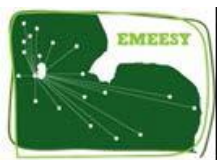


## Hypertension UHL Children's Medical Guideline

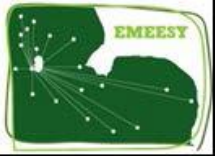
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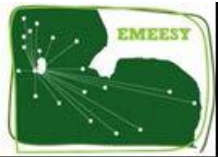


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<b>Title of Guideline</b>	<b>Guideline for the assessment and management of Hypertension in Paediatric Patients</b>														
<b>Contact Name and Job Title (author)</b>	Dr Andrew Lunn Paediatric Nephrology Consultant														
<b>Directorate &amp; Speciality</b>	Family Health – Paediatric Nephrology														
<b>Date of submission</b>	May 2022														
<b>Date on which guideline must be reviewed (this should be one to three years)</b>	May 2025														
<b>Explicit definition of patient group to which it applies (e.g. inclusion and exclusion criteria, diagnosis)</b>	Children and Young People presenting to Nottingham Children’s Hospital with Hypertension, and appropriate treatment, when necessary, of neonatal hypertension														
<b>Abstract</b>	This guideline describes the Assessment and Management of Hypertension in Neonatal and Paediatric patients.														
<b>Key Words</b>	Paediatric, Child, Young Person, Neonate, Hypertension, High Blood Pressure, Renal														
<b>Statement of the evidence base of the guideline – has the guideline been peer reviewed by colleagues?</b>	2a														
<b>Evidence base: (1-5)</b> <table border="1" data-bbox="76 1400 651 1729"> <tr> <td><b>1a</b></td> <td><b>meta analysis of randomised controlled trials</b></td> </tr> <tr> <td>1b</td> <td>at least one randomised controlled trial</td> </tr> <tr> <td>2a</td> <td>at least one well-designed controlled study without randomisation</td> </tr> <tr> <td>2b</td> <td>at least one other type of well-designed quasi-experimental study</td> </tr> <tr> <td>3</td> <td>well –designed non-experimental descriptive studies (ie comparative / correlation and case studies)</td> </tr> <tr> <td>4</td> <td>expert committee reports or opinions and / or clinical experiences of respected authorities</td> </tr> <tr> <td>5</td> <td>recommended best practise based on the clinical experience of the guideline developer</td> </tr> </table>	<b>1a</b>	<b>meta analysis of randomised controlled trials</b>	1b	at least one randomised controlled trial	2a	at least one well-designed controlled study without randomisation	2b	at least one other type of well-designed quasi-experimental study	3	well –designed non-experimental descriptive studies (ie comparative / correlation and case studies)	4	expert committee reports or opinions and / or clinical experiences of respected authorities	5	recommended best practise based on the clinical experience of the guideline developer	
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<b>Consultation Process</b>	Children’s Renal Unit guideline review, Staff of Nottingham Children’s Hospital via the guideline email process														
<b>Target audience</b>	Clinicians and healthcare professionals caring for children and young people treated for Hypertension at Nottingham University Hospitals NHS Trust														



This guideline has been registered with the trust. However, clinical guidelines are guidelines only. The interpretation and application of clinical guidelines will remain the responsibility of the individual clinician. If in doubt contact a senior colleague or expert. Caution is advised when using guidelines after the review date.



## Document History

Version Number	Date Produced	Author
V1	May 2008	Dr D Wood Dr S Rhodes
V2	Sept 2013	Dr David Broodbank Dr Corinne Langstaff
V3	May 2016	Dr Andrew Lunn Dr Rebecca Calthorpe
V4	Jan 2019	Dr Andrew Lunn Dr Rebecca Calthorpe
V4.1	Jan 2021	Dr Andrew Lunn Dr Karen Norman Dr Drew Maxted
V5	Jan 2022	Dr Andrew Lunn Dr Karen Norman
V5.1		Dr Pradeep Nagisetty

### Changes from previous guideline:

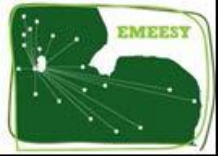
1. Revised introduction
2. Measuring blood pressure section moved from appendix to main guideline.  
Includes indications for ABPM.
3. Updated definition and classification of hypertension to include ABPM definitions
4. Reorganisation of investigation section by indication.
5. Updated Goals of Therapy: Lifestyle intervention section to include referral to CEW service
6. References revised and updated
7. Added Appendix 2: ABPM centiles
8. Added Appendix 5: high risk conditions in which routine ABPM indicated

### 1. Introduction

Hypertension is an increasingly recognised problem in the general paediatric population with a prevalence of 3.5%<sup>1</sup>. These numbers increase in children with chronic conditions such as obesity, chronic kidney disease, prematurity and sleep disordered breathing. Hypertension in neonates is rare, with an incidence of 0.2% - 3%. It is more common in babies with chronic lung disease<sup>2</sup>.

Hypertension in childhood corresponds with high blood pressure in adulthood, which in turn is associated with an increased risk of cardiovascular disease and death. Early identification and management of hypertension is thus likely to have a significant impact on the long-term health of children and young people.

High blood pressure in children and young people is frequently asymptomatic. The

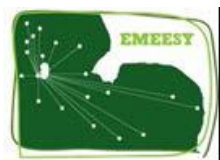


American Academy of Paediatrics clinical practice guideline for screening and management of high blood pressure in children and adolescents recommends annual blood pressure monitoring for all children 3 years and above.<sup>3</sup> This is not yet standard practice in UK healthcare settings, where measurement of blood pressure in children and young people is largely restricted to paediatric services, and occurs on an ad hoc basis when patients present for other clinical reasons. It is therefore encouraged that all children and young people undergo blood pressure measurement when accessing children's healthcare services in order to identify those with hypertension as early as possible.

**Related documents :**

Hypertension in Pregnancy UHL Obstetric Guideline C37/2020

*UHL – To discuss all pregnant patients with UHL obstetrics team and consider transfer to them.*



## 2. Measuring Blood Pressure

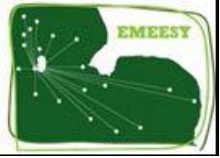
### 2.1 Paediatrics

Manual blood pressure measurement using a sphygmomanometer is the gold standard in children and young people. Whilst auscultation should be used in older children, the use of a Doppler technique is preferable in very young children as the Korotkov sounds are less reliably heard in this group.

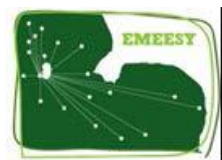
Blood pressure may initially be measured using an automated oscillometric device that has been validated for use in children. It should be noted that these may overestimate blood pressure. Any high blood pressure measured this way should be checked manually.

#### Key practice points:

- **Cuff:**
  - Appropriate cuff size is essential for accurate BP measurement by both auscultatory and oscillometric methods.
  - The largest cuff which can fit on the arm should be used.
  - The cuff should be 2/3 the length of the upper arm and the bladder should cover 80-100% the circumference of the arm.
    - Errors due to too large a cuff are unlikely but if the cuff is too small blood pressure can be overestimated.
  - The arrow on the cuff should be placed over the brachial artery.
- **Environment:**
  - The child should be rested for at least 5 minutes in a calm, child-friendly environment.
- **Positioning:**
  - The brachial artery should be at the level of the heart and blood pressure should be measured in the right arm when possible.
  - The sphygmomanometer should be at the level of the heart.
- **Technique:**
  - The first BP reading should be estimated by palpating the brachial or radial artery and inflating the cuff to obtain an approximate systolic BP.
  - Auscultation should then be performed, inflating the cuff to approx. 30mmHg above the estimated BP then slowly reduce the pressure.
  - Cuff pressure at the appearance of the first Korotkov sound (K1) is the systolic BP. Diastolic BP is recorded at the disappearance of Korotkov sounds (K5) In some children this may not occur in which case the muffling of sounds (K4) may be recorded.
- **Doppler**
  - The Doppler probe is placed over the brachial or radial artery and the cuff inflated until the signal disappears.
  - The point at which the signal returns is the systolic blood pressure.
  - The diastolic pressure cannot be identified with this method.



- **Automated**
  - Oscillometric devices have the advantage of reducing inter-observer error.



- They do not read blood pressure in the same way as the auscultatory method, however, and systolic blood pressures often tends to read slightly higher by on automated machines.
- **Any child with a BP above the 90<sup>th</sup> centile should have it re-checked manually.**
- Not all oscillometric machines have been validated in children. Note that the default maximum pressure is usually 200mmHg which is too high for a child. **The maximum pressure should be set at 20 – 30 mmHg above baseline prior to use.**
- In the presence of oedema and in low BW infants, oscillometric devices over-estimate systolic BP by as much as 10 mmHg.
- **Ambulatory blood pressure monitoring (ABPM)**
  - ABPM is helpful to determine true blood pressure. It can be performed in children over 5 years of age.
  - Its use is recommended in the following situations<sup>3</sup> (for definitions, please see section 3 of this guideline)
    - Children and young people with elevated blood pressure for > 1 year
    - Children and young people with stage 1 hypertension over three clinic visits
    - Children and young people with high risk conditions (see Appendix 5)
    - Children and young people with suspected white coat hypertension
  - Results should be reviewed by a clinician experienced in interpretation of 24 hour blood pressure monitoring.

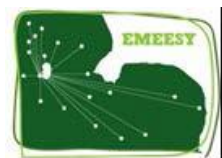
## 2.2 Neonates

In neonates the gold standard is direct arterial blood pressure monitoring, which should be considered in the following categories:

- 1: Infant in the acute phase of RDS and requiring ventilation
- 2: An infant in whom indirect methods of BP measurements suggest significant hypo-or hypertension
- 3: Any infant on inotropic drugs to support the circulation

Alternatively, a doppler technique can be used. BP should be taken when baby is quiet and not feeding (systolic BP can be 5 mmHg lower in sleeping babies)<sup>4</sup>. As blood pressure obtained in the leg may be higher than that in the arm, nursing staff should document the extremity used for BP measurement and attempt to use the same extremity for a number of serial measurements.





### 3. Definition and Classification of Hypertension

Hypertension can be defined according to clinic (“office”) measurements, or by ABPM assessment.

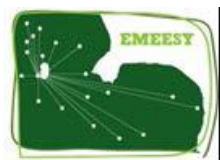
#### 3.1 Clinic BP Measurements<sup>3,5</sup>

Blood pressure measurements should be taken on at least three separate occasions before diagnosing hypertension.

	<13 years	≥13 years
<b>Normal BP</b>	Average SBP/DBP <90 <sup>th</sup> percentile*	<120/<80
<b>Elevated BP</b>	Average SBP/DBP ≥ 90 <sup>th</sup> to <95 <sup>th</sup> percentile  OR  120/80 to <95 <sup>th</sup> percentile (whichever is lower)	120/<80 – 129/<80
<b>Hypertension</b>		
- Stage 1	Average SBP/DBP ≥ 95 <sup>th</sup> percentile to < 95 <sup>th</sup> percentile + 12mmHg  OR  130/80 – 139/89 (whichever is lower)	130/80 – 139/89
- Stage 2	Average SBP/DBP ≥ 95 <sup>th</sup> percentile + 12mmHg  OR  ≥140/90 (whichever is lower)	≥140/90

SBP = Systolic blood pressure; DBP = Diastolic blood pressure

\*For blood pressure centiles in children please see Appendix 1.



### 3.2 ABPM Measurements<sup>6</sup>

For ABPM centiles see Appendix 2

Classification	Clinic BP	Mean Ambulatory SBP or DBP	SBP or DBP load %
Normal BP	<b>&lt;90<sup>th</sup> percentile</b>	<b>&lt;95<sup>th</sup> percentile</b>	<b>&lt;25</b>
White coat hypertension	<b>≥95<sup>th</sup> percentile</b>	<b>&lt;95<sup>th</sup> percentile</b>	<b>&lt;25</b>
Prehypertension	<b>≥90<sup>th</sup> percentile or &gt;120/80</b>	<b>&lt;95<sup>th</sup> percentile</b>	<b>≥25</b>
Masked hypertension	<b>&lt;95<sup>th</sup> percentile</b>	<b>&gt;95<sup>th</sup> percentile</b>	<b>≥25</b>
Ambulatory hypertension	<b>&gt;95<sup>th</sup> percentile</b>	<b>&gt;95<sup>th</sup> percentile</b>	<b>25-50</b>
Severe ambulatory hypertension	<b>&gt;95<sup>th</sup> percentile</b>	<b>&gt;95<sup>th</sup> percentile</b>	<b>&gt;50</b>

Note that an ABPM study should be assessed for validity before being used to diagnose hypertension. US guidelines<sup>3</sup> require 1-2 readings per hour during wake and sleep periods, and a total of 40-50 readings for the 24 hour period. European guidance requires at least 70% of expected measurements to be valid, including at least 20 during the day and 7 at night.

### 3.3 Hypertension within the neonatal period (up to 28 days past the expected due date):

Persistent SBP and/or DBP above the upper 95% confidence interval for infants of similar post conception age<sup>7</sup>. For neonatal BP centiles, please see Appendix 3.

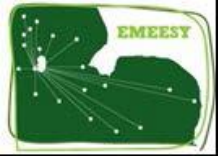
## 4. Presentation

Hypertension most commonly presents as an asymptomatic incidental finding. It may also be identified during screening in at risk groups.

Other clinical presentations include:

- Congestive cardiac failure and cardiogenic shock
- Neurological presentations
  - Headache
  - Cerebrovascular incident
  - Hypertensive encephalopathy
  - Facial nerve palsy
- Failure to thrive
- Less acutely ill babies may also present with feeding difficulties, unexplained tachypnoea, apnoea and irritability

The history and examination needs to seek out these important features. This guideline is not intended to provide an exhaustive list of all the clinical features of the many



causes of hypertension. A list of differential diagnoses by age can be found in Appendix 5.

## 5. Investigation

The aims of investigations are:

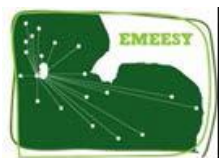
- (a) To identify the cause of hypertension if this is not already known,
- (b) To assess for presence of any co-morbidities and
- (c) To identify any end-organ damage.

A significant number of children with hypertension will have an underlying cause, thus investigation is usually justified. Patients over the age of 6 years who are obese, have a strong family history of hypertension, and/or do not have a history or physical examination findings suggestive of a secondary cause of hypertension may not require extensive investigation, especially if blood pressures fall within the elevated blood pressure range<sup>3</sup>.

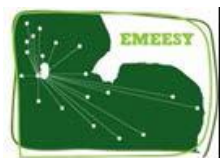
Investigations will be directed by clinical findings but below is a suggested scheme:

CHILDREN AND NEONATES
-----------------------

<b>To identify a secondary cause of hypertension</b>
--



URINE	<ul style="list-style-type: none"> <li>• <b>Urinalysis for protein / blood</b> <ul style="list-style-type: none"> <li>○ Urine PCR should be sent regardless of urine dip result, as very dilute urine may contain protein that is not identifiable by urine dipstick.</li> </ul> </li>   <li>• <b>Microscopy for cells, cast and infection</b></li>   <li>• <b>Urine catecholamines (&lt;16 years)</b> <ul style="list-style-type: none"> <li>○ Random urine sample. This requires an ACIDIFIED (hydrochloric acid) bottle can be obtained on request from the biochemistry lab. Patients <b>should not</b> pass urine directly into an acidified bottle – the sample can be decanted immediately post-collection in a universal container, <b>Please discuss with local laboratory before sending this test to ensure correct processing.</b></li> </ul> </li>   <li>• <b>Urine metanephrines (≥16 years)</b> <ul style="list-style-type: none"> <li>○ Random urine sample. This requires an ACIDIFIED (hydrochloric acid) bottle can be obtained on request from the biochemistry lab. Patients <b>should not</b> pass urine directly into an acidified bottle – the sample can be decanted immediately post-collection.</li> </ul> </li>   <li>• <b>If indicated:</b> <ul style="list-style-type: none"> <li>○ Urine pregnancy test</li> <li>○ Urine toxicology screen</li> <li>○ Urine steroid profile</li> </ul> </li> </ul>
BLOOD	<ul style="list-style-type: none"> <li>• Full blood count</li> <li>• Urea and electrolytes</li> </ul>



	<ul style="list-style-type: none"> <li>• Creatinine <ul style="list-style-type: none"> <li>○ Calculate eGFR (see eGFR guidelines)</li> </ul> </li> <li>• Bone profile</li> <li>• Albumin</li> <li>• Thyroid function tests</li> <li>• Plasma renin and aldosterone <ul style="list-style-type: none"> <li>○ Blood sample should be taken in EDTA tube and taken directly to the laboratory for immediate separation and freezing. Do not put in pod.</li> </ul> </li> </ul>
IMAGING	<ul style="list-style-type: none"> <li>• Renal ultrasound (with renal vessel doppler if available)</li> </ul>
<b>To identify co-morbidities</b>	
BLOOD	<ul style="list-style-type: none"> <li>• Fasting lipids</li> <li>• Glucose</li> </ul>
<b>To assess for end-organ damage</b>	
IMAGING	<ul style="list-style-type: none"> <li>• Echocardiogram <ul style="list-style-type: none"> <li>○ To assess for presence of left ventricular hypertrophy, may also identify a cause eg. Coarctation of aorta</li> </ul> </li> </ul>
OTHER	<ul style="list-style-type: none"> <li>• Retinal examination (in those with severe or long standing hypertension)</li> <li>• Note UEs and urinalysis are also part of the end-organ assessment</li> </ul>

## NEONATES ONLY

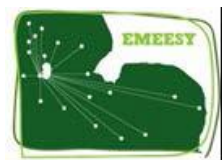
- CXR
- Other investigations to be considered after discussion with the Paediatric Nephrology Team:
  - Urine VMA, Urine HVA
  - Blood: TFTs, 17 OH Progesterone, aldosterone, plasma renin.
  - Radiological: DMSA, MCUG

If possible, blood and urine samples should be taken prior to commencing treatment. However, treatment should not be delayed unnecessarily.

## 6. Management

### 6.1 Goals of Therapy<sup>3</sup>

- i. To reduce SBP/DBP to <90<sup>th</sup> percentile or <130/80 in children ≥ 13 years with hypertension.



- ii. In children and young people with chronic kidney disease, this target is lowered to SBP/DBP <50<sup>th</sup> percentile patients as this has been shown to have a renoprotective effect<sup>8</sup>.

## 6.2 Management Options

### 1. Lifestyle advice

All children with elevated BP (on clinic measurement), prehypertension (on ABPM) and hypertension (by either assessment) should receive lifestyle advice.

- Dietary advice regarding healthy eating (including reducing salt intake). All children with elevated BP, pre-hypertension or hypertension should be referred to a dietician.
- Regular physical activity (60 minutes/day)
- Weight reduction if overweight or obese
  - Consider referral to CEW clinic if hypertensive, obese, motivated and other causes excluded
- Interventions to improve sleep if sleep apnoea identified.
- Advice regarding alcohol, caffeine and drugs

Note that lifestyle interventions are more successful if the whole family participate. Signpost families to: [Healthier Families - Home - NHS \(www.nhs.uk\)](http://www.nhs.uk)

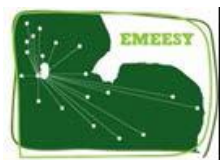
### 2. Pharmacological Intervention is indicated in:-

- Stage 2 hypertension
- Persistent stage 1 hypertension after a trial of lifestyle advice
- Symptomatic hypertension
- Secondary hypertension
- Hypertension with associated target-organ damage
- Diabetes (types 1 and 2)
- CKD

The selection of an appropriate anti-hypertensive depends upon the age of the patient, the clinical scenario and the presence of any contraindications. This guidance intends to highlight some important points about each drug class but is not intended to replace a full clinical assessment or the advice contained within the BNFc. AAP Hypertension guidelines<sup>4</sup> recommend ACE-I/ARB, a long-acting calcium channel blockers or thiazide diuretic as first line treatment.

### General Principles

- Once daily dosing regimens are preferable when possible to aid compliance
- Younger children (<1 yr) may need multiple daily dosing to increase dose flexibility e.g. captopril rather than enalapril or propranolol rather than atenolol.
- Doses should be commenced at the starting dose in the BNFc and then gradually



titrated until the desired blood pressure is achieved (see goals of therapy).

- In infants or those with impaired cardiac function it may be necessary to initiate antihypertensive medication in hospital with BP monitoring – **these patients should be discussed with a paediatric nephrologist**.

#### **Calcium Channel Blockers** (eg. nifedipine, amlodipine, nicardipine)

- Can be used as first or second line agents in most cases of hypertension if not contraindicated (eg. diabetes mellitus (nifedipine))
- Nifedipine has a short half-life and so can lead to relatively large fluctuations in BP. Amlodipine is therefore preferable for long term treatment, though modified release preparations of nifedipine are an acceptable alternative in patients able to swallow tablets.
- Patients under 6 years of age may have an increased ability to clear amlodipine. Dividing the daily dose into two divided doses in this age group may therefore improve efficacy, though this has not been robustly demonstrated to be beneficial.

#### **Beta Blockers** (eg propranolol, atenolol)

- Beta blockers are no longer recommended as first line in the treatment of hypertension<sup>4</sup>. They can still be used as a second line agent in most cases of hypertension if not contraindicated. Cases of phaeochromocytoma need concurrent alpha-blockade

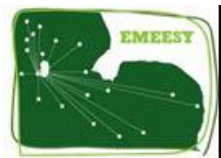
#### **ACE Inhibitors** (eg.captopril, enalapril, lisinopril)

- Good first line agent in cases of chronic kidney disease, providing renal artery stenosis has been excluded.
- Electrolytes and creatinine must be checked 7 – 10 days after initiating or increasing an ACE inhibitor dose because of the risk of renal impairment and hyperkalaemia. For this reason, they are not routinely used in neonates.
- Counsel teenage girls regarding the contraindication in pregnancy
- Counsel regarding the importance of stopping medication whilst unwell with diarrhoeal or vomiting illnesses
- Enalapril tablets can be crushed and made into a suspension. This removes the need for expensive special preparations.
- Angiotensin 2 receptor blockers (eg. Losartan) may provide an alternative in those who are unable to tolerate ACE.
- Can increase risk of AKI if dehydrated. Patients / parents should be given information from Think Kidneys website with advice on what to do if they become dehydrated  
<https://www.thinkkidneys.nhs.uk/aki/resources/paediatrics/>

#### **Diuretics** (eg. furosemide)

- May be the most appropriate treatment for hypertension in the context of fluid overload –for example, glomerulonephritis, where a loop diuretic might be considered
- When used in management of chronic hypertension, a thiazide is recommended.
- Counsel regarding the importance of stopping medication whilst unwell with diarrhoeal or vomiting illnesses



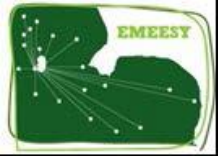


- Can increase risk of AKI if dehydrated. Patients / parents should be given information from Think Kidneys website with advice on what to do if they become dehydrated  
<https://www.thinkkidneys.nhs.uk/aki/resources/paediatrics/>

### 6.3 Patient information

Parents and young people should be directed to information available on [Hypertension | infoKID](#) and offered a printed version of the summary leaflet.





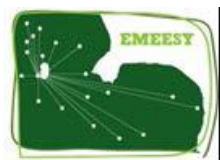
## **7. Algorithms for management of specific categories of the hypertensive child or neonate**

**7.1 Hypertensive crisis** (Hypertension with seizures, encephalopathy or cardiac failure)

**7.2 Symptomatic** (Hypertension with headaches, facial nerve palsy, visual disturbance) or Stage 2 hypertension

**7.3 Asymptomatic stage 1 hypertension**

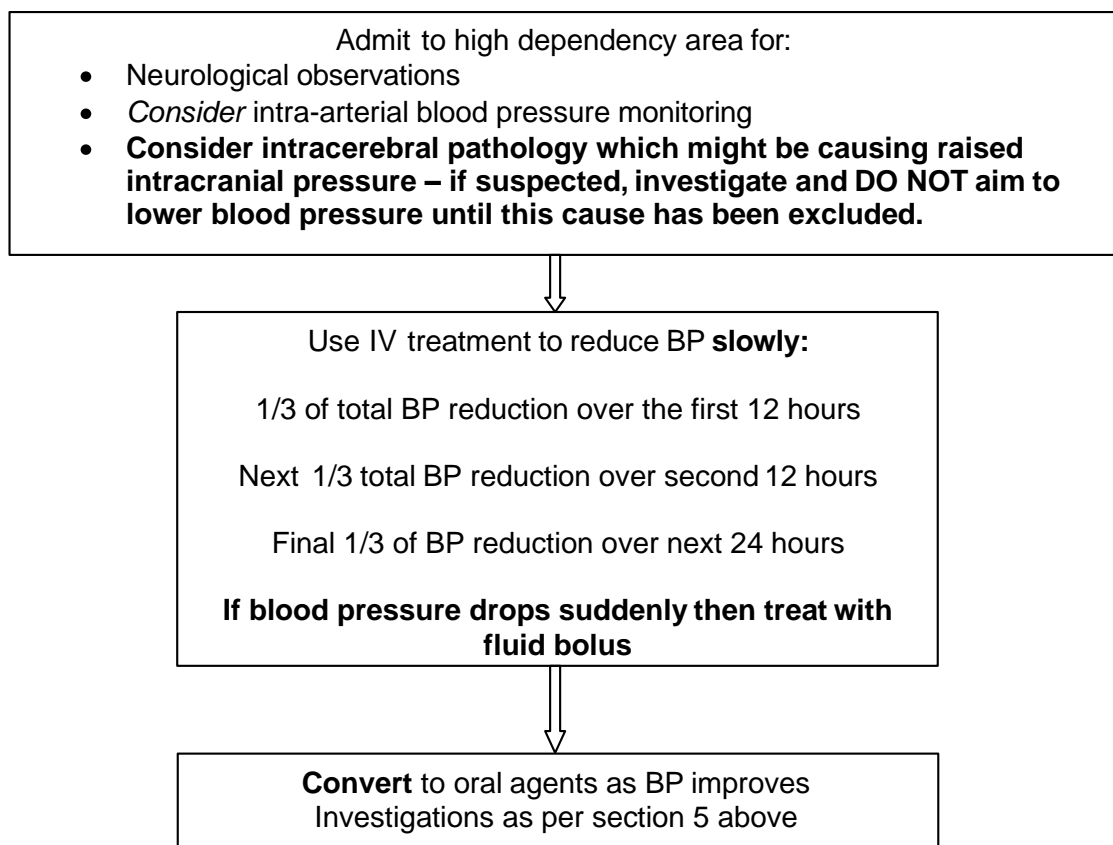
**7.4 Hypertension within the neonatal period**



## 7.1 Hypertensive crisis:

Hypertension with seizures, encephalopathy or cardiac failure

These children require admission to an HDU or PICU setting (or another appropriate ward e.g. tertiary nephrology ward) for close blood pressure monitoring and intravenous anti-hypertensives. **Advice should be sought from a paediatric nephrologist.**

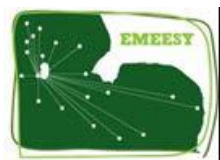


**Intravenous Options:**

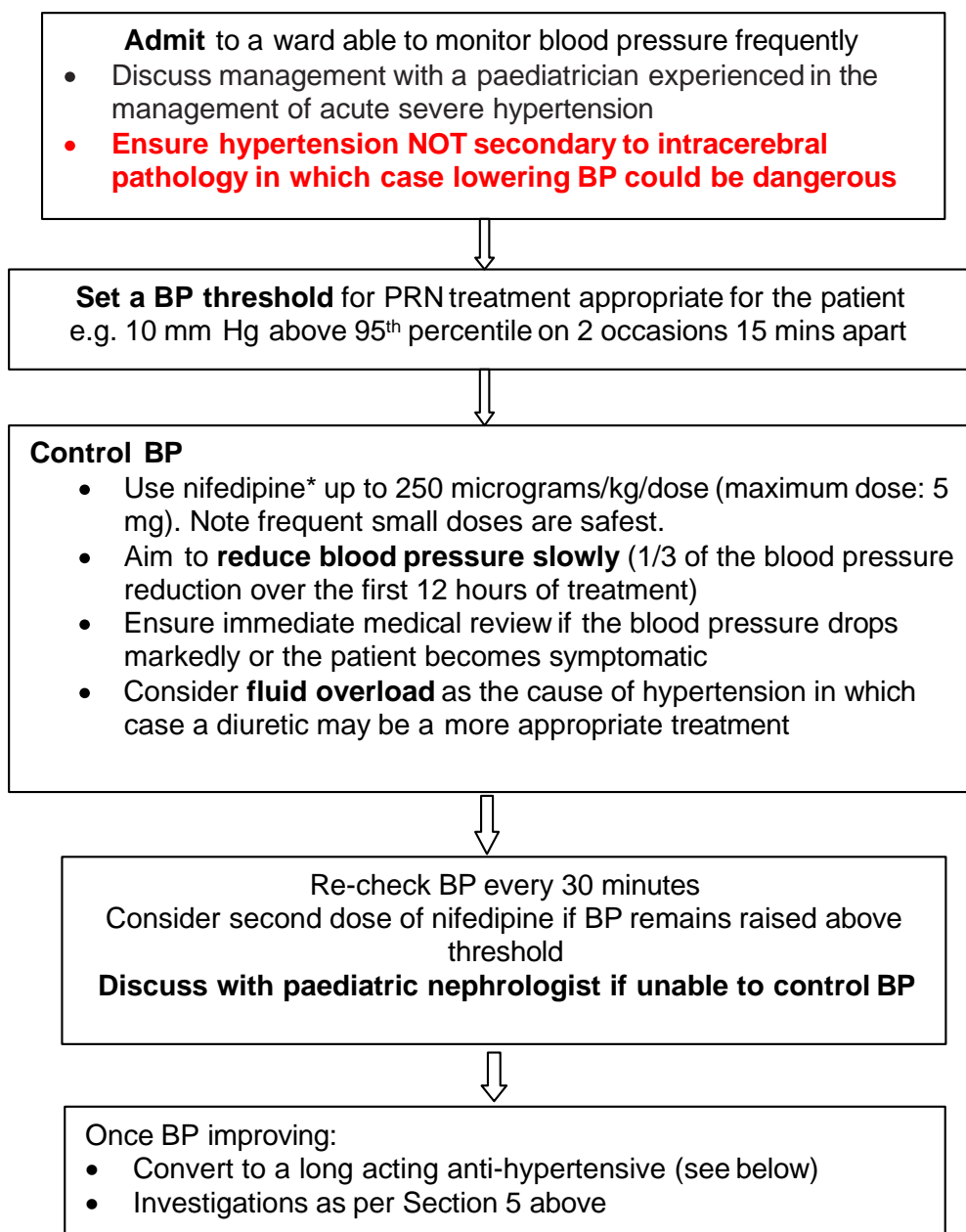
- **Labetalol**
- **Nicardipine( Not available in Leicester)**
- **Sodium Nitroprusside**

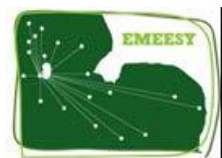
See PICU pharmacopeia for dosing regimes and BNFC for cautions / contraindications

**Special considerations;**  
If proven / suspected phaeochromocytoma consideration should be given to alpha-blockade and patients should be managed in conjunction with paediatric oncologist.



## 7.2 Symptomatic hypertension and/or stage 2 hypertension





**\*Nifedipine contraindications:**

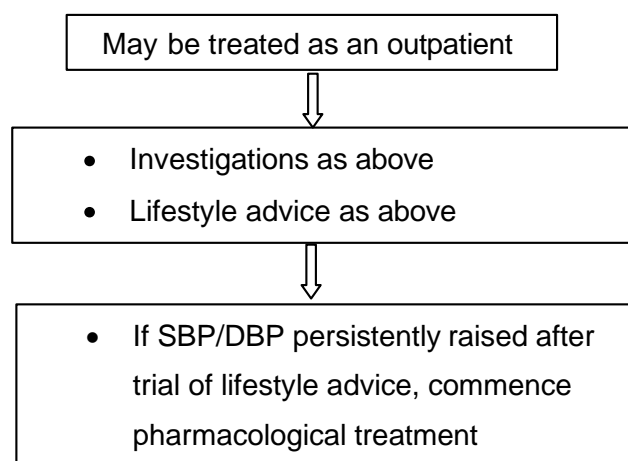
- Shock
- Advanced aortic stenosis
- Encephalopathy / cranial hypertension

**Cautions**

- Impaired cardiac function
- Diabetes (may affect blood sugars)
- Hepatic impairment

**If nifedipine is not available, hydralazine IV preparation can be used orally, dosed as per BNF.**

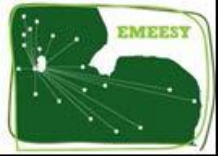
### 7.3 Asymptomatic stage 1 hypertension



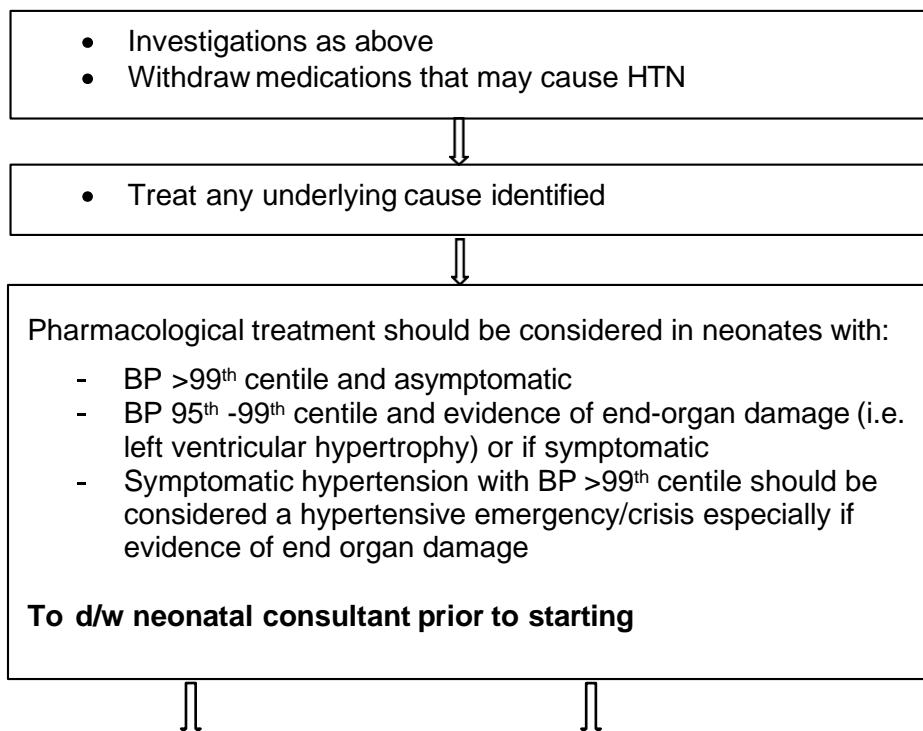
**Refer patients with:**

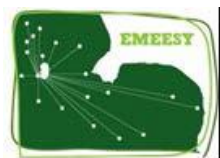
- Secondary hypertension to a paediatrician experienced in the management of childhood hypertension
- Features of renovascular disease:
  - Elevated peripheral renin/aldosterone
  - Basic renal imaging suggestive of renovascular disease
  - Hypertension that remains difficult to control despite the use of two agents, even if other investigations are normal

To a centre with experience in performing renal angiography in children.



#### 7.4 Hypertension within the neonatal period (up to 28 days past the expected due date)





**Hypertensive crisis:** reduce BP as described in 6.1

In neonates medications used are:

- 1<sup>st</sup> line: IV labetalol
- 2<sup>nd</sup> line: IV nicardipine
- 3<sup>rd</sup> line: IV hydralazine

Not a hypertensive crisis:

- Ca channel blockers
- Vasodilators (hydralazine)
- Beta-blockers
- Diuretics (modest effect on BP)

ACE inhibitors not routinely used, effective at lowering BP but significant side effects

Aim should be to reduce BP to <90<sup>th</sup> centile.

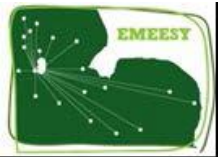
**Outcome:** The long-term prognosis of infants with hypertension is in most cases quite good<sup>9</sup> but is dependent on the cause as some forms of neonatal hypertension may persist beyond infancy. In particular, polycystic kidney disease (PKD) and other forms of renal parenchymal disease may continue to cause hyper tension throughout childhood<sup>7</sup>.

## 8. Audit Points

1. Is blood pressure being measured correctly in inpatient and outpatient situations?
2. Have patients had appropriate investigations to elicit secondary causes of hypertension?
3. Have investigations been undertaken prior to commencing treatment if appropriate?
4. Is blood pressure being maintained within the recommended parameters?
5. Has an appropriate choice of antihypertensive agent been made?

## 9. References

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h. Dionne JM, Abitbol CL, Flynn JT. Hypertension in infancy: diagnosis, management, and outcome. Pediatr Nephrol 2011

i. The ESCAPE Trial Group Strict Blood Pressure Control and Progression of Renal Failure in Children N Engl J Med 2009; 361:1639-1650

j. Watkinson M. Hypertension in the newborn baby. Arch Dis Child Fetal NeonatalEd. 2002; 86:F78-F81

k. Wühl E, Witte K, Soergel M et al German Working Group on Pediatric Hypertension. Distribution of 24hr ambulatory blood pressure in children: normalized reference values and role of body dimensions. J Hypertens 2002; 20: 1995-2007

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m. Rees, L. Et al. Paediatric Nephrology second edition. Oxford University Press 2012

## 10. Education and Training

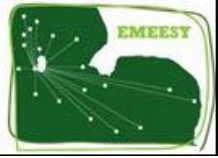
None

## 11. Key Words

Blood pressure, diastolic blood pressure (DBP), Systolic Blood Pressure (SBP), Ambulatory Blood Pressure Monitoring (ABPM)

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**The Trust recognises the diversity of the local community it serves. Our aim therefore is to provide a safe environment free from discrimination and treat all individuals fairly with dignity and appropriately according to their needs.  
As part of its development, this policy and its impact on equality have been reviewed and**



**no detriment was identified.**

<b>CONTACT AND REVIEW DETAILS</b>	
<b>Guideline Lead (Name and Title)</b> P Nagisetty	<b>Executive Lead</b> Chief Medical Officer
<b>Details of Changes made during review:</b> Revisions detailed at beginning of guideline and re-formatting	





## Appendix 1: Blood pressure centiles by gender, age and height centile<sup>4</sup>

Age	BP centile	Boys - Height Centile													
		SBP							DBP						
		5%	10%	25%	50%	75%	90%	95%	5%	10%	25%	50%	75%	90%	95%
1	50 <sup>th</sup>	85	85	86	86	87	88	88	40	40	40	41	41	42	42
	90 <sup>th</sup>	98	99	99	100	100	101	101	52	52	53	53	54	54	54
	95 <sup>th</sup>	102	102	103	103	104	105	105	54	54	55	55	56	57	57
	95 <sup>th</sup> +12	114	114	115	115	116	117	117	66	66	67	67	68	69	69
2	50 <sup>th</sup>	87	87	88	89	89	90	91	43	43	44	44	45	46	46
	90 <sup>th</sup>	100	100	101	102	103	103	104	55	55	56	56	57	58	58
	95 <sup>th</sup>	104	105	105	106	107	107	108	57	58	58	59	60	61	61
	95 <sup>th</sup> +12	116	117	117	118	119	119	120	69	70	70	71	72	73	73
3	50 <sup>th</sup>	88	89	89	90	91	92	92	45	46	46	47	48	49	49
	90 <sup>th</sup>	101	102	102	103	104	105	105	58	58	59	59	60	61	61
	95 <sup>th</sup>	106	106	107	107	108	109	109	60	61	61	62	63	64	64
	95 <sup>th</sup> +12	118	118	119	119	120	121	121	72	73	73	74	75	76	76
4	50 <sup>th</sup>	90	90	91	92	93	94	94	48	49	49	50	51	52	52
	90 <sup>th</sup>	102	103	104	105	105	106	107	60	61	62	62	63	64	64
	95 <sup>th</sup>	107	107	108	108	109	110	110	63	64	65	66	67	67	68
	95 <sup>th</sup> +12	119	119	120	120	121	122	122	75	76	77	78	79	79	80
5	50 <sup>th</sup>	91	92	93	94	95	96	96	51	51	52	53	54	55	55
	90 <sup>th</sup>	103	104	105	106	107	108	108	63	64	65	65	66	67	67
	95 <sup>th</sup>	107	108	109	109	110	111	112	66	67	68	69	70	70	71
	95 <sup>th</sup> +12	119	120	121	121	122	123	124	78	79	80	81	82	82	83
6	50 <sup>th</sup>	93	93	94	95	96	97	98	54	54	55	56	57	57	58
	90 <sup>th</sup>	105	105	106	107	109	110	110	66	66	67	68	68	69	69
	95 <sup>th</sup>	108	109	110	111	112	113	114	69	70	70	71	72	72	73
	95 <sup>th</sup> +12	120	121	122	123	124	125	126	81	82	82	83	84	84	85
7	50 <sup>th</sup>	94	94	95	97	98	98	99	56	56	57	58	58	59	59
	90 <sup>th</sup>	106	107	108	109	110	111	111	68	68	69	70	70	71	71
	95 <sup>th</sup>	110	110	111	112	114	115	116	71	71	72	73	73	74	74
	95 <sup>th</sup> +12	122	122	123	124	126	127	128	83	83	84	85	85	86	86
8	50 <sup>th</sup>	95	96	97	98	99	99	100	57	57	58	59	59	60	60
	90 <sup>th</sup>	107	108	109	110	111	112	112	69	70	70	71	72	72	73
	95 <sup>th</sup>	111	112	112	114	115	116	117	72	73	73	74	75	75	75
	95 <sup>th</sup> +12	123	124	124	126	127	128	129	84	85	85	86	87	87	87
9	50 <sup>th</sup>	96	97	98	99	100	101	101	57	58	59	60	61	62	62
	90 <sup>th</sup>	107	108	109	110	111	112	113	70	71	72	73	74	74	74
	95 <sup>th</sup>	112	112	113	115	116	118	119	74	74	75	76	76	77	77
	95 <sup>th</sup> +12	124	124	125	127	128	130	131	86	86	87	88	88	89	89
10	50 <sup>th</sup>	97	98	99	100	101	102	103	59	60	61	62	63	63	64
	90 <sup>th</sup>	108	109	111	112	113	115	116	72	73	74	74	75	75	76
	95 <sup>th</sup>	112	113	114	116	118	120	121	76	76	77	77	78	78	78
	95 <sup>th</sup> +12	124	125	126	128	130	132	133	88	88	89	89	90	90	90
11	50 <sup>th</sup>	99	99	101	102	103	104	106	61	61	62	63	63	63	63
	90 <sup>th</sup>	110	111	112	114	116	117	118	74	74	75	75	75	76	76
	95 <sup>th</sup>	114	114	116	118	120	123	124	77	78	78	78	78	78	78
	95 <sup>th</sup> +12	126	126	128	130	132	135	136	89	90	90	90	90	90	90
12	50 <sup>th</sup>	101	101	102	104	106	108	109	61	62	63	63	63	63	63
	90 <sup>th</sup>	113	114	115	117	119	121	122	75	75	75	75	75	76	76
	95 <sup>th</sup>	116	117	118	121	124	126	128	78	78	78	78	78	79	79
	95 <sup>th</sup> +12	128	129	130	133	136	138	140	90	90	90	90	90	91	91
13	50 <sup>th</sup>	103	104	105	108	110	111	112	61	60	61	62	63	64	65
	90 <sup>th</sup>	115	116	118	12	124	126	126	74	74	74	75	76	77	77
	95 <sup>th</sup>	119	120	122	125	128	130	131	78	78	78	78	80	81	81
	95 <sup>th</sup> +12	131	132	134	137	140	142	143	90	90	90	90	92	93	93
14	50 <sup>th</sup>	105	106	109	111	112	113	113	60	60	62	64	65	66	67
	90 <sup>th</sup>	119	120	123	126	127	128	129	74	74	75	77	78	79	80
	95 <sup>th</sup>	123	125	127	130	132	133	134	77	78	79	81	82	83	84
	95 <sup>th</sup> +12	135	137	139	142	144	145	146	89	90	91	93	94	95	96
15	50 <sup>th</sup>	108	110	112	113	114	114	114	61	62	64	65	66	67	68
	90 <sup>th</sup>	123	124	126	128	129	130	130	75	76	78	79	80	81	81
	95 <sup>th</sup>	127	129	131	132	134	135	135	78	79	81	83	84	85	85
	95 <sup>th</sup> +12	139	141	143	144	146	147	147	90	91	93	95	96	97	97
16	50 <sup>th</sup>	111	112	114	115	115	116	116	63	64	66	67	68	69	69
	90 <sup>th</sup>	126	127	128	129	131	131	132	77	78	79	80	81	82	82
	95 <sup>th</sup>	130	131	133	134	135	136	137	80	81	83	84	85	86	86
	95 <sup>th</sup> +12	142	143	145	146	147	148	149	92	93	95	96	97	98	98
17	50 <sup>th</sup>	114	115	116	117	117	118	118	65	66	67	68	69	70	70
	90 <sup>th</sup>	128	129	130	131	132	133	134	78	79	80	81	82	82	83
	95 <sup>th</sup>	132	133	134	135	137	138	138	81	82	84	85	86	86	87
	95 <sup>th</sup> +12	144	145	146	147	149	150	150	93	94	96	97	98	98	99

Age	BP centile	Girls - Height Centile													
		SBP							DBP						
		5%	10%	25%	50%	75%	90%	95%	5%	10%	25%	50%	75%	90%	95%
1	50 <sup>th</sup>	84	85	86	86	87	88	88	41	42	42	43	44	45	46
	90 <sup>th</sup>	98	99	99	100	101	102	102	54	55	55	56	57	58	58
	95 <sup>th</sup>	101	102	102	103	104	105	105	59	59	60	60	61	62	62
	95 <sup>th</sup> +12	113	114	114	115	116	117	117	71	71	72	72	73	74	74
2	50 <sup>th</sup>	87	87	88	89	90	91	91	45	46	47	48	49	50	51
	90 <sup>th</sup>	101	101	102	103	104	105	106	58	58	59	60	61	62	62
	95 <sup>th</sup>	104	105	106	106	107	108	109	62	63	63	64	65	66	66
	95 <sup>th</sup> +12	116	117	118	118	119	120	121	74	75	75	76	77	78	78
3	50 <sup>th</sup>	88	89	89	90	91	92	93	48	48	49	50	51	53	53
	90 <sup>th</sup>	102	103	104	104	105	106	107	60	61	61	62	63	64	65
	95 <sup>th</sup>	106	106	107	108	109	110	110	64	65	65	66	67	68	69
	95 <sup>th</sup> +12	118	118	119	120	121	122	122	76	77	77	78	79	80	81
4	50 <sup>th</sup>	89	90	91	92	93	94	94	50	51	51	53	54	55	55
	90 <sup>th</sup>	103	104	105	106	107	108	108	62	63	64	65	66	67	67
	95 <sup>th</sup>	107	108	109	109	110	111	112	66	67	68	69	70	70	71
	95 <sup>th</sup> +12	119	120	121	121	122	123	124	78	79	80	81	82	82	83
5	50 <sup>th</sup>	90	91	92	93	94	95	96	52	52	53	55	56	57	57
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	95 <sup>th</sup>	108	109	109	110	111	112	113	68	69	70	71	72	73	73
	95 <sup>th</sup> +12	120	121	121	122	123	124	125	80	81	82	83	84	85	85
6	50 <sup>th</sup>	92	92	93	94	96	97	97	54	54	55	56	57	58	59
	90 <sup>th</sup>	105	106	107	108	109	110	111	67	67	68	69	70	71	71
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	95 <sup>th</sup> +12	121	121	122	123	124	125	126	82	83	84	84	85	86	86
7	50 <sup>th</sup>	92	93	94	95	97	98	99	55	55	56	57	58	59	60
	90 <sup>th</sup>	106	106	107	109	110	111	112	68	68	69	70	71	72	72
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	95 <sup>th</sup> +12	121	122	123	124	125	126	127	84	84	85	85	86	86	87
8	50 <sup>th</sup>	93	94	95	97	98	99	100	56	56	57	59	60	61	61
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	95 <sup>th</sup> +12	122	123	124	125	127	128	129	84	85	86	86	87	87	87
9	50 <sup>th</sup>	95	95	97	98	99	100	101	57	58	59	60	60	61	61
	90 <sup>th</sup>	108	108	109	111	112	113	114	71	71	72	73	73	73	73
	95 <sup>th</sup>	112	112	113	114	116	117	117	74	74	75	75	75	75	75
	95 <sup>th</sup> +12	124	124	125	126	128	129	130	86	86	87	87	87	87	87
10	50 <sup>th</sup>	96	97	98	99	101	102	103	58	59	59	60	61	61	62
	90 <sup>th</sup>	109	110	111	112	113	115	116	72	73	73	73	73	73	73
	95 <sup>th</sup>	113	114	114	116	117	119	120	75	75	76	76	76	76	76
	95 <sup>th</sup> +12	125	126	126	128	129	131	132	87	87	88	88	88	88	88
11	50 <sup>th</sup>	98	99	101	102	104	105	106	60	60	60	61	62	63	64
	90 <sup>th</sup>	111	112	113	114	116	118	120	74	74	74	74	74	75	75
	95 <sup>th</sup>	115	116	117	118	120	123	124	76	77	77	77	77	77	77
	95 <sup>th</sup> +12	127	128	129	130	132	135	136	88	89	89	89	89	89	89
12	50 <sup>th</sup>	102	102	104	105	107	108	108	61	61	61	62	64	65	65
	90 <sup>th</sup>	114	115	116	118	120	122	122	75	75	75	75	76	76	76
	95 <sup>th</sup>	118	119	120	122	124	125	126	78	78	78	78	79	79	79
	95 <sup>th</sup> +12	130	131	132	134	136	137	138	90	90	90	90	91	91	91
13	50 <sup>th</sup>	104	105	106	107	108	108	109	62	62	63	64	65	65	66
	90 <sup>th</sup>	116	117	119	121	122	123	123	75	75	75	76	76	76	76
	95 <sup>th</sup>	121	122	123	124	126	126	127	79	79	79	79	80	80	81
	95 <sup>th</sup> +12	133	134	135	136	138	138	139	91	91	91	91	92	92	93
14	50 <sup>th</sup>	105	106	107	108	109	109	109	63	63	64	65	66	66	66
	90 <sup>th</sup>	118	118	120	122	123	123	123	76	76	76	76	77	77	77
	95 <sup>th</sup>	123	123	124	125	126	127	127	80	80	80	80	81	81	82
	95 <sup>th</sup> +12	135	135	136	137	138	139	139	92	92	92	92	93	93	94
15	50 <sup>th</sup>	105	106	107	108	109	109	109	64	64	64	65	66	67	67
	90 <sup>th</sup>	118	119	121	122	123	123	124	76	76	76	77	77	78	78
	95 <sup>th</sup>	124	124	125	126	127	127	128	80	80	80	81	82	82	82
	95 <sup>th</sup> +12	136	136	137	138	139	139	140	92	92	92	93	94	94	94
16	50 <sup>th</sup>	106	107	108	109	109	110	110	64	64	65	66	66	67	67
	90 <sup>th</sup>	119	120	122	123	124	124	124	76	76	76	77	78	78	78
	95 <sup>th</sup>	124	125	125	127	127	128	128	80	80	80	81	82	82	82
	95 <sup>th</sup> +12	136	137	137	139	139	140	140	92	92	92	93	94	94	94
17	50 <sup>th</sup>	107	108	109	110	110	110	111	64	64	65	66	66	66	67
	90 <sup>th</sup>	120	121	123	124	124	125	125	76	76	77	77	78	78	78
	95 <sup>th</sup>	125	125	126	127	128	128	128	80	80	80	81	82	82	82
	95 <sup>th</sup> +12	137	137	138	139	140	140	140	92	92	92	93	94	94	94

**Appendix 2: ABPM Centiles<sup>10</sup>**

Centiles of mean day and night systolic and diastolic BP, stratified according to gender and height.

**Appendix 3 90th and 95th percentiles of mean day- and night-time systolic and diastolic BP, stratified according to gender and height**

BOYS Height (cm)	Systolic BP				Diastolic BP			
	Day		Night		Day		Night	
	90th pct	95th pct	90th pct	95th pct	90th pct	95th pct	90th pct	95th pct
120	120.6	123.5	103.7	106.4	79.1	81.2	61.9	64.1
125	121.0	124.0	104.9	107.8	79.3	81.3	62.2	64.3
130	121.6	124.6	106.3	109.5	79.3	81.4	62.4	64.5
135	122.2	125.2	107.7	111.3	79.3	81.3	62.7	64.8
140	123.0	126.0	109.3	113.1	79.2	81.2	62.9	65.0
145	124.0	127.0	110.7	114.7	79.1	81.1	63.1	65.2
150	125.4	128.5	111.9	115.9	79.1	81.0	63.3	65.4
155	127.2	130.2	113.1	117.0	79.2	81.1	63.4	65.6
160	129.2	132.3	114.3	118.0	79.3	81.3	63.6	65.7
165	131.3	134.5	115.5	119.1	79.7	81.7	63.7	65.8
170	133.5	136.7	116.8	120.2	80.1	82.2	63.8	65.9
175	135.6	138.8	118.1	121.2	80.6	82.8	63.8	65.9
180	137.7	140.9	119.2	122.1	81.1	83.4	63.8	65.8
185	139.8	143.0	120.3	123.0	81.7	84.1	63.8	65.8

GIRLS	Systolic BP				Diastolic BP			
	Day		Night		Day		Night	
	90th pct	95th pct	90th pct	95th pct	90th pct	95th pct	90th pct	95th pct
Height (cm)								
120	118.5	121.1	105.7	109.0	79.7	81.8	64.0	66.4
125	119.5	122.1	106.4	109.8	79.7	81.8	63.8	66.2
130	120.4	123.1	107.2	110.6	79.7	81.8	63.6	66.0
135	121.4	124.1	107.9	111.3	79.7	81.8	63.4	65.8
140	122.3	125.1	108.4	111.9	79.8	81.8	63.2	65.7
145	123.4	126.3	109.1	112.5	79.8	81.8	63.0	65.6
150	124.6	127.5	109.9	113.1	79.9	81.9	63.0	65.5
155	125.7	128.5	110.6	113.8	79.9	81.9	62.9	65.5
160	126.6	129.3	111.1	114.0	79.9	81.9	62.8	65.4
165	127.2	129.8	111.2	114.0	79.9	81.9	62.7	65.2
170	127.5	130.0	111.2	114.0	79.9	81.8	62.5	65.0
175	127.6	129.9	111.2	114.0	79.8	81.7	62.3	64.7

### Appendix 3: Neonatal blood pressure centiles<sup>6</sup>

Post-conceptual age	50th percentile	95th percentile	99th percentile
<b>44 weeks</b>			
SBP	88	105	110
DBP	50	68	73
<b>MAP</b>	<b>63</b>	<b>80</b>	<b>85</b>
<b>42 weeks</b>			
SBP	85	98	102
DBP	50	65	70
<b>MAP</b>	<b>62</b>	<b>76</b>	<b>81</b>
<b>40 weeks</b>			
SBP	80	95	100
DBP	50	65	70
<b>MAP</b>	<b>60</b>	<b>75</b>	<b>80</b>
<b>38 weeks</b>			
SBP	77	92	97
DBP	50	65	70
<b>MAP</b>	<b>59</b>	<b>74</b>	<b>79</b>
<b>36 weeks</b>			
SBP	72	87	92
DBP	50	65	70
<b>MAP</b>	<b>57</b>	<b>72</b>	<b>77</b>
<b>34 weeks</b>			
SBP	70	85	90
DBP	40	55	60
<b>MAP</b>	<b>50</b>	<b>65</b>	<b>70</b>
<b>32 weeks</b>			
SBP	68	83	88
DBP	40	55	60
<b>MAP</b>	<b>49</b>	<b>64</b>	<b>69</b>
<b>30 weeks</b>			
SBP	65	80	85
DBP	40	55	60
<b>MAP</b>	<b>48</b>	<b>63</b>	<b>68</b>
<b>28 weeks</b>			
SBP	60	75	80
DBP	38	50	54
<b>MAP</b>	<b>45</b>	<b>58</b>	<b>63</b>
<b>26 weeks</b>			
SBP	55	72	77
DBP	30	50	56
<b>MAP</b>	<b>38</b>	<b>57</b>	<b>63</b>

This table provides estimated values for blood pressures after two weeks of age in infants from 26 to 44 weeks post conceptual age. The 95th and 99th percentile values are intended to serve as a reference to identify infants with persistent hypertension that may require treatment.

SBP: systolic blood pressure; DBP: diastolic blood pressure; MAP: mean arterial pressure. *Reproduced from: Dionne JM, Abitbol CL, Flynn JT. Hypertension in infancy: diagnosis, management, and outcome. Pediatr Nephrol* <sup>6</sup>

#### Appendix 4: Causes of Hypertension

Hypertension may be either primary (no underlying cause identified) or secondary to an underlying cause. Of those with an underlying cause the majority will be renal or renovascular in nature. Hypertension in children should be investigated with primary hypertension being a diagnosis of exclusion.

The secondary causes of hypertension can be considered by age of presentation:

< 1 year (including neonates)	1-5 years	5-10 years	10-20 years
<p><b>Renovascular:</b></p> <ul style="list-style-type: none"> <li>Renal artery stenosis</li> </ul> <p><b>Renal disease</b></p> <ul style="list-style-type: none"> <li>Congenital renal disease (e.g. dysplasia)</li> <li>Renal vein or artery thrombosis</li> </ul> <p><b>Cardiac disease</b></p> <ul style="list-style-type: none"> <li>Aortic coarctation</li> </ul> <p><b>Tumours</b></p> <ul style="list-style-type: none"> <li>Neuroblastoma</li> <li>Wilm's tumour</li> </ul> <p><b>Complications of prematurity</b></p> <ul style="list-style-type: none"> <li>Bronchopulmonary dysplasia</li> <li>Patent ductus arteriosus</li> <li>Intraventricular haemorrhage</li> <li>Hydrocephalus</li> </ul> <p><b>Drugs</b></p>	<p><b>Renovascular</b></p> <ul style="list-style-type: none"> <li>Renal artery stenosis</li> <li>Middle aortic syndrome</li> </ul> <p><b>Renal disease</b></p> <ul style="list-style-type: none"> <li>Congenital renal disease</li> <li>Glomerulonephritis</li> <li>Renal vein thrombosis</li> </ul> <p><b>Tumours</b></p> <ul style="list-style-type: none"> <li>Phaeochromocytoma</li> <li>Neuroblastoma</li> <li>Wilm's tumour</li> <li>Brain tumour</li> </ul> <p><b>Drugs</b></p> <ul style="list-style-type: none"> <li>Corticosteroids</li> </ul> <p><b>Genetic</b></p> <ul style="list-style-type: none"> <li>Monogenic hypertension (e.g. Liddle's syndrome)</li> </ul>	<p><b>Renovascular</b></p> <ul style="list-style-type: none"> <li>Renal artery stenosis</li> <li>Middle aortic syndrome</li> </ul> <p><b>Renal disease</b></p> <ul style="list-style-type: none"> <li>Congenital renal disease</li> <li>Reflux nephropathy</li> <li>Glomerulonephritis</li> <li>Other parenchymal renal disease e.g. nephronophthisis</li> </ul> <p><b>Tumours</b></p> <ul style="list-style-type: none"> <li>Endocrine tumours <ul style="list-style-type: none"> <li>Cushing syndrome and disease</li> <li>Conn syndrome</li> <li>Phaeochromocytoma</li> <li>Neuroblastoma</li> </ul> </li> <li>Wilm's tumour</li> <li>Brain tumour</li> </ul>	<p><b>Renovascular</b></p> <ul style="list-style-type: none"> <li>Renal artery stenosis</li> </ul> <p><b>Renal disease</b></p> <ul style="list-style-type: none"> <li>Congenital renal disease</li> <li>Reflux nephropathy</li> <li>Glomerulonephritis</li> </ul> <p><b>Tumours</b></p> <ul style="list-style-type: none"> <li>Endocrine tumours</li> <li>Brain tumour</li> </ul> <p><b>Drugs</b></p> <ul style="list-style-type: none"> <li>Steroids</li> <li>Oral contraceptive pill</li> <li>Illicit drug use/Alcohol</li> </ul> <p><b>Genetic</b></p> <ul style="list-style-type: none"> <li>Monogenic hypertension</li> </ul> <p><b>Other</b></p> <ul style="list-style-type: none"> <li>Pregnancy</li> </ul>

Adapted from: Oxford Specialist Handbooks in Paediatrics: Paediatric Nephrology Rees, L; Bockenbauer D, Webb NJA, Punaro, MG<sup>11</sup>

## Appendix 5: High-risk conditions

Ambulatory blood pressure monitoring should be considered routinely in the following high risk conditions<sup>4</sup>:

Condition
Secondary hypertension
CKD or structural renal abnormalities
Type 1 and Type 2 DM
Solid-organ transplant recipients
Obesity
Obstructive sleep apnoea
Aortic coarctation (repaired)
Genetic syndromes associated with HTN e.g. NF1/2; Turner syndrome, Williams syndrome
Treated hypertensive patients
Patients born prematurely