series of dynamic changes of QRS complex because of complete left anterior fascicular block (LAFB) combined with fast rate dependent left septal fascicular block and different degrees left posterior fascicular block.

CASE REPORT

A 72-year-old man referred to our hospital for annual physical examination. On physical examination at admission, there were unremarkable findings. Laboratory data revealed: serum total cholesterol 5.34 mmol/L, low den-

sity lipoprotein cholesterol (LDLC) 3.29 mmol/L. Carotid artery color Doppler ultrasound examination showed carotid atherosclerosis. Electrocardiogram demonstrated that Complete left bundle branch block (CLBBB) with intermittent left axis deviation (LAD; QRS duration was 0.12 seconds, QRS axis +23 degrees or –49 degrees).

Figure 1 showed an electrocardiogram from the patient holding his breath with low rate of heartbeat (68 beats per minute): LAFB (QRS duration:0.10 seconds, QRS axis –60 degrees). Figure 2 demonstrated an electrocardiogram from the man with normal breath and heart rate elevated: RS pattern waves were present in leads II, III, aVF, V5, and V6 with increasing of ratio of R/S. q wave disappeared in lead I. The q amplitude of lead aVL decreased with r wave. Small r wave were present in leads V1, V2, and V3. The seventh QRS wave was consistent with the CLBBB and intermittent LAD (QRS duration was 0.12 seconds, QRS axis +23 degrees, or –49 degrees).

When left bundle branch block (LBBB) with normal frontal plane axes was present, electrocardiogram would be concordant with the aforementioned electrocardiogram.

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Figure 1. Left anterior fascic: holding breath, heart rate of 68 per min, qR waves were present in leads I and aVL and rS waves in II, III and aVF. QRS axis -60 degrees.

Figure 2. Normal breath and heart rate elevated: RS pattern waves were present in leads II, III, aVF, V5 and V6 with increasing of R/S. q wave disappeared in lead I. The q amplitude of lead aVL decreased with r wave. Small r wave were present in leads V1, V2 and V3. The seventh QRS wave was consistent with the Complete Left Bundle Branch Block (CLBBB) and intermittent left axis deviation (LAD) (QRS duration was 0.12s, QRS axis $+23$ degrees or -49 degrees). When left bundle branch block (LBBB) with normal frontal plane axes was present, initial vector would be concordant with the aforementioned electrocardiogram.

DISCUSSION

CLBBB and intermittent LAD may occur as a consequence of (1) Main LBBB with intermittent LAFB. (2) Different degrees of conduction block in left anterior fascicular branch and left posterior

fascicular branch. In this case, with the heart rate decreasing, the electrocardiogram mainly showed LAFB along with normal QRS duration. However, when heart rate increased, the normal QRS wave pattern would change to narrow QRS wave with LAD alleviating to the pattern of LBBB and then

vary to wide QRS wave with left anterior branch block or normal electrical axis alternatively.

After a careful analysis of this evolutionary process, we consider this pattern of electrocardiogram is a complete LAFB with varying degrees of left posterior fascicular block. Cannon⁴ suggested that various LBBB could contribute to the QRS axis deviation.

Normally, ventricular depolarization occurs first from the left to right septum, followed by the synchronized depolarization of both ventricles from apex to base and endocardium to epicardium.

As a result of the vector of depolarization of left anterior fascicular branch counteracting to that of left posterior fascicular branch, the frontal plane QRS vector normally range from 0 degrees to +90 degrees. With the simple LAFB, the frontal plane QRS vector would deviate to the left, correspondingly the QRS complex axis would dramatically deviate by -60 degrees. If CLAFB combines with mild left posterior fascicular block, the ventricular muscular electrical depolarization related to the left posterior fascicular branch would prolong and it would partially compensate for the left deviation from the CLAFB. The electrocardiogram would manifest mitigation of left deviation of the LAFB wave axis. Concurrently the duration of QRS wave would not prolong since the left ventricular activation and right ventricular activation occur simultaneously. When left posterior fascicular block accentuate progressively, ultimately from mild to moderate, the activation of left ventricular myocardium would significantly delay than that of right ventricular myocardium. So under this situation, the depolarization of left and right ventricles would not be synchronically and QRS complex duration would prolong. Accordingly the frontal plane QRS axis would deviate to the left more than that in the CLAFB with mild left posterior fascicular block. The electrocardiogram revealed CLBBB with LAD increasing, (-49 degrees). When the degree of left posterior fascicular block became severe, synchronizing with the left anterior fascicular branch, the electrocardiogram was CLBBB with no axis deviation.

The term left septal fascicular block is not recommended because of the lack of universally accepted criteria in AHA/ACC/HRS guideline.⁵ There are various reports about the electrocardiographic presentations of left septal fascicular block, and they mainly fall to two categories:

- (1) Initial QRS vector directed to the left, loss or attenuation of initial r wave in right precordial leads accompanied by loss of septal q wave,⁶
- (2) The prolongation of depolarization of left septal ventricle induces the prominent anterior QRS force,⁷⁻⁹ a striking R wave would manifest in the right precordial leads concurrently. The causes of the discrepancies between two categories may relate to the anatomical variations of left septal fascicular branch and the individual variability of anatomical location of interventricular septum.

In this case, LAFB combining with mild or severe left posterior fascicular block was with change in initial vector. In this pattern, the electrocardiographic presentation was as follows: there was diminution in initial right QRS axis deviation and loss of q wave of initial QRS complex in lead I; the amplitude of initial q wave of QRS complex in aVL diminished accompanying with prior r wave; diminution in amplitude of V1-V3 in right precordial leads. However, in the case of LAFB combining with moderate left posterior fascicular block, there was no change in the initial vector and the PR interval was without change, these all indicated that the conductivity of the right branch remained unchanged. Apparently these intermittent changes in initial vector mentioned above could rule out the infarction in interventricular septum, ventricular preexcitation, and breathing. These phenomena definitively could not be elucidated by LAFB, LPFB, or right bundle branch block.

Normally, the depolarization of the left and right surfaces of interventricular septum was simultaneously, and the excitation of right surface conducted by right bundle branch has a little more delay than that of left surface, but generally no more than 5 milliseconds. The depolarization of the interventricular septum almost accomplishes within 35 milliseconds after activation of ventricle. There are some reports¹⁰⁻¹² indicate that normal right bundle branch conduct and mild delay of left septal fascicular branch conduct would make the initial left-to-right QRS vector attenuate or vanish. The electrocardiogram reveals diminution in amplitude of septal q wave or loss of septal q wave. In this case, the intermittent changes of initial vector imply that there is intermittent mild septal fascicular block. This is accordant with some published reports.^{6, 10, 13, 14}

SUMMARY

In this case, there are different degrees of block of anterior, septal, and posterior fascicular of the left bundle branch, indicating pathological changes in left ventricle. However, the values of this electrocardiographic presentation indicating the left ventricular function still need more investigations.

REFERENCES

1. Durrer, Dirk, RTH Van Dam, and E Freud Total excitation of the isolated human heart. *Circulation* 1970;41:899-912.
2. Lazzara R, Yeh BK, Samet P: Functional anatomy of the canine left bundle branch. *Am J Cardiol* 1974;33(5):623-632.
3. Massing G, James T: Anatomical configuration of the His bundle and bundle branches in the human heart. *Circulation* 1976;53(4):609-621.
4. Cannom DS, Goldreyer BN, Damato AN: Atrioventricular conduction system in left bundle-branch block with normal QRS axis. *Circulation* 1972;46(1):129-137.
5. Wagner G, Macfarlane P, Wellens H, et al.: American Heart Association Electrocardiography and Arrhythmias Committee, Council on Clinical Cardiology; American College of Cardiology Foundation. *J Am Coll Cardiol* 2009;53(11): 1003-1011.
6. MacAlpin RN: In search of left septal fascicular block. *Am Heart J* 2002;144(6):948-956.
7. Hoffman I, Mehta J, Hilsenrath J, et al.: Anterior conduction delay: A possible cause for prominent anterior QRS forces. *J Electrocardiol* 1976;9(1):15-21.
8. Pastore C: Guidelines for interpreting rest electrocardiogram. *Arq Bras Cardiol* 2003, **80**:1-17.
9. Nakaya Y, Hiasa Y, Murayama Y, et al.: Prominent anterior QRS force as a manifestation of left septal fascicular block. *J Electrocardiol* 1978;11(1):39-46.
10. Uhley H: The Quadrifascicular Nature of the Peripheral Conduction System. *Cardiac Arrhythmias*. New York, NY: Grune & Stratton, 1973, pp. 339-348.
11. Piccolo E, Raviele A, Delise P, et al.: The role of left ventricular conduction in the electrogenesis of left ventricular hypertrophy. An electrophysiologic study in man. *Circulation* 1979;59(5):1044-1055.
12. Kulbertus H: Concept of left hemiblocks revisited. A histopathological and experimental study. *Adv Cardiol*. 1975;14:126-35.
13. Gambetta M, Childers RW: Rate-dependent right precordial Q waves: "Septal focal block". *Am J Cardiol* 1973;32(2):196-201.
14. Hassett MA, Williams RR, Wagner G: Transient QRS changes simulating acute myocardial infarction. *Circulation* 1980;62(5):975-979.