Journal Reading

Diagnosis of ST-Elevation Myocardial Infarction in the Presence of Left Bundle Branch Block With the ST-Elevation to S-Wave Ratio in a Modified Sgarbossa Rule

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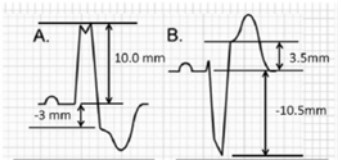
Introduction

- Identification of acute coronary occlusion is critical to initiating urgent angiography & appropriate reperfusion therapy.
- Identification of STEMI in the setting of LBBB remains challenging.
- In the setting of LBBB, STE or STD commonly occurs in the absence of AMI.



ST seg & T discordant to QRS

Introduction

- **Sgarbossa's rule** (>= 3 points)
  - Concordant STE of 1 mm (0.1 mV) in >=1 lead (5 points)
  - Concordant STD of 1 mm in leads V1 to V3 (3 points)
  - Excessively discordant STE, defined as >= 5 mm STE when the QRS result is negative (2 points)
- Specificity was high (98%), sensitivity was only 20%.

Introduction

- All validating studies used a creatine kinase (CK) for AMI, not coronary occlusion by angiography, meaning non-STEMI & STEMI.
- Ant. STEMI is most often diagnosed by STE in leads V1 to V4; however, in LBBB, these leads normally already have discordant STE.

The aim of this study

- Evaluate the performance of Sgarbossa rule in LBBB & angiographic evidence of coronary occlusion.
- Changing 3rd component of the Sgarbossa rule to a proportional rule would improve its sensitivity and specificity.

Materials and methods

Slection of participants

- Data were collected at 3 Minnesota hospitals.
- LBBB + symptoms of AMI (chest pain, shortness of breath, or both)
  - STEMI group with angiographic evidence of occlusion
  - Control group with no occlusion
- **Angiographic evidence of occlusion**
  - Occlusion (thrombolysis in MI 0 to 1 flow)
  - Stenosis with either thrombosis or ulcerated culprit lesion & peak 24-hour troponin I >= 10 ng/mL

Materials and methods

- **Absence of coronary occlusion was**
  - All troponin I (-) within 24 hours
  - Any troponin I(+) with angio showing either NO culprit lesion or a culprit lesion but both NO occlusion & peak level of troponin I < 10 ng/mL
  - If no angiogram, an echo with NO wall motion abnormality & peak troponin I <10 ng/mL
- **Exclusion criteria**
  - Hyperkalemia (K> 5.5 mEq/L)
  - Extreme tachycardia (rate >130 beats/min)
  - Severe hypertension (DBP> 120 mm Hg)
  - Pulmonary edema with respiratory failure

a ST-segment elevation ≥1 mm and concordant with the QRS in at least 1 lead

b ST-segment depression ≥1 mm in any of leads V1–V3

c Excessively discordant ST-segment elevation in any one lead

c-i Absolute as defined by ST-segment elevation ≥5 mm in at least 1 lead

c-ii Proportional as defined by most negative ratio of ST/S and at least 1 mm of STE

Result: Cut point for ST/S ratio with >90% specificity determined to be <–0.25

d Excessively discordant ST-segment deviation (elevation *or* depression) defined by most negative ST/S ratio in any lead with >1 mm ST-segment elevation or depression

Result: Cut point for ST/S ratio with >90% specificity determined to be <–0.30

I	a, b, c-i	Sgarbossa rule (original; with weighting): >3 points from components a (5 points), b (3 points), c-i (2 points)
II	a, b, c-i	Sgarbossa Rule without weighting, equivalent to a score >2 points: at least 1 of components a, b, c-i
III	a, b, c-ii	Modified Sgarbossa rule (no weighting, proportional discordant STE): at least 1 of components a, b, c-ii
IV	a, b, or d	Modified Sgarbossa rule (no weighting, proportional discordant STE or STD): at least 1 of components a, b, d
V	d	Overall proportional discordance rule

Results

Characteristics of Study Subjects

- 45 p't with acute coronary occlusion (33 of whom had an ECG available).
- 129 p't met criteria for the control group.
- P't with an acute occlusion and LBBB were older (mean age 73 versus 67 years) and more often men (59% versus 46%) than the controls.

No. of leads and location in which each rule component was found	Control (n=129)	ACO (n=33)
	% (n)	
Component a: concordant ST elevation		
No. of leads		
0	98 (127)	58 (19)
1	2 (2)	27 (9)
≥2	0	15 (5)
Location		
Any of V1–V4, aVR	0	3 (1)
Any of II, III, aVF	2 (2)	21 (7)
Any of I, aVL, V5, V6	0	21 (7)
Component b: ST depression ≥1 mm in any of V1–V3	1 (1)	21 (7)
Component c-i: excessively discordant ST elevation, absolute ≥5 mm		
No. of leads		
0	91 (118)	70 (23)
1	5 (6)	21 (7)
≥2	4 (5)	9 (3)
Location		
Any of V1–V4, aVR	9 (11)	30 (10)
Any of II, III, aVF	0	0
Any of I, aVL, V5, V6	0	0
Component c-ii: excessively discordant ST elevation, proportional (ST/S ≤0.25)		
No. of leads		
0	91 (117)	21 (7)
1	9 (12)	27 (9)
≥2	0	52 (17)
Location		
Any of V1–V4, aVR	8 (10)	58 (19)
Any of II, III, aVF	2 (2)	27 (9)
Any of I, aVL, V5, V6	0	9 (3)
Component d: excessive discordance overall, proportional (ST/S ≤0.30)		
No. of leads		
0	88 (113)	0
1	10 (13)	27 (9)
≥2	2 (3)	73 (24)
In any lead	12 (16)	100 (33)

Component, n	Control, N=129	Acute Coronary Occlusion, N=33	Left Anterior Descending Artery, N=20	Circumflex, N=4	Right Coronary Artery, N=9
a					
Concordant ST-segment elevation	2	14	7	3	4
Any of leads aVR, V1–V4	0	1	0	1	0
Any of leads II, III, aVF	2	7	1	2	4
Any of leads I, aVL, V5, V6	0	7	7	0	0
b					
Concordant ST-segment depression, any of leads V1–V3	1	7	1	4	2
c-i					
Excessively discordant ST-segment elevation, absolute	11	10	10	0	0
Any of leads V1–V4, aVR	11	10	10		
Any of leads II, III, aVF	0	0	0		
Any of leads I, aVL, V5, V6	0		0	0	
c-ii					
Excessively discordant ST-segment elevation, proportional	12	26	17	1	8
Any of leads V1-V4, aVR	10	19	16	0	3
Any of leads II, III, aVF	2	9	2	1	6
Any of leads I, aVL, V5, V6	0	3	3	0	0
d					
Excessive discordance overall, proportional	16	33	20	4	9

Rule	Sensitivity (95% CI)	Specificity (95% CI)	Positive Likelihood Ratio	Negative Likelihood Ratio
I, Sgarbossa weighted (a, b, c-i)	52 (34–69)	98 (93–100)	22 (16–31)	0.5 (0.2–1.6)
II, Sgarbossa unweighted (a, b, or c-i)	67 (48–82)	90 (83–95)	6.6 (5.2–8.5)	0.4 (0.2–0.8)
III, Modified Sgarbossa (a, b, or c-ii)	91 (76–98)	90 (83–95)	9.0 (8.0–10)	0.1 (0.03–0.3)
IV, Modified Sgarbossa (a, b, or d)	100 (89–100)	86 (79–92)	7.2 (6.7–7.7)	0
V, Overall discordance (d)	100 (89–100)	88 (81–93)	8.1 (7.6–8.6)	0

Limitations

- It is likely that other p't with LBBB & an acute coronary were NOT identified by our methods.
- All controls did NOT have angiograms; thus, we canNOT rule out acute coronary occlusion.
- Some patients were excluded for lack of complete data.
- Our ECG measurements were from inexperienced ECG reader, with selective overreading by an experienced reader.
- The acute coronary occlusion group included 33 individuals.

Discussion

- To our knowledge, this is the first and only study to use angiographic endpoints to evaluate the accuracy of the ECG in the diagnosis of AMI in the presence of LBBB.
- AHA guidelines recommend reperfusion therapy for patients with chest pain & new LBBB.
- LBBB + AMI have higher mortality than p't with normal conduction+ AMI.
- LBBB + presumed AMI + reperfusion therapy for have lower mortality than their counterparts with normal conduction (likely because the data include LBBB without acute coronary occlusion).

Discussion

- In reality, despite guideline recommendations, patients with LBBB & ischemic symptoms infrequently undergo reperfusion therapy, or it is delayed, and this is true even for those who receive a biomarker diagnosis of AMI.

-> Clinical experience suggests that chest pain in LBBB is infrequently due to AMI and even less frequently due to coronary occlusion or near occlusion (STEMI).

Discussion

- Ant. STEMI caused by LAD occlusion results in STE in leads V1 to V4. In LBBB, the normal discordance results in STE in leads V1 to V4 at baseline.

-> Sgarbossa' s weighted criteria give only 2 points for excessive discordance and thus will "miss" a large number of ant. STEMIs.

->Unweighted criteria were more sensitive (52% versus 67%).

- Replacing the absolute criterion of 5 mm (criterion c-i) with proportional one (c-ii), the rule was more accurate with sensitivity of 91% and specificity of 90%.

Discussion

- Sgarbossa' s criteria are associated with suboptimal sensitivity.
  - The rule does NOT consider the relative amplitudes of ST seg. & S-wave(proportionality)
  - The ECG is NEVER very sensitive for AMI as diagnosed by biomarkers.
- When proportionality is taken into account, despite the presence of LBBB, the ECG may be much better than previously thought.

Conclusion

- Diagnosis of acute coronary occlusion in the setting ofLBBB, particularly LAD occlusion, remains a challenging clinical problem.
- In this study, ST/S ratio has a significantly greater diagnostic sensitivity and accuracy, than maximum ST elevation.
- Replacing criterion 3 (excessively discordant ST elevation) as defined by >= 5 mm with a proportional criterion (ST/S ratio<–0.25) improved the diagnostic characteristics of the Sgarbossa criteria.
- Proportionally excessive discordant STE or STD may prove to be even more valuable.

Thanks for your attention