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Left Bundle Branch Block

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Continuing Education Activity

Left bundle branch block (LBBB) is a common electrocardiographic (ECG) abnormality seen in patients whose normal cardiac conduction down both anterior and posterior left fascicles of the His-Purkinje system is compromised. Although LBBB is often associated with significant heart disease and is often the result of myocardial injury, strain or hypertrophy, it can also be seen in patients without any particular clinical disease. This activity reviews the cause and presentation of LBBB and highlights the role of the interprofessional team in its management.

Objectives:

- Describe the evaluation of a patient with LBBB.
- Outline the treatment for LBBB.
- Review the prognosis of patients with LBBB.
- Summarize the importance of improving care coordination among interprofessional team members to improve outcomes for patients affected by LBBB.

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Introduction

Left bundle branch block (LBBB) is a common electrocardiographic (ECG) abnormality seen in patients whose normal cardiac conduction down both anterior and posterior left fascicles of the His-Purkinje system is compromised. Although LBBB is often associated with significant heart disease and is often the result of myocardial injury, strain or hypertrophy, it can also be seen in patients without any particular clinical disease. In isolation the presence of LBBB does not lend itself to any specific clinical

concern, nor does it affect prognosis. However, in the proper clinical context, LBBB can of great consequence and importance, especially in patients presenting with acute chest pain, syncope and in those suffering from heart failure with reduced ejection fraction (HFrEF).[1] New onset LBBB in the proper setting of concerning clinical symptoms should always be considered a sign of pathology and can indicate myocardial infarction. New LBBB is considered an ST-segment elevation equivalent in patients presenting with chest pain.[2] Although the QRS and ST segments of an ECG are traditionally regarded as uninterpretable in the presence of LBBB, emerging Sgarbossa criteria have been developed allowing some interpretation of ECGs despite LBBB. [3][4]

Etiology

Stretching of cardiac tissue can lead to conduction issues between cardiac myositis. In this, the left bundle is no exception. The chief cause of LBBB is dilated cardiomyopathy. Specifically, enlargement of the left ventricle causing stretching and separation of the Purkinje fibers. The cause of dilated cardiomyopathy itself is quite varied including ischemic, infective, valvular, infiltrative, and inflammatory causes. Ischemic is, however, the most common cause. [1]

Epidemiology

LBBB is prevalent in about 0.06% to 0.1% of the general population. Approximately 33% of patients with heart failure have LBBB. Incidence increases with severity of left ventricular failure in heart failure patients. [1]

Pathophysiology

In addition to cardiac stretching, cardiac scarring or infiltration can disrupt the conduction system either through myocardial infarction or fibrosis like lenegre's disease or amyloidosis. [1]

History and Physical

LBBB itself is asymptomatic, there are no signs or symptoms other than the distinct pattern on EKG. [1][5]

Evaluation

LBBB is often detected on ECG. Diagnostic criteria are defined by the American College of Cardiology (ACC) and American Heart Association (AHA) as follows:

1. Rhythm must be of super-ventricular origin (EG: ventricular activation coming from atrial or AV nodal activation)
2. QRS Duration greater than 120 ms
3. Lead V1 should have either a QS or a small r wave with large S wave
4. Lead V6 should have a notched R wave and no Q wave [6]

Treatment / Management

LBBB itself has no specific treatment. The condition is usually permanent and requires treatment of underlying disorders.[1] The exception to this is in HFrEF with sinus rhythm, and LBBB with QRS duration greater than 150 ms with NYHA class II-IV heart failure will benefit from cardiac resynchronization therapy as recommended by the ACC and AHA. In addition to proper medical therapy, CRT has been shown to reduce death in this population by up to 37%. Cardiac re-synchronization should also be considered in patients either without sinus rhythm (EG atrial fibrillation) and QRS duration of 120 to 149 but is a weaker recommendation. It should be noted that CRT does not remove the LBBB but is accomplished using a bi-ventricular pacemaker to pace both left and right ventricle simultaneously. This process circumvents the ventricle's conduction system entirely. [7]

Differential Diagnosis

Differentials for LBBB include intra-ventricular conduction delay - which can result in similar ECG findings but often will not have an R wave in V6. A paced rhythm can often be confused with LBBB but again often does not have an R wave in V6 and pacer spikes are usually seen. An LBBB pattern with QRS duration less than 120 ms is called an incomplete LBBB. A ventricular rhythm (run of PVCs) without super-ventricular stimulation can appear very similar to a left bundle branch block and in certain uncommon situations would be indistinguishable from LBBB. [6]

Prognosis

In otherwise healthy individuals, LBBB does not confer any specific or additional risk. Mortality hazard ratio (HR) for LBBB is only 1.3 of normal. However, in patients with new onset, LBBB mortality HR is greater than 10-times normal.[1] Specific at-risk populations of patients with LBBB are those who are presenting with chest pain and have new-onset LBBB which should be considered equivalent to ST-segment elevation.[2] In patients with heart failure, the presence of left bundle branch block is associated with increased cardiovascular outcomes and mortality. However, in a recent study which

attempted to isolate LBBB's sole contribution to outcomes found that if contributions of confounders are excluded LBBB contributes far more modestly to poor outcomes. This is likely because LBBB is more of a symptom of dilated cardiomyopathy as opposed to a causative agent in the progression of the disease.[7]

Patients with LBBB are restricted from piloting aircraft in both the United States and the United Kingdom. This is due to LBBB being a possible precursor to complete atrioventricular block. Such association is supported by epidemiologic data and patients presenting with syncope or pre-syncope in the setting of LBBB should undergo testing with ECG and Holter monitor. [8]

Pearls and Other Issues

An ECG is often considered "uninterpretable" in the presence of LBBB. This is in fact false. There are many things that we can interpret on an ECG despite LBBB.

Clinicians can determine rate and rhythm. The LBBB only affects the left ventricle making any part of the QRS and ST segment uninterpretable, but the atrial rhythm is still valid.

In the setting of acute myocardial infarction, there are a set of criteria called Sgarbossa criteria which can be applied to the ECG to increase predictive value for or against myocardial infarction. These criteria are not as good as ST-segment elevation in the absence of LBBB. Their sensitivity is only 49%, but specificity is greater than 90%.

1. Concordant ST elevation greater than 1 mm in leads with a positive QRS complex (5 points)
2. Concordant ST depression greater than 1 mm in V1 to V3 (3 points)
3. Discordant ST elevation greater than 5 mm in leads in a negative QRS complex (2 points)

Three or more points means acute myocardial infarction.

Modified Sgarbossa criteria were validated in 2015. The sensitivity of the modified criteria increases to 80% without affecting specificity. The third criteria regarding greater than 5 mm of discordance were chosen rather arbitrarily. The modified criteria change 5 mm to greater than 25% of the downward QRS deflection.

Criteria 3 is modified as follows: Discordant ST elevation greater than 25% of downward QRS deflection in a negative QRS complex (2 points)

Definition of Terms

Concordant: Means QRS and T wave go the same direction.

Discordant: Means QRS is opposite direction of T wave.

Positive QRS Complex: Net voltage of QRS goes upward from baseline.

Negative QRS Complex: Net voltage of QRS goes downward from baseline. [3][4]

Enhancing Healthcare Team Outcomes

LBBB may be encountered in clinical practice by the nurse practitioner, primary care provider, emergency department physician and the internist. While LBBB by itself may be a normal occurrence, it is important to refer these patients to a cardiologist to determine that there is no underlying cardiac pathology.

In otherwise healthy individuals, LBBB does not confer any specific or additional risk. Mortality hazard ratio (HR) for LBBB is only 1.3 of normal. However, in patients with new onset, LBBB mortality HR is greater than 10-times normal.[1] Specific at-risk populations of patients with LBBB are those who are presenting with chest pain and have new-onset LBBB which should be considered equivalent to ST-segment elevation.[2] In patients with heart failure, the presence of left bundle branch block is associated with increased cardiovascular outcomes and mortality.

The cardiology nurse should educate the patient on the significance of LBBB. In the US, patients with LBBB are not allowed to pilot an aircraft or other heavy equipment.[9][8]

Review Questions

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Disclosure: Dmitriy Scherbak declares no relevant financial relationships with ineligible companies.

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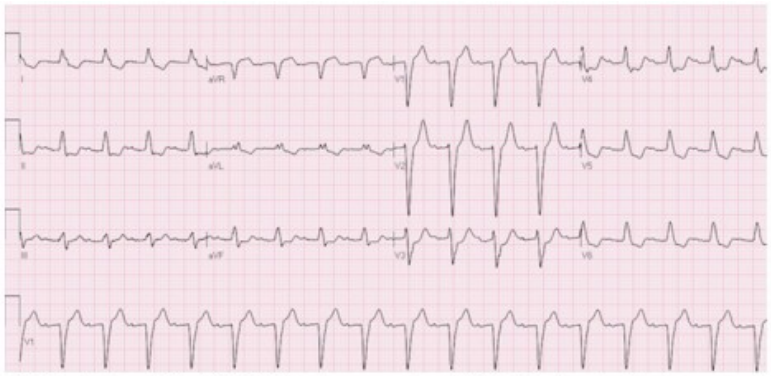
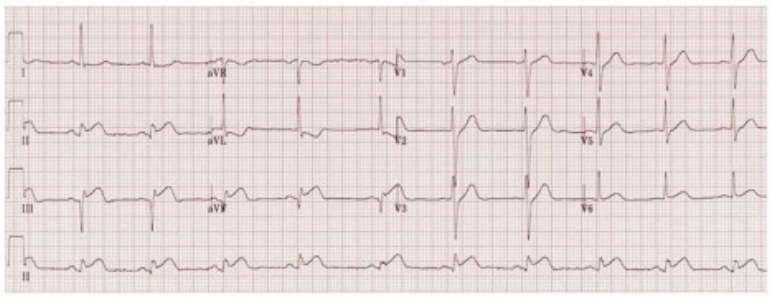
Figures



Left Bundle Branch Block (LBBB). Note the concordance in V3 for Sgarbossa's Criteria



Inferior wall MI. Note ST segment elevation in leads II, III, and aVF

ECG- Left Bundle Branch Block and inferior wall MI. Contributed by Steven Mountfort

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