Short Distance Bipolar Electrocardiographic Leads in Diagnosis of Left Ventricular Hypertrophy

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Novel small and wearable electrocardiogram (ECG) devices offer new means of recording cardiac activity in different applications. Our objective was to evaluate the performance of closely separated (6 cm) bipolar leads in differentiating subjects with left ventricular hypertrophy (LVH) from normal subjects.

The study population consists of 236 healthy subjects, 116 pure LVH patients having either pure left-sided valvular disease or sustained hypertension (150/90 mmHg or higher) and 189 complex LVH patients with various cardiac conditions frequently associated with LVH.

A total of 36 vertical, 30 horizontal and 66 diagonal bipolar leads located on the anterior thorax were analyzed. The QRS amplitudes of bipolar leads were calculated for each patient and the overall diagnostic performance of the bipolar leads was assessed by receiver operating characteristic (ROC) analysis. In addition the sensitivities of leads were calculated at equal specificity of 90%. As a reference Sokolow-Lyon criteria was applied to the data.

The ROC areas and sensitivities for the best bipolar leads in group comparisons of normal subjects vs. pure LVH subjects and normal subjects vs. complex LVH subjects are listed in Table 1. The best leads differentiating normals from pure and complex LVH subjects are vertical leads located on lower anterior thorax and mid-thoracic region, respectively. These leads have better performance and are more sensitive than clinically applied Sokolow-Lyon criteria. It should also be noted that the cut off point criteria for complex LVH is reversed.

As a conclusion the new short distance bipolar leads are efficient in discriminating subjects with LVH from normal subjects based on QRS amplitude.

Table 1. ROC areas, sensitivities and cut off points at 90 % specificities for the best bipolar leads and for Sokolow-Lyon criteria. Group comparisons were normal subjects vs. pure LVH and normal vs. complex LVH. Note that the diagnostic criteria for bipolar lead in case of complex LVH is reversed.

Method	ROC area	Sensitivity at 90% specificity	Cut off point (μV) at 90% specificity
Sokolow-Lyon (pure)	0.73	42 %	> 4255
Best bipolar (normal vs. pure)	0.81	59 %	>765
Sokolow-Lyon (complex)	0.67	39 %	< 1766
Best bipolar (normal vs. comp)	0.85	65 %	< 816