Pediatric Blood Pressure- Measurement and Definition

Dr Prithi Inamdar

Associate Professor, Department of Pediatrics, Padmashree D. Y. Patil Medical College, Navi Mumbai

ECHO India

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KIDNEY FOUNDATION FOR CHILDREN

Frequency of monitoring > 3years

- Annual blood pressure measurement for children ≥3 years.
- Every health care visit
  - Obese
  - Medications known to increase blood pressure,
  - Renal disease,
  - History of coarctation,
  - Diabetes
- warrant regular measurements if they have any of the followings: congenital heart disease, recurrent urinary tract infection, urological malformation, solid organ transplant, bone marrow transplant, malignancy, neurofibromatosis, tuberous sclerosis or sickle cell disease. Small for gestational age newborns, premature (

Children younger than 3 years

TABLE 9 Conditions Under Which Children Younger Than 3 Years Should Have BP Measured

History of prematurity <32 week's gestation or small for gestational age, very low birth weight, other neonatal complications requiring intensive care, umbilical artery line
Congenital heart disease (repaired or unrepaired)
Recurrent urinary tract infections, hematuria, or proteinuria
Known renal disease or urologic malformations
Family history of congenital renal disease
Solid-organ transplant
Malignancy or bone marrow transplant
Treatment with drugs known to raise BP
Other systemic illnesses associated with HTN (neurofibromatosis, tuberous sclerosis, sickle cell disease,[114] etc)
Evidence of elevated intracranial pressure

Adapted from Table 3 in the Fourth Report.[1]

BP Measurement Technique

- Multiple measurements
- Oscillometric or auscultatory.
- 2 additional oscillometric or auscultatory BP measurements at the same visit and average them.
- Auscultation - averaged measurement.
- Oscillometric reading is ≥90th percentile - 2 auscultatory measurements

Best BP Measurement Practices

- Seated in a quiet room for 3–5 min before measurement, with the back supported and feet uncrossed on the floor.
- Right arm
- The arm should be at heart level, 90 degree supported, and uncovered above the cuff.
- The patient and observer should not speak.

Best BP Measurement Practices

- The cuff should be inflated to 20–30 mm Hg above the point at which the radial pulse disappears.
- Avoid overinflation.
- The cuff should be deflated at a rate of 2–3 mm Hg per second.
- The first (phase I Korotkoff) and last (phase V Korotkoff) audible sounds should be taken as SBP and DBP.
- If the Korotkoff sounds are heard to 0 mm Hg, the point at which the sound is muffled (phase IV Korotkoff) should be taken as the DBP, or the measurement repeated with less pressure applied over the brachial artery.
- The measurement should be read to the nearest 2 mm Hg.

Correct cuff size

- The bladder length should be 80%–100% of the circumference of the arm,
- The width should be at least 40%.
- Midarm circumference
  - Midpoint between the acromion of the scapula and olecranon of the elbow,
  - Shoulder in a neutral position
  - Elbow flexed to 90°

Leg BP

- Prone position.
- Midthigh with the stethoscope placed over the popliteal artery.
- The SBP in the legs is usually 10%–20% higher than the brachial artery pressure

Measurement of BP in the Neonate

- Oscillometric technique till the infant is able to cooperate with manual BP determination.
- The cuff bladder length should encircle 80% to 100% of the arm circumference; a cuff bladder with a width-to-arm circumference ratio of 0.45 to 0.55
- Calm state

Physical Examination

Body system	Finding	Possible etiology
Vitals	Tachycardia	Hyperthyroidism, Neuroblastoma, pheochromocytoma
	Decreased lower extremity pulses	Coarctation of the aotra
Eyes	Proptosis	Hyperthyroidism
	Retinal Changes	Severe HTN
ENT	Adenotonsillar hypertophy/ snoring	Sleep disordered breathing/ sleep apnea
Height, weight	Growth retardation	Chronic renal failure
	Obesity	Cushings Syndrome/ Insulin resistance syndrome
Head , neck	Elfin facies	William syndrome
	Moon facies	Cushing syndrome
	Goitre	Hyperthryroidism
	Webbed neck	Turners

Physical Examination

Body system	Finding	Possible etiology
Skin	Neurocutaneous markers	Neurofibromatosis/ Tuberous sclerosis
	Acanthosis nigricans	Type2 DM
Hematological	Pallor	Renal failure, sickle cell
Chest/ cardiac	Cardiac Symptoms	CHD/ SLE
Abdomen	Mass	Wilms Tumour/ Neuroblastoma/ PCC
	Bruit	Rena Artery Stenosis
	Palpable kidney	PKD/ Multicystic dysplastic/ Hydronephrosis
Genitourinary	Ambiguous genitalia	CAH
Extremities	Muscle weakness	Hyperaldosteronism/ Liddles syndrome

Screening testing

- All patients
  1. Urinalysis
  2. BUN, Creatinine, Electrolytes
  3. Lipid profile
  4. Renal USG if abnormal urinalysis or renal function
- Obese
  1. Hb A1c
  2. SGOT/SGPT
- Optional tests
  1. Drug screen
  2. Sleep study

Definition of Hypertension

Cateogories	1-13 years	>13year
Normal BP	< 90th percentile	<120/<80 mm Hg
Elevated BP	>90th percentile - <95th percentile or 120/80 mm Hg to < 95th percentile(whichever is lower)	120/<80 to 129/ <80 mm Hg
Stage 1 HTN	≥ 95th percentile to <95th percentile + 12 mm Hg or 130/80 to 139/89 mm Hg (whichever is lower)	130/80 to 139/89 mm Hg
Stage 2 HTN	≥95th percentile + 12 mm Hg or ≥140/90 mm Hg (whichever is lower)	≥140/90 mm Hg

Ambulatory Blood Pressure monitoring

- Children more than 5 years of age
  - BP is in the “elevated” category for at least 1 year
  - Stage 1 hypertension across three clinic visits.
  - CKD, secondary hypertension, type 1 or 2 diabetes mellitus (DM), obstructive sleep apnea syndrome (OSAS), a history of prematurity, and in children who have undergone solid-organ transplant or coarctation repair.

White Coat Hypertension

- BP ≥95th percentile in the office or clinical setting but <95th percentile outside of the office or clinical setting.
- WCH is diagnosed by ABPM when the mean SBP and DBP are <95th percentile and SBP and DBP load are <25%.
- Screening BP measured at regular well-child care visits with consideration of a repeat ABPM in 1 to 2 years.

Simplified BP Chart

- 90th percentile BP for age and sex for children at the 5th percentile of height.
- Screening tool
- Not be used to diagnose
- For adolescents ≥13 years of age, a threshold of 120/80 mm Hg

TABLE 6 Screening BP Values Requiring Further Evaluation

Age, y	BP, mm Hg			
	Boys		Girls	
	Systolic	DBP	Systolic	DBP
1	98	52	98	54
2	100	55	101	58
3	101	58	102	60
4	102	60	103	62
5	103	63	104	64
6	105	66	105	67
7	106	68	106	68
8	107	69	107	69
9	107	70	108	71
10	108	72	109	72
11	110	74	111	74
12	113	75	114	75
≥13	120	80	120	80

Target Blood

- Less than 90th percentile
- CKD- BP targets were revised to below 50th percentile.
- Non-pharmacological interventions:
  - Dietary intervention (DASH diet including more of fruits, vegetables, low fat milk products and low salt content)
  - Increased physical activity has been strongly supported.
  - Encouraging patient and family educations.