

Hipertensión arterial en Pediatría

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Nefrólogo Pediatra HGF – Clínica Reñaca

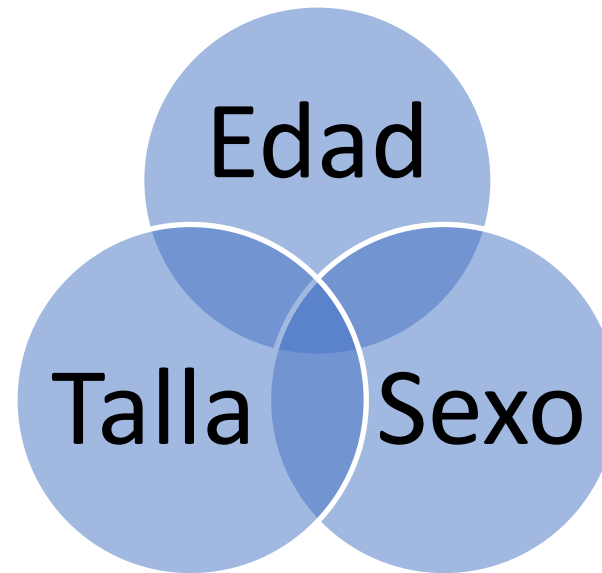
Mayo 2019

Presión arterial normal

- Distribución normal de presión arterial en edad pediátricas



Variable según



- Definición controvertida:

- No basado en aumento de riesgo CV
- Falta de datos pediátricos
- Criterio estadístico ha prevalecido históricamente

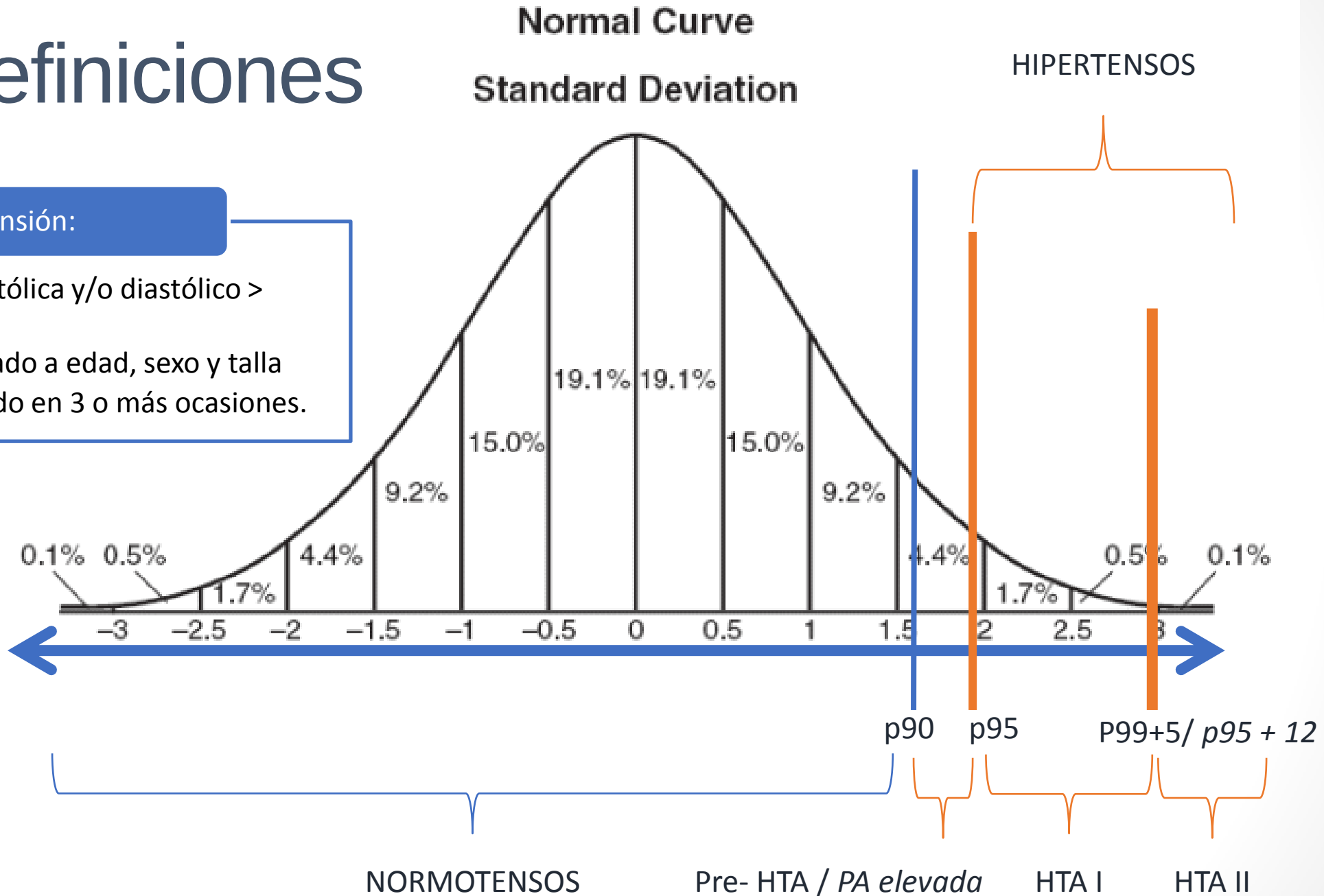


NORMAL: PA sistólica y diastólica < p90

Definiciones

Hipertensión:

- PA sistólica y/o diastólico > p95
- Ajustado a edad, sexo y talla
- Medido en 3 o más ocasiones.



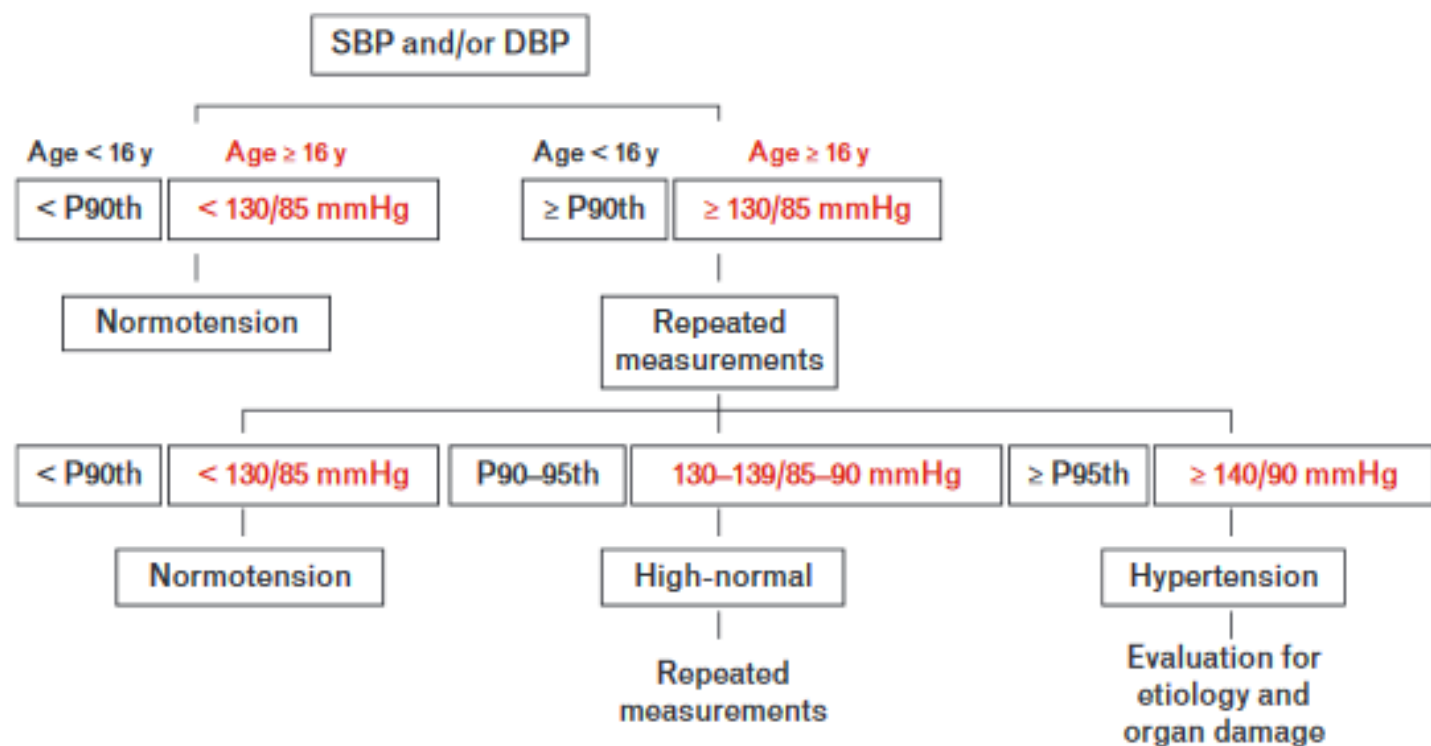


FIGURE 1 Flowchart for the diagnosis of hypertension based on percentile distribution of age, sex and height. Less than 16 years and on defined threshold at least 16 years. P, percentile.

TABLE 1. Classification of hypertension in children and adolescents

Category	0–15 years SBP and/or DBP percentile	16 years and older SBP and/or DBP values (mmHg)
Normal	<90th	<130/85
High-normal	≥90th to <95th percentile	130–139/85–89
Hypertension	≥95th percentile	≥140/90
Stage 1 hypertension	95th percentile to the 99th percentile and 5 mmHg	140–159/90–99
Stage 2 hypertension	>99th percentile plus 5 mmHg	160–179/100–109
ISH	SBP ≥95th percentile and DBP <90th percentile	≥140/<90

ISH, isolated systolic hypertension.

TABLE 3 Updated Definitions of BP Categories and Stages

For Children Aged 1–13 y	For Children Aged ≥13 y
Normal BP: <90th percentile	Normal BP: <120/<80 mm Hg
Elevated BP: ≥90th percentile to <95th percentile or 120/80 mm Hg to <95th percentile (whichever is lower)	Elevated BP: 120/<80 to 129/<80 mm Hg
Stage 1 HTN: ≥95th percentile to <95th percentile + 12 mmHg, or 130/80 to 139/89 mm Hg (whichever is lower)	Stage 1 HTN: 130/80 to 139/89 mm Hg
Stage 2 HTN: ≥95th percentile + 12 mm Hg, or ≥140/90 mm Hg (whichever is lower)	Stage 2 HTN: ≥140/90 mm Hg

- Anormal: PA > 130/80
- Considerar PA similar a recomendaciones de adulto desde los 13 años

BP Levels for Boys by Age and Height Percentile

Updated: January, 2012

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Age yrs	BP Percentile	Systolic BP (mmHg)							Diastolic BP (mmHg)						
		5th	10th	25th	50th	75th	90th	95th	5th	10th	25th	50th	75th	90th	95th
2	Height - inches	31.9	32.4	33.3	34.2	35.1	36.0	36.5	31.9	32.4	33.3	34.2	35.1	36.0	36.5
	Height - cm	81.1	82.4	84.5	86.9	89.2	91.4	92.6	81.1	82.4	84.5	86.9	89.2	94.4	92.6
	NT	84	85	87	88	90	92	92	39	40	41	42	43	44	44
	PreHT	97	99	100	102	104	105	106	54	55	56	57	58	58	59
	Stage 1 HT	101	102	104	106	108	109	110	59	59	60	61	62	63	63
	Stage 2 HT	114	115	116	118	120	122	122	71	72	73	74	75	76	76
3	Height - inches	35.1	35.6	36.5	37.5	38.6	39.5	40.1	35.1	35.6	36.5	37.5	38.6	39.5	40.1
	Height - cm	89.2	90.5	92.7	95.3	97.9	100.4	101.9	89.2	90.5	92.7	95.3	97.9	100.4	101.9
	NT	86	87	89	91	93	94	95	44	44	45	46	47	48	48
	PreHT	100	101	103	105	107	108	109	59	59	60	61	62	63	63
	Stage 1 HT	104	105	107	109	110	112	113	63	63	64	65	66	67	67
	Stage 2 HT	116	117	119	121	123	124	125	76	76	77	78	79	80	80
4	Height - inches	37.6	38.2	39.3	40.4	41.5	42.5	43.1	37.6	38.2	39.3	40.4	41.5	42.5	43.1
	Height - cm	96.5	97.1	99.7	102.5	105.4	108.0	109.5	96.5	97.1	99.7	102.5	105.4	108.0	109.5
	NT	88	89	91	93	95	96	97	47	48	49	50	51	51	52
	PreHT	102	103	105	107	109	110	111	62	63	64	65	66	66	67
	Stage 1 HT	106	107	109	111	112	114	115	66	67	68	69	70	71	71
	Stage 2 HT	118	119	121	123	125	126	127	79	80	81	82	83	83	84
5	Height - inches	39.9	40.6	41.7	43.0	44.2	45.3	46.0	39.9	40.6	41.7	43.0	44.2	45.3	46.0
	Height - cm	101.5	103.2	106.0	109.2	112.3	115.1	116.8	101.5	103.2	106.0	109.2	112.3	115.1	116.8
	NT	90	91	93	95	96	98	98	50	51	52	53	54	55	55
	PreHT	104	105	106	108	110	111	112	65	66	67	68	69	69	70
	Stage 1 HT	108	109	110	112	114	115	116	69	70	71	72	73	74	74
	Stage 2 HT	120	121	123	125	126	128	128	82	83	84	85	86	86	87
6	Height - inches	42.2	43.0	44.2	45.5	46.9	48.1	48.8	42.2	43.0	44.2	45.5	46.9	48.1	48.8
	Height - cm	107.3	109.2	112.2	115.7	119.1	122.1	123.9	107.3	109.2	112.2	115.7	119.1	122.1	123.9
	NT	91	92	94	96	98	99	100	53	53	54	55	56	57	57
	PreHT	105	106	108	110	111	113	113	68	68	69	70	71	72	72
	Stage 1 HT	109	110	112	114	115	117	117	72	72	73	74	75	76	76
	Stage 2 HT	121	122	124	126	128	129	130	85	85	86	87	88	89	89

Guías EEUU

- Guías de 2017 de AAP incluyen tabla resumen basadas en talla p5 para edad.
- Guías de 2017 de AAP modifican valores del Fourth Report on PA (NIH Task Force 2004)
 - Excluyen pacientes obesos

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

Rango de HTA neonatal

Gestational age (week)	BP %	SBP (mmHg)	DBP (mmHg)	MAP (mmHg)
26-28	50 th	55-60	30-38	38-45
	95 th	72-75	50-50	57-58
	99 th	77-80	54-56	63-63
30-32	50 th	65-68	40-40	48-48
	95 th	80-83	55-55	63-64
	99 th	85-88	60-60	68-69
34-36	50 th	70-72	40-50	50-57
	95 th	85-87	55-65	65-72
	99 th	90-92	60-70	70-71
38-40	50 th	77-80	50-50	59-60
	95 th	92-95	65-65	74-75
	99 th	97-100	70-70	79-80
42-44	50 th	85-88	50-50	62-63
	95 th	98-105	65-68	76-80
	99 th	102-110	70-73	81-85

*Modified from table presented in reference. SBP=Systolic blood pressure, DBP=Diastolic blood pressure, MAP=Mean arterial pressure, BP=Blood pressure

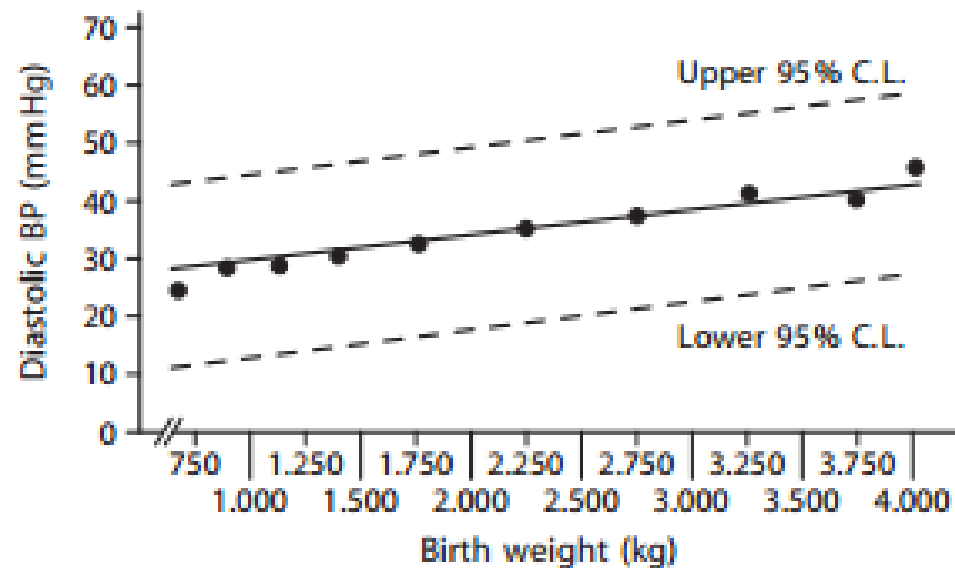
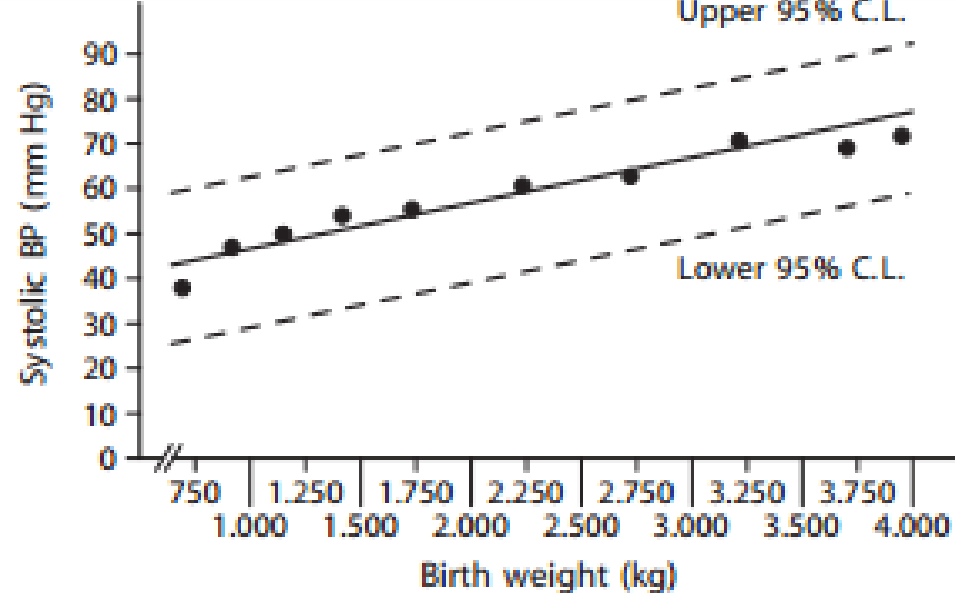


Fig. 1 Linear regression of mean systolic and diastolic blood pressures by birth weight on day 1 of life, with 95% confidence limits (*upper and lower dashed lines*). Reproduced from Zubrow et al. [9], with permission from the copyright holders, Stockton Press, a division of Nature America

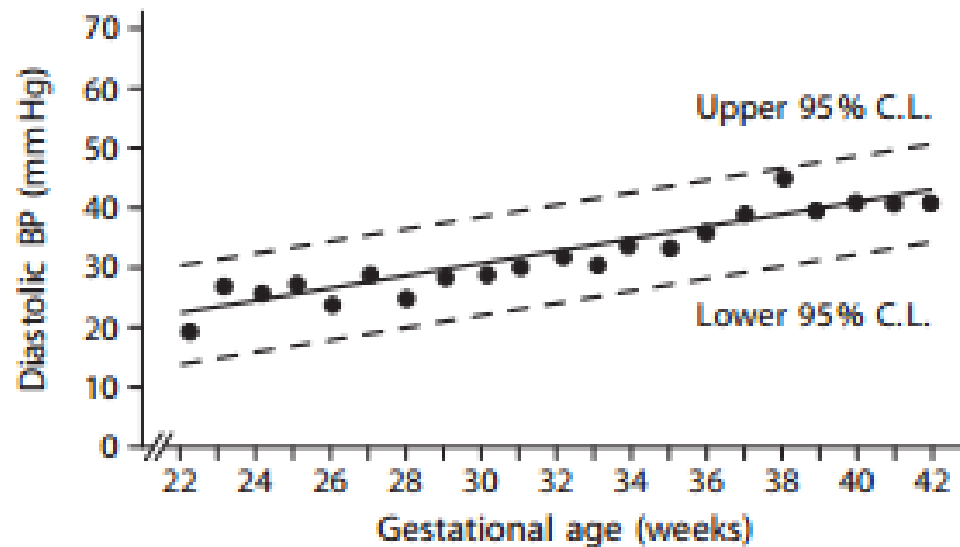
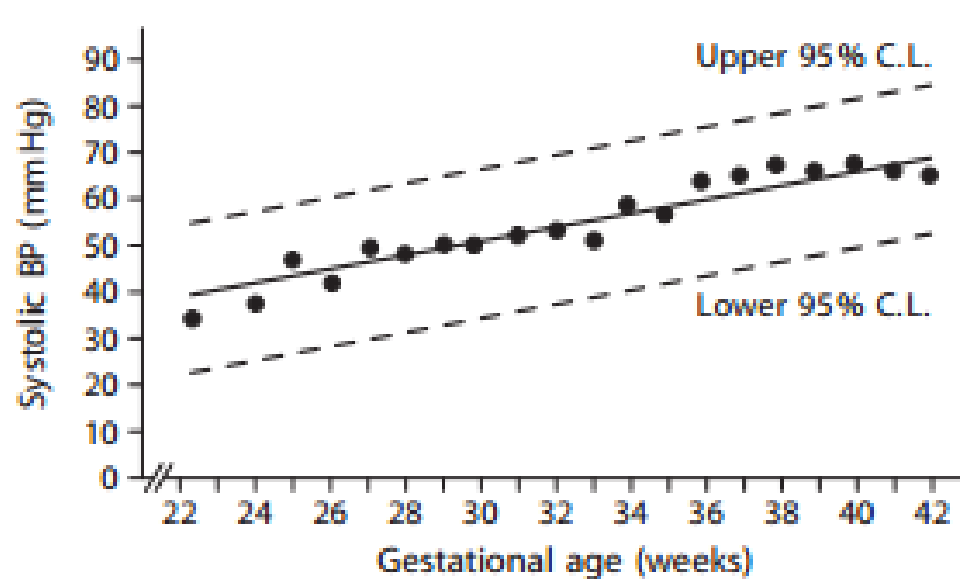


Fig. 2 Linear regression of mean systolic and diastolic blood pressures by gestational age on day 1 of life, with 95% confidence limits (*upper and lower dashed lines*). Reproduced from Zubrow et al. [9], with permission from the copyright holders, Stockton Press, a division of Nature America

Toma correcta de presión arterial

- Niño tranquilo
- Sentado y quieto x 5 min
- Espalda apoyada
- Pies en piso
- Brazo derecho
- Lactante:
 - Se puede tomar en decúbito supino
- Manguito:
 - Ancho: 40% de distancia de olécranon a acromion
 - Largo: 80% a 100% de circunferencia de brazo o 2/3 de longitud de brazo.

Medidas de los manguitos de Presión de acuerdo a la edad.

- Menores de 1 año	- 5 cm.
- 1 a 3 años	- 5 a 8 cm.
- 4 a 8 años	- 9 a 10 cm.
- 9 a 15 años	- 10 a 12 cm.

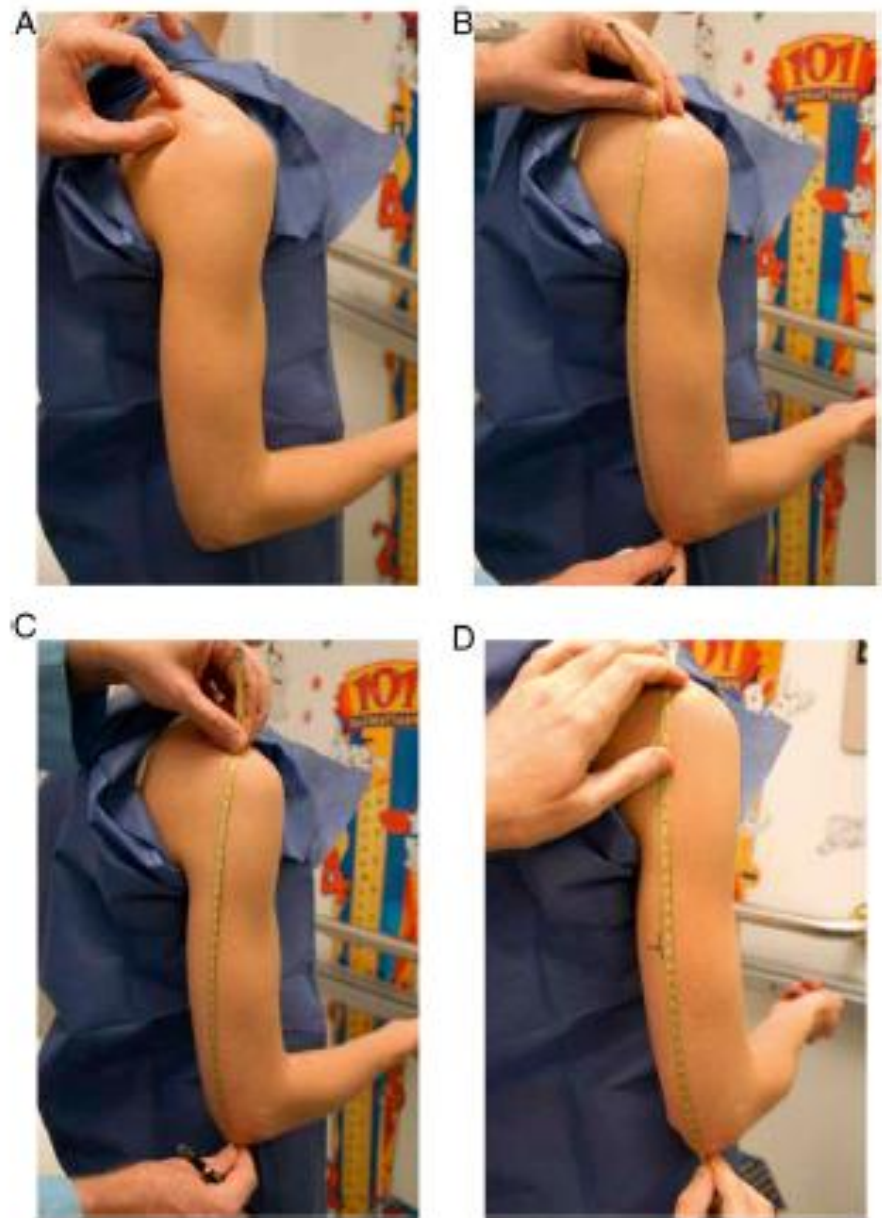
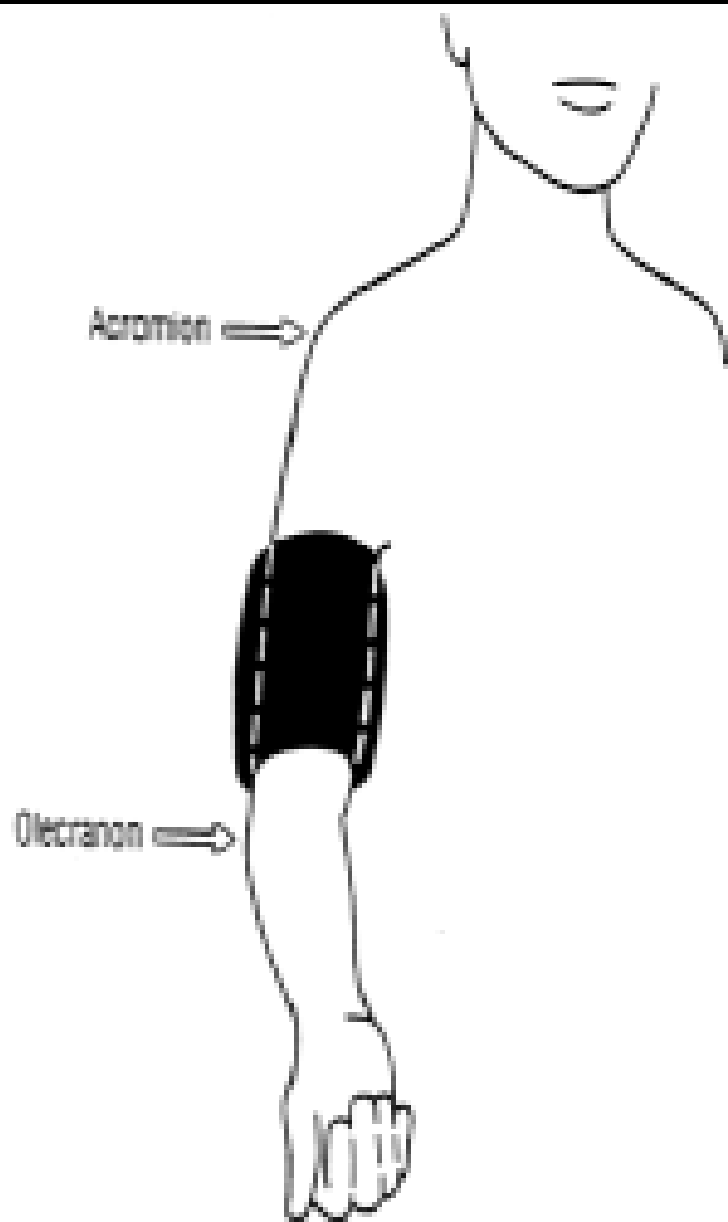


FIGURE 2

Determination of proper BP cuff size.²³ A, Marking spine extending from acromion process. B, Correct tape placement for upper arm length. C, Incorrect tape placement for upper arm length. D, Marking upper arm length midpoint.

Forma correcta de tomar presión

Manómetro convencional de Hg.

Técnica :

- Inflar cuff 20 mmHg sobre desaparición de pulso radial
- Desinflar a velocidad 2- 3 mmHg por segundo
- PA diastólica en fase 5 de Korotkoff
- En cifras sospechosas repetir a lo menos 3 ocasiones diferentes

Ideal: Medir en 4 extremidades

¿A quiénes tomar PA?

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

Medición de PA en > 3 añ

- Recomendaciones europeas
 - > 3 años: Siempre
 - < 3 años: Según antecedentes

Antecedentes:

- Obesidad IMC > p95
- Medicamentos que suban PA
- Historia de enfermedad renal
- Historia de coartación aórtica
- Diabetes



Con antecedentes

- Rutina



Sin antecedentes

- Anual



- Recomendaciones AAP



TABLE 8 Common Pharmacologic Agents Associated With Elevated BP in Children

Over-the-counter drugs	Decongestants Caffeine Nonsteroidal anti-inflammatory drugs Alternative therapies, herbal and nutritional supplements
Prescription drugs	Stimulants for attention-deficit/hyperactivity disorder Hormonal contraception Steroids Tricyclic antidepressants
Illicit drugs	Amphetamines Cocaine

Adapted from the Fourth Report.¹

Tabla 3. Frecuencia y causas de hipertensión arterial en niños menores de 10 años de edad*

<i>Frecuencia</i>	<i>Sistema</i>	<i>Diagnóstico</i>
70 %	Enfermedad del parénquima renal	Glomerulonefritis aguda, glomerulonefritis crónica, pielonefritis crónica, enfermedad renal poliquística, síndrome urémico hemolítico, encapsulación fibrosa del riñón, tumor de Wilms, riñón hipoplásico unilateral, hidronefrosis, lupus eritematoso sistémico, trasplante renal
10 %	Enfermedad renovascular	Estenosis de la arteria renal, trombosis de la arteria renal, trombosis de la vena renal
5 %	Enfermedad cardiovascular	Coartación de aorta, arteritis de Takayasu
3 %	Enfermedad endócrina	Feocromocitoma, neuroblastoma, hipertiroidismo, hiperplasia adrenal congénita, hiperaldosteronismo primario, síndrome de Cushing
0,5 %	Sistema nervioso central	Aumento de la presión intracraneana
0,01 %	Medicamentoso	Agentes simpaticomiméticos
10 %	Hipertensión esencial	

* Tomado de Hanna y col., *J. Pediatr.* 118: 327-340, 1991.

Epidemiología

Etiología esencial en aumento

Prevalencia en aumento

Obesidad

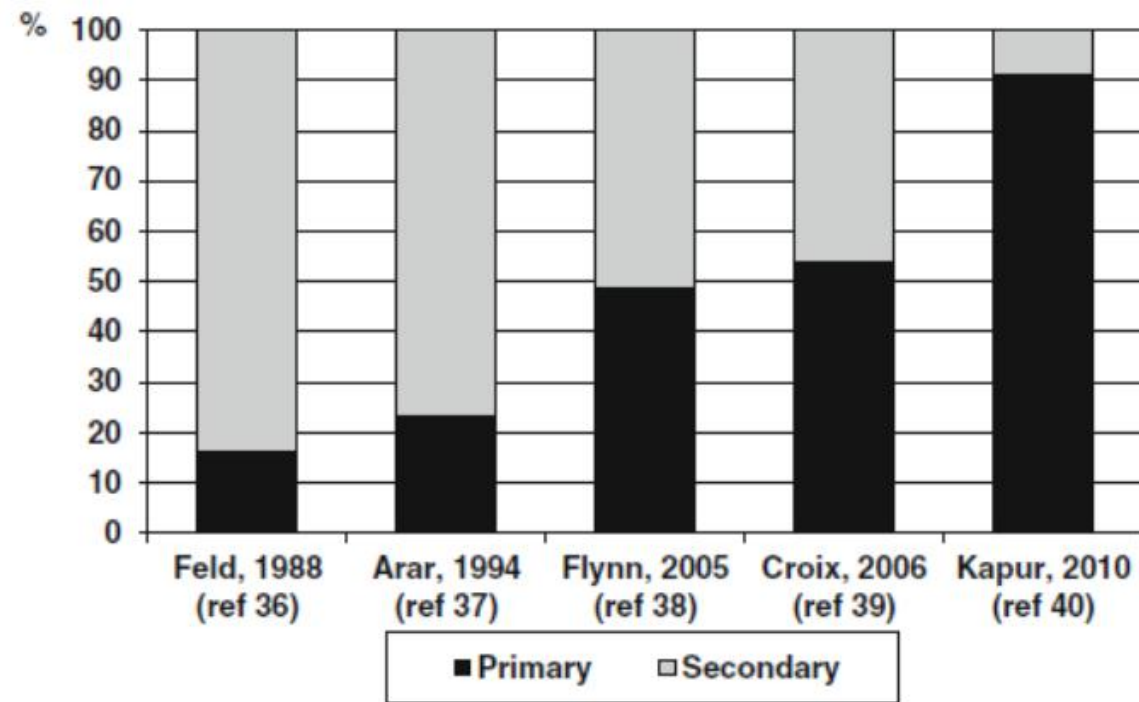


Fig. 1 Frequency of primary hypertension in pediatric referral series

J. Pediatr Nephrol, 2013; 28: 1059-1066

Asia	9.4-24%
Europa	12.8%
Latinoamérica	4.8-15%

Curr Opin Nephrol Hypertens 2012; 21: 318-322.

Prevalencia en Europa

TABLE 4. European studies of hypertension prevalence in children and adolescents

Reference	Patients (n)	Origin	Age range and/or mean age (years)	Methods	Readings (n)	Prevalence (%)
Chiolero <i>et al.</i> [31]	5207	Region of Switzerland	12.3	Oscillometric	Three visits to confirm high blood pressure	2.2
Katona <i>et al.</i> [32]	10 194	Debrecen, Hungary	15–18, 16.6	Oscillometric	Three visits to confirm high blood pressure	2.5
Ostrowska-Nawarycz and Nawarycz [33]	25 309	Tódź, Poland	7–18	Auscultatory method	Separate visits to confirm high blood pressure	4.9
Akgun <i>et al.</i> [34]	1963	Van, Turkey	7–16	N/A	Single visit	9
Maldonado <i>et al.</i> [36]	5381	Portugal	4–18, 12.5	Oscillometric	Single visit	13
Flechtner-Mors <i>et al.</i> [41]	57 915 (overweight or obese)	A total of 188 centers from Germany, Austria and Switzerland	6–18	Oscillometric or auscultatory method	Median blood pressure of 6 weeks	22

Prevalencia en Chile

Rev Méd Chile 2009; 137: 39-45

Tabla 1. Distribución de las presiones arteriales en el grupo de niños estudiados

	Presión arterial sistólica n (%)	Presión arterial diastólica n (%)
Normal	105 (93,7)	112 (100)
Prehipertensión	4 (3,6)	0
HTA estadio 1	3 (2,7)	0
HTA estadio 2	0	0
Total	112 (100)	112 (100)

Epidemiología en Chile

- 2980 escolares chilenos

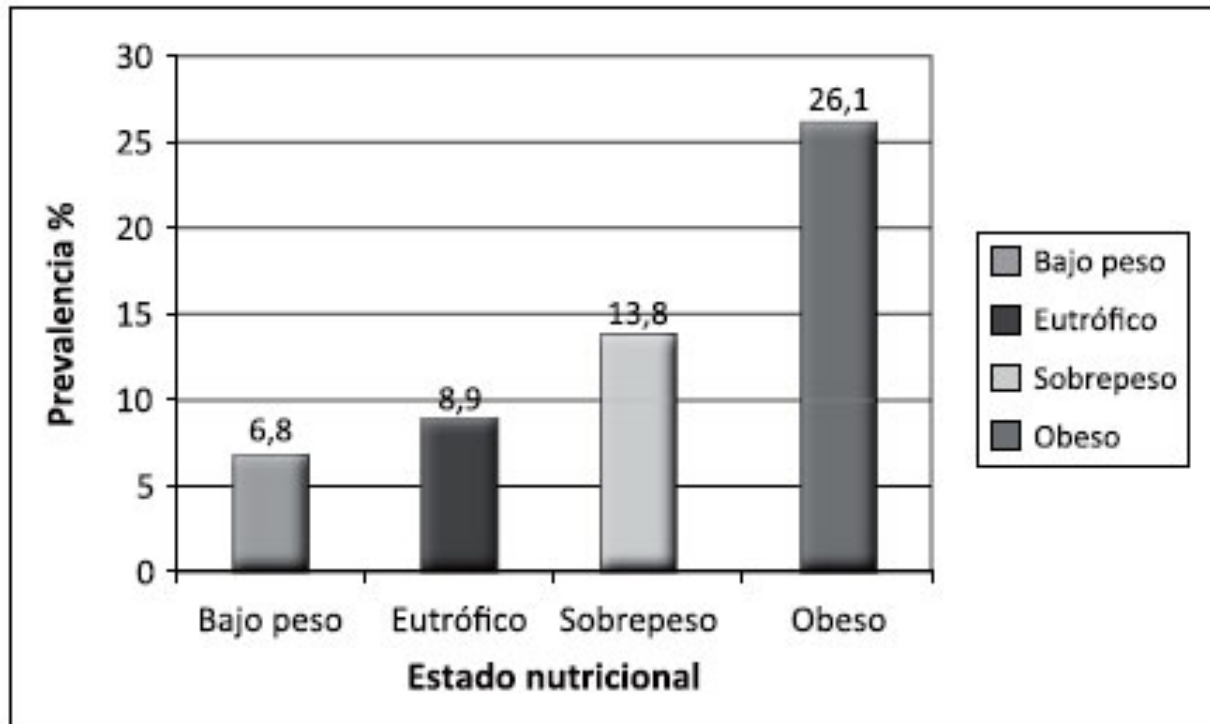


Figura 1. Prevalencia (%) de HTA (sistólica y/o diastólica) según estado nutricional.

Tabla 3. Riesgo del sobrepeso y la obesidad para tener HTA

Sobrepeso*	Obeso*
1,33 (0,88-2,02) ¹	3,12 (2,15-4,53) ²
1,90 (1,31-2,75) ²	4,01 (2,85-5,65) ²
1,62 (1,23-2,14) ²	3,60 (2,80-4,63) ²

Los valores muestran el OR (IC 95%). *= En referencia a la condición nutricional eutrófica. ¹= $p > 0,05$; ²= $p < 0,001$.

Etiologías más frecuentes

TABLA II. Causas de hipertensión en neonatos y lactantes

- Trombosis de la arteria renal tras canalización de la arteria umbilical
- Coartación de aorta
- Lesión renal congénita
- Estenosis de arteria renal
- Displasia broncopulmonar
- Otras menos frecuentes

Etiologías más frecuentes

TABLA III. Causas de hipertensión en niños menores de 10 años

MÁS FRECUENTES	
• Enfermedad renal • Coartación de aorta	
OTRAS	
• Estenosis art. renal • Hipercalcemia • Neurofibromatosis • Tumores neurogénicos • Feocromocitoma • ↑ Mineralocorticoides	• Hipertiroidismo • Transitoria tras cirugía urológica • Transitoria por tracción ortopédica • Esencial

Etiologías más frecuentes

TABLA IV. Causas de hipertensión en la adolescencia

MÁS FRECUENTES

- Enfermedad renal
- ESENCIAL

OTRAS

- Estenosis art. renal
- Hipercalcemia
- Neurofibromatosis
- Tumores neurogénicos
- Feocromocitoma
- ↑ Mineralocorticoides
- Hipertiroidismo
- Transitoria tras cirugía urológica
- Transitoria por tracción ortopédica
- Coartación de aorta

Factores de riesgo

Circulation. 2011;123:292-298.

Table 4. Increase of Systolic and Diastolic BP by Presence of Defined Prenatal, Parental, or Environmental Risk Factors in Comparison to Children Without the Respective Risk Factor

Risk Factor	Prevalence, %	Difference, mm Hg					
		Systolic BP			Diastolic BP		
		Mean	95% CI	<i>P</i>	Mean	95% CI	<i>P</i>
Prematurity	9.0	+1.4	0.5–2.3	0.002			
Birth weight <2500 g	10.7	+0.9	0.1–1.6	0.04			
Maternal smoking during pregnancy	8.0	+1.1	0.2–2	0.03			
Gestational hypertension	5.6	+2.5	1.4–3.5	<0.0001	+1.2	0.4–2.1	0.01
Obesity (BMI >95th percentile)	5.8	+6.0	5.0–7.0	<0.0001	+3.8	3.0–4.7	<0.0001
Overweight (BMI 85–95th percentile)	6.3	+3.6	2.8–4.3	<0.0001	+1.7	1.0–2.4	<0.0001
Chronic medication (eg, steroids or β -sympathomimetics)	1.0	+2.2	0.5–3.9	<0.01	+2.3	0.9–3.7	0.001
Parental hypertension	12.5	+2.1	1.4–2.9	<0.0001	+1.5	0.9–2.1	<0.0001
Parental obesity	17.7	+1.2	0.5–1.8	0.0003	+1.3	0.8–1.8	<0.0001
Parental smoking	33.4	+1.0	0.5–1.3	0.0001	+0.5	0.03–0.9	0.03
Lower parental educational level	44.3	+1.3	0.8–1.8	<0.0001			

CI indicates confidence interval.

Compromiso órgano blanco

Cardiovascular

- HVI (ECG - Ecocardio)
- Aumento grosor íntima - media

Renal

- Microalbuminuria - Proteinuria
- Alt. VFG → Creatinina

Oftalmológico

- Arterias retinianas (fondo ojo)

Cerebral

- Disfunción cognitiva

TABLE 16. Criteria to define hypertension-induced organ damage

LVH

LVH should be defined as LVMI or RWT $\geq$ 95th percentile by age and sex [107–109]

Carotid intima thickness

cIMT $\geq$ 95th percentile by age and sex [113,114]

PWV

PWV $\geq$ 95th percentile by age and sex [84,123,124]

Kidney

Albuminuria (as measured by urinary albumin/creatinine quotient >30 mg/g creatinine or >3 mg/mmol creatinine) or even proteinuria (as measured by urinary albumin/creatinine quotient >300 mg/g creatinine or >30 mg/mmol creatinine) or by 24 h urinary protein excretion (>200 mg/m²/day) [1]

cIMT, carotid intima media thickness; LVH, left ventricular hypertrophy; LVMI, left ventricular mass index; PWV, pulse wave velocity; RWT, relative wall thickness.

Clínica

Síntomas:

- Derivados de HTA o enfermedad causal

Asintomática

Recién Nacidos:

- ICC
- Letargia
- Irritabilidad
- SDRN
- Convulsiones
- Falta de incremento ponderal

Niños:

- Cefalea
- Náusea o emesis
- Poliuria, polidipsia
- Irritabilidad
- Fatiga
- Cambios personalidad
- Epistaxis
- Retardo crecimiento

MAPA

Aumenta capacidad diagnóstica de HTA

- Sobre todo en grupos de > riesgo: DM, Nefrópatas, Uropatías

Mejor correlación con daño de órgano blanco

- Puede ser superior a determinación en box para predecir mortalidad y morbilidad cardiovascular.
- Sin estudios que correlacionen alteración en niños con outcome cardiovascular de adultos

Determina con más precisión:

- PA normal
- Hipertensión de delantal blanco
- Prehipertensión
- Hipertensión ambulatoria
- Hipertensión enmascarada

Parámetros de MAPA

- Mediciones cada 15-30 min durante el día y 20-60 min durante la noche
- Por lo menos una lectura válida cada hora
- Interpretación:
 - Promedio de PAS y PAD (diurno y nocturno)
 - Carga de PAS y PAD (diurna y nocturna)
 - Anormal $\geq 25\%$
 - Dipping nocturno
 - Disminución del promedio de PAS y PAD $\geq 10\%$
 - $([\text{Promedio de PA diurno-nocturno}]/\text{promedio de PA diurno} \times 100)$

Holter de PA aumenta detección de casos en pediatría

Table 1 Basic characteristics of patients

Parameter	DEFINITION A (with MAP)		DEFINITION B (without MAP)		<i>p</i> value
	NT	HTN	NT	HTN	
Number of patients	183	46	192	37	0.0001
Number of diabetics	60	24	64	20	< 0.0001
Number of normotensive patients with kidney disease	18	0	18	0	NS
Age (years)	15.3 (12.9; 16.8)	15.5 (13.2; 16.8)	15.3 (12.9; 16.7)	15.7 (13.2; 17.0)	NS
Gender (male/female)	94/89	22/24	99/93	17/20	N/A
BMI (kg/m ²)	20.9 (18.2; 23.9)	20.9 (19.1; 23.6)	21.0 (18.2; 23.9)	20.9 (19.1; 23.1)	NS
BMI (SDS)	0.3 (−0.2; 1.1)	0.2 (−0.1; 1.1)	0.3 (−0.2; 1.1)	0.2 (−0.1; 1.0)	NS
Height	168.0 (156.2; 177.0)	162.8 (159.2; 173.3)	168.0 (156.6; 176.0)	162.5 (158.9; 173.5)	NS
Weight	60.6 (47; 72.8)	59 (51.8; 70.4)	60.2 (48; 73)	58.9 (48.9; 70.2)	NS
Overweight/obesity	8/33	3/5	8/35	3/3	N/A



MAPA y correlación con órgano blanco

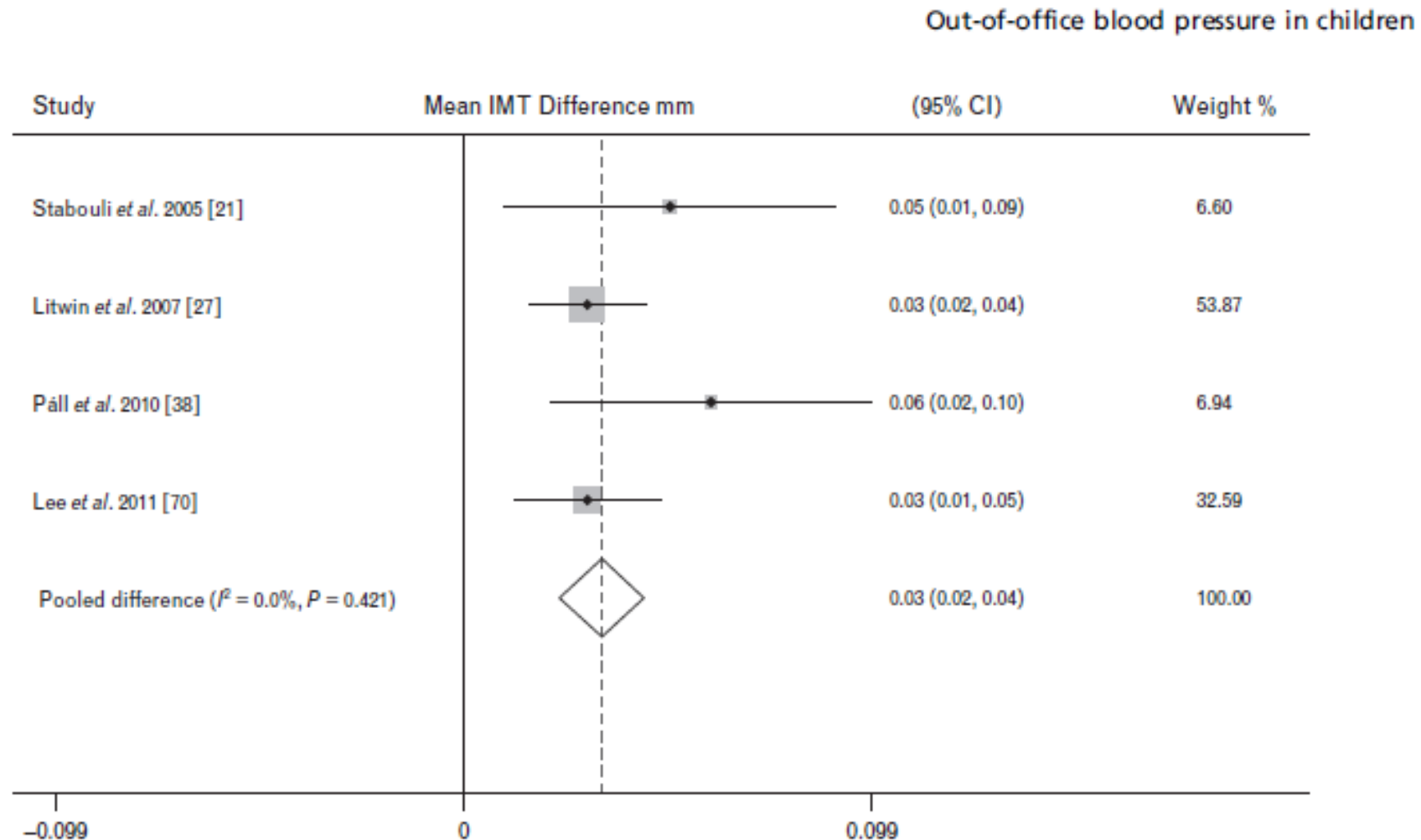


FIGURE 4 Forest plot of pooled differences in carotid intima-media thickness (IMT) between hypertensive and normotensive children.

MAPA

Ventajas



Box 1 ADVANTAGES OF ABPM OVER OFFICE BP MEASUREMENTS

- Provides much larger number of readings
- Provides highly reproducible average 24-h, daytime and night-time values
- Identifies white-coat and masked hypertension phenomena in untreated and treated individuals
- Provides a profile of BP behaviour in the individual's usual daily environment
- Demonstrates nocturnal hypertension and dipping patterns
- Assesses BP variability over the 24-h period
- Assesses the 24-h efficacy of antihypertensive medication
- Detects excessive BP lowering during 24 h
- Is a much stronger predictor of cardiovascular morbidity and mortality

Desventajas



Box 2 LIMITATIONS OF ABPM

- Limited availability in general practice
- May cause discomfort particularly at night
- Reluctance to use by some patients especially for repeat measurement
- Cost implications (though the cost of devices is reducing, which soon may make ABPM possibly more cost effective than clinic measurements)
- Imperfect reproducibility of hourly values
- Provision of intermittent measurements in resting rather than fully ambulatory conditions
- Possibility of inaccurate readings during activity
- Occasional inability to detect genuine artefactual measurements

Table 3. Suggested Revised Schema for Staging of Ambulatory BP Levels in Children

Classification	Office BP*	Mean Ambulatory SBP or DBP†‡	SBP or DBP Load, %‡§
Normal BP	<90th %tile	<95th %tile	<25
White coat hypertension	≥95th %tile	<95th %tile	<25
Prehypertension	≥90th %tile or >120/80 mm Hg	<95th %tile	≥25
Masked hypertension	<95th %tile	>95th %tile	≥25
Ambulatory hypertension	>95th %tile	>95th %tile	25–50
Severe ambulatory hypertension (at risk for end-organ damage)	>95th %tile	>95th %tile	>50

%tile indicates percentile; BP, blood pressure; DBP, diastolic blood pressure; and SBP, systolic blood pressure.

*Based on National High Blood Pressure Education Program Task Force normative data.^{101a}

†Based on normative pediatric ABPM values in Appendix Tables A1 through A4.

‡For either the wake or sleep period of the study, or both.

§For patients with elevated load but normal mean ambulatory BP and office BP that is either normal (<90th percentile) or hypertensive (≥95th percentile), no specific ambulatory BP classification can be assigned based on current evidence and expert consensus. These “unclassified” patients should be evaluated on a case-by-case basis, taking into account the presence of secondary hypertensiona or multiple cardiovascular risk factors.

||Some clinicians may prefer the term *sustained hypertension* rather than *ambulatory hypertension*.

Utilidad de MAPA

- HTA secundaria
- ERC
- DM 1 y 2
- Obesidad
- SAHOS
- Sd. Genéticos
- Pacientes en tto con antihipertensivos

Table 2. Conditions in Which ABPM May Be Particularly Helpful*

Condition	Relevance of ABPM
Secondary hypertension	Elevated load, abnormal dipping and variability
Chronic kidney disease	Prevalence of hypertension, masked hypertension, association with target-organ changes and disease progression
Types 1 and 2 diabetes mellitus	Abnormal circadian variation, association with microalbuminuria and vascular changes
Obesity	Masked hypertension, correlation between BMI and hypertension severity, abnormal dipping, association with target-organ damage
Sleep apnea	Hypertension severity, abnormal circadian variation
Genetic syndromes Neurofibromatosis type 1 Turner syndrome Williams syndrome	Abnormal BP patterns indicating secondary cause of hypertension, especially renal artery stenosis and aortic coarctation
Treated patients with hypertension	Response to antihypertensive medications and/or lifestyle changes
Hypertension research	Reduction in subject number in drug trials

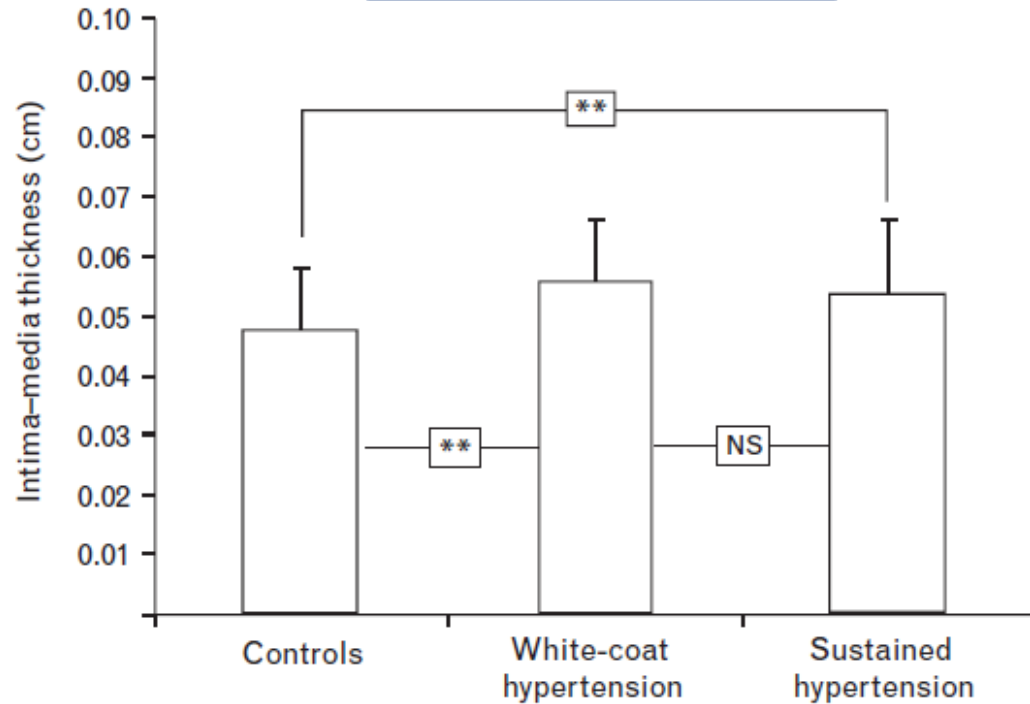
ABPM indicates ambulatory blood pressure monitoring; BMI, body mass index; and BP, blood pressure.

*For a detailed discussion and references, see the [online-only Data Supplement](#).

Hipertenso de delantal blanco no es tan benigno

Grosor íntima – media
de carótidas

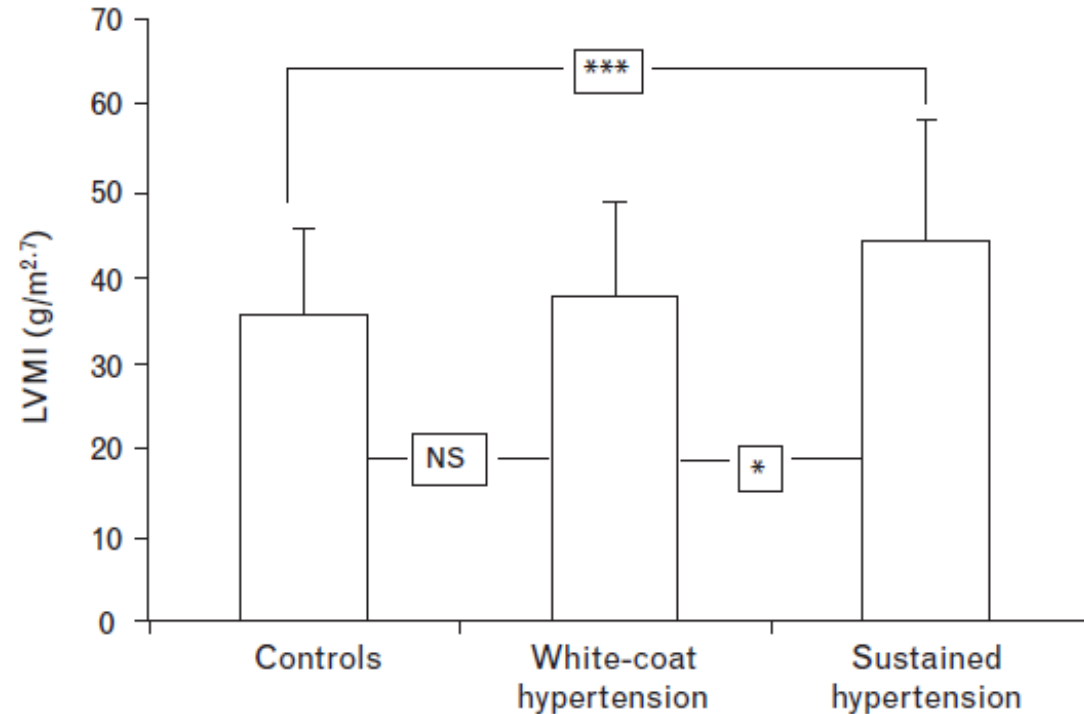
Fig. 1



Intima-media thickness of the common carotid arteries (in cm) in normotensive control persons, in white-coat and in sustained hypertensive adolescents. Means and standard deviations are shown. ** indicates $P < 0.01$.

Índice de masa de
ventrículo izquierdo

Fig. 2



Left ventricular mass index (in g/m^{2.7}) in normotensive control persons, in white-coat and in sustained hypertensive adolescents. Means and standard deviations are shown.

Valores de PA en MAPA diurnos y nocturnos

Hypertension. 2004;43:547-554.)

TABLE 2. Tables of percentiles for ABP (systolic/diastolic) values in children

Height (cm)	Boys			
	Day		Night	
	90th	95th	90th	95th
120	122/80	125/82	103/61	106/63
125	122/80	125/82	105/61	108/63
130	122/80	126/82	106/62	110/64
135	123/80	126/82	108/63	111/65
140	123/80	126/82	109/63	113/65
145	124/79	127/81	111/64	114/66
150	125/79	128/81	112/64	116/66
155	127/79	130/81	113/64	117/66
160	129/79	133/81	114/64	118/66
165	132/80	135/82	116/64	119/66
170	134/80	138/82	117/64	121/66
175	136/81	140/83	119/64	122/66
180	138/81	142/83	120/64	124/66
185	140/81	144/84	122/66	125/66

From [1], by permission.

Valores de PA en MAPA diurnos y nocturnos

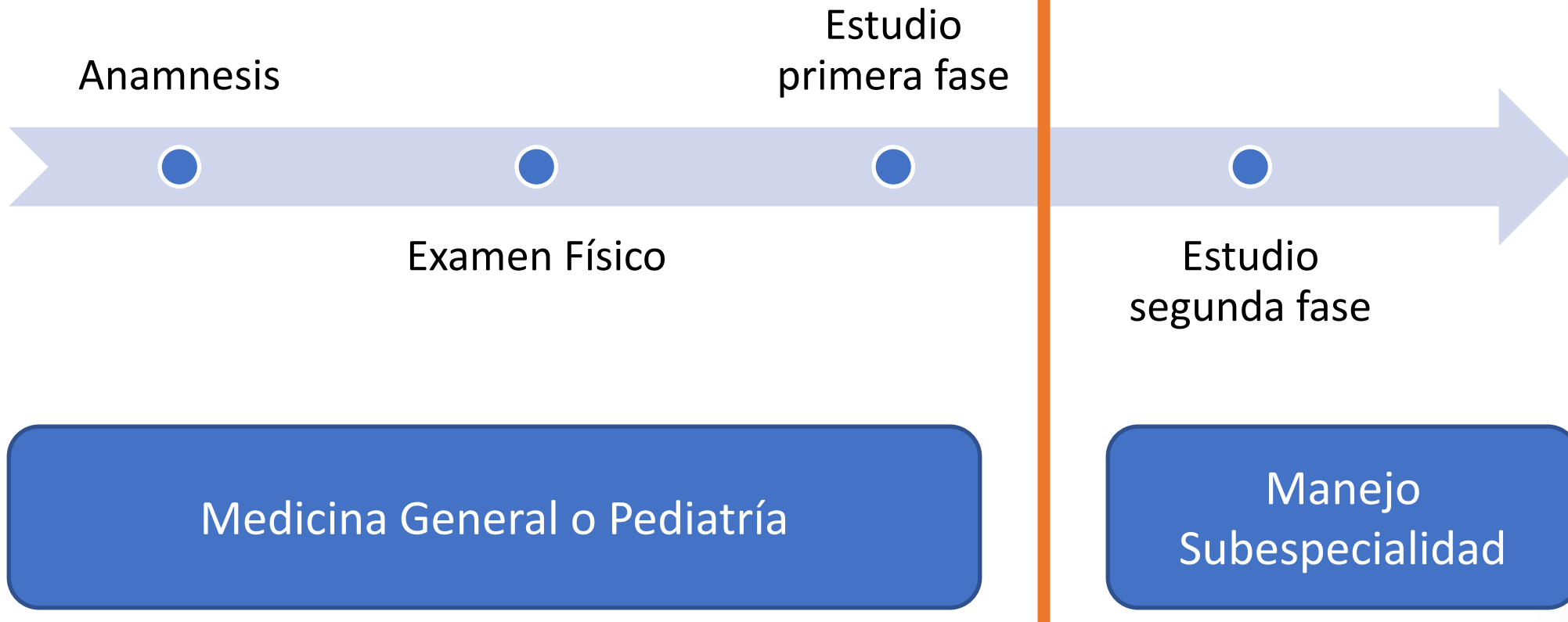
Hypertension. 2004;43:547-554.)

TABLE 2. Table adolescents

Height (cm)	Girls			
	Day		Night	
	90th	95th	90th	95th
120	118/80	120/82	103/63	106/65
125	119/80	121/82	104/63	107/66
130	120/80	122/82	106/63	108/66
135	120/80	123/82	107/63	109/66
140	121/80	124/82	108/63	110/66
145	123/80	125/82	109/63	112/66
150	124/80	126/80	110/63	113/66
155	125/80	128/82	111/63	114/66
160	126/80	129/82	111/63	114/66
165	127/80	130/82	112/63	114/66
170	128/80	131/82	112/67	115/71
175	129/81	131/82	113/63	115/66
180	—	—	—	—
185	—	—	—	—

From [1], by permissio

Secuencia lógica



Guías AAP 2017: No se hace estudio segunda fase en obesos

Anamnesis

Miscelánea

- Edad
- Sexo
- Síntomas
- Antecedentes familiares

Antecedentes perinatales

- SHE
- Peso nacimiento
- Peso placenta

Antecedentes neonatales

- Uso de catéter umbilical
- Estadía en UCI Neo
- DBP

Antecedentes pediátricos

- Glomerulonefritis
- SHU
- ITU
- Nefropatía por reflujo
- Uropatías obstructivas

Examen físico

Peso

Talla

Pulsos

Signos Cushing

Fondo de ojo

Faringe

Palpación
tiroides

Cardiaco: cuarto
ruido, ritmo
galope, soplos

Pulmonar: Frotos
bilaterales bases
pulmonares

Abdomen:
Masas, soplos

Caracteres
sexuales

Exámenes iniciales

□ Sangre:

Función
renal

ELP

P. lipídico

Glicemia

Hemograma
y VHS

□ Orina:

Orina completa

ELU

Microalbuminuria
- Proteinuria

Creatininuria

□ Otros:

EKG

Eco
Cardio

Eco Renal

Fondo de
ojo

Según sospecha diagnóstica

Exámenes	Eventual diagnóstico
Actividad de renina plasmática Aldosterona plasmática y urinaria	Hiperaldosteronismo vs Hiperreninismo
17- Hidroxicorticoesteroides y 17- Ketoesteroides en orina	Hiperplasia suprarrenal congénita con HTA
Uretrocistografía	Nefropatía por reflujo
Ecografía con Doppler Renal Cintigrafía renal pre y post captopril Angio TAC vs Angiorresonancia Angiografía vasos renales	Hipertensión renovascular
Bp renal	Glomerulopatía
Catecolaminas plasmáticas y urinarias	Feocromocitoma

Prevención en pacientes con factores de riesgo

Cambio de estilo de vida

- Involucrar al grupo familiar
- Dieta:
 - Hipocalórica en caso de obesidad
 - Restricción de Sodio en la dieta
 - Rica en potasio
 - Pobre en calcio
 - Aumento consumo magnesio, ácido fólico, grasas insaturadas
- Ejercicio físico
 - Aeróbico
 - 20 a 60 minutos, 3 veces por semana
- Eliminar alcohol y tabaco
- Evitar uso drogas hipertensoras
 - ACO
 - Esteroides
 - Descongestionantes nasales
 - ¿Metilfenidato?

Dieta DASH

TABLE 16 DASH Diet Recommendations

Food	Servings per Day
Fruits and vegetables	4–5
Low-fat milk products	≥ 2
Whole grains	6
Fish, poultry, and lean red meats	≤ 2
Legumes and nuts	1
Oils and fats	2–3
Added sugar and sweets (including sweetened beverages)	≤ 1
Dietary sodium	<2300 mg per d

Adapted from Barnes TL, Crandell JL, Bell RA, Mayer-Davis EJ, Dabelea D, Liese AD. Change in DASH diet score and cardiovascular risk factors in youth with type 1 and type 2 diabetes mellitus: the SEARCH for Diabetes in Youth study. *Nutr Diabetes*. 2013;3:e91; US Department of Health and Human Services, US Department of Agriculture. Appendix 7. Nutritional goals for age-sex groups based on dietary reference intakes and dietary guidelines recommendations. In: *2015-2020 Dietary Guidelines for Americans*. Washington, DC: US Department of Health and Human Services, US Department of Agriculture; 2015; and Expert Panel on Integrated Guidelines for Cardiovascular Health and Risk Reduction in Children and Adolescents; National Heart, Lung, and Blood Institute. Expert Panel on Integrated Guidelines for Cardiovascular Health and Risk Reduction in Children and Adolescents: Summary Report. *Pediatrics*. 2011;128 (suppl 5): S213–S256.

Conducta según PA

J Hypertens 2009 27:1719–1742

Manejo de la hipertensión arterial en niños y adolescentes

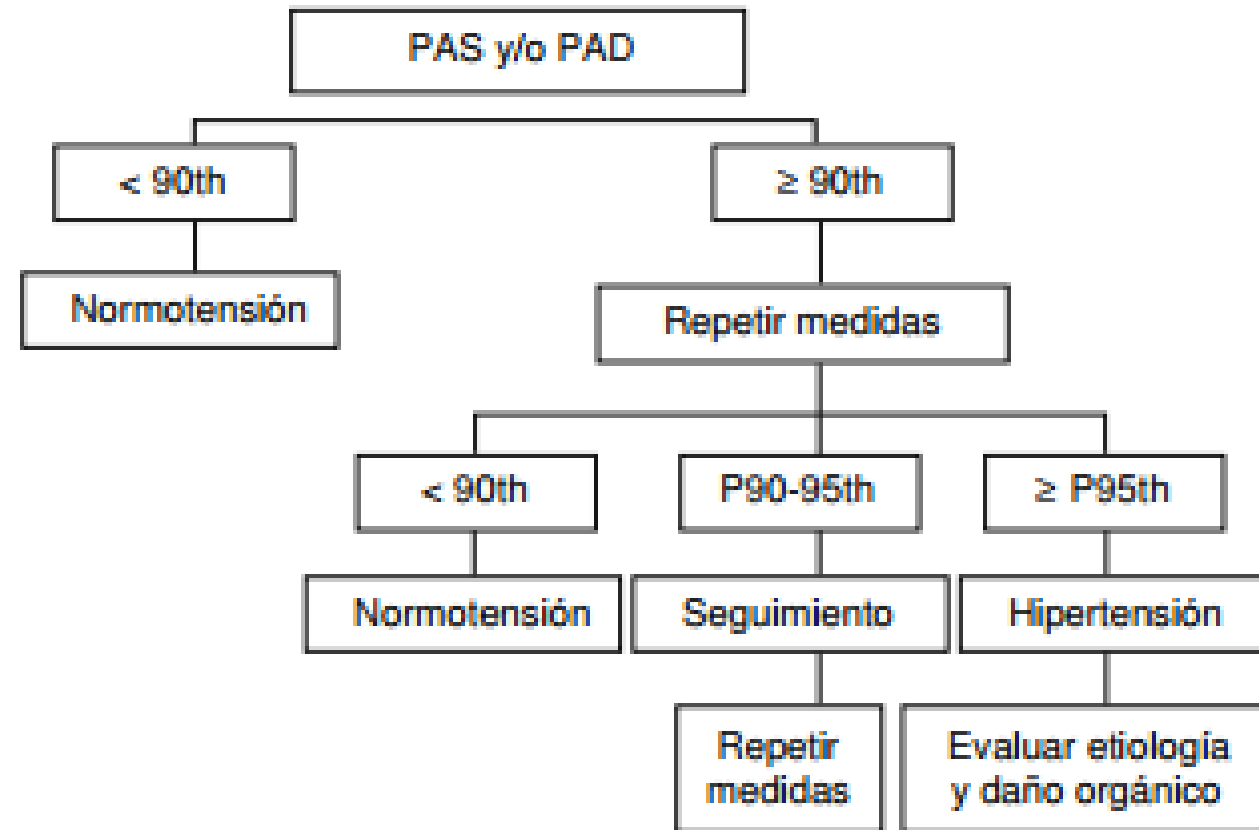
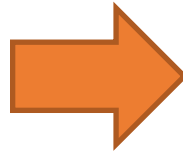


Figura 1 Algoritmo diagnóstico de la hipertensión. P, percentil.

Tratamiento manejo crónico

1° Cambio
estilos de vida

2° Fármacos



- Tratamiento escalonado:
 - Monodroga:
 - IECA
 - BB
 - BCC
 - Asociación dos drogas
 - Agregar diurético

¿Cuándo iniciar fármacos?

J Hypertens 2009 27:1719–1742

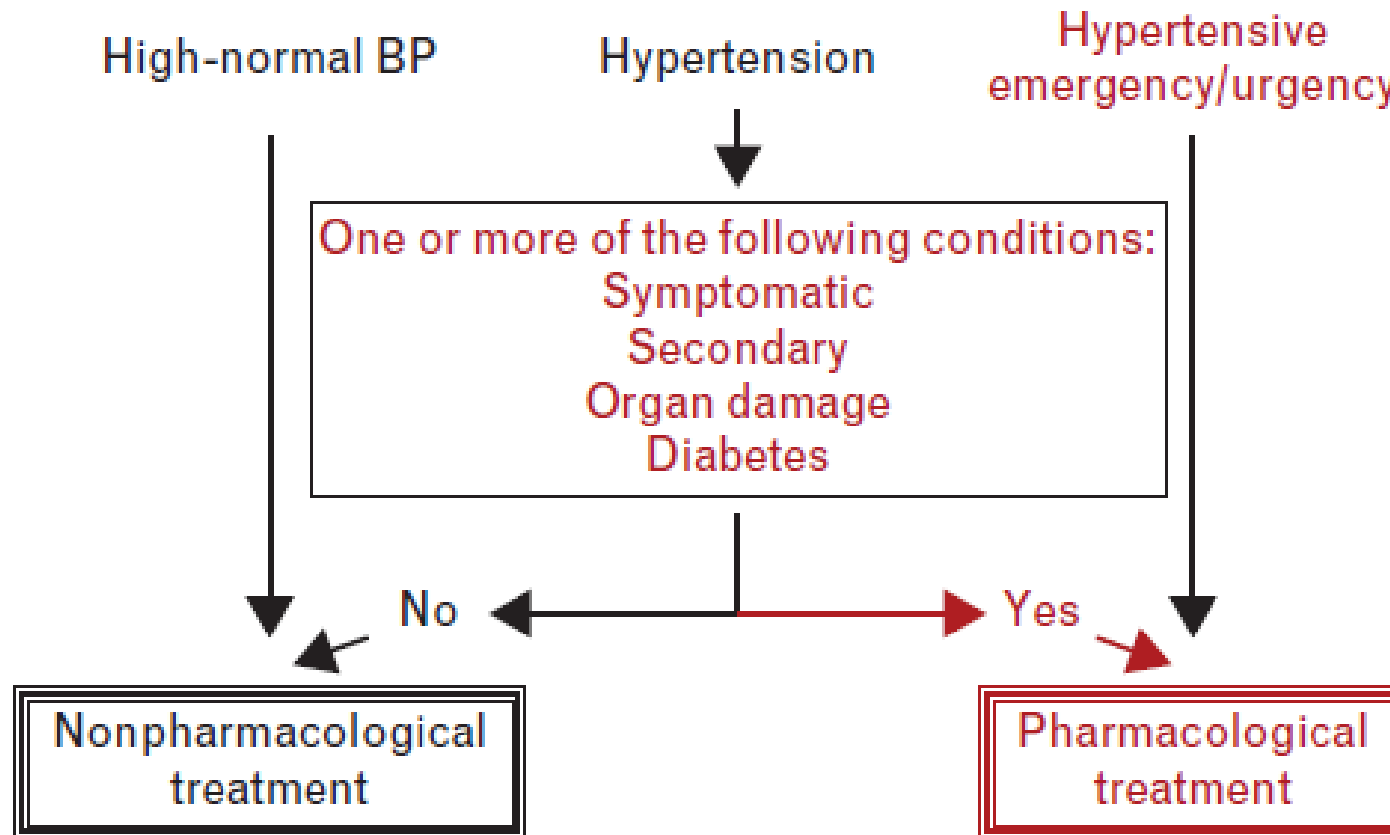


FIGURE 2 When to initiate antihypertensive treatment. One or more of the conditions listed in the box are required for the start of antihypertensive drugs. Persistent hypertension, despite nonpharmacological measures, requires initiation of antihypertensive drug treatment.

Metas de tratamiento

TABLE 17. Blood pressure goal in hypertensive children (for office, home and 24-h ambulatory blood pressure measurements)

General hypertensive population ^a	
Blood pressure goal	<95th percentile is recommended <90th percentile should be considered
DM1 and DM2 ^b	
Blood pressure goal	<90th percentile is recommended <75th percentile is recommended in children with nonproteinuric CKD <50th percentile is recommended in children with proteinuric CKD
Children with CKD ^c	
Blood pressure goal	<75th percentile is recommended in children with nonproteinuric CKD <50th percentile is recommended in children with proteinuric CKD

CKD, chronic kidney disease; DM1, diabetes type 1; DM2, diabetes type 2.

^aIn patients aged 16 years or older, the adult cutoff values for office BP are used, 140/90 mmHg.

^bIn patients aged 16 years or older, the adult cutoff values for office BP are used, 130/80 or 125/75 mmHg with proteinuric CKD.

^cIn patients aged 16 years or older, the adult cutoff values for office BP are used, 130/80 or 125/75 mmHg with proteinuric CKD.

Tabla 7 Dosis iniciales recomendadas para distintos fármacos antihipertensivos seleccionados para el tratamiento de la hipertensión en niños y adolescentes

Clase	Fármaco	Dosis	Intervalo
Diuréticos	Amiloride	0,4–0,6 mg/kg al día	q.d.
	Clortalidona	0,3 mg/kg al día	q.d.
	Furosemida	0,5–2,0 mg/kg por dosis	q.d.–b.i.d.
	Hidroclorotiazida	0,5–1 mg/kg al día	q.d.
	Espironolactona	1 mg/kg al día	q.d.–b.i.d.
Bloqueantes beta adrenérgicos	Atenolol	0,5–1 mg/kg al día	q.d.–b.i.d.
	Metoprolol	0,5–1,0 mg/kg al día	q.d. (LP)
	Propanolol	1 mg/kg al día	b.i.d.–t.i.d.
Bloqueantes del canal de calcio	Amlodipino	0,06–0,3 mg/kg al día	q.d.
	Felodipino ^a	2,5 mg al día	q.d.
	Nifedipina	0,25–0,5 mg/kg al día	q.d.–b.i.d. (LP)
Inhibidores de la enzima de conversión de angiotensina	Captopril	0,3–0,5 mg/kg por dosis	b.i.d.–t.i.d.
	Enalapril	0,08–0,6 mg/kg al día	q.d.
	Fosinopril	0,1–0,6 mg/kg al día	q.d.
	Lisinopril	0,08–0,6 mg/kg al día	q.d.
	Ramipril ^a	2,5–6 mg al día	q.d.
Bloqueantes de los receptores de angiotensina	Candesartan	0,16–0,5 mg/kg al día	q.d.
	Irbesartan ^a	75–150 mg al día	q.d.
	Losartan	0,75–1,44 mg/kg al día	q.d.
	Valsartan	2 mg/kg al día	q.d.

b.i.d.: dos veces al día; LP: liberación prolongada; q.d.: una vez al día; t.i.d.: tres veces al día. No debe excederse en ningún caso la dosis máxima recomendada en adultos.

^aNo se dispone de datos de dosis en función del peso.

Tabla 8 Enfermedades en las que se recomienda el uso de clases específicas de antihipertensivos, o en las que está contraindicado

<i>Clase de antihipertensivo</i>	<i>Recomendado</i>	<i>Contraindicado</i>
Diuréticos ahorradores de potasio diuréticos	Hiperaldosteronismo	Insuficiencia renal crónica
Diuréticos de asa	Insuficiencia renal crónica Insuficiencia cardiaca congestiva	
Bloqueantes beta-adrenérgicos	Coartación de la aorta Insuficiencia cardiaca congestiva	Asma bronquial
Bloqueantes de los canales de calcio	Postransplante	Insuficiencia cardiaca congestiva
Inhibidores de la enzima de conversión de angiotensina	Enfermedad renal crónica Diabetes mellitus	Estenosis bilateral de la arteria renal Estenosis de las arterias renales (en uno de los riñones)
	Insuficiencia cardiaca congestiva	Hiperpotasemia Embarazo Las mujeres en edad fértil deben utilizar un método de contraceptivo fiable
Antagonistas del receptor de la angiotensina	Enfermedad renal crónica Diabetes mellitus	Estenosis bilateral de la arteria renal Estenosis de las arterias renales (en uno de los riñones)
	Insuficiencia cardiaca congestiva	Hiperpotasemia Embarazo Las mujeres en edad fértil deben utilizar un método de contraceptivo fiable
Vasodilatadores intravenosos	Enfermedades potencialmente mortales	