Technical Errors and Artifacts

This article discuss various technical errors and artifacts which can lead to misinterpretation of serial ECG.

Keywords: Electrocardiograph, Electrodes, Atrial Flutter

Technical errors

Wrong placement of leads

- Switching of limb leads: It can produce error in interpretation of sequential ECGs. Changes occurring in different limb leads due to wrong placement are shown in Fig. 1. Interchange of upper limb leads results in false impression of dextrocardia (technical dextrocardia).

- Switching of chest electrodes: Total reversal of precordial electrodes in six channel recorder can give wrong interpretation of dextrocardia in chest leads (Fig. 2a). Interchange of right and left precordial electrodes can cause sudden disappearance of R resembling 'reverse progression' (Fig. 2b).

- Wrong placement of chest electrodes: It is not infrequent. Higher placement of right precordial leads can result in appearance of 'slow progression of R' and may be

![Fig. 1: Showing changes occurring in different limb leads due to wrong placement of limb electrode](image)

![Fig. 2(a): Showing dextrocardia due to wrong placement of precordial leads (b): Showing 'reverse progression' due to wrong lead placement](image)

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misinterpreted as an old anterior infarction. (Fig. 3a). Sometimes this technical error can cause RSR' configuration with negative P wave in V1(Fig. 3b). Wrong placement of posterior leads (V7-V9) can produce wrong impression of posterior myocardial infarction (Fig. 3c). These errors are more common with six channel recorders.

- **Recording of chest leads without changing the machine switch to 'V' lead:** This causes identical configuration of lead aVF and leads to V1-V6 (Fig. 4).

- **Recording at 50mm/sec speed:** Recording at 50mm/sec speed causes broadening of all waves and intervals (Fig. 5). It stimulates bradycardia. However in sinus bradycardia the duration of waves and intervals remains normal.

**Poor electrodes contact**

This results in wandering baseline (Fig. 6a), which can be confused with arrhythmia. However careful observation and measurement shows normal QRS spikes marching through the wandering baseline. This can also result in acute baseline shift (Fig. 6b,c) which creates problem in interpretation of PR segment and ST segment.

**Artifacts**

**Related to patient**

Tremors, shivering, hiccups can produce artifacts in baseline that can be confused with atrial flutter (Fig. 7a,b,c). Such artifacts, however, are not present in all leads. Tremors produce artifacts in leads related to the limb having tremors.

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Hiccup produces disturbance in chest leads. Regular QRS spikes help in identification. Limb tremors may disappear on command or during sleep.  

**Cable malfunction**

It can produce identical morphologies in left chest leads (Fig. 8).

**Electrical noise**

Alternating current interference can produce fine high frequency vibrations in baseline (Fig. 9). Such artifacts can also occur due to improper earthing or improper contact of neutral electrode (right lower limb electrode). Regular QRS helps in identification.

**Artifacts related to motor speed**

Standard speed while recording is 25mm/sec. If the motor is defective then speed may change spontaneously. Slowing of speed results, in wrong impression of tachycardia (Fig. 10a). It can be differentiated because tachycardia due to diminished motor speed squeezes all waves and intervals. This dose not occur in tachyarrhythmias. Further tachycardia produced by slow motor speed produces unphysiological coupling interval (<140 milliseconds). Increased speed results in false impression of bradycardia. However, unlike sinus bradycardia, all waves and intervals are widened (Fig. 10b). Changing speed can give wrong impression of atrial fibrillation (Fig. 10c). Motor problem produces changing width of waves and intervals as compared to fixed duration of QRS, T and QT during AF. Transient retrograde motion of motor can produce curved QRS (Fig. 10d) or splitting of terminal portion of QRS (Fig. 10e).

**Artifacts related to stylus**

- Standard- Normal standard is of 10mm (1 mv). If the standard is more (>10mm), QRS amplitude increases and can give false impression of ventricular hypertrophy.
by voltage criteria. On the other hand small standard (<10mm) can give false impression of low voltage ECG (Fig. 11).

- High frequency signals\(^3\) (Fig. 12). These can mimic pacing spikes and can result in wrong interpretation of ECG in patients with permanent pacemaker patients.
- Improper damping – Under damping (Fig. 13c) results in spikes that can increase height of R wave and increased depth of S wave. Over damping (Fig. 13d) results in loss of sharpness of onset of R wave and J point and false ST depression (Fig. 13e). It can also mask delta wave of pre excitation syndrome (Fig. 13 f and f').
- Restriction of movement above or below a particular level results in cutting of R wave and S wave (Fig. 14a,b).
Artifact related to transient loss of electric current to the stylus
This results in straight line with loss of all waves producing falls impression of SA block (Fig. 15a,b). In problem created by artifact, there is no T wave following the preceding QRS.

Battery depletion
Can change size of various waves.

Computerised interpretation
Currently available systems are not accurate enough to be relied on in presence of complex abnormalities or in critical clinical environment.¹ No computer program can replace a skilled physician.⁴

Placement of precordial leads are made with marked neglect of chest land marks.⁵ This is more common now than previously⁶ and creates severe problems for computer interpretation of serial ECG.⁶

References