Analysis of atrial fibrillatory activity from high-resolution surface electrocardiograms: Evaluation and application of a new system

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Background
Algorithms of signal processing allow the estimation of atrial fibrillation (AF) activity from surface electrocardiograms (ECGs).

Objective
To evaluate a new commercially available ECG system for AF analysis from surface potentials. METHODS: Patients (n=52, mean [+/- SD] age of 68 +/- 9.6 years) with persistent AF (mean duration 44 +/- 52.2 months), referred for cardiac surgery, underwent high-gain, high-resolution ECG preoperatively. After QRST cancellation, the frequency content of AF was identified by fast Fourier transformation. Epicardial potentials were registered at the right atrial appendage, the right atrium (RA), the left atrium (LA) and the left atrial appendage intraoperatively (nine patients).

Results
Mean (+/- SD) fibrillatory rate (MFR) in lead V(1) (393 +/- 40.4 fibrillations/min [fpm]) correlated significantly with V(2) (391 +/- 43.3 fpm, r=0.976; P<0.05) and II (379 +/- 41.1 fpm, r=0.878; P<0.05), and was stable within an interval of 13.6 +/- 3.8 min (27 patients). In the right atrial appendage, RA, LA and left atrial appendage, the relative difference in MFR was small (5.6%, 6.6%, 6.8% and 5.7%, respectively, compared with V(1)). The mean peak frequency component at 75% of the maximum power was significantly smaller in the LA than in the RA (13 +/- 4.2 fpm versus 22 +/- 7.2 fpm, respectively; P<0.01), and in patients with high (more than 390 fpm) compared with low (390 fpm or fewer) fibrillatory activity (14 +/- 7.6 fpm versus 22 +/- 13.3 fpm, respectively; P<0.05). There was a nonsignificant trend to higher fibrillatory activity with longer AF duration. Other characteristics (age, sex, LA size, ejection fraction, type of heart disease and medication) were not associated with the MFR.

Conclusions
Using the CardioLink system, AF analysis from surface ECG is reliable and equivalent to epicardial measurements. By noninvasive assessment of individual electrical remodelling, this system certainly supports clinical AF research.