Electrocardiographic proposal classification criteria for Left Bundle Branch Block

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I- According to the degree (QRS duration) and pattern:

1. **Criteria (most used in literature):**
    1. **Incomplete Left Bundle Branch Block (ILBBB):** QRS duration (QRSd) from 90 to 110 ms in adults, between 90 and 100 ms in children 8 to 16 years of age, and between 80 and 90 ms in children less than 8 years of age, presence of left ventricular hypertrophy pattern, R peak time > 60 ms in leads V4, V5, and V6 and absence of q wave in leads I, V5, and V6.()
    2. **Complete Left Bundle Branch Block (CLBBB):** QRSd ≥ 120 ms in adults, greater than 100 ms in children 4 to 16 years of age, and greater than 90 ms in children less than 4 years of age, broad notched or slurred R wave in leads I, aVL, V5, and V6 in at least and an occasional RS pattern in V5 and V6 2 contiguous leads attributed to displaced transition of QRS complex, absent q waves in leads I, V5, and V6, (in the lead aVL, a narrow q wave may be present in the absence of myocardial pathology), R-wave peak time (RWPT) ≥ 60 ms in leads V5 and V6 and concomitant normal RWPT in the right precordial leads V1, V2, and V3, when small initial r waves can be discerned in the above leads, ST and T waves usually opposite in direction to QRS, positive T wave in leads with upright QRS may be normal (positive concordance), **Observation:** depressed ST segment and/or negative T wave in leads with negative QRS (negative concordance) are abnormal (**Sgarbossa 1996; Gunnarsson 2001**)11,12.

The appearance of LBBB may change the mean QRS axis in the frontal plane to the right, to the left, or to a superior, in some cases in a rate-dependent manner. (**Swiryn 1980;46(1):53–8.; Childers 2000**). **Stricter o Strauss criteria for complete LBBB:** QRS duration ≥ 140 ms for men and ≥ 130 ms for women, along with mid-QRS notching or slurring in ≥ 2 contiguous leads. This new value are used for Cardiac Resynchronization Therapy (CRT) (**Strauss 2011**)

2, Mexican School Criteria ool (Sodi 1964):

- 1st degree left bundle branch block;

- 2nd degree left bundle branch block: 1st degree & 2nd degree correspond to incomplete LBBB;

- 3rd degree left bundle branch block, advanced (ALBBB or complete LBBB) CLBBB0.

  - Complete LBBB by classical criteria: QRS duration ≥ 120ms

  - Stricter criteria QRS duration ≥140 ms (men) or 130 ms (women), QR or rS in leads V1 and V2, and mid-QRS notching or slurring in ≥2 of leads V1, V2, V5, V6, I and aVL.

3. Spanish School criteria (Bayés de Luna 2007). Global left ventricular blocks:

a) Advanced Left Bundle Branch Block (ALBBB) or third degree (equivalent to CLBBB (QRS duration ≥ 120 ms),

b) Non-advanced global left ventricular blocks:

- First degree LBBB (partial) corresponds to types I and II of Mexican school: isolated R in V6 with more or fewer slurring but QRS duration < 120 ms.

- Intermittent or second degree LBBB: corresponds to special type of ventricular aberrancy.

II- According to topography:

a) **Predivisional or troncular LBBB** (90%) QRSd = 120 to 160 ms Observation: The intermittent forms are nearly always pre-divisional

- Of the left His bundle;
- Of the truncus of the left bundle branch;

b) Fascicular or divisional: by unequal dromotropic involvement of divisions or fascicles of the left bundle branch (LBB): left anterior fascicle(LAF), left posterior fascicle(LPF) and left septal fascicle (LSF).

c) Parietal, global Purkinjian, diffuse intraventricular, intramyocardial or intramural (in the Purkinje-muscle union). Characterized by: wider QRS, clockwise rotation of the QRS loop in the horizontal plane of the vectorcardiogram. In general, they point out greater myocardial involvement.

III- According to steadiness:

a) Permanent or definite: most of them.

b) Intermittent, transient, episodic or of second degree LBBB that could be:

Rate-dependent intermittent LBBB (Arias 2006):

- \- Tachycardia-dependent or in “phase 3”;
- \- Bradycardia-dependent or in “phase 4”.

Independent from heart rate: mechanism Mobitz type I; Mobitz type II by Wenckebach phenomenon; and by significant hypopolarization. **Etiologies (Bazoukis 2016):** general, local, and epidural anesthesia; (**Pratila 1978**) acute pulmonary embolism (**Kasmani 2009**); during cardiac interventions; (**Shimamoto 1998**) mad honey poisoning; (**Sayin 2012**) acute pancreatitis; (**Pezzilli 1999**) drugs effect; coronary fistulas connecting main pulmonary artery with coronary arteries, (**Juraschek 2011**) chest contusion, (**Pizzo 2005**) cervical wound, (**Ishikawa2014**) Guillain-Barre syndrome, **(Serrano Junior**

1987) takotsubo cardiomyopathy, (**Di Cori 2010**) Graves-Basedow disease, (**Lubczynska-Kowalska 1971**) hemorrhagic stroke, (**Martynov 2004**) myocarditis in enteric fever, (**Prabha1995**) myocarditis along with acute ischemic cerebellar, pontine and lacunar infarction following viper bite, (**Bhatt 2013**) electroconvulsive therapy, (**Adams 2014**) endoscopic retrograde cholangiopancreatography, (**Kounis 2003**) athletic heart syndrome, (**Chapman1977**) tachycardia induced cardiomyopathy, (**Senoo2014**) endoscopic brachytherapy for lung cancer, (**Vasic 2009**) and propionic aciduria. (**Ardoin 2009**)

IV- According to electrical axis of QRS complex in the Frontal Plane. See figure

a) With QRS axis not deviated: between -29° and $+60^{\circ}$ (≈ 65% to 70% of cases)

b) With QRS axis with extreme deviation to the left: beyond -30^{0}: between -30° and -90° (**Parharidis 1997**) (≈25% of cases). The presence of left axis deviation had a 41.9% sensitivity and a 91.6% specificity for the presence of organic heart disease. Aortic valve disease in LBBB pts seems to be frequently accompanied by left axis deviation. In LBBB patients, those without left axis deviation seem to benefit more from cardiac resynchronization therapy with defibrillator (CRT-D) than those with left axis deviation **(Brenyo 2013**).

c) With QRS axis deviated to the right: between $+60^{\circ}$ and $+90^{\circ}$ (≈ 3.5 a 5% of cases)

d) With QRS axis with extreme deviation to the right: beyond $+90^{\circ}$ (< than 1% of cases). It is named "paradoxical type of Lepeschkin“ (**Lepeschkin 1951**). The majority of subjects had dilated cardiomyopathy with biventricular enlargement (**Childers 2000**). The uncommon combination of LBBB and right axis deviation is a marker of severe myocardial disease, specially primary congestive cardiomyopathy. The mechanism of production of this ECG pattern appears to be diffuse conduction system involvement in advanced myocardial disease (**Nikolic 1985**). Causes that determine paradoxical complete LBBB:

- Complete LBBB associated to right ventricular hypertrophy/enlargement or severe cardiomyopathy with biventricular enlargement. or diffuse advanced myocardial disease.(3) >98% of cases.

- Fascicular Complete LBBB (LAFB + LPFB) with a higher degree of block in the postero-inferior division. In presence of AF LBBB with intermittent right axis deviation is explained by an additional LPFB accompanying predivisional LBBB (**Patenè 2008; 2012**)

- LBBB in Wegener granulomatosis (**Khurana 2000**)

- Complete LBBB associated to lateral infarction (free wall of left ventricle)

- Complete LBBB with accidental exchange of limb electrodes

- Complete LBBB associated with true dextrocardia (**Salazar 1978**)

Types of CLBBB according to electrical axis of QRS complex in the Frontal Plane

I. With QRS axis not deviated: between -30° and +60° (≈ 65% to 70% of cases)
II. With QRS axis with extreme deviation to the left: beyond –30° (≈25% of cases)
III. With QRS axis deviated to the right: between +60° and +90° (≈ 3.5 a 5% of cases)
IV. With QRS axis with extreme deviation to the right: beyond +90° (< than 1% of cases). It is named "paradoxical type of Lepeschkin“ (**Lepeschkin 1951**). Causes that determine paradoxical complete LBBB:
V. Some congenital heart disease (extremely rare).

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