

Ischemic ECG Changes Predict Myocardial Injury in Patients with Intracerebral Hemorrhage

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Faculty Disclosure

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Presenter Disclosure Information

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No relevant financial relationship exists



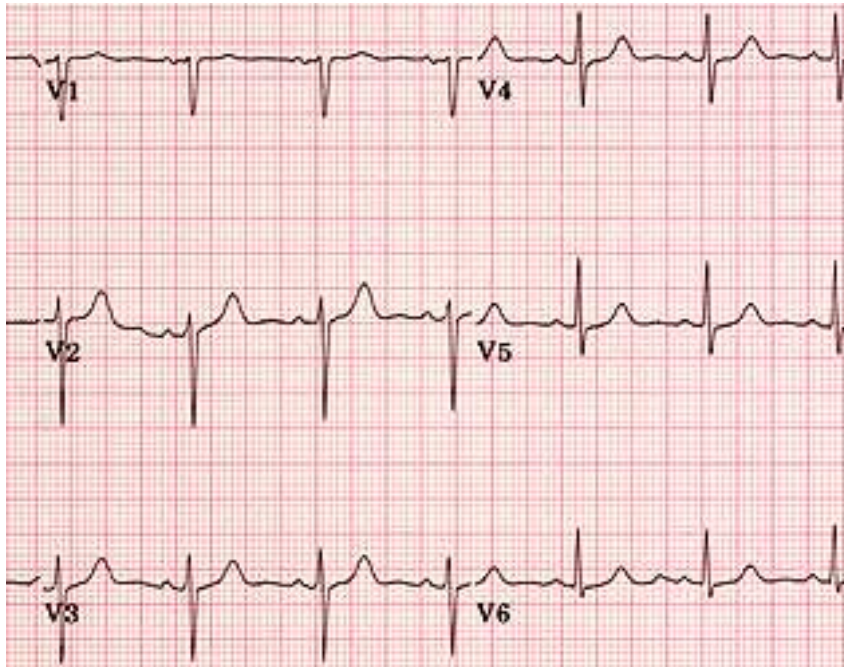
Background

- ECG abnormalities are common in patients with intracerebral hemorrhage (ICH).
- It is challenging to diagnose myocardial injury in this population.
- When confronted with an abnormal ECG in a patient with ICH, should this be considered:
 - true ischemia?
 - just “stroke-related ECG changes”?

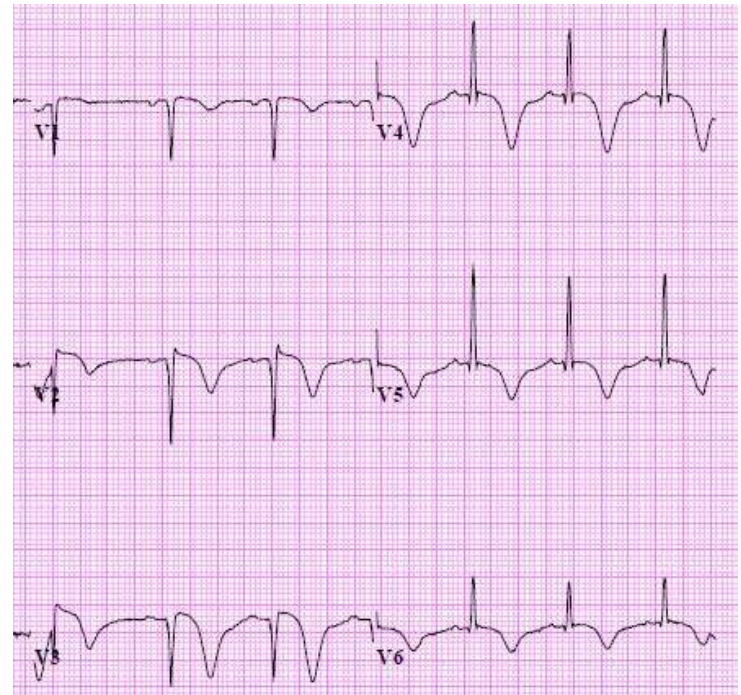


ECGs

Normal ECG



Ischemic ECG changes



Objectives

- We hypothesized that certain ECG abnormalities should be considered “real”.
- We predicted that ECG changes that:
 - meet criteria for myocardial ischemia



predict myocardial injury in patients with ICH



Methods

Study Design

- A retrospective review:
 - Since 1994, consecutive patients with ICH presenting to Massachusetts General Hospital (MGH) are registered prospectively.
 - Information on demographics and outcome is collected prospectively.
 - We retrospectively reviewed ECGs and cardiac workups.



Selection of Participants

- Inclusion criteria
 - All ICH from 1998 to 2004
- Exclusion criteria
 - age <18 years,
 - ICH secondary to head trauma, ischemic stroke with hemorrhagic transformation, brain tumor, vascular malformation, or vasculitis.
 - Being made DNR
 - Transfer



ECG Reading

- Categorized into two groups using 2007 ESC/ACCF/AHA/WHFA criteria:
 - ischemic ECGs
 - non-ischemic ECGs
 - kappa statistic: 0.85

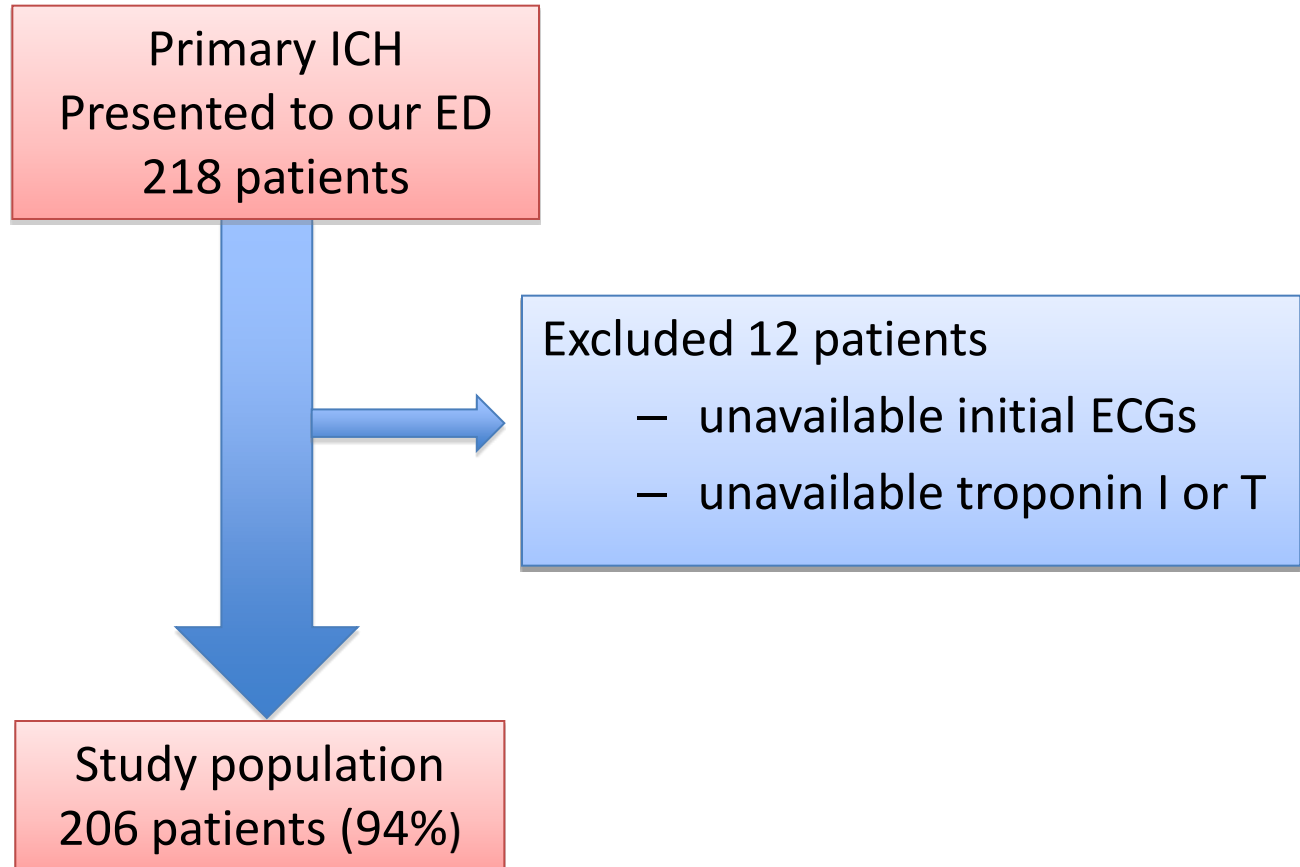


Measurements

- The primary outcome
 - myocardial injury within 30 days
 - Defined by troponin elevation
- The secondary outcome
 - mortality at 90 days
 - review of medical records
 - follow-up telephone calls to family members
 - a search of the Social Security Death Index



Results 1



Demographics

Variable	Non-ischemic ECG N=123 (59%)	Ischemic ECG N=83 (41%)
Age	75 (64 -82)	77 (66-82)
Male sex	56%	55%
h/o CAD	21%	30%
Initial GCS	14 (9-15)	14 (9-15)
ICH volume	19 (6-46) cc	13 (3-49) cc



Outcomes

- ECGs with new changes meeting the definition of ischemia:
 - 83 patients (41%)
- Troponin elevations:
 - 24 patients (12%)
- 90-day mortality:
 - 61 patients (30%)



Predictors of Myocardial Injury

Univariate analysis

Variable	Troponin Negative N=181	Troponin Positive N=25
Age	75 (66-82)	73 (63-82)
Male	57%	44%
Diabetes	18%	43%
CAD	23%	34%
Ischemic EKG	37%	64%
90 day mortality	28%	44%



Predictors of outcomes

Multivariable analysis

- Predictors of Myocardial injury

Independent Predictors	Odds Ratio	95% Confidence Interval
Ischemic ECG changes	3.2	1.3-8.2
H/O Diabetes	3.2	1.3-8.7

- Predictors of 90-day mortality

- After controlling for initial GCS score and hematoma volume, ischemic ECG changes do NOT independently predict mortality



Limitations

- Retrospective design
 - Care was not standardized across the cohort
 - ? Underestimation of myocardial injury
- Information bias
 - The type and degree of myocardial injury?
 - TTE, Stress test, Cath only in 12 pts
- Confounders (ischemic change- +’ve Troponin)
 - Takotsubo, CMP, micro-vessel disease, PE



Conclusion

- Myocardial injury is common in patients with primary ICH.
- ECG changes that meet the definition of “ischemia” independently predict myocardial injury.
- Should not disregard these findings as nonspecific in the setting of ICH.



Exploratory analysis of ECG findings and risk of myocardial injury

Distribution	Frequency	Myocardial Injury	p value
I, aVL TWI	18 patients 14	39% 43%	0.002 0.003
II, III, aVF	38 Patients	13%	0.8
V1-V4	37 Patients	19%	0.2
V5, V6 QW	44 Patients 5	23% 60%	0.03 0.01



Diffusely distributed ECG changes Neurogenic causes?

No significant association b/t multiple
distributions and myocardial injury

Number of distributions	Myocardial injury
1	17%
2	17%
3	44%
4	0%

Hypotheses

ECG changes

- Increased sympathetic nervous system activity on the heart
- Catecholamine-mediated myocardial injury
 - Tachycardia
 - Vasoconstriction
 - Direct toxic effects on myocytes
- ICH and CAD have common risk factors
 - Myocardial injury could occur in ICH d/t progression of concomitant coexisting CAD