

# The University of Glasgow 12-Lead ECG Analysis Algorithm

## What is the Glasgow Algorithm?

Developed by Peter Macfarlane, DSc, FESC, and his team, the University of Glasgow 12-lead ECG Analysis Algorithm has more than 35 years of history and is considered one of the top three resting ECG interpretive algorithms in the world. The Glasgow algorithm was developed and continuously improved over the years by a team of world-renowned ECG researchers. Dr. Macfarlane and Physio-Control collaborated to make some changes to the Glasgow algorithm to improve its utility in the prehospital setting.

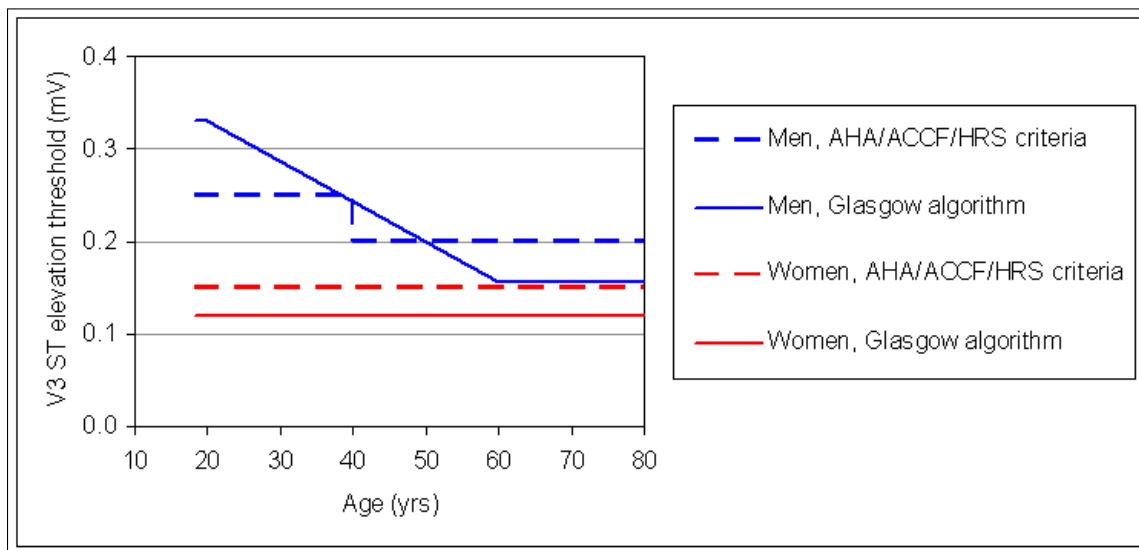


Figure 1, Thresholds for ST elevation in lead V3

## The Glasgow Algorithm and 2009 AHA/ACCF/HRS Recommendations

The 2009 AHA/ACCF/HRS recommendations, of which Dr. Macfarlane was a coauthor, have new ST elevation myocardial infarction (STEMI) criteria that for the first time depend on both age and gender.<sup>1</sup> The recommendations are, in fact, a simplified version of the criteria used in the Glasgow algorithm—simplified so that a human can remember the criteria. For example, Figure 1 shows the thresholds for ST elevation in lead V3. The AHA/ACCF/HRS criteria for males have a step change at age 40 years, and thresholds are rounded to the nearest 0.05 mV. The Glasgow criterion for V3 in males varies continuously from age 20 to 60 years, i.e. the threshold is set to a finer resolution. It also needs to be set on a lead-by-lead basis as was determined by Macfarlane after measuring ST levels in a large database of normals.<sup>2</sup> The finer

adjustment of thresholds for ST elevation is easily managed by the computer algorithm, but difficult for a human to remember and apply.

Another 2009 AHA/ACCF/HRS recommendation is to use the criteria from a study of 26,003 patients by Sgarbossa et al to allow detection of some STEMI ECGs when the patient also has left bundle branch block (LBBB).<sup>3</sup> A recent meta-analysis by Tabas confirmed that across eleven studies the Sgarbossa criteria were useful for diagnosing acute myocardial infarction in patients with LBBB.<sup>4</sup>

The Glasgow algorithm has been evaluated against a prehospital ECG database and has been shown to be significantly more sensitive and specific for detecting ST elevation MI than the original ESC/ACC criteria.<sup>5,6,7</sup> Its performance was similar to that of board certified cardiologists.

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### Comparing the Glasgow Algorithm to Other Interpretive Algorithms

Differences between the Glasgow algorithm and other interpretive algorithms commonly used in prehospital monitor/defibrillators are summarized in the table below.

	LIFEPAK® 15 monitor/defibrillator	LIFEPAK 12 defibrillator/monitor	Zoll® M- & E-series defibrillators	Philips® MRx monitor/defibrillator
12-lead ECG interpretive algorithm	Glasgow v27	GE 12SL v14	GE 12SL v14	DXL vPH100B
Age and gender criteria for STEMI	Yes	No	No	Yes
LBBB criteria for STEMI	Yes	No	No	No information available
STEMI Statement	*** MEETS ST ELEVATION MI CRITERIA ***	*** ACUTE MI SUSPECTED ***	***** Acute MI * *****	>>> ACUTE MI <<<
Published results from testing with prehospital ECGs	Yes <sup>67</sup> (references are available from your sales consultant)	Yes	Yes	No

Figure 2, Comparison Table





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**Sample ECG Strips from LIFEPAK 15 Monitor/Defibrillator and LIFEPAK 12 Defibrillator/Monitor**

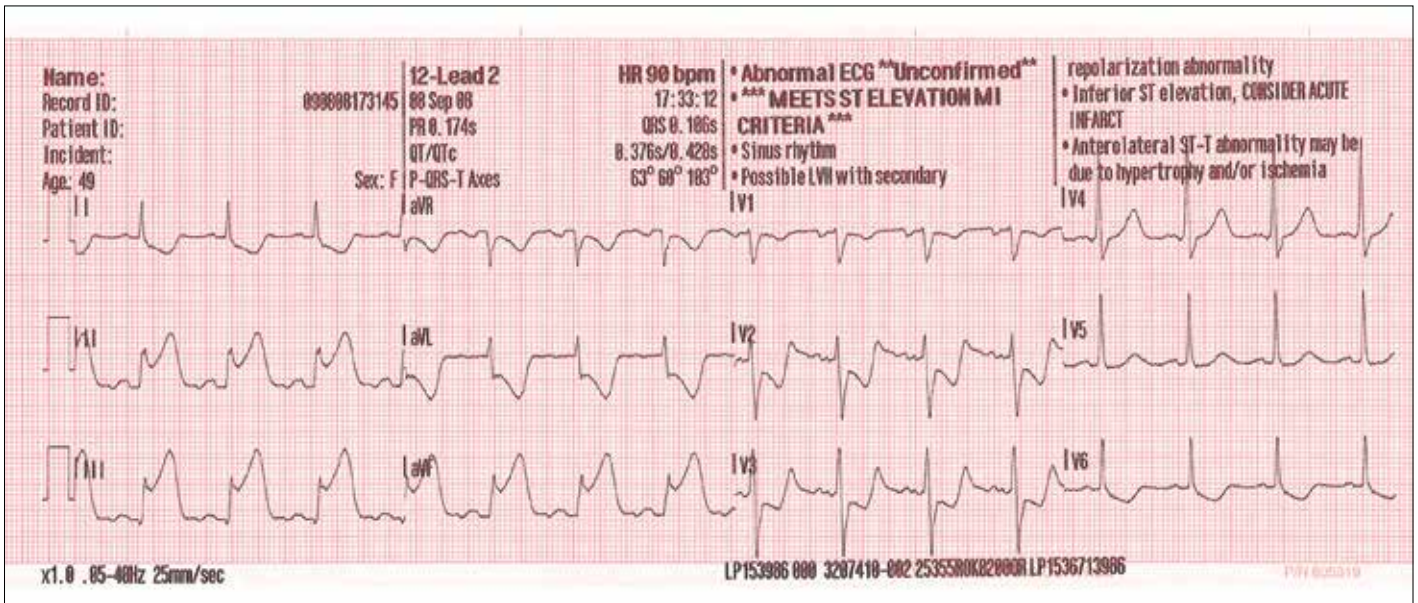


Figure 3, ECG printout from LIFEPAK 15 monitor/defibrillator

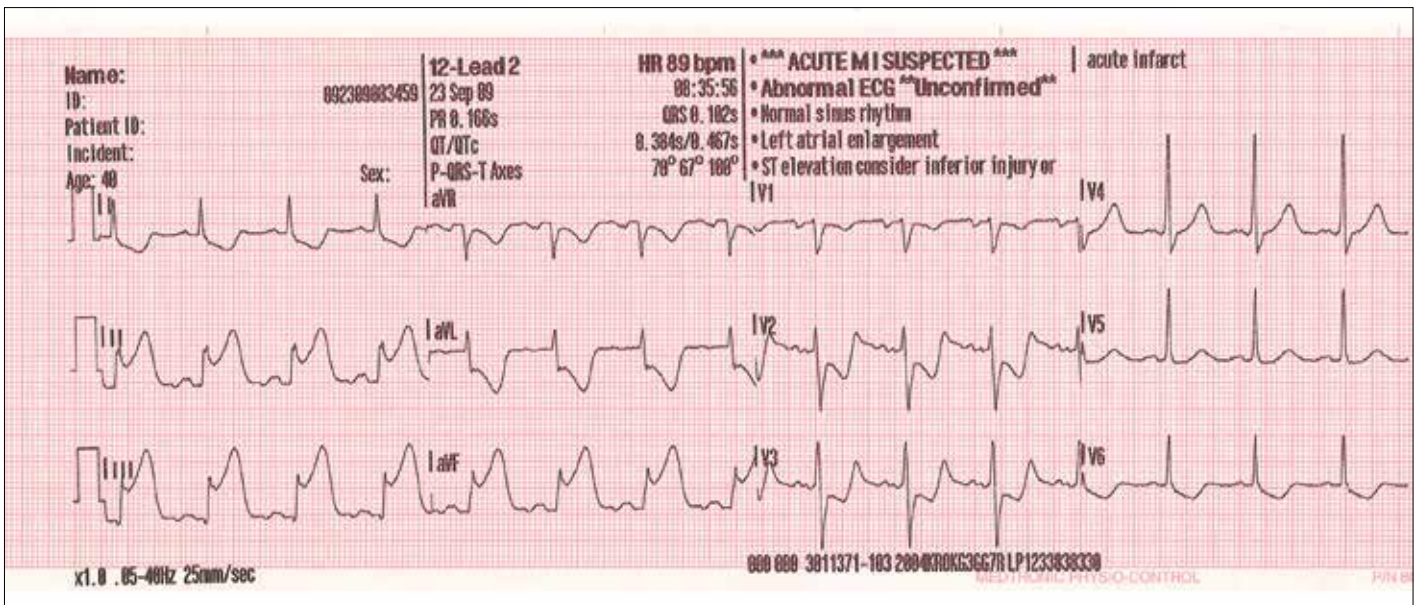


Figure 4, ECG printout LIFEPAK 12 defibrillator/monitor

For details on the validation and accuracy of the University of Glasgow 12-lead ECG Analysis Program, see the Physio-Control publication, "Glasgow 12-lead ECG Analysis Program: Statement of Validation and Accuracy" (available from your sales consultant).

## REFERENCES

1. Wagner GS, Macfarlane P, et al. AHA/ACCF/HRS recommendations for the standardization and interpretation of the electrocardiogram: Part VI: Acute ischemia/infarction: A scientific statement from the American Heart Association Electrocardiography and Arrhythmias Committee, Council on Clinical Cardiology; the American College of Cardiology Foundation; and the Heart Rhythm Society: endorsed by the International Society for Computerized Electrocardiology. *Circulation*. 2009;119:e262-70.
2. Macfarlane PW. Age, sex, and the ST amplitude in health and disease. *J Electrocardiol*. 2001;34(suppl):235-41.
3. Sgarbossa EB, et al. Electrocardiographic diagnosis of evolving acute myocardial infarction in the presence of left bundle-branch block. *N Engl J Med*. 1996;334:481-7.
4. Tabas JA, et al. Electrocardiographic criteria for detecting acute myocardial infarction in patients with left bundle branch block: a meta-analysis. *Ann Emerg Med*. 2008;52:329-36.
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6. Macfarlane PW, Browne D, Devine B, Clark E, Miller E, Seyal J, Hampton D. Modification of ACC/ESC criteria for acute myocardial infarction. *J Electrocardiol*. 2004;37(suppl):98-103.
7. Macfarlane PW, Hampton DR, Clark E, Devine B, Jayne CP. Evaluation of age and sex dependent criteria for ST elevation myocardial infarction. *Computers in Cardiology*. 2007;34:293-6.

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