Electrocardiographic criteria for detecting acute myocardial infarction in patients with left bundle branch block: a meta-analysis

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CRD summary
This review evaluated the Sgarbossa electrocardiogram algorithm. The authors concluded that an algorithm score of 3 or more was useful for diagnosing acute myocardial infarction (AMI) and that patients with symptoms suggesting AMI should receive immediate intervention when this score is reached. Methodological limitations in the review and possible over-interpretation of the data suggested that the authors’ conclusions may be overstated.

Authors' objectives
To evaluate the utility of the Sgarbossa electrocardiogram (ECG) algorithm for diagnosing acute myocardial infarction (AMI) in the presence of left bundle branch block.

Searching
The authors searched MEDLINE and Scopus from 1996 (the year the algorithm was introduced) to December 2005 without language restrictions. Search terms were reported. Reference lists of identified articles were also screened.

Study selection
Studies that evaluated the Sgarbossa ECG algorithm were eligible for the review. The primary outcome of the review was diagnostic accuracy (sensitivity, specificity and positive and negative likelihood ratios). A secondary outcome was intra- and inter-observer agreement for the presence or absence of ECG criteria defined in the algorithm. Inclusion criteria for participants and study designs were not explicitly stated but most included studies involved hospitalised patients with suspected AMI or participants in thrombolytic trials. ECGs for control patients were selected from outpatient databases in some studies. Included studies used a Sgarbossa algorithm score of 2 or more, 3 or more or both as a cut-off. The reference standard for detection of AMI was high-specificity cardiac marker testing (creatine kinase-MB or troponin), although one study in which this test was not applied to either group was included.

Two reviewers independently screened citations for relevance. Subject experts were also included.

Assessment of study quality
Studies were classified as level I (best quality) if high-specificity cardiac marker testing was applied to both the AMI and control groups, level II if testing was used in one group and level III if high-specificity testing was used in neither group. It appeared that validity was assessed by two independent reviewers.

Data extraction
Data were extracted by two reviewers independently using a standard form. If exact numbers of true and false positives and negatives were not reported, they were calculated from the published sensitivities, specificities and positive and negative predictive values.

Methods of synthesis
Summary estimates of sensitivity, specificity, positive and negative likelihood ratios and diagnostic odds ratio were calculated by meta-analysis using a fixed-effect model. Separate summary estimates were calculated for algorithm scores of 3 or more and 2 or more. In addition, estimates for level I studies were calculated separately using a random-effects model. Heterogeneity between studies for both cut-off scores was assessed by inspection of the summary receiver operating characteristic (SROC) curve and by calculating the Q statistic with p<0.1 taken to indicate significant heterogeneity. A Spearman correlation coefficient between sensitivity and specificity was calculated to test for a threshold effect.

Results of the review
Eleven studies (n = 2,100) were included, of which five were classed as level I and five as level II. Ten studies (n =
1,614) evaluated an algorithm score of 3 or more. Both the SROC curve and diagnostic odds ratio (odds ratio 9.9; $X^2$ 13.0, $p = 0.16$) indicated homogeneity among studies and the Spearman correlation was not significant. Summary sensitivity was 20 per cent (95% confidence interval (CI): 18%, 23%), specificity 98 per cent (95% CI: 97%, 99%), positive likelihood ratio 7.9 (95% CI: 4.5, 13.8) and negative likelihood ratio 0.8 (95% CI: 0.8, 0.9). These results were considered to indicate comparable accuracy to other ECG findings used in practice. Subgroup analysis of level I studies gave similar results.

For an algorithm score of 2 or more (seven studies, $n = 1,213$), the SROC curve and diagnostic odds ratio indicated significant heterogeneity. Sensitivity ranged from 20 per cent (specificity 93 per cent) to 79 per cent (specificity 100 per cent) and specificity ranged from 61 per cent (sensitivity 44 per cent) to 100 per cent (sensitivity 99 per cent). Results for 14 groups of observers (six studies, $n = 1,287$) revealed substantial inter-observer agreement ($kappa = 0.7$).

**Authors' conclusions**
A Sgarbossa ECG algorithm score of 3 or more was useful for diagnosing the presence of AMI in patients who present with left bundle branch block on ECG. The algorithm is not useful for excluding AMI.

**CRD commentary**
The review question was clear, but inclusion criteria for participants and study designs were not clearly stated. This could mean that subjective decisions were taken during study selection and made it difficult for the reader to assess the appropriateness of the study selection. The search covered only two databases and reference lists, so it was possible that relevant studies were missed. No language restrictions were imposed. Unpublished studies were not sought. Publication bias was not assessed and the authors acknowledged that the review could be at risk of publication bias. Validity was assessed and the results used in the analysis, but only one criterion was used. This made it difficult to be certain of the reliability of the included studies and hence the synthesis derived from them. Some relevant details of included studies were presented, although study designs were not described, which again made it difficult to evaluate the reliability of the included studies. Appropriate methods were used to minimise errors and bias in study selection, validity assessment and data extraction. Studies were pooled by meta-analysis where statistical heterogeneity was not significant, although the model used was not the best available according to current recommendations. Relevant subgroup analyses and tests for threshold effect were performed. The authors' conclusions were possibly overstated in view of the moderate value of the summary positive likelihood ratio. This, together with the methodological and reporting limitations of the review, made the reliability of the conclusions uncertain.

**Implications of the review for practice and research**
Practice: The authors stated that patients with left bundle branch block and symptoms consistent with AMI should receive immediate percutaneous coronary intervention or fibrinolysis when a Sgarbossa ECG algorithm score of 3 is reached.

Research: The authors did not state any implications for research.

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This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.