Modified limb lead system: Its effects on wave amplitudes and axis in surface ECG

Modified limb lead (MLL) electrocardiogram (ECG) system may be used during rest or exercise ECG test, or in atrial activity enhancement. Due to modifications to limb electrode placement, changes are likely to happen in ECG wave amplitudes and frontal plane axis, which may alter the clinical limits of normality and ECG diagnostic criteria (1). There are also several other alternative lead systems that are placed on the human torso to record and study the electrical activity of the atria (2–4). A few recent studies have proposed modification to the standard 12-lead ECG system of placing the limb electrodes closer to the atria in order to enhance atrial ECG components (5–7).

Sivaraman et al. (3) recently proposed a MLL system. In their subsequent study, they reported on the normal limits of the MLL system and documented the changes in P wave amplitudes and frontal plane P wave axis (8). It was found that P wave amplitude increased in all the modified leads compared with the standard leads, which led the MLL system to be seen as optimal lead system to study the electrical activity of atrial ECG components. Seen in the light of their previous findings using MLL system, observing the changes that occurred in ECG wave amplitudes (R, S, T), ST segment amplitudes (STa), and frontal plane axis shift due to the MLL system as described in the paper of Sivaraman et al. (9) published in this issue of the Anatolian Journal of Cardiology was of interest. In this study, they also examined the magnitude of ECG wave amplitudes and STa differences between standard limb lead (SLL) and MLL ECG systems, which may lead to deviations beyond clinical limits of normality. The observational study included 60 male patients with sinus rhythm of mean age 38.85±8.76 (SD) years, with range of 25 to 58 years. The authors comprehensively measured and evaluated STa from the J point to 80 milliseconds after the onset of the J point (J+80ms). STa deviations were analyzed for 20 milliseconds after the onset of the J point to validate whether the MLL system had any effect on the ST segments (Table 3 of the article). In general, ST segment elevation greater than 100μV is defined as clinical threshold level in the frontal plane (10). The documented STa values from this study are of importance in understanding the effects of the MLL system on STa deviations.

As the authors (9) themselves pointed out, the QRS and T axis measurements were generally more affected when the electrodes were moved from the limb to the torso of the patients, and concluded that the deviations in the frontal plane meant QRS axis had an effect on clinical specificity. This is due to the fact that MLL system records the ECG in a principally different way from the standard 12-lead ECG. In summary, this study on MLL ECG is useful in observing changes in ECG amplitudes and frontal plane axis shift and helps the clinicians/researchers to come to the conclusion that this MLL ECG may not be used to diagnose with SLL threshold values.

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