

Mason-Likar electrode configuration can confound the recognition of electrode cable interchange

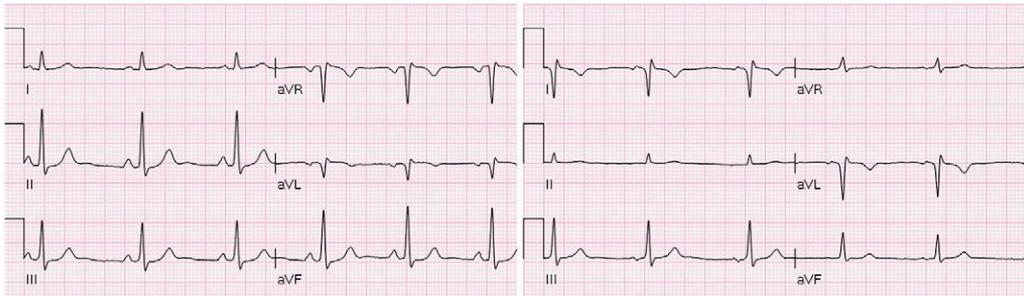


Fig. 1. A 12-lead resting ECG with correct (top panel) and with incorrect (bottom panel) cable connections.

Fig. 1 (left panel) presents a 12-lead resting electrocardiogram (ECG) acquired in a healthy subject who has participated in a drug trial. Except for a mild prolongation of the QRS complex to 114 milliseconds, the ECG is within normal limits. The ECG presented in Fig. 1 (right panel) has been recorded in the same subject 8 minutes later using the same set of electrodes. Obviously, the second ECG has been acquired with incorrect cable connection, but exactly which cables were interchanged?

In this case, the right arm and right leg (ground) cables have been swapped. However, the telltale sign of this technical mistake,¹ namely, a (almost) flatline in lead II, is missing, although the amplitude of lead II is reduced. The reason is that the leg electrodes have been positioned on the iliac crests, in a modification of the Mason-Likar configuration,² instead of the ankles. Although the potential between the 2 ankles is practically 0, this difference is substantially greater between electrodes positioned on the abdomen and increases further when the electrodes are moved further cranially on the abdomen.³ Therefore, if, in this case, the leg electrodes were positioned more cranially according to the original Mason-Likar configuration (“...in the anterior axillary line, halfway between the costal margin and the crest of the ilium.”²), the amplitude of “lead II” would be even higher.

In the ECG on Fig. 1 (right panel), there is a change in P wave morphology compared with Fig. 1 (left panel), which cannot be attributed to the cable misplacement because interchange of the right arm and right leg cables does not affect lead III.³ The likely cause is transient appearance of an ectopic atrial rhythm. Apart from that, the P wave shape in Fig. 1 (right panel) fits the expected changes because of right arm–right leg cable interchange.³ Because of the small amplitude of the P wave, the abdominal position of the neural electrode visibly affects to a much lesser degree the P wave than the QRS complex during right arm–right leg cable interchange.

The Mason-Likar configuration or its arbitrary variants are often used in clinical resting electrocardiography following the popular misconception that ECGs recorded with this configuration are essentially identical to those acquired with peripheral electrodes in their standard positions. This case once again highlights the danger of the indiscriminate use of this electrode configuration.

References

1. Haisty WK, Pahlm O, Edenbrandt L, Newman K. Recognition of electrocardiographic electrode misplacements involving the ground (right leg) electrode. *Am J Cardiol* 1993;71:1490.
2. Mason RE, Likar I. A new system of multiple-lead exercise electrocardiography. *Am Heart J* 1966;71:196.
3. Batchvarov VN, Malik M, Camm AJ. Incorrect electrode cable connection during electrocardiographic recording. *Europace* 2007;9:1081.

Velislav N. Batchvarov, MD, PhD
A. John Camm, MD, FACC, FAHA
Division of Clinical Sciences
St George's University of London
London, United Kingdom
E-mail address: vbatchva@sgul.ac.uk

Dilshat Djumanov, PhD
Jorg Taubel, FFPM, MD
Richmond Pharmacology Limited
London, United Kingdom