Analysis of Depolarization Abnormalities in the Evaluation of Patients with Chest Pain

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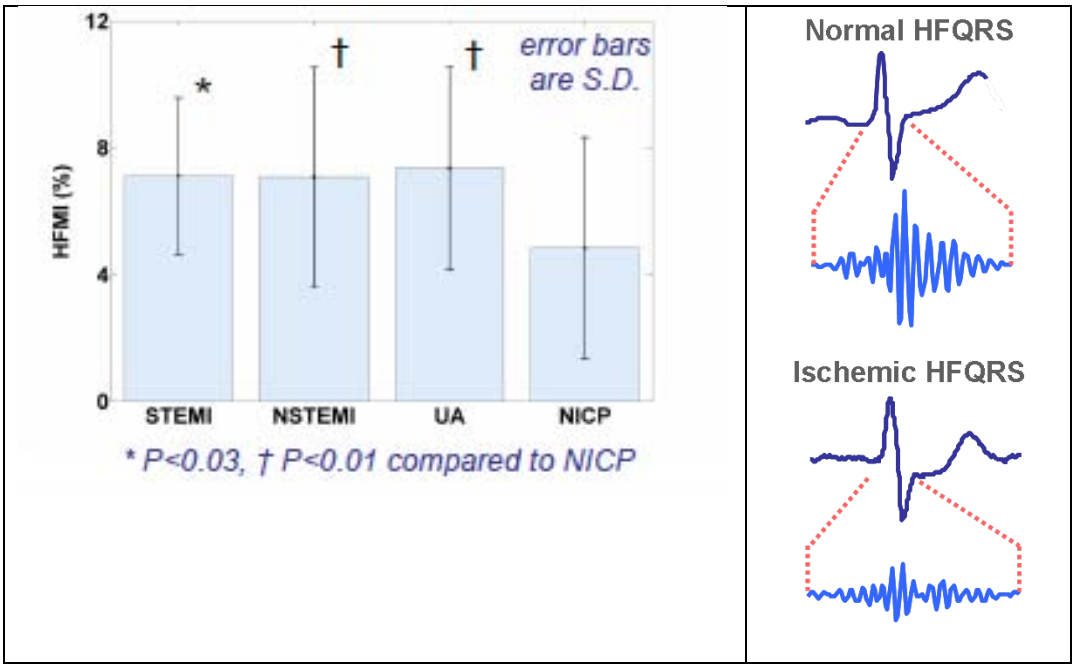
Background: The ECG of patients presenting with chest pain and suspected myocardial ischemia or infarction (MI) is often normal or non-diagnostic. Ischemia causes depolarization changes that can be quantified by computerized analysis of high-frequency mid-QRS components (HFQRS). We aimed to evaluate the usefulness of HFQRS analysis in detection of acute ischemia in patients with chest pain.
Methods: High-resolution,12 lead ECG was acquired in the emergency department in 172 patients (age 61±13 yrs, 119 men) with acute chest pain, and was used to assess both HFQRS and ST-T abnormalities. Patients were classified post-hoc based on discharge diagnosis and one-month follow-up as ST-elevation MI (STEMI,N=10), non STEMI (NSTEMI,N=19), unstable angina (UA,N=18) and non-ischemic chest pain (NICP,N=80). Patients with uncertain diagnosis (N=16) or inadequate signal quality (N=29) were excluded. High-frequency morphological index (HFMI), which quantifies the extent of HFQRS signal abnormalities (in %), was computed using custom software.
Results: The time from onset of chest pain to ECG acquisition was 5.1±4 hrs. ST-T abnormalities were indicative of ischemia in 92% of STEMI pts, 45% of NSTEMI pts and 14% of UA pts; ST-T morphology was normal in 75% of the NICP pts. The HFMI was significantly higher in ACS pts compared to NICP pts (7.2±3 vs. 4.8±3, $p<0.001$), with no difference between the 3 ACS groups. In the subgroup of pts with normal or inconclusive ECG, NSTEMI and UA pts had higher HFMI than NICP patients (7.7±3 vs. 4.7±3, $p<0.001$). HFMI was negative in 12 of 14 NICP patients with inconclusive ECG and positive in all 8 ACS patients with inconclusive ECG. HFMI diagnosis was significantly more sensitive than conventional ECG interpretation (70% vs 51%, $p<0.001$) with comparable specificity.
Conclusions: HFQRS analysis provides indications of acute ischemia, complementary to conventional ECG. HFQRS-derived indexes may aid in rapid risk stratification of patients with chest pain.


12
8
4
0
HFMI (%)
*
†
†
error bars
are S.D.
STEMI
NSTEMI
UA
NICP
* P<0.03, † P<0.01 compared to NICP
Normal HFQRS
Ischemic HFQRS