Bradycardia and Normal Heart Rate in the Newborn Period

The normal heart rate increases from the first day of life. It reaches a peak between the first and the second month and then declines returning to the values recorded at birth by the sixth month. During the following 6 months, it remains stable and then slowly declines after 1 year due to maturation of vagal innervation of the sinus node.

Clinically significant gender differences in heart rate are not seen in the neonatal period. Resting and sleeping heart rates in newborns and infants are lower compared to when they are alert and heart rate increases significantly when they are crying.

Mean heart rate in the first year of life range increases from 127 beats per minute (bpm) at birth, reaching a maximum of 145 bpm at about 1 month of age, before decreasing to 113 bpm by age 2 years. Heart rates between the 2nd and 98th percentile in the first year of life are shown in below.

<table>
<thead>
<tr>
<th>Age</th>
<th>Heart rate 2nd to 98th percentile in bpm (mean)</th>
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</thead>
<tbody>
<tr>
<td>0-1 days</td>
<td>93-154 (123)</td>
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<tr>
<td>1-3 days</td>
<td>91-159 (123)</td>
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<tr>
<td>3-7 days</td>
<td>90-166 (129)</td>
</tr>
<tr>
<td>7-30 days</td>
<td>107-182 (140)</td>
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<tr>
<td>1-3 months</td>
<td>121-179 (150)</td>
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</tbody>
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Some causes of neonatal bradycardia:

1) Sinus bradycardia:
   - Hypoxia
   - Acidosis
   - Infection / sepsis
   - Electrolyte abnormalities
   - Neonatal hypothyroidism
   - Increased intracranial pressure
   - Hypervagal states - e.g. high position of NG tube, Gastro oesophageal reflux disease
   - Obstructive jaundice

2) Sinus node dysfunction - consequence of direct injury to sinus node
   - Central line tip in right atrium
   - Congenital heart disease (atrial isomerism, ASD, AVSD, single ventricle, CCTGA)
   - Post cardiac intervention (e.g. cardiac catheterisation, surgery)

3) Conduction abnormalities or channel-opathy
   - Kearne-Sayre Syndrome
   - Long QT syndrome

4) Heart block
   - Congenital- maternal connective tissue disorders
   - Acquired- post-surgery, myocarditis, rheumatic heart disease, congenital syphilis, diphtheria, Lyme disease.
Recommendations:

Persistent neonatal bradycardia in an awake baby of less than 90 beats per minute (2\textsuperscript{nd} percentile) in the newborn period should prompt assessment and investigation to rule out common cardiac and non-cardiac causes of bradycardia. A careful assessment of the baby needs to be undertaken by the neonatal team before referral to cardiology. The assessment should include:

- History
- Maternal drug history
- Maternal connective tissue disorders
- Birth details – difficult labour resulting in hypoxia
- Examination
- Blood glucose and capillary blood gas
- Serum electrolytes, renal function, calcium and magnesium
- Follow NNU thyroid function test guideline (in addition to Guthrie card)
- SS-A (anti-Ro antibodies) and SSB (anti-La antibodies)
- Baseline ECG with calculation of QTc and PR interval (by the ECG computer package – confirm with hand calculation if abnormal)

If the ECG is abnormal, or any abnormality is found in the cardiovascular examination or if the baby becomes unwell, discussion with on-call paediatric cardiology team should be undertaken for urgent assessment including echocardiography.

The baby should be observed by the neonatal/midwifery transitional care team for 2 days pending results of any investigations. At least 4-hourly monitoring is recommended. A repeat ECG should be performed on day 3. If the heart rate has normalised and all the investigations are normal then the baby can be discharged home. If there is medical or parental concern, consider the need for neonatal clinic follow-up.

If the heart rate remains <2\textsuperscript{nd} percentile in an awake baby, all the investigations are normal and the baby remains well then a referral to Paediatric Cardiology should be made. An urgent 24 hour Holter should be considered.

References:


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