

AHA/ACC/HRS STANDARD ECG INTERP. 2009

Normal QRS Duration

< 4 yrs	≤ 90 ms
4 – 16 yrs	≤ 100 ms
≥ 17 yrs	≤ 110 ms

Complete RBBB

1. QRS duration > ULN children or >120 ms adults
2. Rsr', rsR', rsr' or notched R wave V1 and/or V2
3. S duration > R lead I & V6 (or S V6 > 40 ms adults)
4. IF notched or dominant R V1 (not rsr), need peak R time > 50 ms V1, but normal peak R time V5-V6 (adults)

Incomplete RBBB

Same criteria RBBB, except QRS duration:

< 4 yrs	86 - 90 ms
4 – 16 yrs	90 - 100 ms
≥ 17 yrs	110 – 120 ms

Complete LBBB

1. QRS duration > ULN children or >120 ms adults
2. Broad notched or slurred R in I, aVL, V5-V6
3. Absent Q I, V5, V6 (may also have narrow Q aVL)
4. Late peak R V5-V6, normal time to peak R V1-3
5. ST T waves usually opposite of QRS direction
 - a. May have + T with +QRS
 - b. May NOT have – T with – QRS (probable ischemia)
6. May be present but not necessary: change frontal plane mean QRS axis (right, left, or superior)

Incomplete LBBB

1. LVH pattern
2. Late peak R V4-6
3. Absent Q I, V5, V6
4. QRS duration:

< 4 yrs	80 - 90 ms
4 – 16 yrs	90 - 100 ms
≥ 17 yrs	110 – 119 ms

Nonspecific IVCD

1. QRS duration > ULN
2. Does not meet criteria for RBBB or LBBB

Left Anterior Fascicular Block*

1. Left axis deviation children; frontal plane axis -45 to -90 adults
2. qR pattern in aVL
3. Delayed peak R time in aVL (adults ≥ 45 ms)
4. QRS duration ≤ normal (< 120 ms adults)

* These criteria do not apply to patients with congenital heart disease in whom left axis deviation is present in infancy

Left Posterior Fascicular Block

1. Right axis deviation children; frontal plane axis >90 & <180 (adults)
2. rS pattern in I & aVL
3. qR pattern in III & aVF
4. QRS duration ≤ normal (< 120 ms adults)

Ventricular Pre-excitation

1. Short PR interval in sinus rhythm (generally <120 ms adults, < 90 ms children)
2. Delta wave (slurred upstroke QRS during or soon after P wave)
3. Secondary ST T wave changes
4. QRS duration > normal

Mean Frontal Plane Axis

Age	QRS Axis		Description
	Normal Values	Abnormal Values	
Adult	-30° to 90°	< -30°	Left-axis deviation
		-30° to -45°	Moderate left-axis deviation
		-45° to -90°	Marked left-axis deviation
		90° to 120°	Moderate right-axis deviation
		120° to 180°	Marked right-axis deviation
8 to 16 y	0° to 120°	>120°	Right-axis deviation
5 to 8 y	0° to 140°	>140°	Right-axis deviation
		<0°	Left-axis deviation
1 to 5 y	5° to 100°	>100°	Right-axis deviation
1 mo to 1 y	10° to 120°	>120°	Right-axis deviation
		<10° to -90°	Left-axis deviation
Neonate	30° to 190°	>190° to -90°	Extreme right-axis deviation
		<30° to <-90°	Left-axis deviation

Left ventricular hypertrophy

	Voltage (mm)				
	Age 0-7 d	Age 7 d-1 y	Age 1-3 y	Age 3-5 y	Age >5 y
RV ₆	>12	>23	>23	>25	>27
SV ₁	>23	>18	>21	>22	>26
SV ₁ +R V ₆	>28	>35	>38	>42	>47

Based on Davignon et al (48). Amplitudes are given in millimeters, where 1 mm=0.1 mV.

Right ventricular hypertrophy

	Voltage (mm)				
	Age 0-7 d	Age 7 d-1 y	Age 1-3 y	Age 3-5 y	Age >5 y
R V ₁	>27	>22	>18	>18	>13
S V ₆	>10	>10	>7	>6	>4
R V ₁ +S V ₆	>37	>43	>30	>24	>17

Based on Davignon et al (48). Amplitudes are given in millimeters, where 1 mm=0.1 mV.

Combined Ventricular Hypertrophy

Features of both right and left ventricular hypertrophy.

Left Atrial Enlargement

1. Broad P-wave (≥ 120 ms lead V1 or II)
2. Widely notched P wave V1 with terminal negative portion ≥ 40 ms

Right Atrial Enlargement

1. Tall upright P-wave lead II (> 2.5 mm)
2. Prominent initial P wave V1 or V2 (> 1.5 mm)

Combined Atrial Enlargement

Features of both right and left atrial enlargement.