

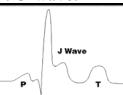
NORMAL PEDIATRIC ECG PARAMETERS									
Age	Heart Rate (bpm)	QRS Axis*	PR Interval (sec)*	QRS Duration (sec†)			Lead V ₁		Lead V ₆
				(mm) [‡]	(mm) [‡]	(mm) [‡]	R Wave Amplitude (mm) [†]	S Wave Amplitude (mm) [†]	
0-7 days	95-160 (125)	+30 to 180 (110)	0.08-0.12 (0.10)	0.05 (0.07)	13.3 (25.5)	7.7 (18.8)	2.5	4.8 (11.8)	3.2 (9.6)
1-3 wk	105-180 (145)	+30 to 180 (110)	0.08-0.12 (0.10)	0.05 (0.07)	10.6 (20.8)	4.2 (10.8)	2.9	7.6 (16.4)	3.4 (9.8)
1-6 mo	110-180 (145)	+10 to +125 (+70)	0.08-0.13 (0.11)	0.05 (0.07)	9.7 (19)	5.4 (15)	2.3	12.4 (22)	2.8 (8.3)
6-12 mo	110-170 (135)	+10 to +125 (+60)	0.10-0.14 (0.12)	0.05 (0.07)	9.4 (20.3)	6.4 (18.1)	1.6	12.6 (22.7)	2.1 (7.2)
1-3 yr	90-150 (120)	+10 to +125 (+60)	0.10-0.14 (0.12)	0.06 (0.07)	8.5 (18)	9 (21)	1.2	14 (23.3)	1.7 (6)
4-5 yr	65-135 (110)	0 to +110 (+60)	0.11-0.15 (0.13)	0.07 (0.08)	7.6 (16)	11 (22.5)	0.8	15.6 (25)	1.4 (4.7)
6-8 yr	60-130 (100)	-15 to +110 (+60)	0.12-0.16 (0.14)	0.07 (0.08)	6 (13)	12 (24.5)	0.6	16.3 (26)	1.1 (3.9)
9-11 yr	60-110 (85)	-15 to +110 (+60)	0.12-0.17 (0.14)	0.07 (0.09)	5.4 (12.1)	11.9 (25.4)	0.5	16.3 (25.4)	1.0 (3.9)
12-16 yr	60-110 (85)	-15 to +110 (+60)	0.12-0.17 (0.15)	0.07 (0.10)	4.1 (9.9)	10.8 (21.2)	0.5	14.3 (23)	0.8 (3.7)
> 16 yr	60-100 (80)	-15 to +110 (+60)	0.12-0.20 (0.15)	0.08 (0.10)	3 (9)	10 (20)	0.3	10 (20)	0.8 (3.7)

New data compiled from Park MK. Pediatric cardiology for practitioners, 3rd ed. St Louis: Mosby; 1996 and Davignon A et al. Pediatr Cardiol 1979; 1:123-131.

*Normal range and (mean), †Mean and (98th percentile).

EKG Findings with Medications:

- Digoxin:
Brady, 1° AVB, ST depress, tall R
- Dig Tox:
Brady, 2/3° AVB, PAC, SVT, PVC, V tach.
- Quinidine/
Procainamide/
Disopyramide:
Prolonged QRS, Prolonged QTc Toxicity:
Tachy, wide P, 1° AVB, QRS & QTc ↑ prolonged, PVC, V tach.
- β-Blockers:
Brady, 1° AVB, shorter QTc.
- Anesthetics
Halothane/Methoxyflurane/Teflurane/Enflurane:
Shorter QTc, T-wave depress, brady, ventricular arrhythmias.
- Phenothiazines:
↓ T amplitude w/ prominent end repolarization (looks like U), prolonged QTc.
- TCA's:
Sinus tach, flat T, 1° AVB, ST/T Δ's, prolonged QRS/QTc.
- Imipramine Tox:
A flutter, AVB,



EKG Findings with Electrolyte Δ's and Systemic Disease:

- ↑ K: (5.5-6.5) – tall, peaked T, (>7) – wide P, (>8) – absent P, (>9) – AV block, V tach, V fib.
- ↓ K: flat T, ST depression, prominent U-wave.
- ↑ Ca: Short ST segment, sinus brady or arrest. ↓ Ca: Prolonged ST segment → prolonged QTc, nl QRS.
- ↑ Mg: Prolonged PR, shorter ST segment → short QTc.
- ↓ Mg: Prolonged ST segment & prolonged repolarization → prolonged QTc, prominent U-wave.

CNS injury: ↑ vagal tone → bradycardia, AV block, J-wave.

Hypothermia: Sinus brady, prolonged PR and QTc, J-wave.

Hyperthyroid: Sinus tach, LVH, prolonged PR, non-specific ST or T-wave Δ's.

Hypothyroid: Sinus brady, absent ST; low P, QRS, & T-wave voltages.

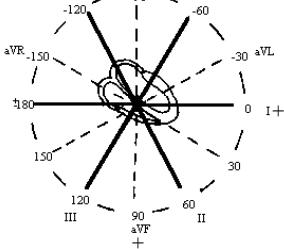
Small square (1mm) = 0.04 sec. Large square (5mm) = 0.2sec. Amplitude: 1mm = 0.1mV.

Rate: 300, 150, 100, 75, 60, 50. (300/# large boxes).

Rhythm: Every QRS preceded by P; normal PR; upright P in I and aVF.

May have normal variation w/ respiration, if no morphologic Δ's of P or QRS.

Axis:



Quick QRS Axis:

I	↑	↑	↓	↓
aVF	↑	↓	↑	↓
Axis	NI	L-dev	R-dev	NW*

*Northwest axis

Normal T-wave Axis:

Age	V1, V2	aVF	I, V5, V6
Birth - 1 day	±	+	±
1 - 4 days	±	+	+
4 days - adolesc.	-	+	+
Adolesc - adult	+	+	+

Intervals: see table for PR & QRS.

QTc = QT / √(preceding R-R); normal ≤ 0.44 sec (≤ 0.45 for infants < 6 months)

P wave: kids < 0.10 sec (2.5 sm box); infants < 0.08 sec (2 sm box); amplitude < 3mm.

Q wave: normal < 0.04 sec (1 sm box); amplitude < 25% of total QRS
(for kids < 3 y/o, amplitude < 5 mm in V4-V6 and ≤ 8 mm in III).

R wave progression: from V1 to V6, R size ↑ & S size ↓, except infants.

ST wave elevation/depression: >1mm in limb leads, >2mm V1-V6 c/w myocardial injury.

T wave changes: tall, peaked in ↑K, flat/low in ↓K, ↓thyroid, ischemia/inflamm., or nl.

Hypertrophy: see table for 98th %ile's for age.

RVH: have at least one of the following:

1. R in V1 AND S in V6 both > 98th %ile for age.
2. Upright T in V1 after DOL#3 (before adolescence).
3. Supplemental: Q wave in V1, RAD, and RV strain (inverted T w/ tall R in V1).

LVH:

1. R in V6 (and V5, I, & aVL) > 98th %ile; and/or S in V1 > 98th %ile for age.
2. Supplemental: LAD, volume overload (Q & tall T in V5-6), and LV strain (inverted T in V6, I, or aVF).

BBB: RBBB = RSR' in V1, slurred S in V6; LBBB = RSR' in V6, slurred S in V1.

Arrhythmias:

- Sinus tach: NSR with HR > 95th %ile for age (and usually < 230 bpm).
- Sinus brady: NSR with HR < 5th %ile for age.
- PAC: narrow QRS, abnormal P and normal QRS.
- A flutter: rate 250-300, sawtooth pattern (no discrete P), variable ventricular response.
- A fib: atrial rate 350-600, ventricular response rate 110-150, fibrillation, nl QRS.
- SVT: Run of ≥3 premature supraventricular beats at >230bpm, narrow QRS & abnl P.
3 types: AV reentrant, AV nodal/junctional, ectopic atrial. Sustained = > 30 sec.
- Nodal Escape/Junctional: P buried in preceding QRS/T, retrograde P (↓ in II, ↑ in aVR).
- PVC: Premature wide QRS w/ compensatory pause. Bi/trigeminy = alternating nl/abnl.
- V tach: Run of ≥3 PVC's at 120-250bpm, wide QRS, dissociated/retrograde/no P wave.
- V fib: Abnl QRS of varying size/morphology w/ irregular rapid rate.

Heart Block:

- 1st: Prolongation of PR interval.
- 2nd (Mobitz I/Wenckebach): Progressive lengthening of PR interval until QRS skipped.
- 2nd (Mobitz II): Paroxysmal skipped QRS without progressive lengthening of PR interv.
- 3rd (Complete): Complete dissociation of P and QRS.

Pre-excitation:

- Wolff-Parkinson-White: tall R, short PR, wide QRS w/ δ-wave.
- Lown-Ganong-Levine: short PR, narrow QRS.
- Mahaim Conduction: normal PR, wide QRS.

