

Please fill in, attach to ECG and include in the patient's notes

Date and time ECG performed:

Patient's Details (affix sticker)

Date:..... Time:

Name:

Indication for ECG:

Date of Birth:

Trust ID & NHS No:
.....

	Measurements	Comments (normal/abnormal)
Rate (/minute)		
Rhythm		
Axis		
PR interval		
QRS duration		
QTc interval		
ST segment		
Other relevant values/waves		

Conclusion: Normal ECG

Borderline ECG Please specify

Abnormal ECG Please specify

If abnormal discuss with senior

Plan/ Follow up:

.....
.....

Any significantly abnormal ECG should be reviewed by a Senior Clinician, and discussed with Paediatric Cardiology Registrar at the Tertiary Cardiology Centre (Evelina Children's Hospital)

Consultant in Charge:
.....

Clinician name:

Grade:

Signature:

Paediatric ECG interpretation

Author: P Venugopalan /L Jervis/S Yaqoob. Evidence search provided by Rachel Playforth
 Approved by: Paediatric consultant group December 2021
 Publication date: December 2021. Version 2
 Review date: December 2023

See front page for ECG proforma

Features of a normal ECG:

Each P wave is followed by QRS and T wave

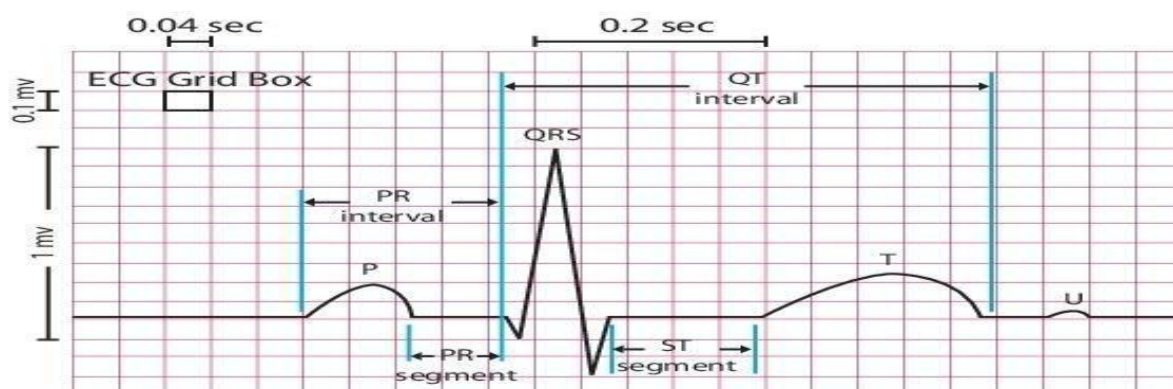
PR and ST segments are isoelectric (i.e. same plane as test line). 1 mm deviation can be normal.

PR interval and QRS duration should be within 98th centile for age

R and S wave in V1 and V6 should be within 98th centile for age

No Q waves in lead I, aVL and V1. Q waves up to 4 mm in V5 & V6 and 8 mm in III and aVF are normal

QRS axis should be in the age-related range. Mild change in the QRS axis may be considered normal in the absence of any other abnormalities.



1 mm horizontally is 0.04 seconds and 1mm vertically is 0.1 mV unless otherwise indicated

Suggested sequence for interpretation (see table 2 for normal age related values):

RATE: at a paper speed of 25mm/s 1mm (1 small box) = 0.04s and 5 mm (1 large box) = 0.2s

1. Count the number of large squares between two R waves and divide that into 300
2. For irregular rhythms count the number of QRS complexes on the 10 second rhythm strip and multiply by 6

RHYTHM: Sinus rhythm if each QRS complex is preceded by a P wave.

AXIS: the net direction of flow of current.

Calculating the Axis:

The QRS complexes in leads I and aVF are used to calculate the axis.

A net positive wave means an upward deflection/ upright QRS and a negative wave means a downward deflection/ downward QRS wave.

A net positive wave in I is towards 0 and negative is towards 180 degrees. Net positive wave in aVF is towards 90 and negative wave is towards -90 degrees in the diagram below.

If the QRS complex is positive in both leads I and aVF, then the axis is normal. A normal axis is age related. There is right axis deviation until 1 month and adult axis by 3-12 years.

STEP 1: Look at the QRS wave in lead 1 and determine if it is a positive or negative deflection

STEP 2: Look at the QRS wave in lead aVF and determine if it is a positive or negative deflection

STEP3: Determine the axis by correlating to the table 1 below

Lead:	1	aVF	
0° - +30°			1) Normal Axis Positive in lead 1 & Positive in aVF
0° - -90°			2) Left Axis Deviation Positive in lead 1 & Negative in aVF
+90° - ±180°			3) Right Axis Deviation Negative in Lead 1 & Positive in aVF
-90° - ±180°			4) NW axis/Indeterminate Negative in Lead 1 & Negative in aVF



Table 1: Calculation of the axis using leads I and aVF

PR interval: Beginning of P wave to beginning of QRS complex (see Table 2 for normal values)

QRS duration: Beginning of Q/S wave to end of S wave (see Table 2 for normal values – normally <0.10 seconds)

QTc: QT divided by square root of preceding RR interval preferably in a rhythm strip. QTc more than 450 msec is abnormal and needs review by consultant

$$QTc \text{ (Bazett)} = \frac{QT}{\sqrt{RR}}$$

ST segment: End of S wave to beginning of T wave. ST segment isoelectric shifts may be normal up to: 1 mm in limb leads and 2 mm in chest leads

T wave: in lead V1 inverts by 7 days and typically remains inverted until at least 7 years old. Upright T waves in the right precordial leads (V1-V3) between ages 7 days and 7 years are a potentially important abnormality and usually indicate right ventricular hypertrophy

Normal RS pattern:

- Newborn: R>S in V1 and S>R in V5 & V6
- Children > 2 yrs: S>R in V1 and R>S in V5 & V6

Signs of Right Atrial Enlargement:

- **Lead II, V1 and V2:** pointed P wave and 3 mm or more

Signs of Left Atrial Enlargement:

- **Lead II:** P waves broad and bifid (> 2.5 mm)
- **Lead V1:** deep terminal component of P wave

Signs of Right Ventricular Hypertrophy

- Monophasic R wave without S wave in V1
- Upright T wave in V1 after 7 days of age until 10 years
- Excessively tall R wave in V1 and excessively deep S wave in V5 and V6 (> 98th Centile)
- Right axis deviation

Signs of Right Ventricular Dilatation

- Right sided T wave inversion extending to lead V4
- RSR pattern in V1

Signs of Left Ventricular Hypertrophy

- Excessively tall R wave in V5 & V6, and excessively Deep S wave in V1 (> 98th Centile)
- Flattened or inverted T wave in V5 & V6
- Left axis deviation

Bundle branch block:

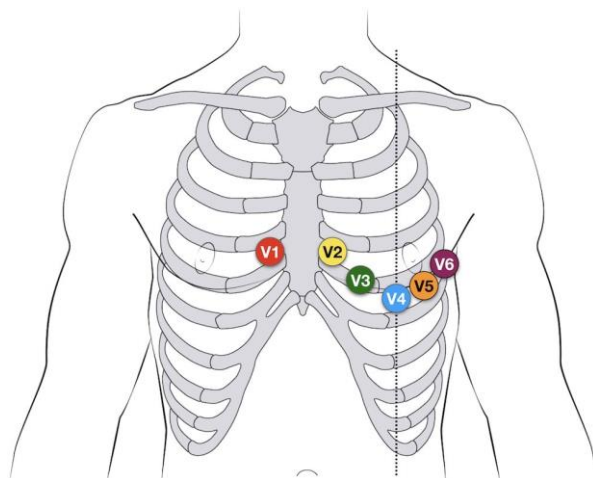
- Prolonged QRS duration and RSR pattern (M) or SRS Pattern (W) in lead V1 suggests bundle branch block

Delta waves:

- Suggests pre-excitation and abnormal AV conduction pathway which needs review

ECG LEAD PLACEMENT

- V1:** 4th intercostal space, right sternal border
- V2:** 4th intercostal space, left sternal border
- V3:** midway between V2 and V4 intercostal space, left mid-clavicular line)
- V4:** 5th left intercostal space, mid-clavicular line
- V5:** anterior axillary line, same horizontal plane as V4
- V6:** mid-axillary line, same horizontal line as V4



OTHER IMPORTANT DATA

Table 2: Age Related ECG Data

AGE	Heart Rate	PR Interval (Sec)	QRS Duration (Sec)	QRS Axis Degrees
1-4 weeks	100 - 180	0.07 – 0.14	0.03 – 0.07	45 to 160
1-6 months	100 - 180	0.07 – 0.16	0.03 – 0.07	30 to 135
7-12 months	100 - 170	0.08 – 0.16	0.03 – 0.08	0 to 135
1-3 years	90 - 150	0.09 – 0.16	0.03 – 0.08	0 to 110
4-5 years	70 - 140	0.09 – 0.16	0.03 – 0.08	0 to 110
5-7 years	65 - 130	0.09 – 0.16	0.03 – 0.09	0 to 110
8-11 years	60 - 110	0.09 – 0.16	0.03 – 0.09	-15 to 110
12-16 years	60 - 100	0.09 – 0.18	0.03 – 0.09	-15 to 110

AGE	R in V1 mm 98 th Centile	S in V1 mm 98 th Centile	R in V6 mm 98 th Centile	S in V6 mm 98 th Centile
1-4 weeks	24	18	15	10
1-6 months	19	15	22	9
7-12 months	20	18	23	7
1-3 years	18	21	23	7
4-5 years	16	23	26	5
5-7 years	16	23	26	5
8-11 years	12	25	26	4
12-16 years	10	22	23	4