Clinical Guideline: NEONATAL HYPERTENSION

Authors: Dr Katharine McDevitt, Maria Thomas

For use in: East of England Neonatal Units, Guidance specific to the care of neonatal patients.

Used by: Medical Staff, Neonatal Nurse Practitioners, Neonatal Nurses, Pharmacists, Paediatric Nurse Practitioners and Paediatric Nurses for Children below Term + 4 weeks nursed on Children's Wards.

Key Words: neonatal, hypertension, BP, antihypertensive, renal

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Clinical Lead Sajeev Job	*S.Job*

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Date of meeting	

Audit Standards:

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NEONATAL HYPERTENSION

INTRODUCTION:

Hypertension in the neonatal period has become increasingly common, and its effects are significant in both acute settings and long-term follow-up care. (1)

DEFINITION:

Hypertension is defined as a measurement exceeding the 95% CI or 95th percentile for infants of the same sex and/or gestational age, recorded on three separate occasions.

Severe hypertension is characterised by:
• a persistent systolic pressure more than 30% above the 95% CI or 95th percentile
• a persistent systolic pressure exceeding the 95% CI or 95th percentile with evidence of end-organ damage (2)

MEASUREMENT OF BLOOD PRESSURE:

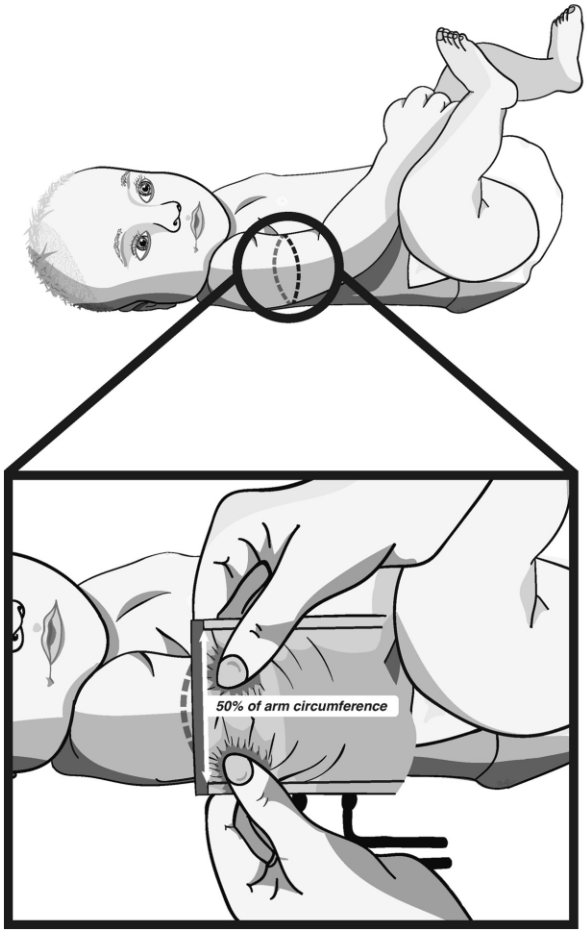
During the neonatal period, intra-arterial measurement of blood pressure through an umbilical arterial catheter is regarded as the gold standard for monitoring. However, the risks of thrombosis and ischemia restrict its use to critically unwell neonates and extremely preterm infants. Non-invasive blood pressure measurement in neonates is performed with an oscillometric device, which is easier to record and less invasive, but can be variable if not measured accurately. (1) (3)

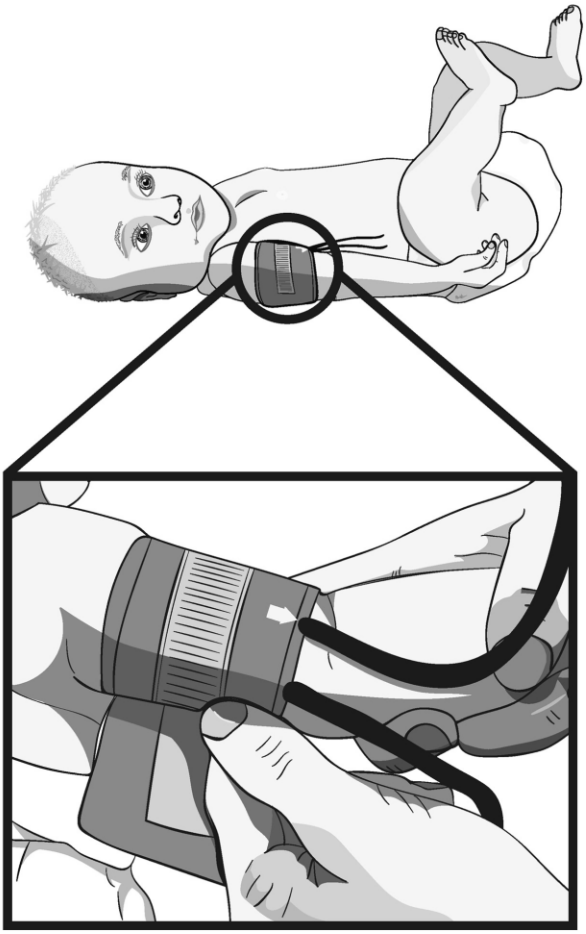
Standardised protocol for non-invasive blood pressure measurement in neonates(4):

• Blood pressure was measured using an oscillometric device 1.5 hours after feeding or medical intervention.
• The infant was positioned either prone or supine during measurement.
• An appropriately sized blood pressure cuff was utilised.
• The measurement was taken on the right upper arm.
• Following cuff placement, the infant was left undisturbed for a duration of 15 minutes.
• The infant was either asleep or in a quiet, awake state at the time of measurement.
• Three consecutive blood pressure readings were obtained at two-minute intervals.

The appropriate cuff size is critical for an accurate measurement of the blood pressure. The bladder length should constitute 80%–100% of the arm's circumference, and the width should be no less than 40%. (5)


Cuff Bladder Width:
Approximately 50%
of arm circumference


50% of arm circumference



A method to determine the proper BP cuff size in neonates and infants. The cuff bladder width should be approximately 50% of the infant's mid-arm circumference. (Illustration by Robert Pintilie.)

BLOOD PRESSURE NORMAL VALUES BASED ON GESTATIONAL AGE: (4)

Postconceptional age	50th percentile	95th percentile	99th percentile
44 Weeks			
SBP	88	105	110
DBP	50	68	73
MAP	**63**	**80**	**85**
42 Weeks			
SBP	85	98	102
DBP	50	65	70
MAP	**62**	**76**	**81**
40 Weeks			
SBP	80	95	100
DBP	50	65	70
MAP	**60**	**75**	**80**
38 Weeks			
SBP	77	92	97
DBP	50	65	70
MAP	**59**	**74**	**79**
36 Weeks			
SBP	72	87	92
DBP	50	65	70
MAP	**57**	**72**	**71**
34 Weeks			
SBP	70	85	90
DBP	40	55	60
MAP	**50**	**65**	**70**
32 Weeks			
SBP	68	83	88
DBP	40	55	60
MAP	**48**	**62**	**69**
30 Weeks			
SBP	65	80	85
DBP	40	55	60
MAP	**48**	**65**	**68**
28 Weeks			
SBP	60	75	80
DBP	38	50	54
MAP	**45**	**58**	**63**
26 Weeks			
SBP	55	72	77
DBP	30	50	56
MAP	**38**	**57**	**63**

SBP -systolic blood pressure
DSP diastolic blood pressure
MAP mean arterial pressure

AETIOLOGY:

The causes of hypertension in the neonatal period can be classified as below(6):

1. Renovascular

Thromboembolism
Renal artery stenosis
Mid-aortic coarctation
Renal venous thrombosis
Compression of renal artery
Congenital rubella syndrome
Renal parenchymal disease

2. Congenital

Polycystic kidney disease
Multicystic-dysplastic kidney disease
Tuberous sclerosis
Ureteropelvic junction obstruction
Congenital nephrotic syndrome
Renal tubular dysgenesis

2. Acquired

Acute tubular necrosis
Cortical necrosis
Interstitial nephritis
Haemolytic-uremic syndrome
Obstruction (stone, tumours)
Pulmonary
Bronchopulmonary dysplasia
Pneumothorax

3. Cardiac

Thoracic aortic coarctation

4. Endocrine

Congenital adrenal hyperplasia
Hyperaldosteronism
Hyperthyroidism
Pseudohypoaldosteronism type II

5. Medications/intoxications

Infant
Dexamethasone
Adrenergic agents
Vitamin D intoxication
Theophylline
Caffeine
Pancuronium
Maternal use of Cocaine or Heroin

6. Neoplasia
Wilms tumour
Mesoblastic nephroma
Neuroblastoma
Pheochromocytoma

7. Neurologic
Pain
Intracranial hypertension
Seizures
Familial dysautonomia
Subdural hematoma

8. Miscellaneous
Total parenteral nutrition
Closure of abdominal wall defect
Adrenal haemorrhage
Hypercalcemia
Traction
Extracorporeal membrane oxygenation
Birth asphyxia
Nephrocalcinosis

INVESTIGATIONS (6,7):

1. First line investigations include the following -

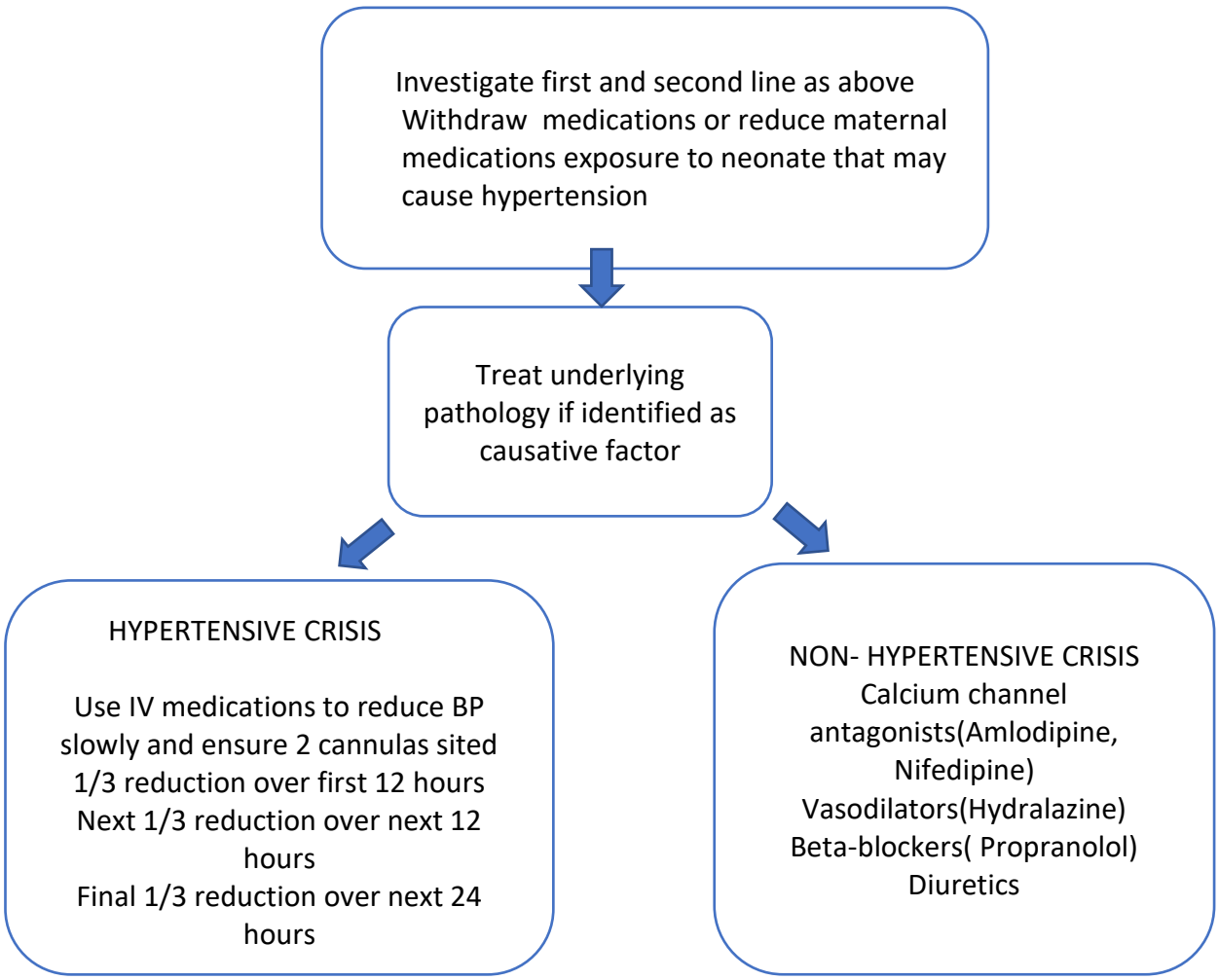
- Urinalysis (± culture)
- Full blood count
- Urea & Electrolytes
- Calcium
- Chest x-ray
- Renal ultrasound with Doppler
- Urine albumin/creatinine ratio

2. Second line investigations include, but not limited to the following-

- Thyroid studies
- Urine VMA/HVA
- Plasma renin activity
- Aldosterone levels
- Cortisol levels
- Echocardiogram
- Abdominal/pelvic ultrasound
- MCUG

- Arteriogram
- Renal angiography
- Nuclear scan (DTPA/Mag-3)

APPROACH TO TREATMENT(8):



- Extreme caution is essential when using nifedipine in neonates because of its rapid onset and short duration of action. If blood pressure drops too quickly, gut and head perfusion might be compromised.
- In the event of an unwanted sudden drop in blood pressure, a fluid bolus must be administered via the second cannula.
- Beta blockers should be avoided in infants with chronic lung disease.(9)

ORAL HYPERTENSIVE DRUGS(9):

AMLODIPINE (calcium channel antagonist)	First line medication for treatment of hypertension. Onset of action in 48 hours
PROPANOLOL (beta blocker)	Second line oral anti-hypertensive , first line for thyrotoxicosis
Nifedipine (Calcium channel antagonist)	Has a quick onset of action but short duration of action, extreme caution with sudden drop in BP
Captopril (ACE inhibitor)	Can develop profound hypotension with single dose. Monitor U&Es daily. Ensure renal vasculature normal before starting. May be considered as second line in conditions with urinary protein loss.

INTRAVENOUS HYPERTENSIVE DRUGS:

Hydralazine (arteriolar vasodilator)	First line of IV treatment of hypertension. Inactivated with dextrose infusion.
Labetalol (α and β blocker)	
Sodium nitroprusside (vasodilator)	

PARENTAL INVOLVEMENT:

The EoE Neonatal ODN recognises a huge variety of people who are involved in caring for and raising a baby. For the purposes of this guideline, “Parents” include all individuals and groups who provide care, love, and support to a baby. This includes biological, adoptive, step and foster parents, guardians, grandparents, extended family members, or chosen family members who have a nurturing role in the baby’s life.

- Parents/carers must be informed when hypertension is suspected or confirmed, including the reason blood pressure monitoring is being undertaken.
- Provide clear, supportive communication explaining:
    - What neonatal hypertension is;

    - Potential causes;
    - The planned investigations;
    - Expected clinical observations.
- Ensure parents are aware of any tests being performed (e.g. blood tests, renal USS, echocardiogram) and offer the opportunity to ask questions.
- In non-urgent situations, obtain informed consent for investigations and treatments as part of shared decision-making.
- When hypertension is secondary to an identifiable condition, explain the underlying cause in family-appropriate language and involve the family in the suggested treatment plan.
- Where medication is required, parents should be informed of: the name of the medication, the reason it is needed, the expected effects, and any potential side effects or monitoring requirements.
- Parents should be encouraged to participate in their baby's care and soothing/handling during investigations and treatment, where clinically appropriate.
- If parents are not present during procedures or investigations, they should be welcomed to the cot side as soon as possible afterwards and updated on how the baby tolerated it and what the results mean.
- Parents should receive regular, sensitive, compassionate communication regarding blood pressure trends, escalation, reasons, planned interventions, and response to treatment.
- Discussions with parents, including consent and information provided, should be documented in the baby's clinical record.
- If long-term follow-up or home monitoring is anticipated, parents should receive clear verbal and written information before discharge, including when to seek medical review.
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