Cardiac axis measurement on electrocardiograms

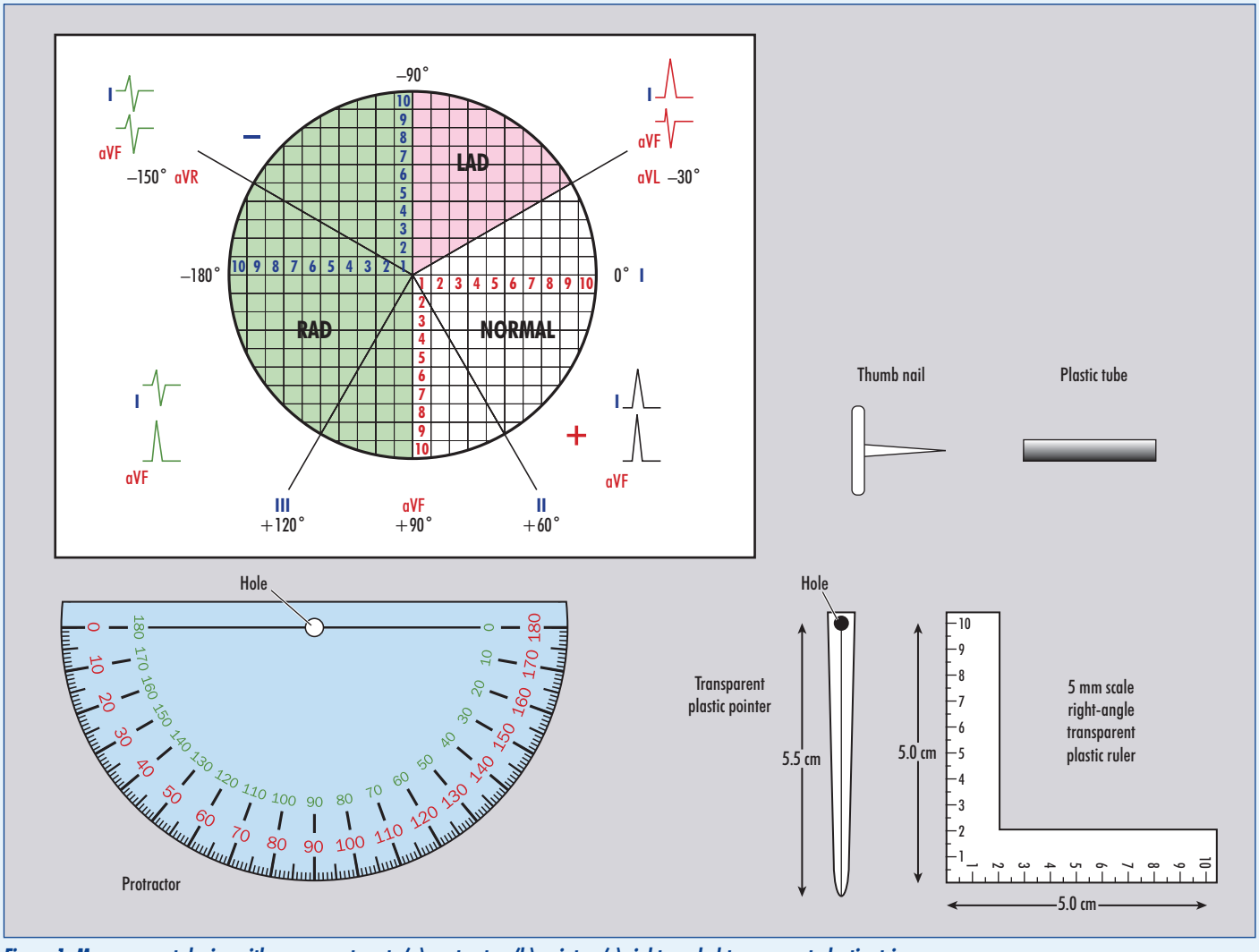

Figure 1. Measurement device with component parts (a) protractor, (b) pointer, (c) right-angled transparent plastic strip.

Introduction

Although cardiac axis measurement causes more confusion and difficulty than any other aspect of electrocardiogram (ECG) assessment for many doctors, it can be easily worked out in a few seconds using the simple method outlined in this article.

Cardiac axis measurement device

A measurement device is essential for this method and can be made using easily available materials.

Dr Khin Maung Aye *is Deputy Medical Superintendent, Jivitadana Sangha Hospital, 38 Kominkochin Road, Bahan, Yangon, Myanmar*

Take a card and draw a 5 cm diameter circle with 5 mm scale lines, figures, marks, words and fill colour as shown in *Figure 1.* Alternatively this could be printed out.

Take a transparent plastic protractor and drill a hole at the centre of the base line. Paint the outer scale pink and inner scale green (*Figure 1a*). Cut a 5.5 cm long plastic pointer with a straight line at the centre from a plastic ruler and drill a hole at the distal end (*Figure 1b*). Cut a 5 cm x 5 cm long, 1 cm breath L-shaped right-angled transparent plastic strip and scratch scale marks every 5 mm (*Figure 1c*).

Pierce a hole at the centre of the circle on the card. Then fix the protractor and pointer to the centre of circle using a thumb tack and fasten with a small plastic tube. The device is ready for use.

Measurement method

Lead I and aVF look at the heart at right angles to each other.

From the ECG strip, their overall QRS sizes and polarities can be calculated by subtracting the depth of the S wave from the height of R wave. i.e. + R + – S = + or –.

The positive polarity (+) means the impulse is moving towards the lead, i.e. from the centre to 0° in lead I and from the centre to + 90° (downwards) in lead aVF, i.e ⌜-shaped red line.

The negative polarity (–) means the impulse is moving from the centre to –180° in lead I and from the centre to –90° (upwards) in lead aVF, i.e. ⌟ -shaped green line.

By using the overall QRS size, we can construct a vector diagram as follows. In

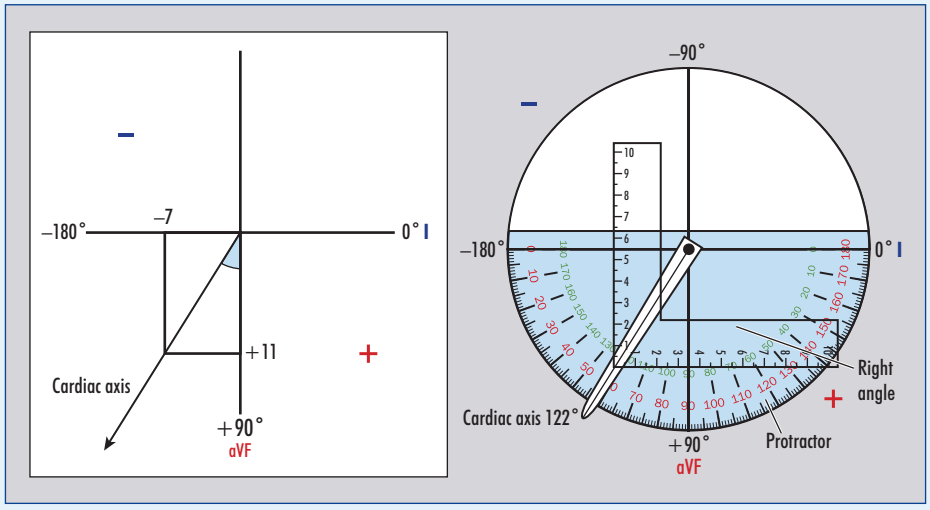

Figure 2. Cardiac axis measurement. a. Using vector diagram. b. Using measurement method.

the ordinary method, the cardiac axis which is lying between the two leads can be calculated by using a pocket calculator to work out the angle at which the current is flowing (*Figure 2a*), using sine, cosine or tangent. For example, the calculated angle in *Figure 2a* is 32° and you must add +90° to get the real 122°, which is confusing.

In the method described here, the real angle can be measured directly. On the measurement device, this vector diagram can be easily constructed by using right-angled plastic strip as seen in *Figure 2b*. Move the plastic pointer until the line lies exactly on the tip of the right angle. You can read the exact degree of cardiac axis from the inner green degree marks of protractor on which the pointer line crosses, if the vector point downwards. If the vector points upwards, read from the outer pink degree marks of the protractor.

There are two worked examples given in *Figures 3* and *4*. In *Figure 3*, for lead 1, the height of R is 3 mm above the iso-electric line, which means +3 and S is 10 mm below the isoelectric line, which means -10. So the overall QRS size, i.e. R+S = +3 + (-10) = -7 mm. So the vector in lead I is directed from centre to -180°, i.e. to the left side.

For lead aVF, the height of R is 11 mm above isoelectric line, which means +11 and the height of S is the same as the iso-electric line, which means 0. The overall QRS size is R + S = +11 + 0 = +11 mm. So the vector in lead aVF is directed from centre to +90°, i.e. downward direction.

In *Figure 4*, the lower arm of right angle is placed 3.5 marks, i.e. -7 mm, from the centre to the left side on lead I and the upright arm of right angle is placed 5.5 marks, i.e. +11 mm, from centre to the downwards direction on lead aVF. Then move the plastic pointer until the line lies exactly on the tip of the right angle. The exact degree of cardiac axis can be interpreted from the inner green degree marks on the protractor on which the pointer line crosses, i.e. 122°.

Conclusions

This can be used as a simple handy pocket medical device for all doctors. The author hopes that this small device will soon become an essential tool in the white coat pocket. BJHM

Figure 3. Worked example 1.

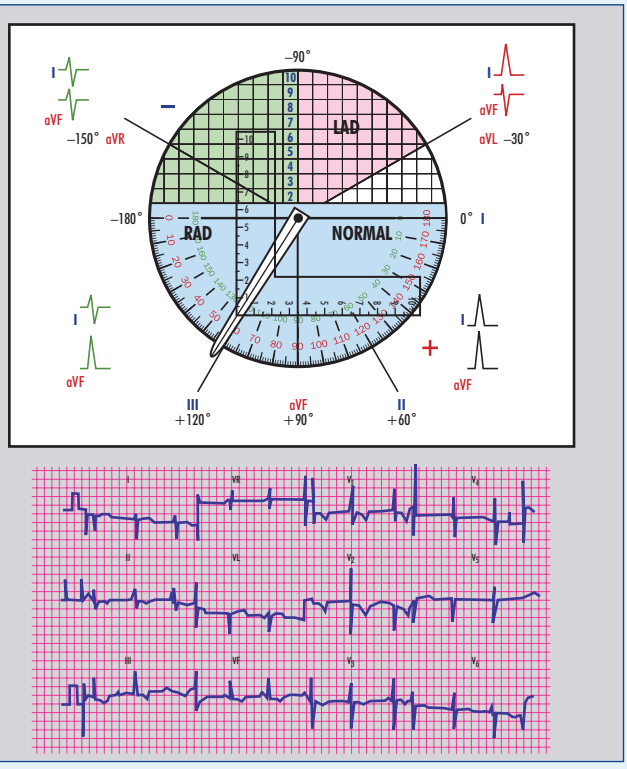

Figure 4. Worked example 2.