Teach me ECGs!!

Dr Cheentan Singh

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ECG interpretation

European Heart Journal (2001) **22**, 702–711
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New normal limits for the paediatric electrocardiogram

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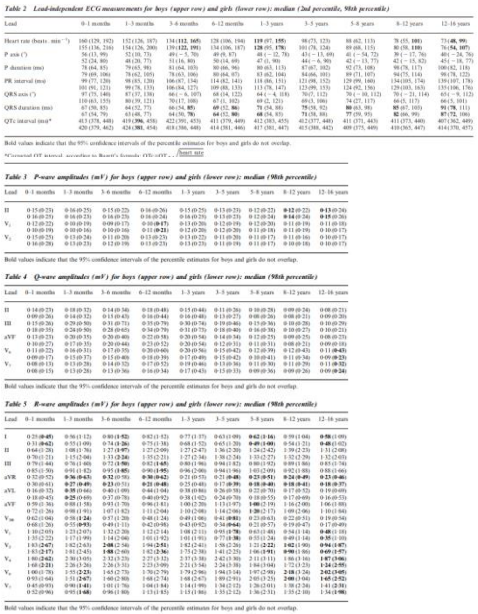

Making ECG interpretation in the Paediatric Emergency Department easier and safer by introduction of an ECG checklist

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NHS Greater Glasgow and Clyde

Results

Between May and November 2018, 600 electrocardiograms were performed in paediatric ED. 48 electrocardiograms of patients known to cardiology services or discussed with the on-call team were excluded.

Of the remaining 552 electrocardiograms;

- 30 were identified by the emergency clinicians as abnormal
- 13 of these were considered normal by cardiology and discharged.
- The other 17 patients were allocated to cardiology outpatient clinic.
- 3 of these 17 required ongoing follow-up.

Indications for ECG

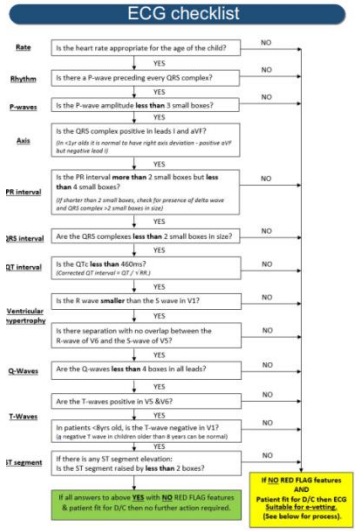
Red Flags

Syncope

- Whist lying down / supine or sitting
- On swimming
- On exercise
- Family history of sudden explained death
- Family history of epilepsy

Prolonged QTc

- Syncope with QTc > 450ms
- Otherwise QTc > 460ms in both boys and girls



RCPCH Conference 2021

PAEDIATRIC ECG PROFORMA – November 2016 **WHITTINGTON HOSPITAL**

Patient Name:

DOB: Age:

Hospital Number: ECG Date:

Presentation:

ECG

Calibrated at 1mm:10mV? ☐ Paper at 25 mm/s? ☐

Lead position: right arm clockwise (R,Y,G,B) + V4R in all under-5s? ☐

RATE

Regular (300 / R-R interval):

Irregular (6 x pnumber of complexes in rhythm strip) :

RHYTHM

Assess LEAD II. 1 small square = 0·04s therefore 1 big square = 0·2s

P wave before every QRS?

?SVT, ?Heart Block

PR Interval

< 2 y	0·08 – 0·16s
2y - 15y	0·09 – 0·18s
>16 y	0·12 – 0·2s

QRS Duration

<2y = <0·08s	>16y = <0·12s

NB Lengthens with age: 'normal' can represent slight prolongation i.e. BBB

QTc Interval

< 6 months	Variable
> 6 months	< 0·44s

QTc = QT/√preceding R-R(s)

AXIS

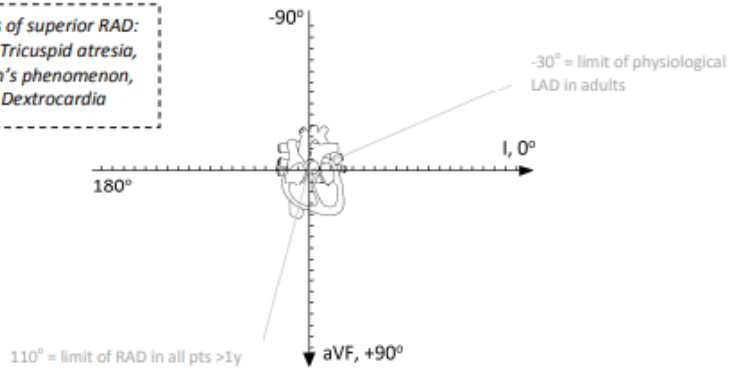
P wave axis (i.e. SAN location) normal?

Normal = positive in I, III and aVF

QRS axis

NB RAD normal in <3/12, normalising to LAD by 1y & progressing to adult parameters by 8y.

Causes of superior RAD: AVSD, Tricuspid atresia, Ebstein's phenomenon, WPW, Dextrocardia



MORPHOLOGY

P wave (lead II)

Normal amplitude < 3mm

Normal duration: < 0·07s (infants) / < 0·09s (children)

RED FLAG: *tall (RA) and wide (or bifid, LA) = combined atrial hypertrophy*

QRS complex

Normal Variants:

- RSR' in V1-V3 in neonates, persisting in 7% of under-5s

- R wave dominance generally regresses by 4y

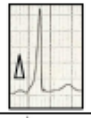
RED FLAGS:

- Delta Wave

- Q waves in I and aVL

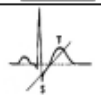
- Deep Q waves (>5mm) inferolaterally

- BBB (WiLLiaM MaRRoW)



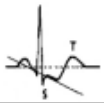
ST segment

Normal variant: Upsloping ST depression



RED FLAGS:

1) Down-sloping ST



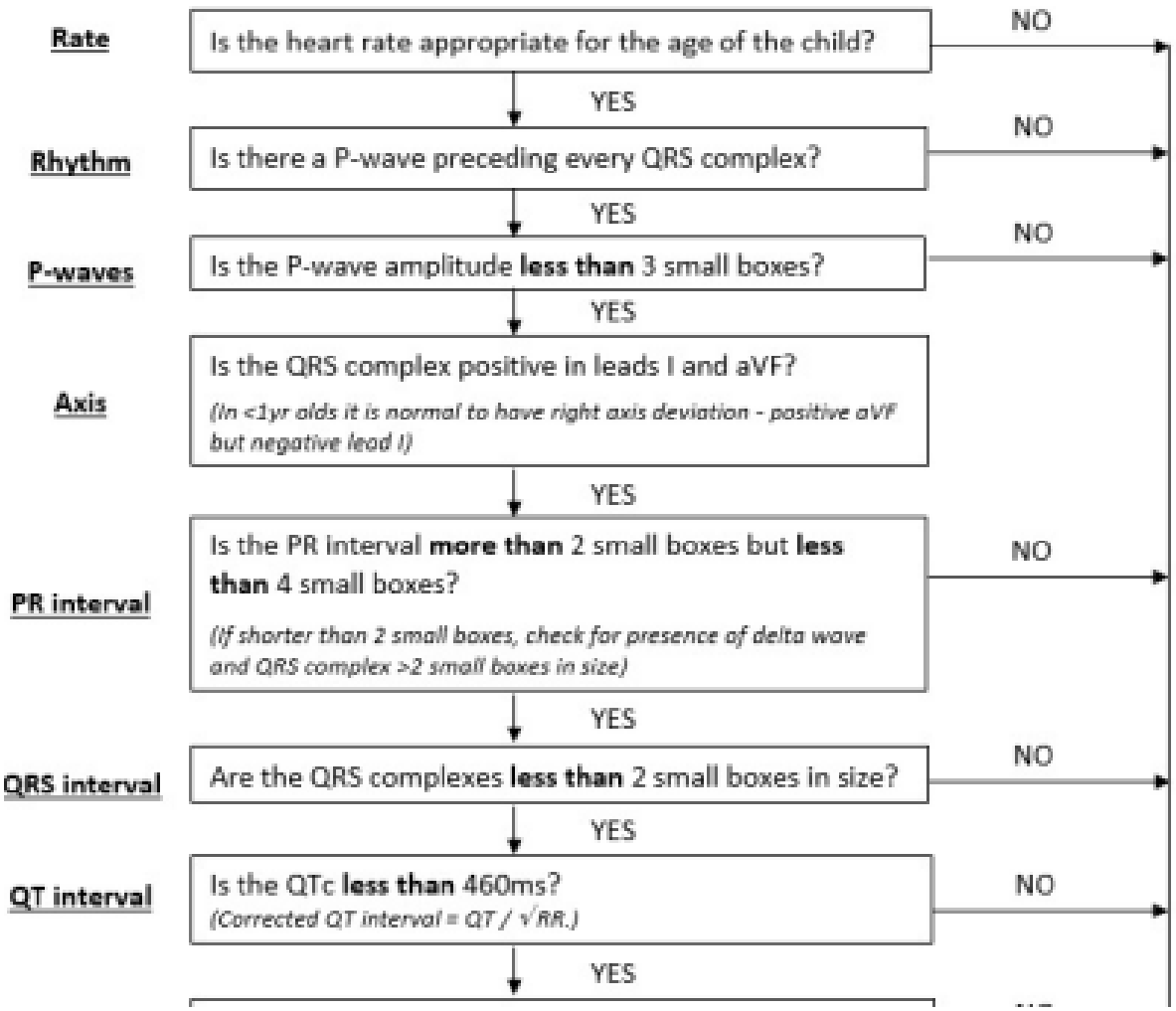
2) Horizontal ST depression > 0·08s

T wave

'Juvenile pattern': Inverted T waves in V1-V4 are physiological after 48hrs of age, persisting in V1 until 8y and often into adolescence.

RED FLAGS: *Tall (>2/3 R wave), peaked // Flat // Deeply inverted*

ECG checklist



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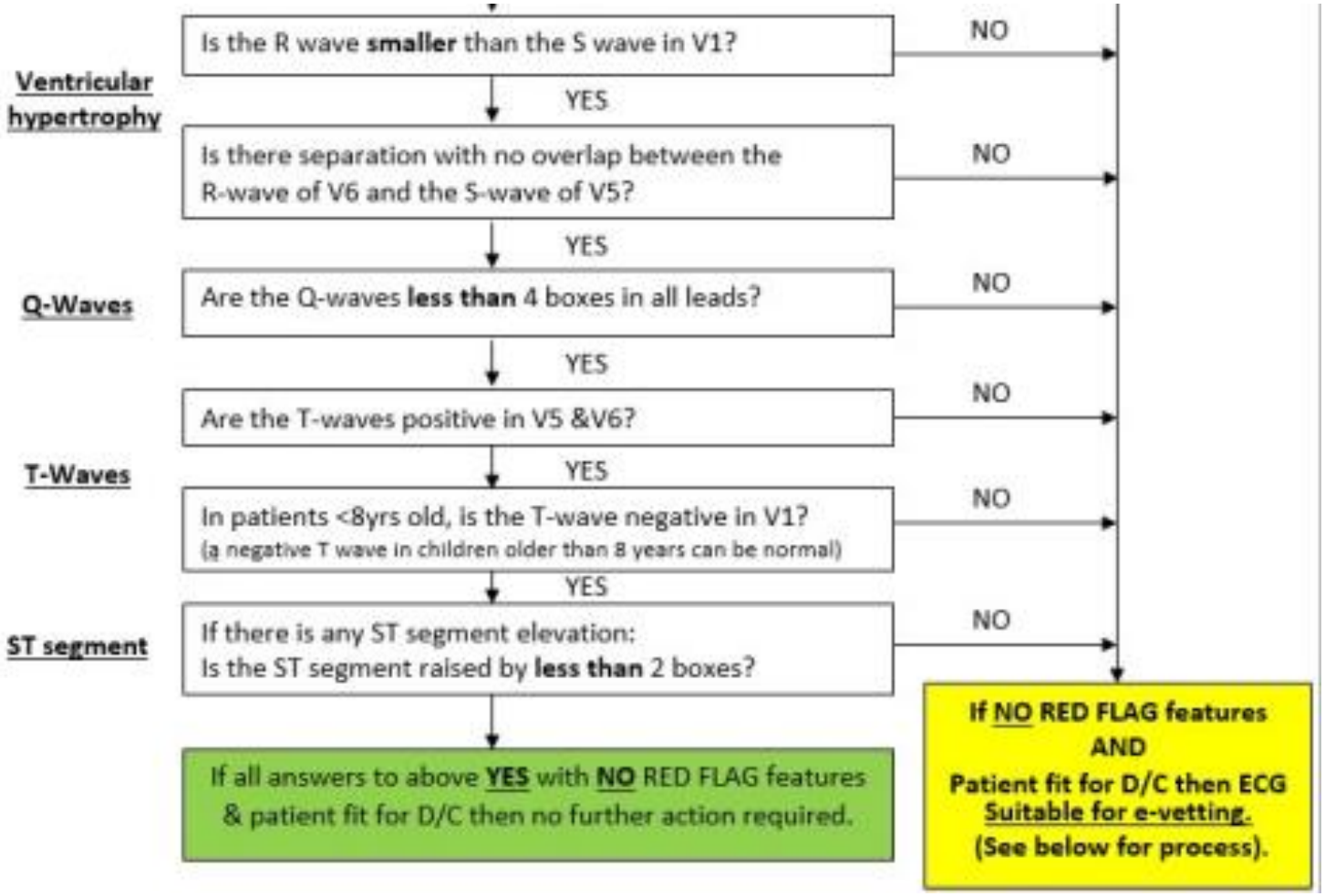
Ventricular hypertrophy
Is the R wave **smaller** than the S wave in V1?
NO
YES
Is there separation with no overlap between the R-wave of V6 and the S-wave of V5?
NO
YES
Q-Waves
Are the Q-waves **less than** 4 boxes in all leads?
NO
YES
Are the T-waves positive in V5 &V6?
NO
YES
T-Waves
In patients <8yrs old, is the T-wave negative in V1?
(a negative T wave in children older than 8 years can be normal)
NO
YES
ST segment
If there is any ST segment elevation:
Is the ST segment raised by **less than** 2 boxes?
NO
If all answers to above **YES** with **NO** RED FLAG features & patient fit for D/C then no further action required.
If **NO** RED FLAG features AND Patient fit for D/C then ECG Suitable for e-vetting. (See below for process).

Paediatric ECG Interpretation

Anna McCorquodale

CHECK CALIBRATION

Lead position matches machine diagram
Vertical 10mm/mV
Horizontal 25mm/sec

1 Rate Calculation

Regular - 300/(no. large squares between R-R)
Note if irregular

2 Rhythm

Assess in rhythm strip (lead II),
1 small square = 0.04 sec
Normal sinus rhythm:

- P wave before each QRS
- Normal P wave morphology
- Normal P wave axis (upright II, III, aVF)
- Normal PR interval
- Appropriate rate for age

3 QRS Axis

Use vector addition plotting arrows along lead I (positive to right) and aVF (positive downwards)

0-90° normal 1-8 years. Mild LAD (-30°) normal puberty- adulthood. RAD
90-180° normal <1 year

4 P Wave

Amplitude <3mm
<2 year 0.08-0.16
2-15 years 0.08-0.2
>15 years 0.12-0.2

Tall - P pulmonale - RA dilatation
Bifid & wide - P mitrale - LA dilatation

5 ST Segment

ST should be isoelectric

6 QTC

QTc = QT/√(preceeding RR)
0-6m - variable - max 0.46 secs
>6m - < 0.45 secs

7 QRS Complex

Duration increases with age and bradycardia
Max duration usually 0.12 secs during childhood
Bundle branch block – prolonged QRS duration and interruption in flow of R/S waves
Partial BBB (i.e. without QRS prolongation) normal finding

In BBB look for the pattern:

wiLLiam **maRRow**

Then look at complex height across the chest leads:

Tall complexes V1-V3 - ?RVH
Tall V4-V6 complexes - ?LVH

8 T Wave

Physiological inversion V1-V3 after birth
Return to upright in reverse order during childhood, persisting inversion of V1 normal variant
Check if very tall/peaked, broad and flat, abnormally inverted or bifid
U wave normal if bradycardic, should be same orientation as T wave

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