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Orthogonal P wave morphology, traditional P wave indices, and the risk of atrial fibrillation in the general population

Authors:
A. Eranti1, J. Carlson2, T.V. Kentta3, F. Holmqvist2, A. Holkeri4, M.A. Haukilahti3, T. Kerola5, A.L. Aro4, H. Rissanen6, K. Noponen7, T. Seppanen7, P. Knekt6, H.V. Huikuri3, M.J. Junttila3, P.G. Platonov2, 1North Karelia Central Hospital, Heart Center - Joensuu - Finland, 2Lund University, Clinical Sciences, Department of Cardiology - Lund - Sweden, 3Medical Research Center Oulu, Research Unit of Internal Medicine - Oulu - Finland, 4Helsinki University Central Hospital, Heart and Lung Center, Division of Cardiology - Helsinki - Finland, 5Paijat-Hame Central Hospital, Department of Internal Medicine - Lahti - Finland, 6National Institute for Health and Welfare (THL), Department of Public Health Solutions - Helsinki - Finland, 7University of Oulu, Center for Machine Vision and Signal Analysis - Oulu - Finland,

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Background: A substantial portion of the risk of atrial fibrillation (AF) remains unexplained by the established risk markers. However, accurate assessment of AF risk would be beneficial, especially among stroke patients and subjects with symptoms attributable to arrhythmia.

Purpose: To study the associations of P-wave indices with AF risk in the general population.

Methods: Electrocardiograms, including orthogonal leads, of 7217 Finnish subjects aged over 30 years who took part in the baseline examinations of the Mini-Finland Health Survey in 1978–80, were digitized. P-wave duration, third-degree interatrial block (IAB), and P terminal force (PTF) were assessed manually. PTF was considered abnormal when the amplitude of the negative terminal part of the P wave in lead V1 was ≥0.1mV and duration ≥40ms. Third-degree IAB was defined as P-wave duration ≥120ms and the presence of ≥2 +/- biphasic P-waves in the inferior leads. Orthogonal P-wave morphology, which is related to left atrial breakthrough site and affected by atrial fibrosis (1 being considered benign, 2 borderline, and 3 shown to be associated with adverse events), was assessed with an automated algorithm, and ascertained manually. Subjects were followed 10 years for AF hospitalization and mortality. The risk of AF associated with P wave parameters was assessed using Cox proportional hazards models. Model discrimination improvement was quantified by the change in C index, integrated discrimination improvement (IDI), and continuous net reclassification improvement (cNRI).

Results: There were 5489 subjects (47.8% male, mean age 50.5 years) with a readable ECG, sinus rhythm, no missing data, and a predefined orthogonal P-wave morphology. Type 3 orthogonal P morphology (n=216, multivariate adjusted HR [mHR] 3.01, 95% confidence interval [CI] 1.66–5.45, p<0.001), P-wave duration ≥120ms (n=752, mHR 1.67, 95% CI 1.06–2.64, p=0.027), and third-degree IAB (n=103, mHR 3.18, 95% CI 1.66–6.13, p=0.001) were independently associated with the risk of AF in separate models. PTF did not independently predict AF. Subjects presenting with both Type 1 orthogonal P-wave morphology and P-wave duration <110ms (n=2074) were at low risk of AF (mHR 0.46, 95% CI 0.26–0.83, p=0.006) when compared to the rest of the subjects. The inclusion of variables combining orthogonal P-wave morphology and P-wave duration to a multivariate model including conventional AF risk factors improved C index from 0.815 to 0.832 (change 0.017, 95% CI 0.001–0.033), IDI was 0.012 (95% CI 0.006–0.051), and cNRI was 0.220 (95% CI 0.048–0.357).

Conclusions: P-wave indices and orthogonal P-wave morphology can be used to identify subjects at high and low risk for AF and possibly direct extensive AF screening protocols towards high-risk subjects in the general
population in order to decrease the risk of cardioembolic stroke. However, more research is needed in this topic.