

# Electrocardiographic detection and monitoring of pulmonary hypertension

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**INTRODUCTION** Early detection of pulmonary hypertension (PH) and monitoring its course is of vital clinical importance. Animal experiments have demonstrated that a sudden increase in pulmonary resistance, creating acute right ventricular pressure overload (RVPO), results, due to mechano-electrical feedback, in immediate changes in the action potential morphology of the involved myocardium. This instantaneously changes the electrocardiogram (ECG) in all patients with RVPO. In contrast, hypertrophy and hypertrophy-related ECG changes will not occur in all patients and take time to develop. The immediate RVPO-related ECG changes cause changes in the ventricular gradient (VG, the spatial QRST integral), that can be computed by dedicated software from the standard 12-lead ECG [1]. In a transversal study of 63 patients in whom invasive pulmonary artery pressures (PAP) were measured, we have demonstrated that a VG projection optimized for RVPO (VG-RVPO) correlated significantly ( $r=0.67$ ,  $P<0.001$ ) with PAP [2]. Purpose of the current study was to demonstrate individual trends in VG-RVPO with emerging, continuing or resolving PH.

**METHODS** Among the patients in our transversal study [1] we identified those of whom our departmental ECG database contained sufficient ECGs at least 1 year preceding and/or following the ECG that was made in association with the index-catheterization, and checked the clinical course of their disease in their digital patient files, with special attention for the echocardiograms. We analyzed the relation between the changes in VG-RVPO and the clinical status of the patient.

**RESULTS** So far, we could construct trends in 8 patients. In 4 patients with emerging or worsening PH, VG-RVPO increased by 7, 14, 15 and by 29 mV·ms. In 2 patients in whom PH continued, VG-RVPO did not change by more than 4 mV·ms. In 2 patients who improved after PH detection, VG-RVPO decreased by 27 and by 41 mV·ms.

**DISCUSSION** So far, we could construct trends in 8 patients. In 4 patients with emerging or worsening PH, VG-RVPO increased by 7, 14, 15 and by 29 mV·ms. In 2 patients in whom PH continued, VG-RVPO did not change by more than 4 mV·ms. In 2 patients who improved after PH detection, VG-RVPO decreased by 27 and by 41 mV·ms. In conclusion, VG-RVPO measurement in periodically made standard 12-lead ECGs in patients at risk of developing PH and in patients with detected and treated PH may help to identify patients who need to be further assessed by echocardiography or catheterization.

[1] Draisma HHM, et al, *Comput Cardiol* 2005 ;32:515-518

[2] Kamphuis VP, Haeck MLA et al, *J Electrocardiol* 2014;47:175-182