ELECTROCARDIOGRAPHIC TECHNICAL PROBLEMS UP DATE - 2008

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(1) Malpositioned electrode placement:

(1-a) Of limb leads: Extremity electrode reversal

No general approach has been established for the diagnoses of the various types of ECGs of limb lead misplacement not involving the right leg (ground) lead. Ho et al (1) have developed a 3-step algorithm for such differential diagnosis that can be applied without having to rely on the comparison with a reference ECG. It is based on the observation that the frontal plane sinus P vector loop is almost invariably inscribed counterclockwise. The 5 types of ECGs of limb lead misplacement can be differentiated according to the P wave axis, the location of the lead aVR in the ECG, and specifically any apparent reversal of the direction of inscription of the frontal plane P vector loop due to lead misplacement. Although most clinicians can recognize the common right arm/left arm lead switch that imitates a non sinus atrial rhythm Characteristic limb lead P wave patterns provide 6 signs capable of inferring from the ECG alone the direction of inscription about 94% of the time. P wave axis itself is diagnostic in an additional 4%. The ECG error of left arm/left leg lead reversal is difficult to identify. PDI amplitude greater than PDII as a terminal positive component to PDIII may diagnose 90% of such errors (2). Reversal of the right arm and right leg connections creates a unique pattern of diffuse low voltage in the limb leads (3).

(1- b) Of precordial leads. Misplaced precordial electrode/s

In recent study was to determine the reliability of ECG precordial electrode placement by doctors and nurses involved in the emergency care of patients admitted with suspected cardiac diseases. A total of 120 subjects were recruited within 2 days from six hospitals. They comprised physicians, nurses and cardiac technicians involved in the clinical assessment and care of patients with suspected cardiac disease. Subjects were asked to complete a questionnaire and marked on two diagrams of the chest wall the positions they would place precordial electrodes V1-V6. This study showed wide inter-individual and inter-group variations in the placement of electrodes. Notably, V1 and V2 were frequently incorrectly positioned in the second intercostal space, especially by physicians. The correct position of V1 in the fourth right intercostal space was identified by 90% of cardiac technicians, 49% of nurses, 31% of physicians (excluding cardiologists) and - most disappointing of all - only 16% of cardiologists ($p < 0.001$ for inter-group differences). V5 and V6 were also often mispositioned, too high on the

lateral chest wall. Nurses and doctors (especially cardiologists) do not know the correct positions for ECG electrodes. Because incorrect positioning of the precordial electrodes changes the ECG significantly, patients are at risk of potentially harmful therapeutic procedures. Equally, doctors who are aware of the possibility of lead misplacement may be inclined to ignore some ECG changes that may be genuine evidence of ischaemia. The only safe solution is proper precordial electrode placement, which requires training and an environment supporting precision (4).

(1-c) Tremor artifacts: Flutter and tremor-induced pseudo-ventricular tachycardia (5).

(1-d) Electrical Interference. Bad grounding. Oscilation base line.

(1-e) *Interference with cardiac pacemakers by a magnetic field at power line frequencies.*

The overall incidence of interaction by a magnetic field was low in patients tested with a wide variety of conventionally programmed pacemaker models. A magnetic field pulsed at power frequency can cause a mode switch and pacing inhibition in patients with devices programmed in the unipolar sensing configuration. The risk of interference appears negligible in patients with bipolar sensing programming (6).

(1-f) *Application of a continuous electrode paste (or excessive) band on precordial leads "Big precordial electrode". Conductor gel strip.*

The electrocardiographic alterations identified in the tracings performed with a continuous electrode paste band that showed statistical significance in relation to the control group were the following: inversion of the P wave in V1; inversion of the T wave in V1, V2, and V3; appearance of R' waves in V1 and V2; disappearance of S waves in V1; appearance of S waves in V5 and V6; alterations in the amplitude of almost all waves, in all leads. and identical morphology from V1 to V6 (7).

(1-g) Poor quality data.

(1h) Missing leads.

References

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