78-year-old man with typical prolonged chest pain at rest

Hombre de 78 años con dolor precordial típico y prolongado al reposo

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Case Repor
Senior man (78-year-old), Caucasian retired electrician, sedentary, obese, type 2 diabetes, and high blood pressure. Natural of Santo André, São Paulo Brazil.

He show up to our Emergency department with complain sudden chest pain at rest, of 3 hours of duration described as a sensation of squeezing radiating to the left arm until the elbow, associated with shortness of breath, nausea, vomiting, and cold sweating.

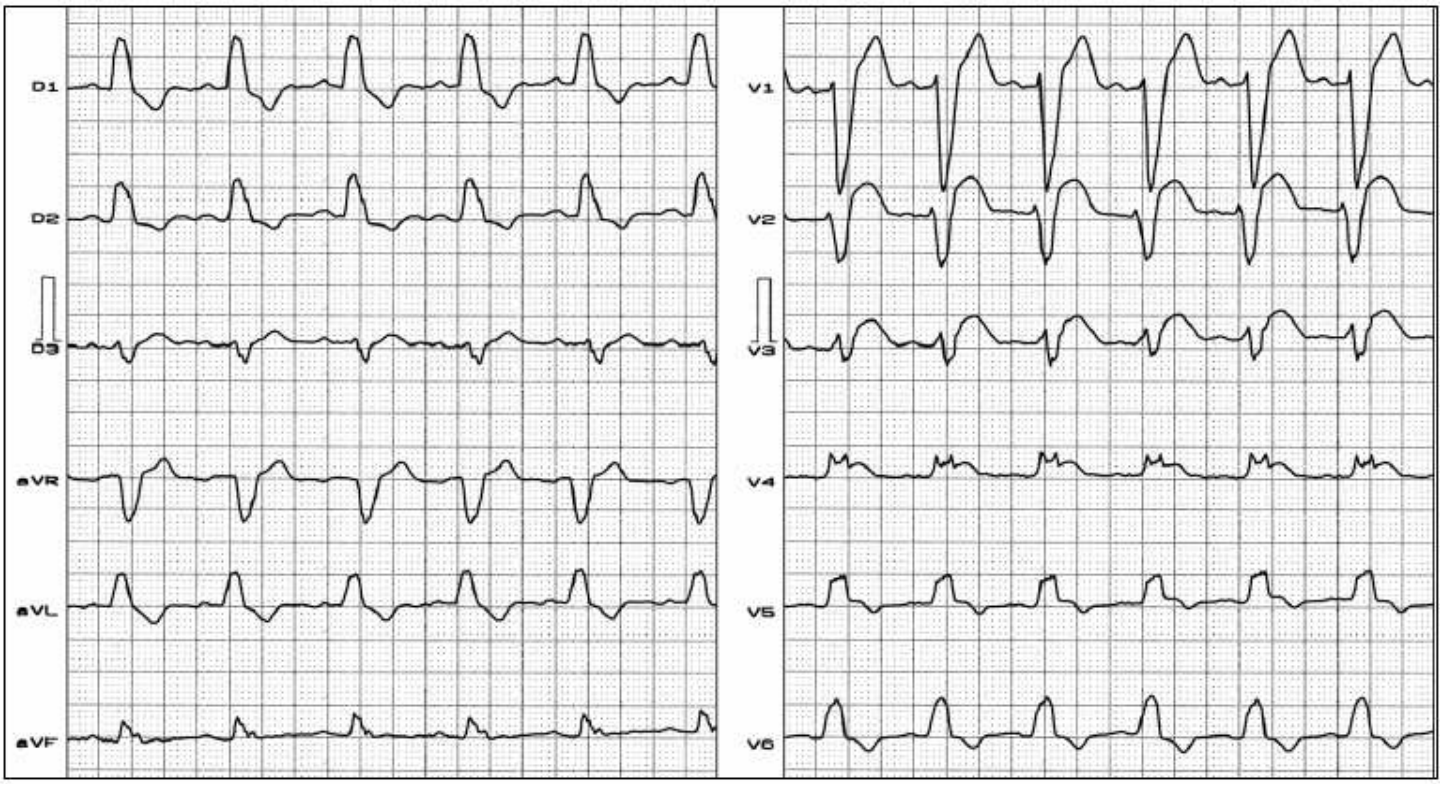
Physical: central obesity (110kg weigh and 176m high) "apple-shaped" body mass index of 35.5, waist circumference 110cm, and waist-hip ratio (WHR) of 1.10, severe pain with significant respiratory distress without requiring ventilatory support.
Low-grade fever 37.2ºC, cold diaforesis, BP, 170/110mmHg,
Visible and papable Ictus on 6th intercostal space on left anterior axilary line, impulsive and broad.
A2 hyperfonetic, third heart sound (S3) with gallop cadency, and an audible fourth heart sound (S4).
Pulmonary basal rales
Elevated jugular venous pressure
Sensitiveliverpalpableat2cm from right costal border
Killip class II: with rales or crackles in the lungs, S3, and elevated jugular venous pressure.

The following ECG was performed in the emergency room at admission.

Presentación de caso Hombre provecto (78 años), blanco, electricista jubilado, sedentário, obeso, diabético tipo 2 e hipertenso. Natural y residente en la ciudad de Santo André, São Paulo Brasil. Comparece a nuestro departamento de emergencias por queja de dolor precordial opresivo de instalación súbita y durante el reposo que tuvo inició hace 3 horas. El dolor se irradia al mienbro superior izquierdo hasta el codo. Concomitantemente se observa: dispnea, náusea, vómitos, sudor frio y febricula. Examen físico: obeso centrípeto (110kg y 1,76 de estatura), contorno corporal "en manzana", índice de masa corporal de 35,5, circunferencia abdominal de 110cm, y relación cintura-cuadril de 1.1.Febrícula 37,2ºC, sudor frío, PA 170/110 mmHg. Ictus visíble y palpáble en el 6º espacio intercostal, sobre la linea axilar anterior izquierda, de carácter impulsivo, y se cubre con 2 pulpas digitalicas. A2 hiperfonetico, tercer ruido con cadencia de galope y cuarto ruido audible. Ausencia de soplos. Rales en bases y elevación de la presión venosa yugular. Higado sensible a 2cm del reborde costal derecho. Killip clase II.

El siguiente ECG fue realizado durante la admisión.

12-LEAD ECG DURING ADMISSION



Estimado Andrés,
En nuestro servicio ante este caso no dudamos que: tiene un BCRI
Supradesnivel del ST isquémico, según criterios de Sgarbossa (ver artículos de ella).
CCG al ingreso y eventual ATC si hubiera obstrucción coronaria. Si la tiene hay lesión severa proximal de la DA.
Los mínimos detalles lo dejamos para eximios electrocardiografistas como vos y Samuel. Saludos.
Oscar Pellizón.

Dear Andrés
In our institution we have not doubt:
LBBB
Ischemic ST segment elevation folowing the Sgarbossa´s criteria (see author manuscripts).
Cinecoronariography at admission, eventually ATC in case of coronary obstruction.
In case of coronary obstruction, certainly proximal LAD is the culprit artery.
Greeting
Oscar Pellizón MD

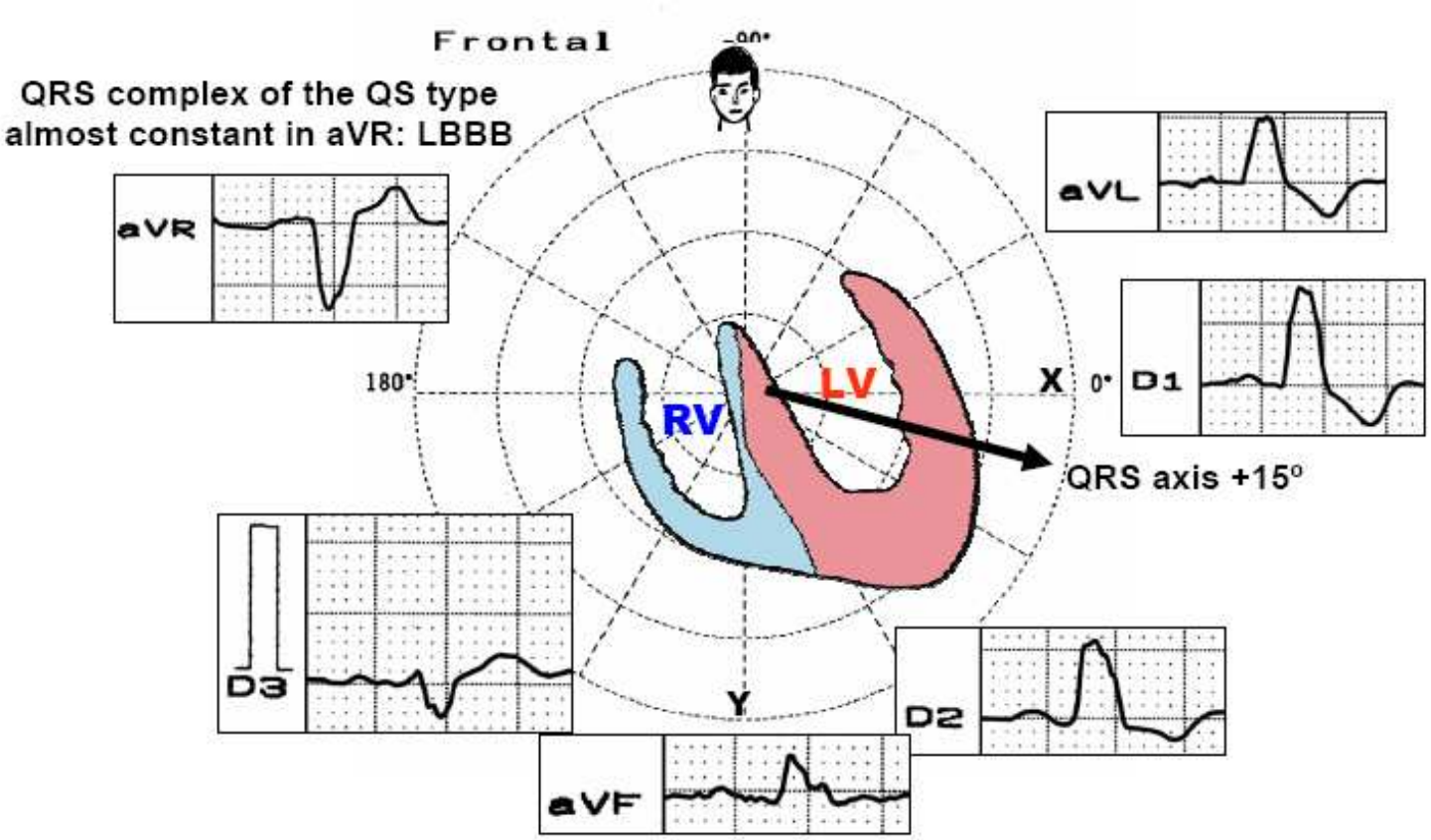
Andrés
This is an anterior STEMI involving the proximal LAD.
Victoria
Vic Ariyarajahvignendra@hotmail.com
Department of Medicine, Thomas Jefferson University Hospital, Philadelphia, PA 19107, USA.

Prof. Andrés
ECG característico de IAM + BRE segundo os criterios de Sgarbossa (supra discordante em V2 > 5mm; supra concordante> 1mm em V4 e V5 (muito específico).
Outros sinais: área do supra de ST em relação ao QRS = 1; o aspecto do ST arredondado sugere também fase aguda do IAM com BRE.

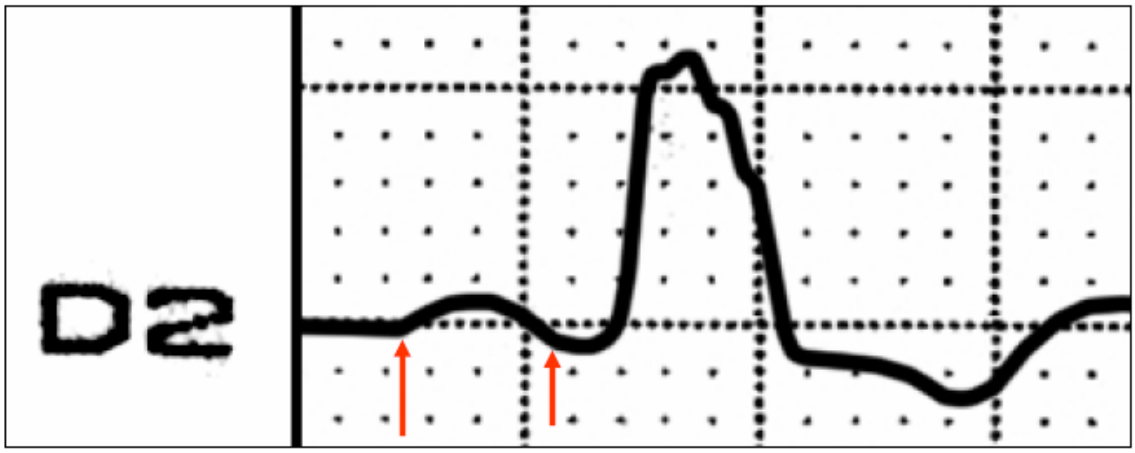
No idoso, principalmente com instabilidade hemodinâmica, o mais recomendable seria a angioplastia primária. A história e o exame físico sugerem disfunção ventricular prévia agravada por síndrome coronariana aguda com supra de ST.
Gostaria de ouvir outras opiniões.
Mortalidade alta nesta situação.
Raimundo Barbosa Barros

Prof Andrés: Characteristic ECG of anterior STEMI complicated with LBBB, following
Sgarbosa´s criteria (STSE discordant in V2> 5mm, STSE concordant > 1mm in V4-V5 (very specific).
The shape of ST segment elevation convex to the top is suggestive of AMI
complicated with LBBB.

In seniors, mainly with haemodynamic instability the best approach is the primary percutaneous transluminal coronary angioplasty (PTCA). The history and physical examination suggest pervious LV dysfunction worsen by anterior STEMI complicated with LBBB.

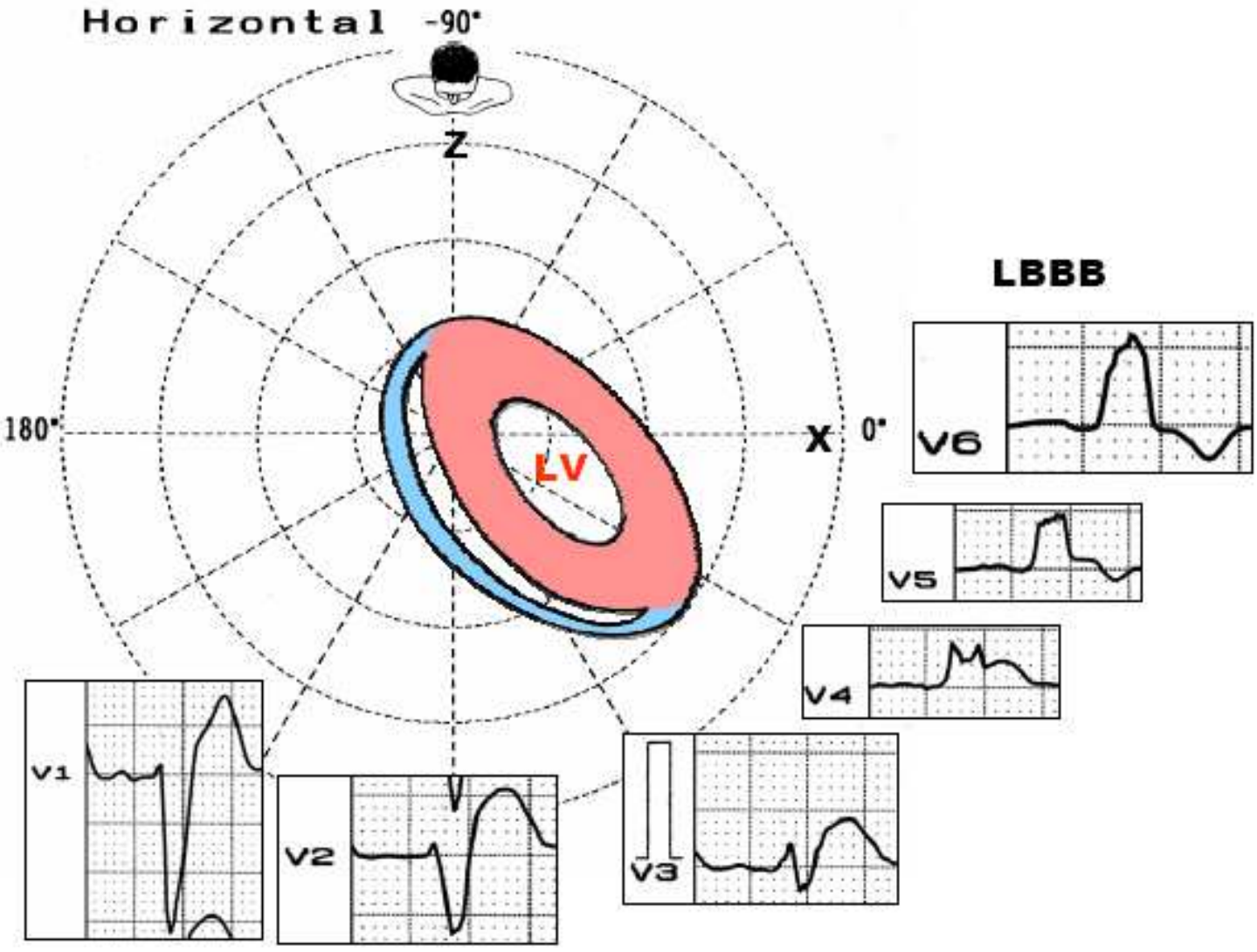


Supraventricular command the rhythm is sinus, Boderline intra-atrial block, P-wave width 120ms, The PR interval is ≥120 ms, QRSd160ms, monophasic, broad notched or slurred R wave, characteristic the absence of initial q waves in leads I recorded slowly in the left leads: I, aVL Secondary alteration of ventricular repolarization is observed with QRS/ST-T angle near the 180º.

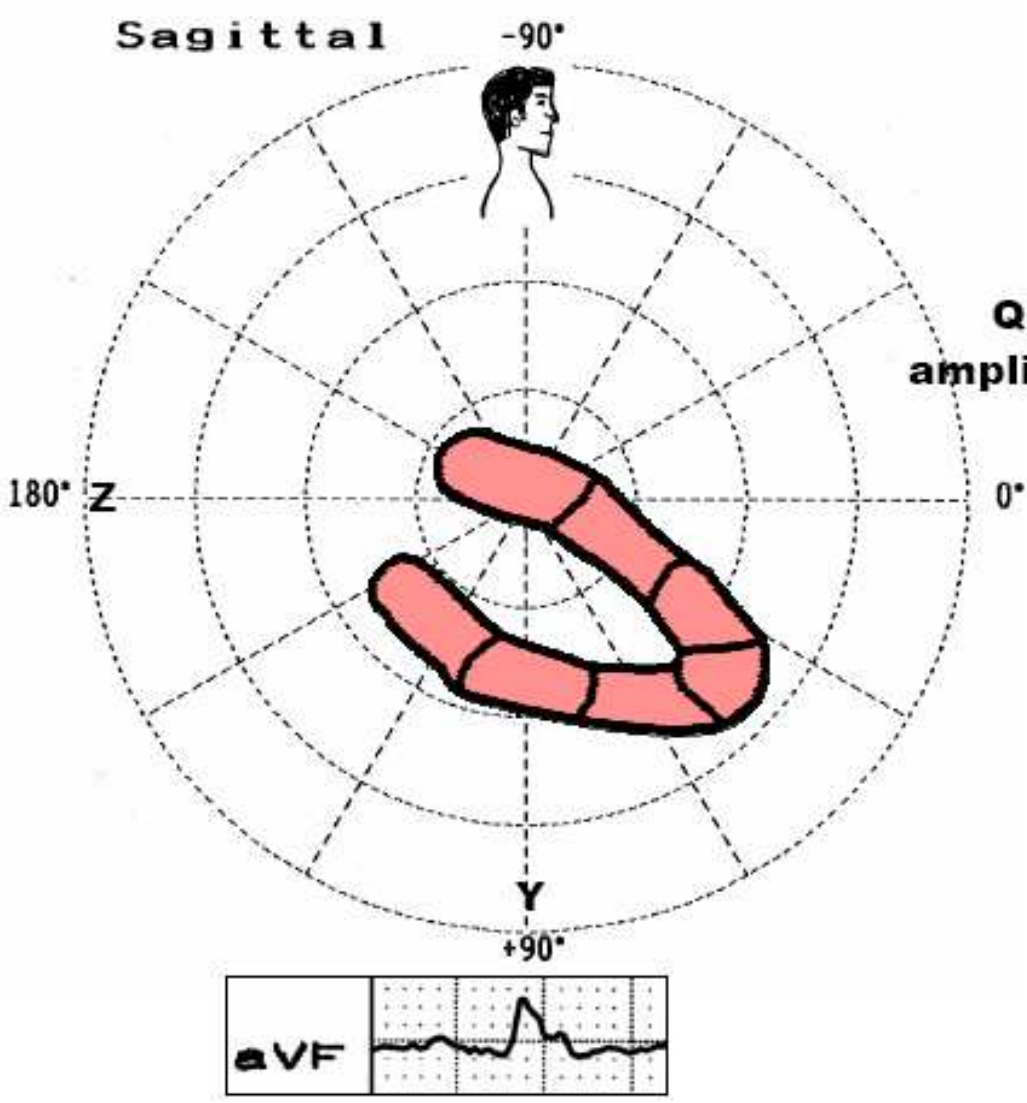


P duration = 120ms prolonged borderline intra-atrialblock

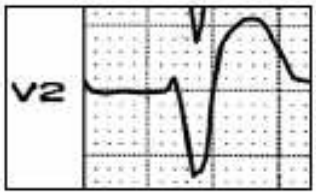
The ST segment elevation is exaggerated and becomes coved, convex-upward. (≥5 mm) in V_2lead. STEMI from V_2 to V_5 (anterolateral wall).



Anterolateral STEMI convex to the top from V2-V5: Acute anterolateral MI



QRS/ST-T ratio amplitude near to 1:1.

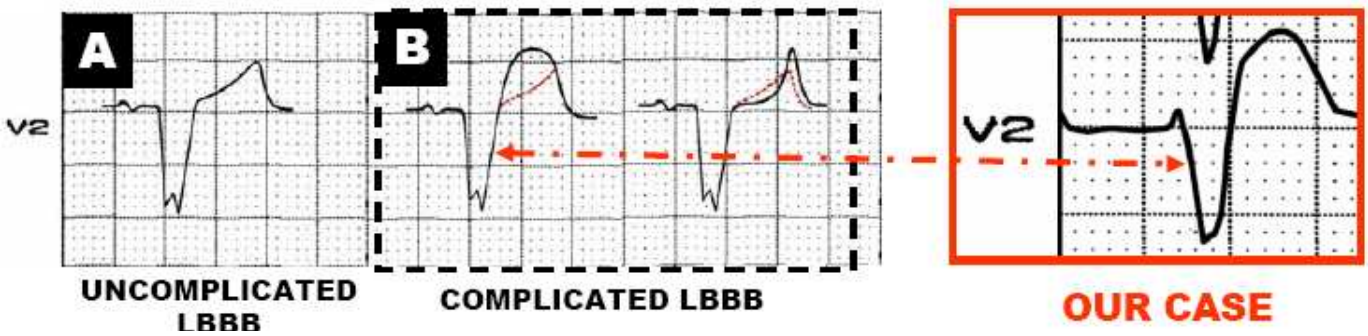


rS

ST elevation upwardly convex

IDENTIFICATION OF ACUTE CORONARY SYNDROMES IN PATIENTS WITH LEFT BUNDLE BRANCH BLOCK

ST-SEGMENT AND T WAVE CHARACTERISTICS ON RIGHT PRECORDIAL LEADS (V1-V2) IN UNCOMPLICATED (A) AND COMPLICATED LBBB (B)

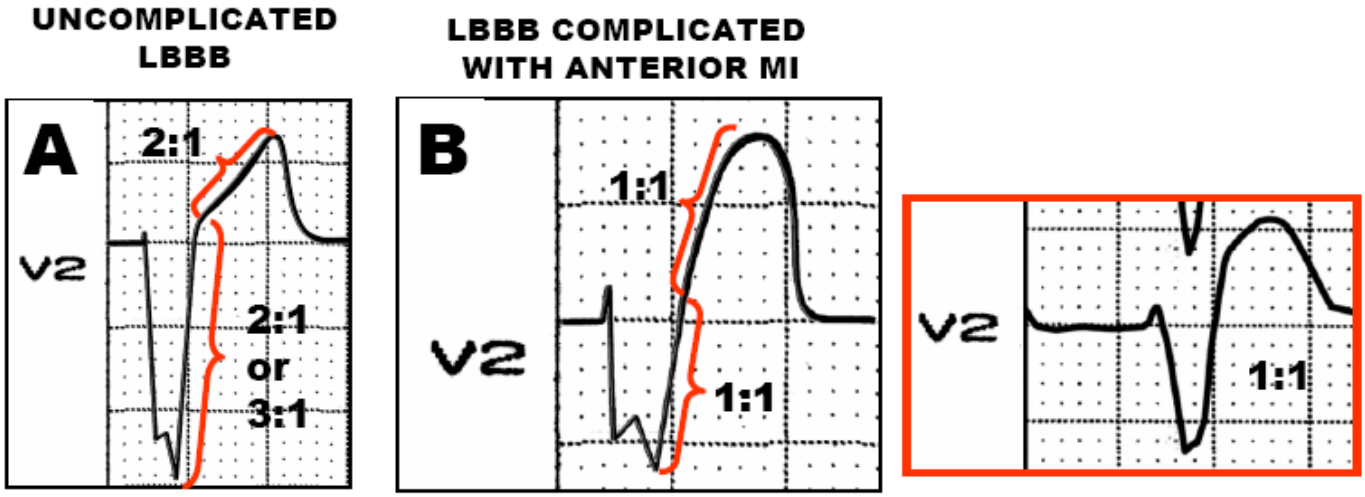


• **A:** The elevated ST segment has a straight upward slope, or an upward slope that is minimally concave-upwards. The T wave is upright, with asymmetrical limbs and a relatively blunt apex.

• **B:** With AMI the ST segment elevation is exaggerated (≥5 mm) in the right precordial leads and becomes coved, convex-upward. The T wave becomes inverted and/or its limbs tend to become more symmetrical.

1. Modified from Leo Schamroth. The Electrocardiology of Coronary Artery Disease. Blackwell Scientific Publications. Oxford London Edinburgh Melbourne. 1975; pg 86.

OTHERS ECG CRITERIA IN LBBB COMPLICATED WITH AMI



A: Ratio of $^{QRS}/_{ST\text{-}T}$ amplitude, 2:1. ST upwardly concave.

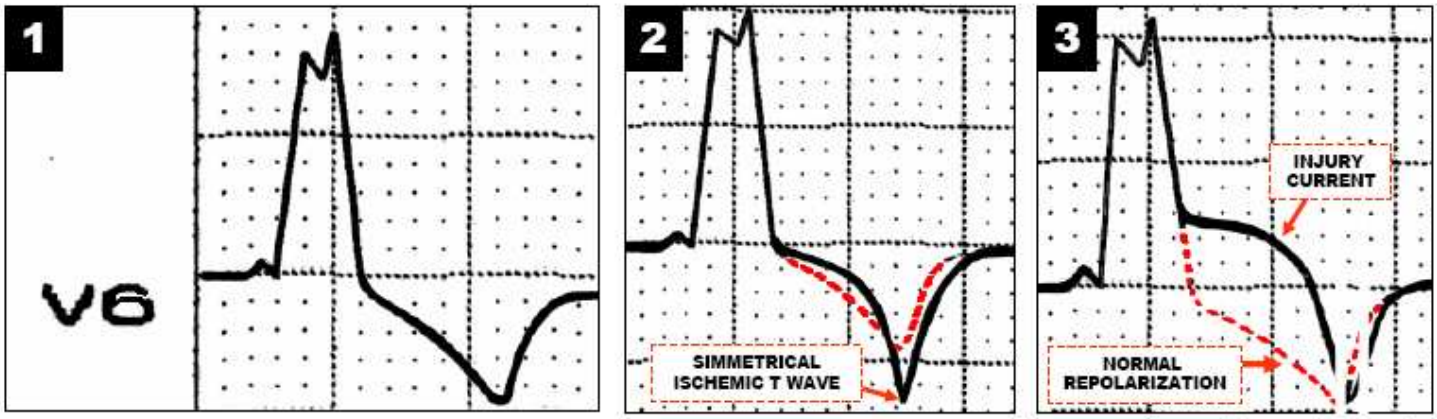
B: Ratio of $^{QRS}/_{ST\text{-}T}$ amplitude 1:1. ST upwardly convex.

Diminution of QRS/ST-T ratio in lead V2: In uncomplicated LBBB, the ratio of QRS voltage to the ST segment voltage is always greater than 1. Usually 2:1 or 3:1 in V2 lead[1]. During AMI the elevation of ST segment with concomitant eventual reduction in the QRS voltage results in a QRS/ST-T ratio near to 1:1.

1) Schamroth L. The Electrocardiology of Coronary Artery Disease Myocardial Infarction Associated with Left Bundle Branch Block 1975; Chapter 10 pp: 93 Blackwell Scientific Publications.

LEFT PRECORDIAL LEADS (V5-V6) IN UNCOMPLICATED LBBB (1) AND LBBB ASSOCIATED TO ACUTE CORONARY SYNDROME (2, 3)

V_6 lead in uncomplicated LBBB and associated to injury, ischemia and/or infarction.



1: Habitual QRS-S/T in uncomplicated LBBB in V_6 Lead.

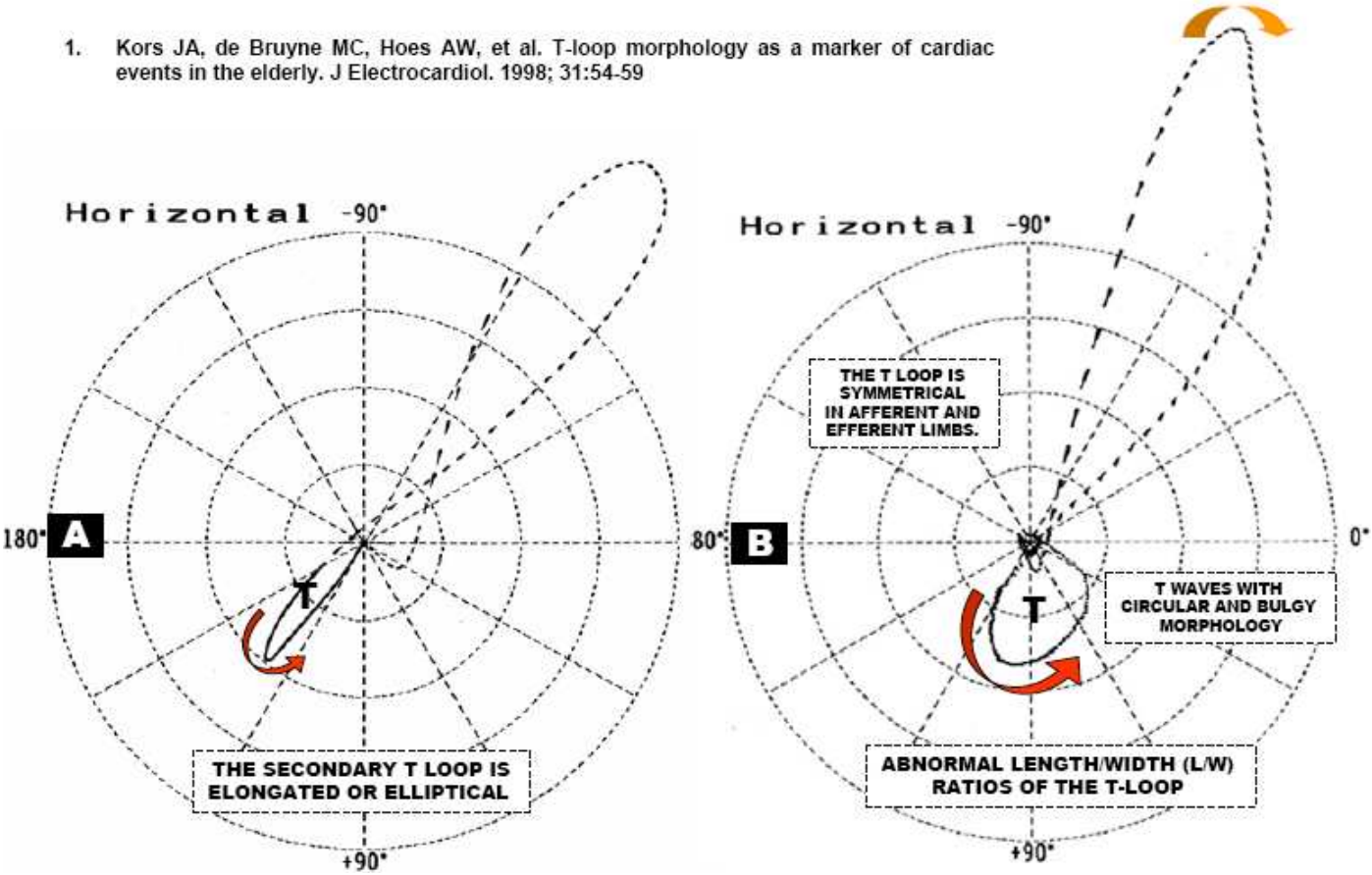
2: LBBB with ischemia (red dots indicate normal T shape).

3: LBBB Associated to Anterolateral Infarction: ST segment elevation convex to the top: subepicardial injury (red dots represent normal repolarization).

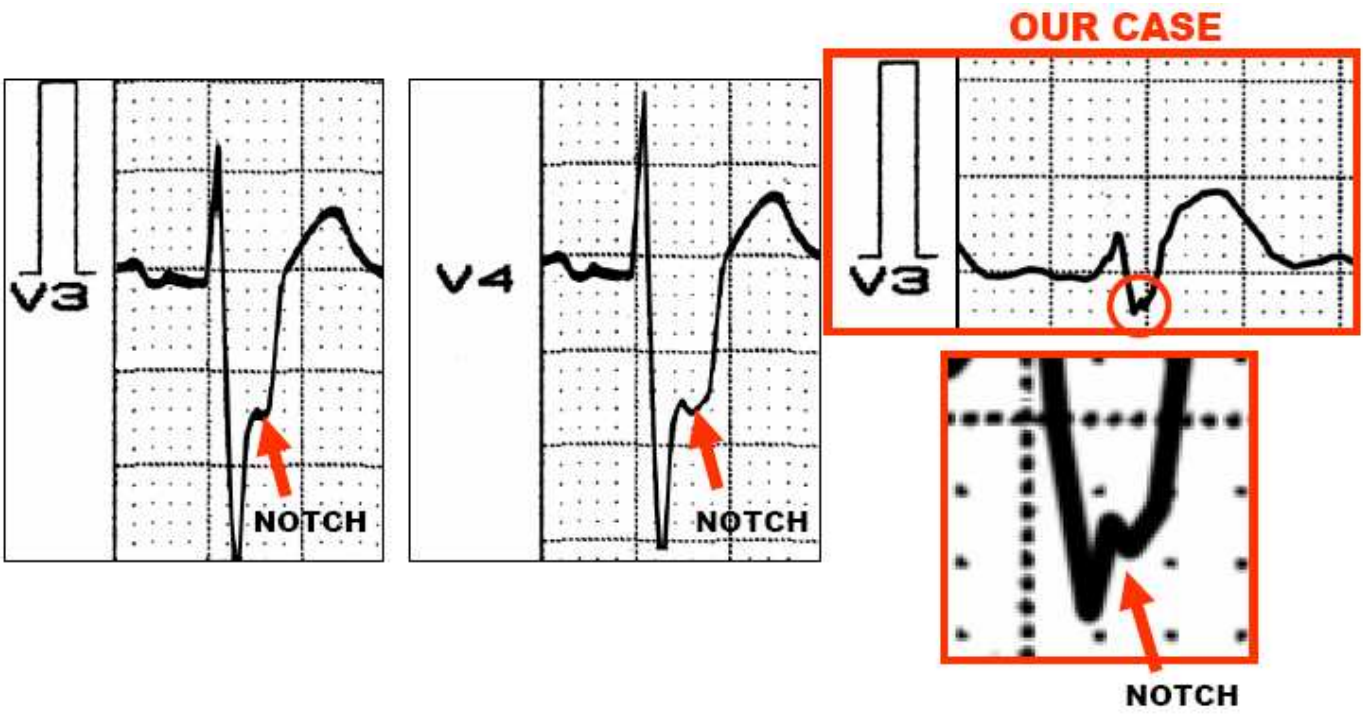
Modified from Schamroth L. The electrocardiology of coronary artery disease. Blackwell Scientific Publications. Oxford-London Edinburgh Melbourne. 1975; pg. 86.

NORMAL (A) AND ISCHEMIC (B) T LOOP ON HP IN PRESENCE OF LBBB

1. Kors JA, de Bruyne MC, Hoes AW, et al. T-loop morphology as a marker of cardiac events in the elderly. J Electrocardiol. 1998; 31:54-59



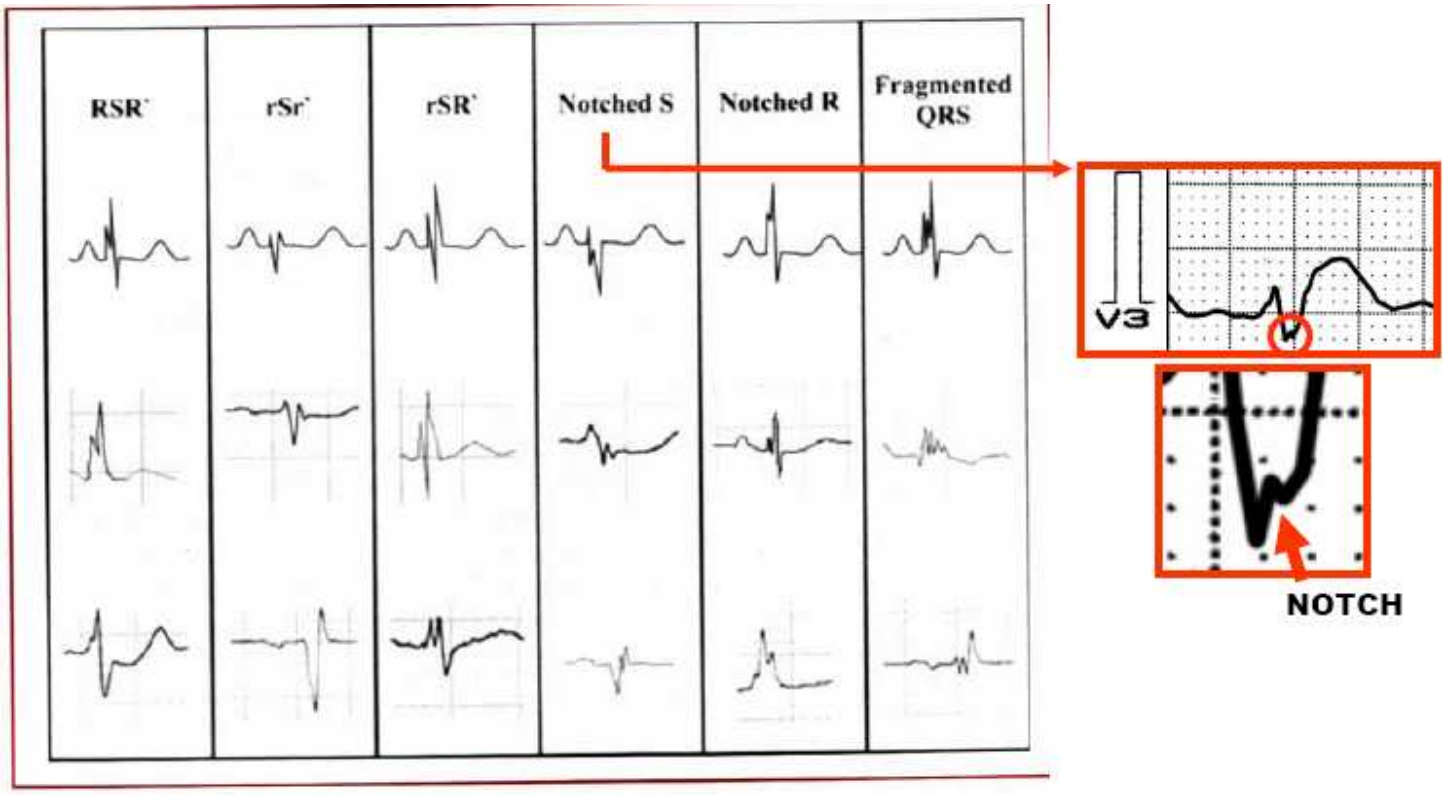
CABRERA'S SIGN[2]: LBBB COMPLICATED WITH ANTERIOR MI



Notch of 50 ms in the ascending ramp of S wave of V3 and V4. It is seen more often with MI than without (anterior more often than inferior), and the left axis increased its sensitivity[1;2].

1) Kindwall KE, Brown JP, Josephson ME. Predictive accuracy of criteria for chronic myocardial infarction in pacing-induced left bundle branch block. Am J Cardiol. 1986; 57:1255-1260.

2) Cabrera E, FriedlandC. Wave of ventricular activation in left bundle branch block with infarct; a new electrocardiographic sign. GacMed Mex. 1953; 83:273-280.



Fragmented QRS (RSR2 pattern and its variants. The different morphologies of fQRS, which include various RSR2 patterns, are shown in this figure. Note that if RSR2 patterns are present in right precordial leads (V1 and V2) with QRS > 100ms (Incomplete RBBB), or QRS > 120ms (Complete RBBB) and in left precordial lead (RSR2 in lead I, V5, and V6) with QRS > 120ms (LBBB), they are defined as complete or incomplete BBB and excluded from the definition of fQRS, whereas if the RSR2 pattern is present in the mid precordial lead of in inferior leads, they are defined as fQRS[1].

1. Das MK, Saha C, El Masry H, Peng J, Dandamudi G, Mahenthiran J, McHenry P, Zipes DP. Fragmented QRS on a 12-lead ECG: a predictor of mortality and cardiac events in patients with coronary artery disease. Heart Rhythm. 2007 Nov;4:1385-1392.

SIGNIFICANCE OF fQRS IN VARIOUS HEART DISEASES

Coronary artery disease (CAD): Das et al[1], demonstrated that the fragmentation of QRS complexes, both narrow (QRS duration <120ms)1 and wide (QRS ≥120ms)[2], represent myocardial scar in patients with suspected or know CAD. Sensitivity, specificity, and the negative predictive value for myocardial scar were 86%, 89% and 93% respectively, for the fQRS, and 31%, 89%, and 94% respectively for the Q wave.

In another study of 879 patients with wide QRS complexes, these authors showed that fragmented wide QRS (f-wQRS) represents myocardial scar[2]. The sensitivity, specificity, positive predictive value and negative predictive value of f-wQRS for myocardial scar were 87%, 93%, 92% and 88%.

Non-CAD: The incidence of QRS fragmentation has not been fully studied in patients with DCM, however, it is common finding on a 12-lead ECG in patients who receive an ICD for primary and secondary prophylaxis.

Others entities with positive fQRS are: ARVD[3], Brugada syndrome[4] (f-QRS appears to be a marker for the substrate for spontaneous VF in BrS and predicts patients at high risk of syncope.), acquired long QT syndrome[5], non ischemic dilated cardiomyopathy with a narrow QRS interval[6].

1. Das MK, Khan B, Jacob S, Kumar A, Mahenthiran J. Significance of a fragmented QRS complex versus a Q wave in patients with coronary artery disease. Circulation. 2006 May 30;113:2495-2501.

2. Das MK, Suradi H, Maskoun W, Michael MA, Shen C, PengJ, Dandamudi G, Mahenthiran J. Fragmented wide QRS on a 12-lead ECG: a sign of myocardial scar and poor prognosis. Circ ArrhythmElectrophysiol. 2008 Oct;1:258-268.

3. Peters S, Trümmel M, Koehler B. QRS fragmentation in standard ECG as a diagnostic marker of arrhythmogenic right ventricular dysplasia-cardiomyopathy. Heart Rhythm.2008 Oct;5:1417-1421.

4. Morita H, Kusano KF, Miura D, Nagase S, Nakamura K, Morita ST, Ohe T, Zipes DP, Wu J. Fragmented QRS as a marker of conduction abnormality and a predictor of prognosis of Brugada syndrome. Circulation. 2008 Oct 21;118:1697-704.

5. Moss AJ. Fragmented QRS: the new high-risk kid on the block in acquired long QT syndrome. Heart Rhythm.2010 Dec;7:1815-1816. Fragmented QRS Complexes Are Associated with Cardiac Fibrosis

6. Basaran Y, Tigen K, Karaahmet T, Isiklar I, Cevik C, Gurel E, et al. Intraventricular Systolic Dyssynchrony in Nonischemic Dilated Cardiomyopathy Patients with a Narrow QRS Interval. Echocardiography. 2010 Jul 5. [Epubahead of print]

MAIN EPIDEMIOLOGIC FEATURES IN LBBB ASSOCIATED WITH ACS

- Patients with LBBB comprise 5-9% of all patients with AMI[1].
- The presence of ST elevation of at least 1mm in the limb leads or 2mm in the chest leads on the ECG[2].
- A new LBBB occurs in 2-3% of patients with AMI[2]. A new LBBB is an independent predictor of all major adverse cardiovascular outcomes during long-term follow-up[3].
- LBBB, Ventricular Paced Rhythm and Left Ventricular Hypertrophy reduce the ability of the ECG to detect Acute Coronary Syndrome change and AMI[4].
- The development of new BBB during AMI is associated with a poor immediate and long term prognosis. This may be related to larger infarcts rather than the conduction defect itself[5].

1) Gunnarsson G, Eriksson P, Dellborg M. Continuous ST-segment monitoring of patients with left bundle branch block and suspicion of acute myocardial infarction. J Intern Med. 2004; 255:571-578.

2) Lie KI, Wellens HJ, Schuilenberg RM, Bundle branch block and myocardial infarction. In Wellens HJJ, Lie K, Janse MJ, eds. The Conduction System of the Heart: Structure, Function and Clinical Applications. Leiden: Stenfert Kroese, 1976: 662-672.

3) Stephenson K, SkaliH, McMurray JJ, et al. Long-term outcomes of left bundle branch block in high-risk survivors of acute myocardial infarction: The VALIANT experience. Heart Rhythm. 2007; 4:308-313.

4) Brady WJ, Chan TC, Pollack M. Electrocardiographic manifestations: patterns that confound the EKG diagnosis of acute myocardial infarction-left bundle branch block, ventricular paced rhythm, and left ventricular hypertrophy. J EmergMed. 2000; 18: 71-78.

5) Hassi M, Kunstmann S, Corbalán R, et al. Intraventricular conduction disorders in acute myocardial infarction: early and late clinical significance Rev Med Chil. 1989; 117:1381-1386.

THROMBOLISIS IN PATIENS WITH A NEW OR RECENT ONSET LBBB

There are two indications for initiating thrombolysis in a patient with cardiac chest pain:

- The presence of ST elevation of at least 1mm in the limb leads or 2mm in the chest leads on the ECG.

- A LBBB pattern.

- There must also be no compelling contraindications to thrombolysis. When meeting a patient for the first time it can be difficult to establish whether the onset of LBBB is new, without a previous ECG, this must be particularly difficult in the pre-hospital setting.

- Thrombolytic drugs are not without risk and careful questioning must be carried out to ensure that they are given appropriately.

- Fibrinolytic therapy is recommended for patients who have chest pain and LBBB. However, the presence of baseline ECG abnormalities makes early accurate identification of AMI difficult. Additionally, nearly 50% of AMI patients with LBBB present without chest pain.

THROMBOLISIS IN PATIENS WITH A NEW OR RECENT ONSET LBBB

•LBBB patients with AMI who present without chest pain are less likely to receive optimal therapy and are at increased risk of death[1].

•Prompt recognition and treatment of this high-risk subgroup should improve survival.

•The clinical history is not effective at distinguishing LBBB patients with AMI among patients who appeared to be candidates for acute reperfusion therapy[2].

1) Shlipak MG, Go AS, Frederick PD, et al. Treatment and outcomes of left bundle-branch block patients with myocardial infarction who present without chest pain. National Registry of Myocardial Infarction 2 Investigators. J Am CollCardiol. 2000;36:706-712.

2) Shlipak MG, Go AS, Lyons WL, et al. Clinical Symptoms and Myocardial Infarction in Left Bundle Branch Block Patients. Cardiology 2000;93:100-104

THE USE OF ECGs CRITERIA, BASED ON SIMPLE ST-SEGMENT CHANGES

• Sgarbossa et al. proposed specific ECG criteria for the diagnosis of AMI in the presence of LBBB based on the criteria performance as applied to 131 patients in the GUSTO-1 trial (*Global Utilization of Streptokinase and Tissue Plasminogen Activator for Occluded Coronary Arteries*) who had AMI and LBBB in comparison to patients from the Duke database who had LBBB and were clinically stable. The application of the most efficient of the criteria was associated with a high specificity and low sensitivity.

•The base-line ECGs of patients enrolled in the GUSTO-1 T trial who had LBBB and AMI confirmed by enzyme studies were blindly compared with the ECGs of control patients who had chronic coronary artery disease and LBBB.

•Of 26,003 patients, 131 (0.5%) with AMI had LBBB[1].

1. Sgarbossa EB, Pinski SL, Barbagelata A, et al. Electrocardiographic diagnosis of evolving acute myocardial infarction in the presence of left bundle-branch block. GUSTO-1 (Global Utilization of Streptokinase and Tissue Plasminogen Activator for Occluded Coronary Arteries) Investigators. N EnglJ Med. 1996; 334:481-487

THE SGARBOSSA'S SCORE

1) ST-segment elevation of at least 1 mm (≥1 mm) in the lead with concordant QRS complex--a score of **5 points**.

2) ST-segment depression of at least 1 mm (≥1 mm) in lead V1, V2 or V3--a score of **3 points**.

3) ST-segment elevation of at least 5 mm (≥5 mm) in the lead with discordant QRS complex--a score of **2 points**.

Enumeration of the criteria by Sgarbossa et al, for the diagnosis of LBBB associated to AMI.

In Sgarbossa study, the clinical prediction rule score values of these signs were 5; 3; and 2, respectively.
A score ≥3 made a diagnosis of AMI with a 90% specificity and a score of2 with > 80%, specificity.

VALUE OF THE ECG AS GUIDE THERAPY IN PATIENTS WITH LBBB AND SUSPECTED AMI

- The ECG is a poor predictor of MI in a community-based cohort of patients with LBBB and acute cardiopulmonary symptoms.

- The ECG cannot reliably be used to rule out AMI in patients withLBBB[1].

- Patients with LBBB and symptoms of AMI should receive reperfusion therapy if there are no contraindications[2].

- Acute thrombolytic therapy should be considered for all patients with LBBB who have symptoms consistent with AMI.

1) Shlipak MG, Lyons WL, Go AS, et al. Should the electrocardiogram be used to guide therapy for patients with left bundle-branch block and suspected myocardial infarction? JAMA, 1999; 281:714-719.

2) Pollack CV, Diercks DB, Roe MT, Peterson ED; American College of Cardiology; American Heart Association. 2004 American College of Cardiology/American Heart Association guidelines for the management of patients with ST-elevation myocardial infarction: implications for emergency department practice. AnnEmergMed. 2005; 45:363-376.

THE ECG SGARBOSSA CRITERIA SENSITIVITY AND SPECIFICITY. VALUE OF SERUM BIOMARKERS·

- The criteria of Sgarbosa are too insensitive to be used as screening (roule out) test to determine which patients with an LBBB do not have an AMI.

- The Sgarbosa criteria are, however, highly specific and can be used reliably as confirmatory test to rule in AMI in patients with LBBB. ECG alone doesn't support the diagnosis of AMI.

- Elevated value of biochemical markers of myocardial necrosis in the presence of LBBB confirms the diagnosis. Currently the best justified strategy is to follow American Heart Association (AHA) and American College of Cardiology (ACC) recommended guidelines to administer thrombolysis to all patients with LBBB presenting with chest pain, particularly if serum biomarkers are elevated[1].

1) Jakuitis A, Statkevicene A. The importance of left bundle branch block in the diagnosis of acute myocardial infarction Medicina (Kaunas). 203; 39: 15-20.i0

THROMBOLYTIC TREATMENT IN PATIENTS WITH LBBB AND AMI

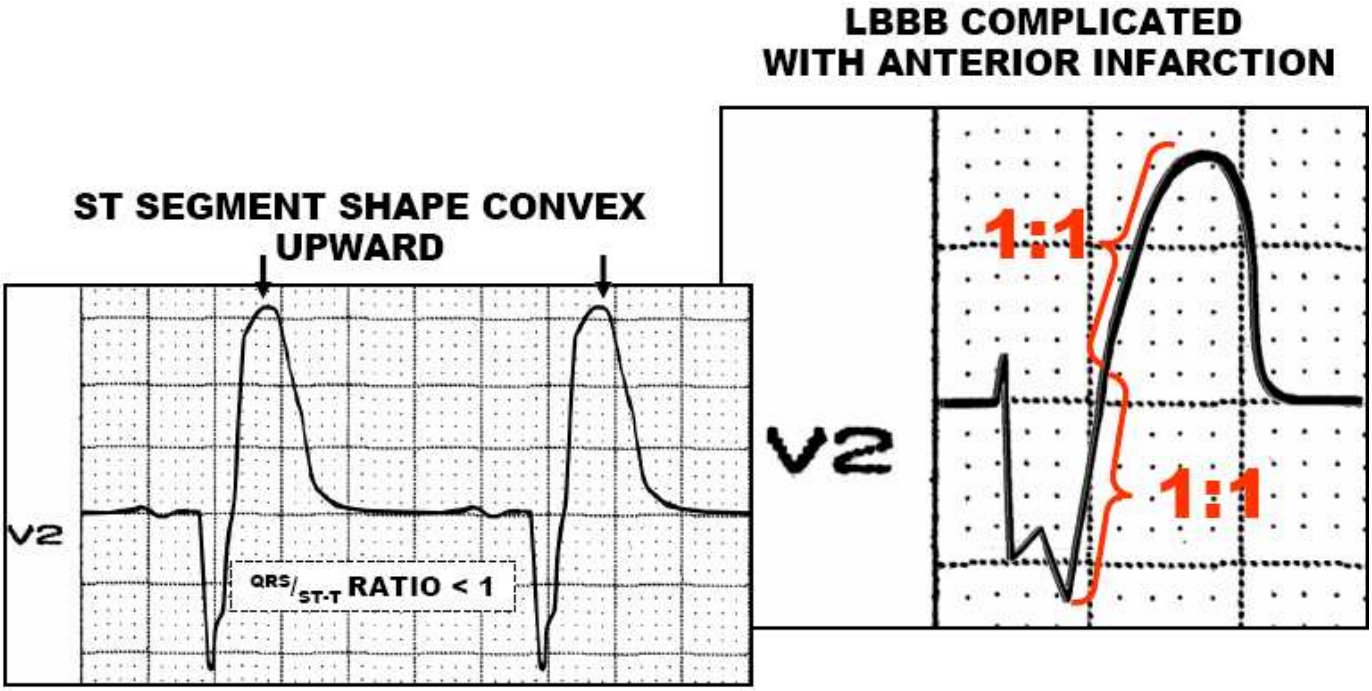
- Currently, thrombolytic treatment is under-utilized in patients with LBBB and AMI, and those who are thrombolyzed endure lengthy delays before treatment.

- Patients with any of the predictive criteria should be thrombolyzed immediately. When the diagnosis is in doubt, if doubt persists, serial ECGs may show evolving ischemic changes[1].

1) Edhouse JA, Sakr M, Angus J, et al. Suspected myocardial infarction and left bundle branch block: electrocardiographic indicators of acute ischaemia. JAccidEmergMed. 1999; 16:331-335.

LEFT BUNDLE BRANCH BLOCK ASSOCIATED WITH ACUTE ANTERIOR MYOCARDIAL INFARCTION

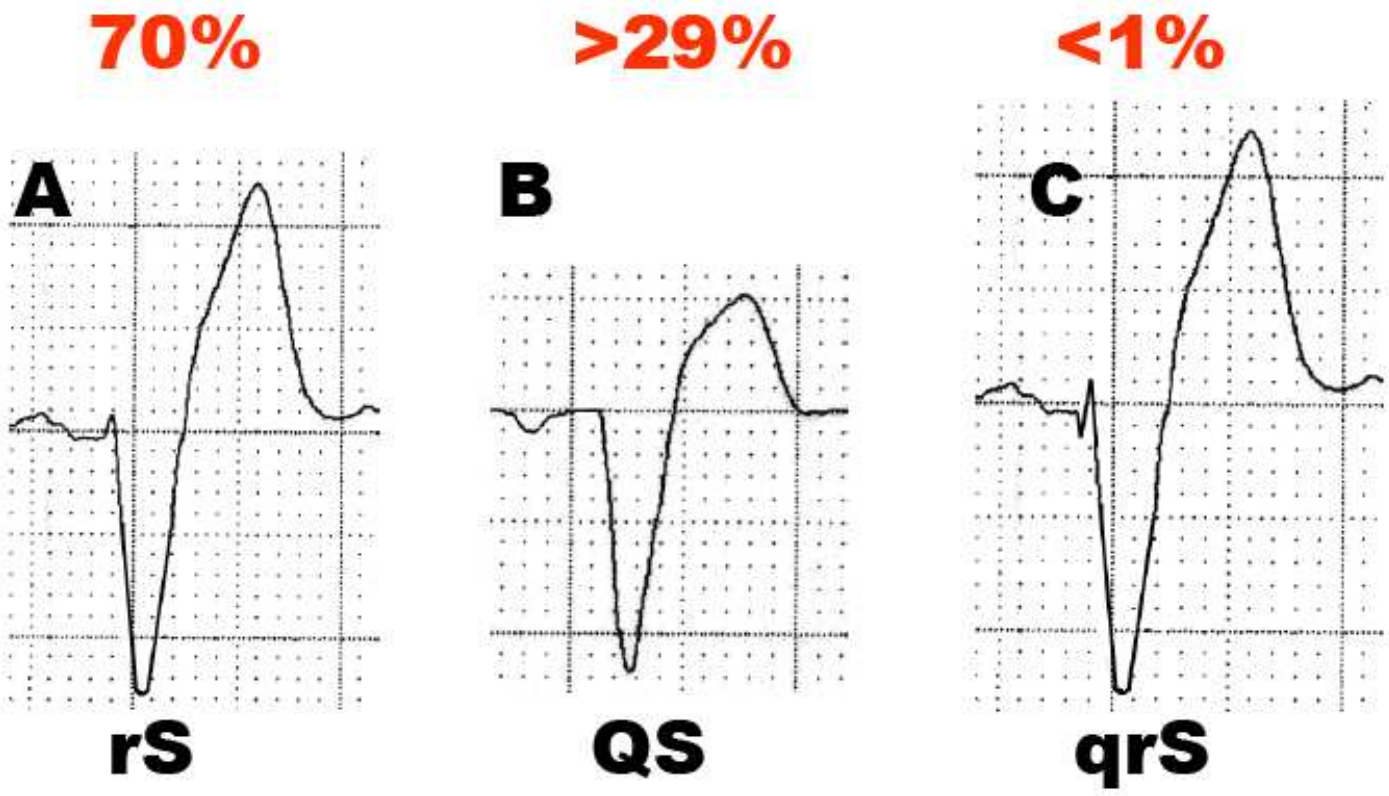
QRS/ST-T RATIO <1 IN LBBB COMPLICATED WITH ANTERIOR MI (POSITIVE SGARBOSSA'S CRITERIA)



ST segment elevation of 5 mm or more when not matching the QRS complex in V1and V2 (negative QRS). Positive Sgarbossa´s criteria.

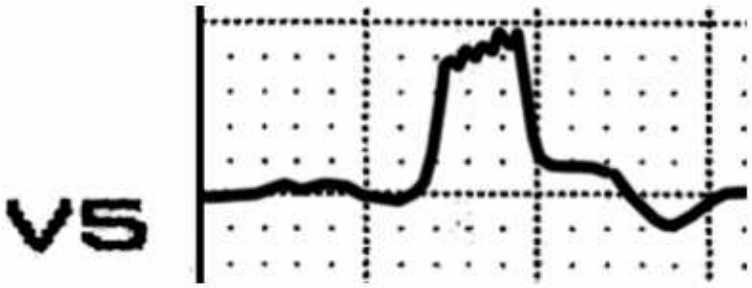
IDENTIFICATION OF CHRONIC MYOCARDIAL INFARCTION IN PATIENTS WITH LEFT BUNDLE BRANCH BLOCK: ELECTRO-VECTORCARDIOGRAPHIC MAIN FEATURES

POSSIBLE QRS MORPHOLOGIES IN RIGHT PERCORDIAL LEADS (V_1-V_2) IN UNCOMPLICATED LBBB



The three possible QRS morphologies in V1–V2in uncomplicated LBBB: rS (70%), QS (>29%) and qrS (>1%).

Voltage decrease of R wave, in V_5 indicating additional involvement in LV free wall (apex).



Our case

V_5 uncomplicated LBBB