Differentiating between right and left bundle branch blocks is important in identifying and treating your patient’s underlying condition and improving patient outcomes. Bundle branch blocks are a relatively frequent finding in a patient’s ECG. They can be clinically insignificant and asymptomatic, or they can signal serious underlying cardiac disease. Let’s start by reviewing the normal electrical conduction system of the heart, and explaining the significance of the different types of bundle branch blocks.

Cardiac conduction system
Cardiac cells, in their resting state, are electrically polarized. This electrical polarity is maintained by membrane pumps that ensure the appropriate distribution of ions (primarily potassium, sodium, chloride, and calcium). The exchange of electrolytes causes depolarization and repolarization that results in myocardial contraction (systole) and relaxation (diastole). Electrical signals that cause your heart to beat begin in the sinoatrial (SA) node, located at the top of the right atrium. The SA node is also called the heart’s “natural pacemaker.” When an electrical impulse is released from this natural pacemaker, it causes the atria to depolarize. The conduction of the electrical impulse throughout the atria is seen on the ECG as the P wave. The signal then passes through the atrioventricular (AV) node. The wave of depolarization sweeps out of the AV node and bundle of His, into the bundle branch system. The right and left bundle branch deliver the current to the right and left ventricles, respectively. (See The anatomy of the ventricular bundle branches.)

This is the most efficient means of transmitting the electrical current. Because the left and right ventricles depolarize nearly simultaneously, the resultant QRS complex, representing ventricular depolarization is narrow-less than 0.12 second in duration. Because the muscle mass of the left ventricle is so much larger than that of the right ventricle, left ventricular electrical forces dominate those of the right ventricle, resulting in a normal electrical axis between 0 and 90 degrees. Therefore, bundle branch block is diagnosed by looking at the width and configuration of the QRS complexes.

Right bundle branch block
In right bundle branch block (RBBB), conduction through the right bundle is obstructed. As a result, right ventricular depolarization is delayed; it does not begin until the left ventricle is almost fully depolarized. (See Right bundle branch block.) This causes three things to happen on the ECG:

1. The delay in right ventricular depolarization prolongs the total time for ventricular depolarization. As a result, the QRS complex widens beyond 0.12 second.
2. The RSR in leads V1 and V2 with ST segment depression and T wave inversion.
3. Reciprocal changes such as late deep S waves seen in leads I, AVL, V5, and V6.
Heart Beats

RBBB is a common intraventricular conduction anomaly and is found in patients with and without structural heart disease. Common causes include myocardial infarction (MI), hypertensive heart disease, and pulmonary diseases. RBBB can be seen in patients who have pulmonary embolism with as many as 67% showing evidence of an RBBB. Given this association, strong consideration for pulmonary embolism should be given to patients presenting with cardiopulmonary signs and symptoms with evidence of a new (or not known to be old) RBBB. RBBB may occur in patients who have acute MI and is estimated to occur in 3% to 7% of patients. Coronary artery disease is among many causes of new RBBB.1

Left bundle branch block
In left bundle branch block (LBBB), left ventricular depolarization is delayed. ECG criteria are:
1. QRS complex widened to greater than 0.12 second
2. broad or notched tall R waves with prolonged upstroke in leads I, AVL, V5, and V6, with ST segment depression and T wave inversion.
3. reciprocal changes in V1 and V2 consisting of broad, deep S waves. Left axis deviation may be present.1

The most common causes of LBBB include coronary artery disease, hypertension, and cardiomyopathy. Other more rare causes include Lev disease (sclerosis of the cardiac skeleton) Lenegre disease (primary degenerative disease of the conduction system), advanced rheumatic heart disease, and calcific aortic stenosis. The presence of LBBB portends a poor long-term prognosis— one study showed that 50% of patients who have a LBBB die within 10 years.

Hemiblocks
The left bundle branch is further subdivided into three separate fascicles and include the septal, anterior, and posterior fascicles. Left anterior fascicular block (LAFB) is found in patients with and without structural disease, and in isolation, is of no prognostic significance. It is, however, one of the most common intraventricular conduction abnormalities in patients who have acute anterior MI and is found in 4% of cases. When new LAFB occurs in the presence of an anterior MI there is a slightly increased risk for progression to advanced heart block. The most common vessel involved in this setting is typically the left anterior descending artery.2

A left posterior fascicular block (LPFB) is much less common than LAFB, but because it supplies the majority of the left ventricle, it is of more concern. The LPFB has a dual blood supply and is much less vulnerable to ischemia than LAFB. The finding of LPFB is nonspecific and rare. It is found most commonly in patients who have coronary artery disease but can be found in patients who have hypertension and valvular heart disease. It is reportedly the least common conduction block found in patients who have acute MI.2 Hemiblocks are diagnosed by looking for left or right axis deviation. Left anterior hemiblock causes a left axis deviation of -30 and +90 degrees. Left posterior hemiblock causes right axis deviation.

Variations on a theme
The term, unifascicular block, is used to describe isolated LAFB, LPFB, or RBBB. Bifascicular block...
is used to describe complete LBBB or combinations of RBBB with LAFB or with LPFB. Last but not the least, a combination of RBBB with both LAFB and LPFB is considered trifascicular block.3

Differentiating RBBB from LBBB
To quickly differentiate RBBB from LBBB, use lead V1 and identify the direction of the terminal force. If the complex is downward it is an LBBB, if it deflects upward it is an RBBB. Another way to imagine this is to think of your car’s turn signal, when you make a right turn (RBBB) you put the turn signal up. When you make a left turn (LBBB) you put the turn signal down. Since the ventricle supplied by the broken bundle branch gets the signal last, the last portion of the QRS complex shows this signal. If it is the right ventricle that is depolarized last, then the ending signal should be moving towards the V1 lead and produce a positive QRS complex. If the left ventricle depolarized last then the ending signal should be moving AWAY from the V1 lead and produce a negative QRS complex.

The significance of bundle branch blocks
Bundle branch blocks can mask an acute MI on the 12-lead ECG. Although bundle branch blocks are not independent predictors of mortality, the presence of transient or persistent bundle branch block with acute MI is recognized as a marker of increased mortality.2

It is important to differentiate between right and left bundle branch block especially since, unlike RBBB, LBBB is often pathologic. In patients who have suspected MI, meticulous interpretation of the ECG is important in differentiating which patients need coronary reperfusion and aggressive treatment. Understanding the differences between these two conduction defects may prevent life-threatening complications.

REFERENCES

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