Critical Review Form
Diagnostic Test

CAN PARAMEDICS READ ST-SEGMENT ELEVATION MYOCARDIAL INFARCTION ON PREHOSPITAL 12-LEAD ELECTROCARDIOGRAMS? *PREHOSPITAL EMERGENCY CARE* 2009; 13:207-214

Objectives: **"To evaluate the paramedics' ability to identify STEMI on standard pre-hospital 12-lead ECGs and appropriately decide to activate the cardiac catheterization laboratory. Our secondary aims were 1) to determine whether paramedic factors such as experience, extent of recent continuing medical education (CME), and confidence in ECG interpretation predict accuracy in diagnosing STEMI or appropriately activating the catheterization laboratory; and 2) to assess whether patient gender and coronary risk factors play a role in paramedics' STEMI diagnoses or decisions to activate the catheterization laboratory". (p. 208)**

Methods: **Rural and urban 12-town Connecticut-based convenience sampling of non-volunteer ALS-certified paramedics who were recruited over a 2-month period in the ED, during CME sessions or at local fire departments. Approximately 4-months prior to the survey study, every paramedic in the system received a one hour refresher lecture on ECG recognition of STEMI as part of their regularly scheduled protocol update.**

Consenting paramedics completed an eight background question plus five clinical vignettes with ECG survey. Three of the cases were STEMI (two anterior/inferior), while two cases were not STEMI.

Investigators assessed agreement between STEMI diagnosis and decision to activate the cath lab using Kappa (κ) and McNemar's test of paired proportions. To evaluate paramedic accuracy independent of year's experience and personal comfort with ECG interpretation or cath lab activation the investigators assessed χ^2 analysis and logistic regression model after collapsing the five-level Likert scale to three levels and years experience into four quartiles. Investigators constructed two logistic regression models (model 1 dependent variable = correct STEMI diagnosis; model 2 dependent variable = appropriate cath lab activation) using multi-level model with the random effect at the medic level.

I.	Are the results valid?	
A.	**Did clinicians face diagnostic uncertainty?**	Yes, paramedics did not know the true diagnosis for any of their paper-vignettes.
B.	**Was there a blind comparison with an independent gold standard applied similarly to the treatment group and to the control group? (Confirmation Bias)**	These are fictitious paper-based vignettes so no criterion standard or potential confirmation bias.
C.	**Did the results of the test being evaluated influence the decision to perform the gold standard? (Ascertainment Bias)**	No criterion standard so there is no potential for ascertainment bias.
II.	**What are the results?**	
A.	**What likelihood ratios were associated with the range of possible test results?**	• The EMS system had 187 paramedics of whom 40 were excluded because they worked < 1 shift/month. Of the remaining 147, 103 (70%) were enrolled. • Paramedics estimated ECG's took a median of three-minutes to obtain. • Paramedic comfort calling a chest pain alert did not differ significantly if doing so automatically activated the cath lab. • Paramedic accuracy: Sen (95% CI) Spec (95% CI) STEMI Diagnosis 92.6(0.89-95.1) 85.4(79.7-89.8) Cath lab Appropriately Activated 88.0(83.8-91.3) 88.3(83.0-92.2) • False-positive cath lab activation occurred in 8.1% (95% CI 5.4 – 12.0) • Only two medics correctly interpreted fewer than 6 of 10 cases. • There was moderate agreement between individual paramedics dx of STEMI and decision to activate the cath lab ($\kappa = 0.63$) • There was no difference in diagnostic accuracy between clinical vignettes or when comparing gender, or cardiac risk factors. • Paramedic expertise or comfort level was not associated with diagnostic accuracy. Adjusted analysis identified only self-reported level low ECG interpretation confidence as associated with ↓ accuracy for the diagnosis of STEMI (OR = 0.07 [95% CI 0.02 – 0.25]) or activating the cath lab (OR = 0.17 [95% CI 0.03 – 0.96]).

III.	How can I apply the results to patient care?	
A.	**Will the reproducibility of the test result and its interpretation be satisfactory in my clinical setting?**	Uncertain. Paramedics were only tested using paper-based scenarios. " When applied to a real-life setting, with much variability in ECG appearance and clinical scenarios, the results may be quite different and may not be so favorable, as other clinical data such as the variety and vagueness of patient complaints or other co-morbidities may alter the propensity of both field personnel and physicians to base their actions primarily on their interpretation of the ECG". (p. 213)
B.	**Are the results applicable to the patients in my practice?**	Probably, although our EMS personnel are less rural than this Connecticut group. The competing EMS lenders, protocols and missions certainly ring true to St. Louis and beyond.
C.	**Will the results change my management strategy?**	No. This is compelling data to support further testing of pre-hospital ECG based cath lab activation without a physician interpretation of the ECG. However, further field-based prognostic testing is needed before incorporation of EMS interpreted ECG's can be widely advocated. Therefore, "our group is proceeding with a study that will assess the amount of time saved and the actual false-positive rate that results when paramedics call the ED to activate the catheterization laboratory from the field when encountering actual patients". (p. 213)
D.	**Will patients be better off as a result of the test?**	Possibly, but actual field testing is still needed.

Limitations

1) **Artificial paper-based scenarios that do not incorporate the stress, fatigue, family or cath lab-based pressures of actual pre-hospital practice. It is uncertain if these findings will be replicated in subsequent field trials.**

2) **Limited external validity to one Connecticut region with exemplary pre-hospital medical director.**

3) **Artificially elevated STEMI prevalence. With lower real-world STEMI prevalence, false-positive rates will likely be elevated.**

4) **Non-validated, non-field tested survey instrument so uncertain internal validity.**

5) **No sensitivity analysis for no-answer responses.**

Bottom Line

Connecticut-based paper-vignette survey of recently ECG trained non-volunteer ALS EMS personnel who work > 1 shift/month suggesting that paramedics can accurately diagnose STEMI and activate the cath lab in pre-hospital settings independent of their level of experience, extra-curricular ECG training, or patient's symptom characteristics. Future trials will need to verify this accuracy in actual field situations complicated by heterogeneous ECG quality, competing distracters and variably trained/motivated pre-hospital providers. Additionally, in order to understand the costs and non-financial barriers to minimizing the initial medical contact to balloon times, future research should establish acceptable false-positive cath lab activation rates and better define barriers (EMS training, cath lab acceptance) to the initiation of pre-hosp cath lab activation.