ECG Quiz 30

CASSA
CARDIAC ARRHYTHMIA SOCIETY OF SOUTHERN AFRICA
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ANSWER

OVERVIEW OF THE ECG

The ECG shows a regular wide QRS rhythm at 90/minute. There are P-waves before each QRS which are upright in lead II and inverted in aVR, compatible with origin in the sinus node. The QRS complexes are very wide, around 180ms, and the pattern suggests complete left bundle branch block, although with some atypical features.

This quick assessment, in the context of the clinical presentation, is sufficient to make a treatment decision. A presenting ECG showing LBBB, in a patient with symptoms suggesting acute myocardial infarction (MI), has the same significance as ST segment elevation in an appropriate distribution.[1,2]

CHOICE OF TREATMENT

In the circumstances described,[3] is the most appropriate choice in keeping with the current guidelines. All the other options involve an unacceptable delay. Thrombolysis in the first 2 - 3 hours offers at least as good an outcome as primary PCI which may be delayed for several hours by transporting the patient to a suitable facility for this intervention.[3] However, changes to the current guidelines are being considered in order to take into consideration the fact that a significant number of patients presenting with LBBB are elderly, at higher risk for bleeding and may not have occluded coronary arteries. The proposed alterations factor in the use of Sgarbossa concordance criteria, point of care troponin levels and bedside echocardiography to differentiate patients with LBBB requiring treatment as a STEMI from patients requiring an NSTEMI treatment strategy.[4]

MORE DETAILED ANALYSIS OF THE ECG

There is more to this tracing than immediately meets the eye. The pattern is, indeed, that of LBBB. The rS complex in V1 is typical. The initial small R-wave is <30ms, confirming normal (rapid) depolarisation of the right ventricle. V6, however, is atypical in that there is an initial Q-wave of around 40ms duration. This would normally negate a diagnosis of LBBB, but has been described in patients with LBBB and anterior myocardial infarction.[5] The QRS in V5 is also unusual: there is complex splintering of the QRS, which is of a low amplitude. Similar splintering is present in the limb leads. Small Q-waves are also present in Lead I and aVL.

There is discordant (opposite to the QRS polarity) ST elevation of 4mm in V2. This does not quite meet the published criterion of 5mm, but the S-wave in V1 - V3 is relatively small. This, together with the coved appearance of the ST segment is compatible with a current of injury, rather than the usual ST elevation in these leads in uncomplicated LBBB. There is no definite concordant ST elevation in any lead, except aVL which comes close. While the presence of LBBB is widely thought to preclude the ECG diagnosis of MI, these features of ST deviation are reported to be fairly reliable indicators of acute MI in patients with LBBB.[5] Their absence, however, does not exclude the diagnosis, as the negative predictive value is low. Table I lists the ECG features which suggest MI in the presence of LBBB.

Abnormal ventricular depolarisation, as occurs in bundle branch block, ventricular rhythms and ventricular pacing, alters repolarisation and causes ST segment shifts and T-wave changes. In LBBB, these secondary repolarisation changes result in ST segment elevation in V1 to V3 and ST depression with T-wave inversion in V5 - 6,

TABLE 1: Signs of myocardial infarction in presence of LBBB

Concordant ST elevation ≥1mm in any lead#
Concordant ST depression >1mm in V1-3#
Discordant ST elevation ≥5mm (less, if the S-wave is small)*
Q-waves in V5 or V6*
Q ≥30ms in I or aVL*
Notching of S-wave in V3 through V5 (Cabrera's sign)*
Notching of the R-wave upstroke in leads I, aVL, V5 and V6 (Chapman's sign)*
Q ≥30ms in leads III and aVF

Indicates features present on this ECG.
#Indicates the features with the highest specificity (the Sgarbossa concordance criteria).

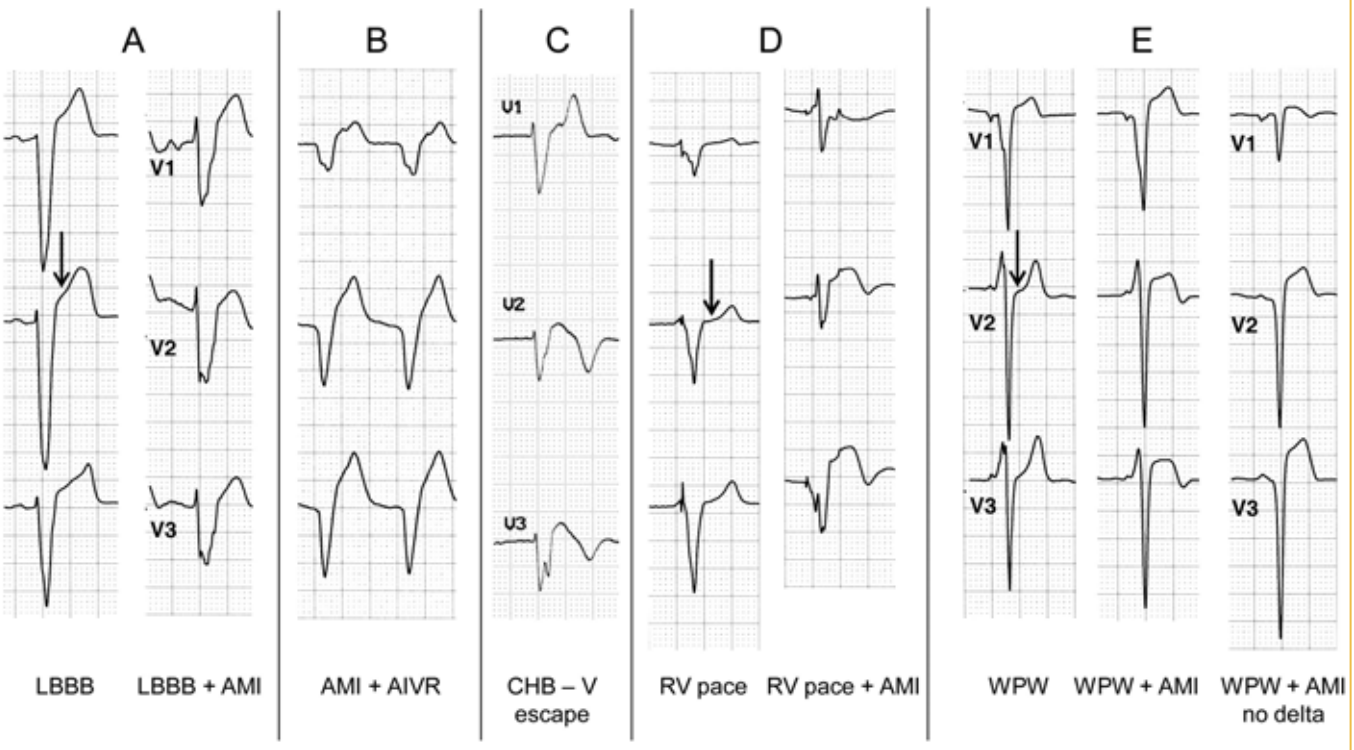

FIGURE 1: Examples of acute ST elevation anterior MI in the presence of different wide QRS rhythms, showing potentially diagnostic ST elevation despite the abnormal QRS:

A: Uncomplicated LBBB vs. LBBB + acute anterior MI. Note the different shape of the ST segments in the ECGs without ischaemia (arrows).

B: Accelerated idioventricular rhythm in a patient with anterior STEMI.

C: Ventricular escape rhythm (LBBB pattern) in anterior infarct complicated by complete heart block.

D: ECGs before and after anterior MI in a patient with a right ventricular pacemaker.

E: ECGs of a 40-year-old man with WPW syndrome before and after acute anterior MI. The first post infarct ECG shows pre-excitation with similar ST elevation to the second, with normally conducted complexes.

opposite to the main QRS deflection. The extent of ST elevation in the mid chest leads is proportionate to the size of the S-wave, but is usually less than 5mm. In this case, the S-wave is relatively small, so the 4mm ST elevation is suggestive of transmural myocardial ischaemia. Note also that the ST elevation is convex upward ("coved"), whereas it is usually slightly concave upward in uncomplicated LBBB (Figure 1A - arrow).

ST elevation tends to persist in the ischaemic territory, even when ventricular depolarisation is altered by an accelerated idioventricular rhythm (Figure 1B), ventricular escape rhythm (Figure 1C), ventricular paced rhythm (Figure 1D) or pre-excitation (WPW) (Figure 1E). This allows for the detection of transmurali schaemia and localisation of the affected region even in the presence of these abnormal rhythms or LBBB.

LESSONS AND CONCLUSIONS

- If a patient presents with a clinical syndrome suggesting acute myocardial infarction and the ECG shows LBBB, treat as for ST elevation myocardial infarction (STEMI), whether or not the ECG shows features diagnostic of MI.
- While LBBB tends to obscure the usual features of STEMI, diagnostic features may still be present (Table I). The most useful are: concordant ST elevation of 1mm or more in any lead; discordant ST elevation of 5mm or more.
- Diagnostic and localising ST segment elevation may also be present in other conditions affecting ventricular depolarisation, such as paced rhythm, ventricular escape rhythms, accelerated idioventricular rhythm and pre-excitation.

REFERENCES

1. ISIS-2 (Second international study of infarct survival) collaborative group. Randomised trial of intravenous streptokinase, oral aspirin, both, or neither among 17 187 cases of suspected acute myocardial infarction: ISIS-2. Lancet 1988;2:349-60.
2. Fibrinolytic Therapy (FTT) Trialists group. Indications for fibrinolytic therapy in suspected acute myocardial infarction: Collaborative overview of early mortality and major morbidity results from all randomised trials of more than 1 000 patients. Lancet 1994;343;311-322.
3. Steg PG, et al. Impact of time to treatment on mortality after pre-hospital fibrinolysis or primary angioplasty: Data from the CAPTIM randomised clinical trial. Circulation. 2003; 108:2851-2856.
4. Neeland IJ, Kontos MC and Lemos JA. Evolving consideration in the management of patients with left bundle branch block and suspected myocardial infarction. JACC 2012,60(2);96-105.
5. Chou's electrocardiography in clinical practice. Ed. Surawicz B and Knilans TK. Saunders-Elsevier (Philadelphia), 6th Ed. 2008.

Conflict of interest: none declared.

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