Hypertensione arteriosa Giovanille

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Hypertensione

Hypertension Highlights online from

Paris, France 13-17 June, 2004

XIV European Meeting on Hypertension

New guidelines for hypertension in children will be released by the US NHBLI in the summer of 2004. The classification is based on distribution criteria in a large, cross-sectional database of 68,000 children. Normal blood pressure is $\leqslant$90 th percentile, pre-hypertension the 90-95 th percentile, Stage 1 hypertension 95-99 th percentile, and Stage 2 hypertension $\geqslant$ 99 th percentile. The updated normative tables are now available on the NHLBI website (**http://www.nhlbi.nih.gov/**).

Definizione

La pressione arteriosa systolica e/or diastolica > 95th Percentile per l' eta e per il sesso, almeno in 3 differenti misurazioni

1987 Task Force on Blood Pressure Control in Children

PRESSIONE ARTERIOSA=

Volume effetivo del sangue
X
Resistenze totali Periferiche

Frequenza della HA Giovanille

- 4 %

- 3% Secondaria
- 1% Primitiva

La pressione arteriosa giovanille deve essere misurata una volta l' anno, dopo l'eta di 3 anni

American Academy of Pediatrics and the Task Force on Blood Pressure Control in Children

Quando dovremmo misurare la PA nei ragazzi < 3 anni

- Prematuri VLBW
- Cardiopathie congeniti
- Hematuria, Proteinuria
- Nephropathie
- Malatie systematiche (Tuberus sclerosis, neurofibrosis, SLE)
- Hypertensione endocranica

Hypertensione Neonatale

Adelman's criteria

Systolica e diastolica PA

- > 90 mmHg και > 60 mmHg nei neonati maturi

e

- > 80 mmHg και > 50 mmHg nei prematuri

Frequenza della Hypertensione neonatale

- 0,7 – 3,2 % nei neonati in ICU
- 0,2 % nei neonati maturi
- 8,9 % nei prematuri neonati in ICU
- 43 % dei bambini con BPD durante il primo anno

Method of blood pressure measurement

- Intra – arterial measurement
- Oscillometry (Dinamap) – ICU
- Doppler ultrasound technique
- Plethysmography – continuous blood pressure monitoring by way of a finger cuff
- Conventional sphygmomanometry
- Palpation
- Flush technique

Ragazzi > 3 anni

- IL Miliore metodo per misurare la PA è con l' ascoltazione
- Prima di mettere la diagnosi di Hypertensione giovanille, dovremmo missurare la PA molte volte in diverse visite
- Quando la PA > 90th Percentile per l' eta e per il sesso con "Dinamap" dovremmo misurare la PA con il metodo classico di ascoltazione

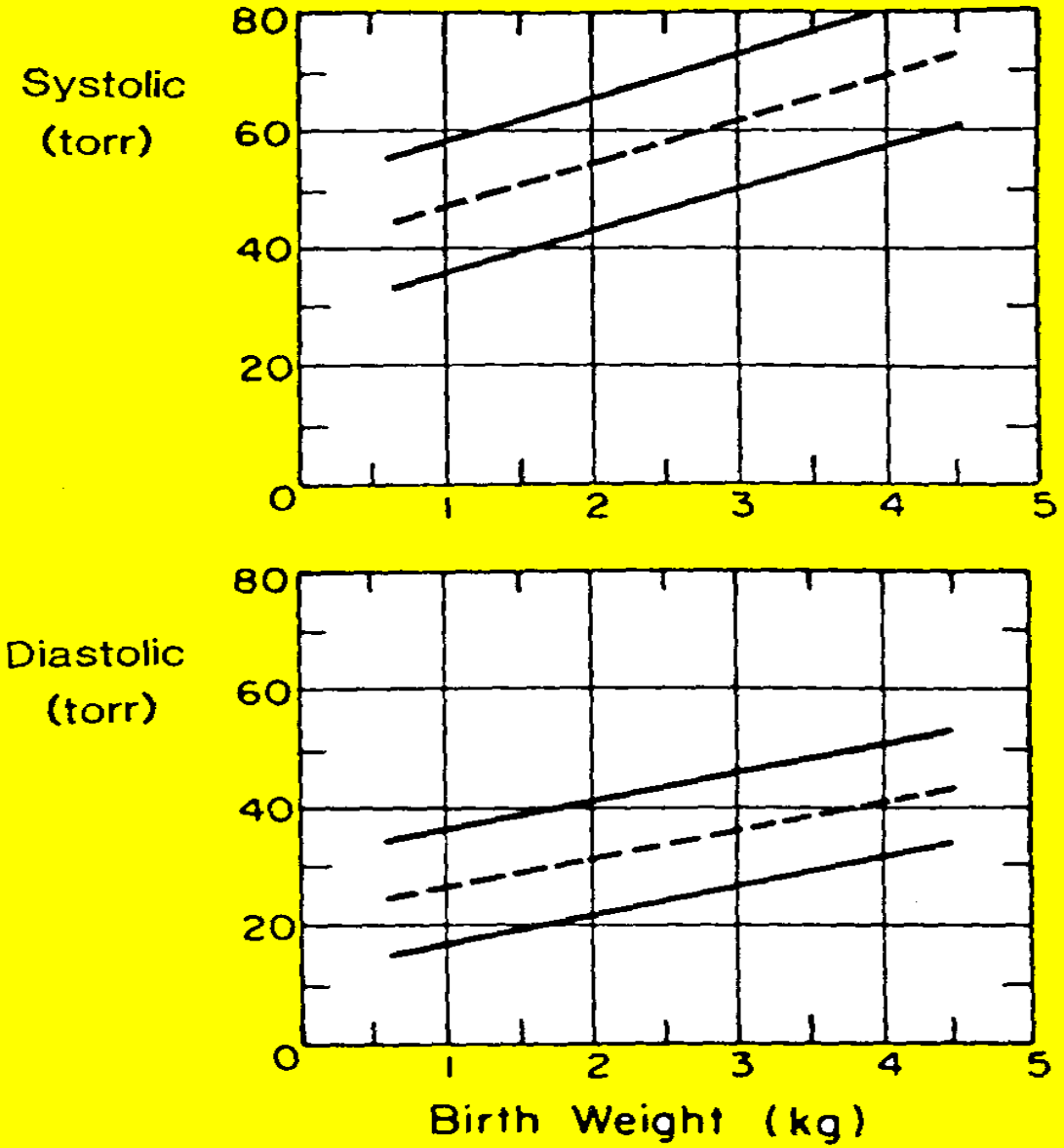


FIG. 4. Linear regression (*broken lines*) and 95% confidence limits (*solid lines*) of systolic (**top**) and diastolic (**bottom**) aortic blood pressures based on birth weight during the first 12 hr of life. (From ref. 20.)

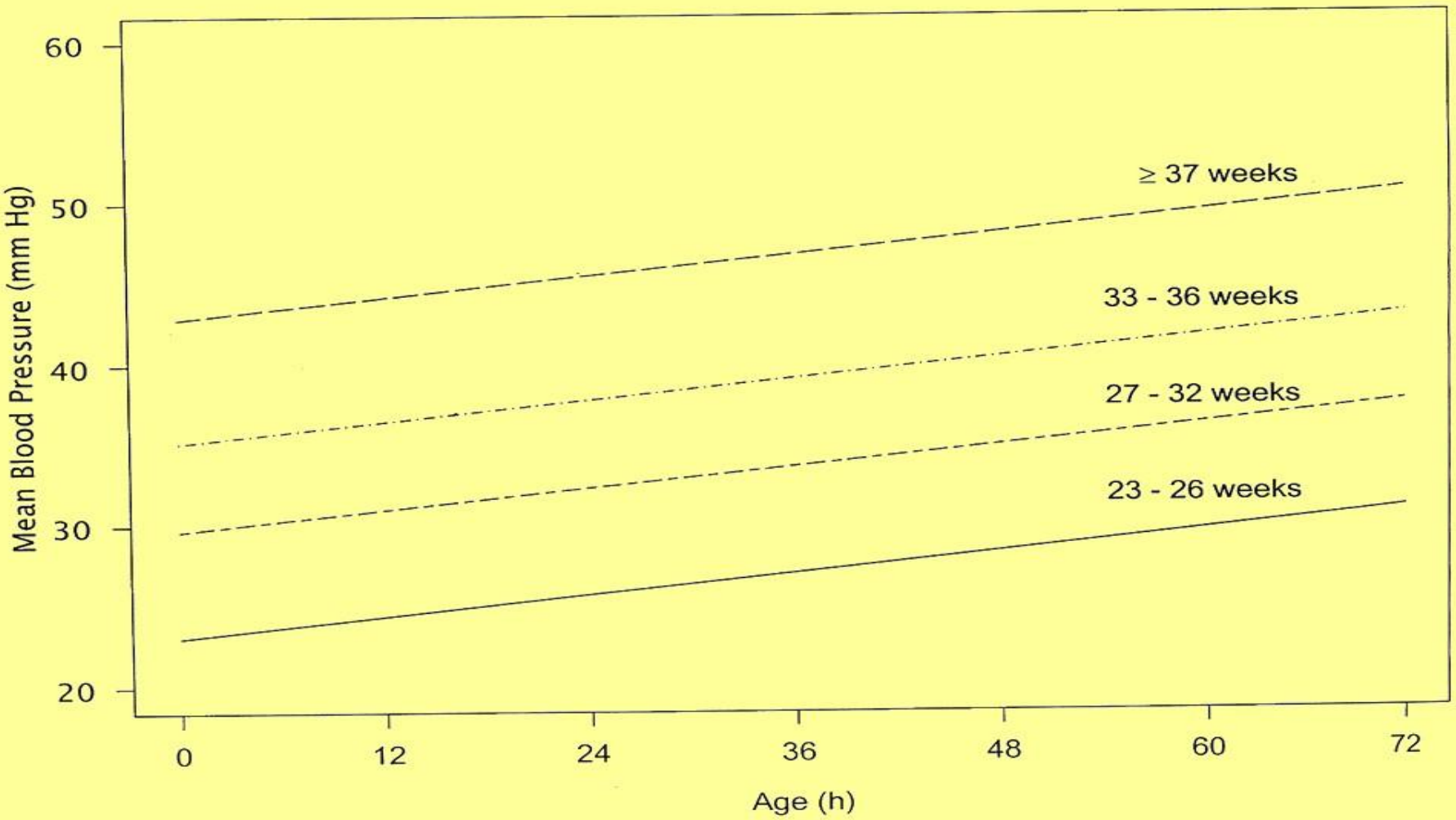


Figure: Normogram for mean blood pressure (BP) in neonates with gestational ages 23 to 43 weeks, derived from continuous arterial BP measurements obtained from 103 infants admitted to the neonatal intensive care unit. The graph shows the predicted mean BP of neonates of different gestational age during the first 72 hours of life. Each line represents the lower limit of 80% confidence interval (two-tail) of mean BP for each gestational age group; 90% of infants for each gestational age group will be expected to have a mean BP value equal or above the value indicated by the corresponding line, the lower limit of the confidence interval.

TABLE 2. *Blood pressure (mean ± SD) during the first month of life*[a]

Age	Blood pressure (mmHg)	
	Systolic	Diastolic
1 day	65 ± 6	48 ± 6
2 days	68 ± 6	50 ± 6
3 days	72 ± 7	53 ± 8
4 days	75 ± 8	56 ± 8
5 days	77 ± 10	55 ± 10
6 days	77 ± 10	55 ± 10
1 week	79 ± 10	55 ± 10
2 weeks	80 ± 10	50 ± 8
1 month	85 ± 10	46 ± 9

[a] Data from AR Sinaiko and from refs. 18 and 19.

Table 2. MEAN ARTERIAL BLOOD PRESSURE (MAP) mm Hg IN PRETERM AND TERM ILL NEONATES FROM BIRTH TO 4 WEEKS

BW-kg	<1.0 kg	1.0–1.5 kg	1.5–2.5 kg	>2.5 kg
Birth	32.9 ± 15.4	39.1 ± 18.2	42.4 ± 19.6	48.8 ± 19.4
7 days	41.4 ± 15.4	47.2 ± 18.2	50.4 ± 19.6	60.2 ± 19.4
14 days	44.6 ± 15.4	50.1 ± 18.2	53.2 ± 19.6	64.2 ± 19.4
28 days	47.6 ± 15.4	53.0 ± 18.2	56.1 ± 19.6	68.3 ± 19.4

Data from Stork EK, Carlo WA, Kliegman RM, et al: Hypertension redefined for critically ill neonates. Pediatr Res 18:321A, 1984; with permission.

Table 3. BLOOD PRESSURES OF 265 FULL-TERM BOYS FROM BIRTH TO 6 MONTHS

Age	Systolic BP (mm Hg)	Diastolic BP (mm Hg)
1st day	67 ± 7	37 ± 7
4th day	76 ± 8	44 ± 9
1 month	84 ± 10	46 ± 9
3 months	92 ± 11	55 ± 10
6 months	96 ± 9	58 ± 10

Adapted from Gemelli M, Manganaro R, Mami C, et al: Longitudinal study of blood pressure during the 1st year of life. Eur J Pediatr 149:318, 1990; with permission.

Table 4. BLOOD PRESSURES OF 254 FULL-TERM GIRLS FROM BIRTH TO 6 MONTHS

Age	Systolic BP (mm Hg)	Diastolic BP (mm Hg)
1st day	68 ± 8	38 ± 7
4th day	75 ± 8	45 ± 8
1 month	82 ± 9	46 ± 10
3 months	89 ± 11	54 ± 10
6 months	92 ± 10	56 ± 10

Adapted from Gemelli M, Manganaro R, Mami C, et al: Longitudinal study of blood pressure during the 1st year of life. Eur J Pediatr 149:318, 1990; with permission.

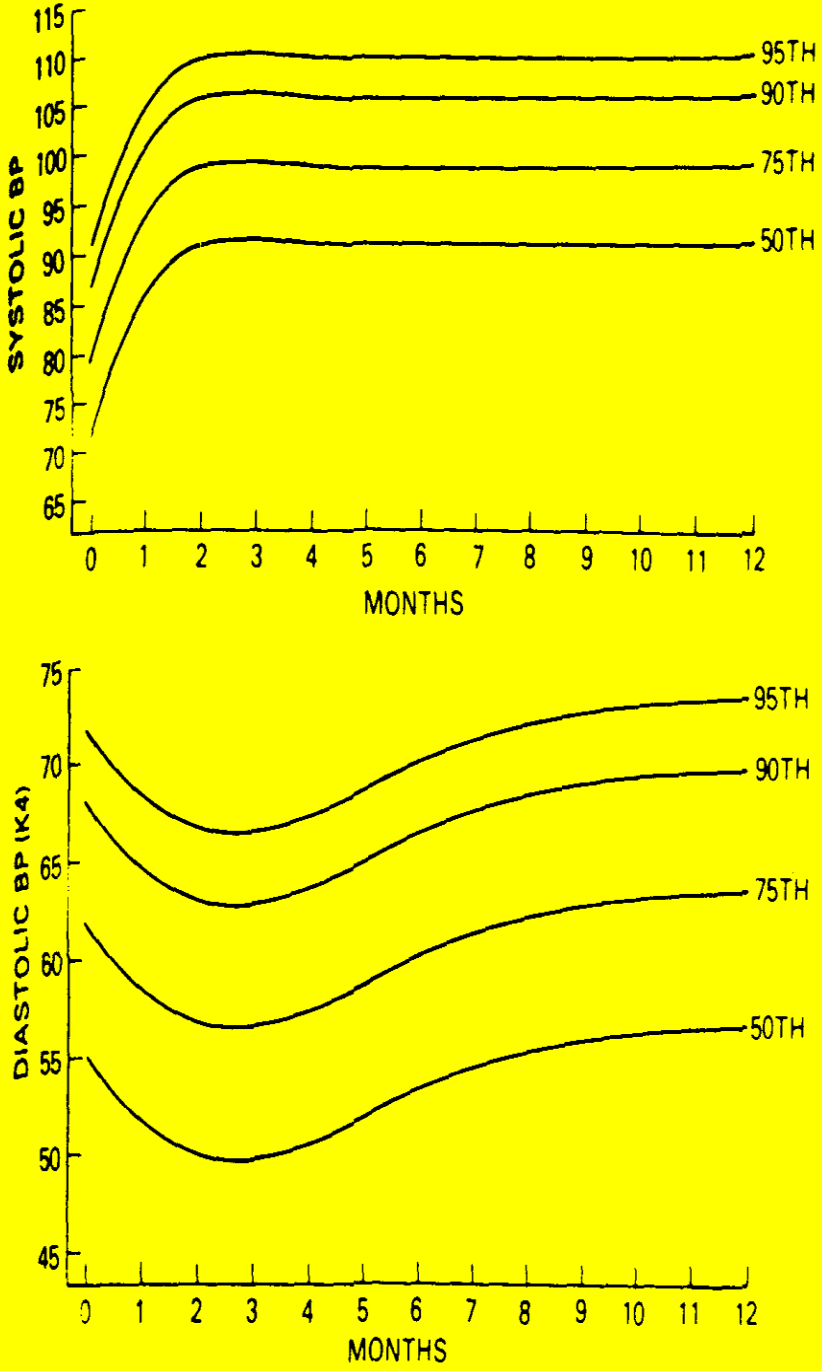


FIG. 1. Age-specific percentiles of blood pressure measurements in boys, birth to 12 months. (From ref. 8.)

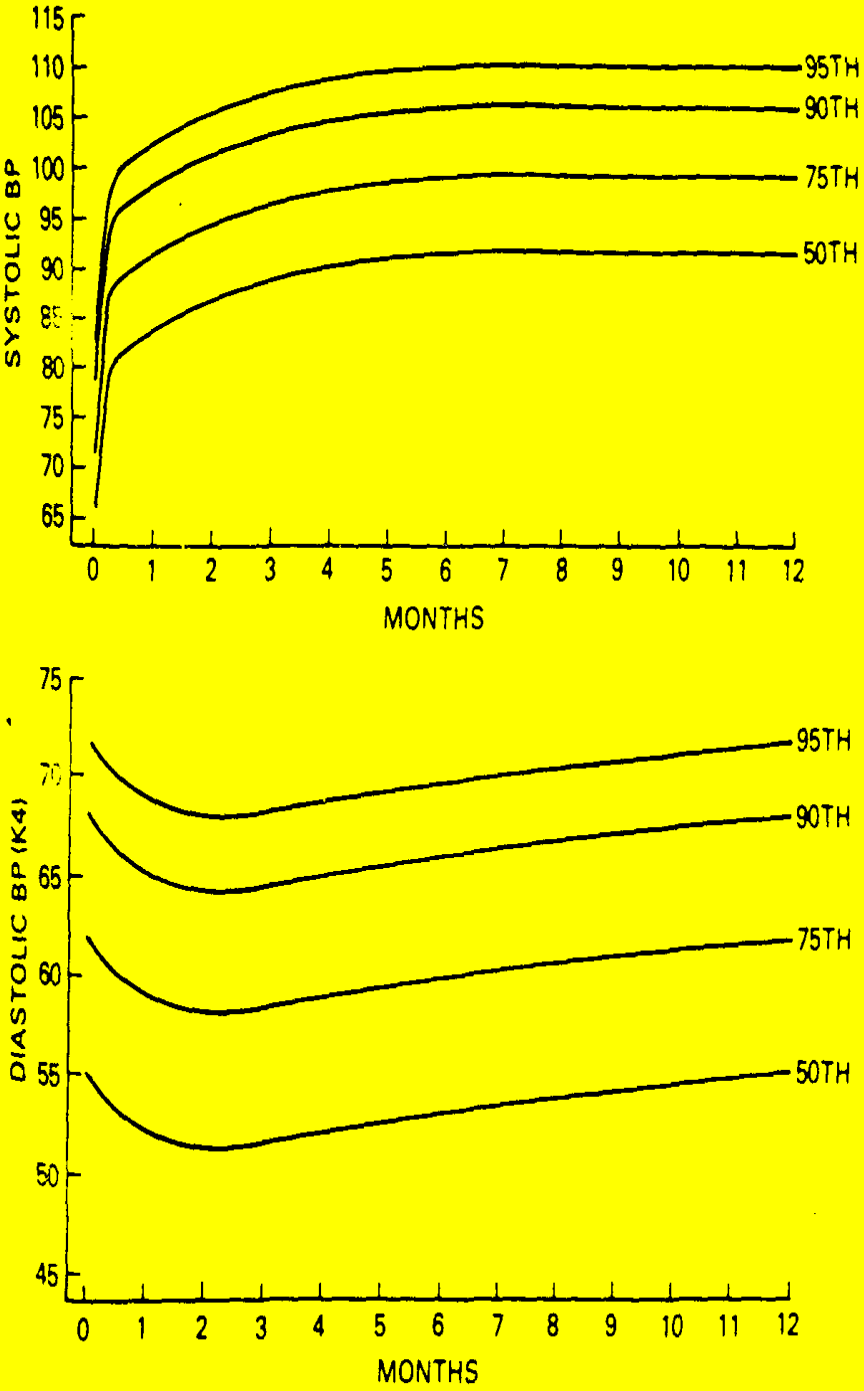
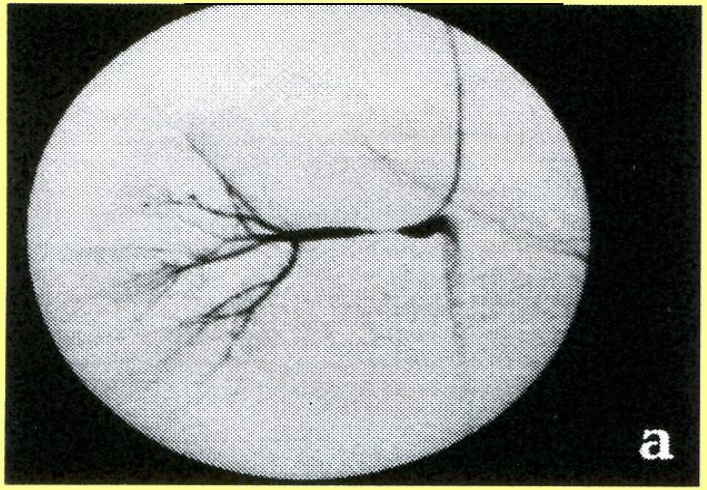


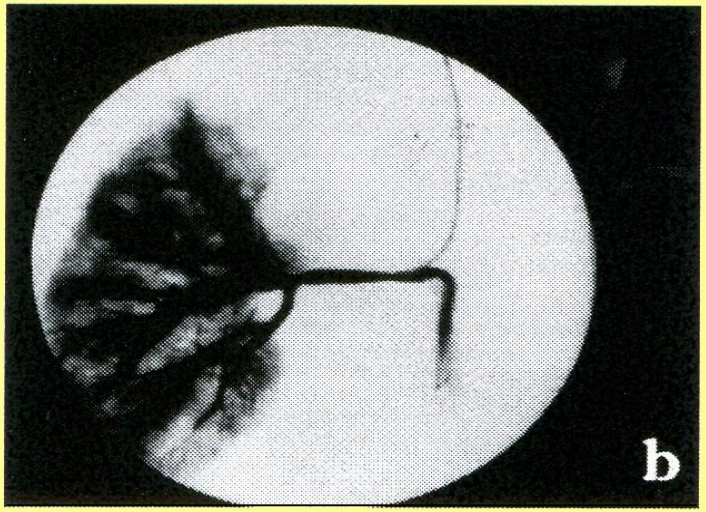
FIG. 2. Age-specific percentiles of blood pressure measurements in girls, birth to 12 months. (From ref. 8.)

Table 5. ETIOLOGIES OF NEONATAL HYPERTENSION

- Renovascular Renal
  - Renal artery thrombosis
  - Congenital renal artery stenosis
  - Renal hypoplasia
  - Renal failure
  - Obstructive uropathy
  - Polycystic kidney disease
  - Congenital mesoblastic nephroma
  - Renal perirenal mass
- Extracorporeal membrane oxygenation
- Bronchopulmonary dysplasia
- Coarctation of the aorta
- Drugs
  - Theophylline
  - Steroids
  - Phenylephrine
  - Cocaine
  - Pancuronium
- Endocrine
  - **11** β-hydroxylase deficiency
  - 17 α-hydroxylase deficiency
  - **11** β-hydroxysteroid dehydrogenase deficiency
  - Dexamethasone suppressible hyperaldosteronism
  - Cushing s syndrome
  - Pheochromocytoma
- Others
  - Seizures
  - Closure of abdominal wall defect
  - Abdominal examination

Fig. 2. Right renal angiography. **a,** Preangioplasty. Segmental diffuse concentric narrowing of the proximal right renal artery is seen. The orifice of the renal artery is saved. **b,** Postangioplasty. The narrowed segment of renal artery is moderately dilated after the balloon angioplasty.





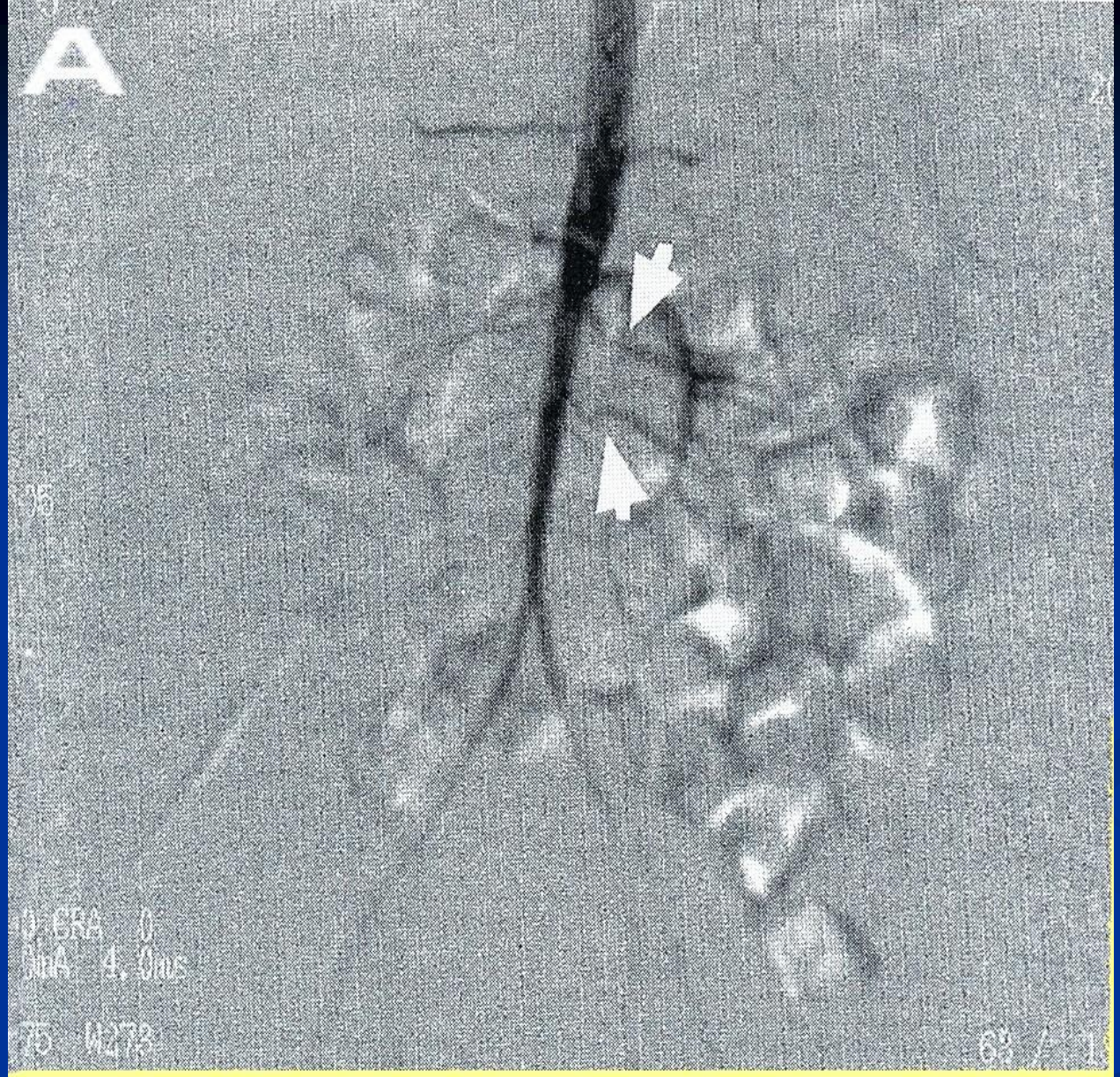


Fig (A) Arteriography of the abdomical aorta at 4 months of age shows 2 left renal arteries arising distal to the superior mesenteric artery. They were constricted (arrows) in the proximal region

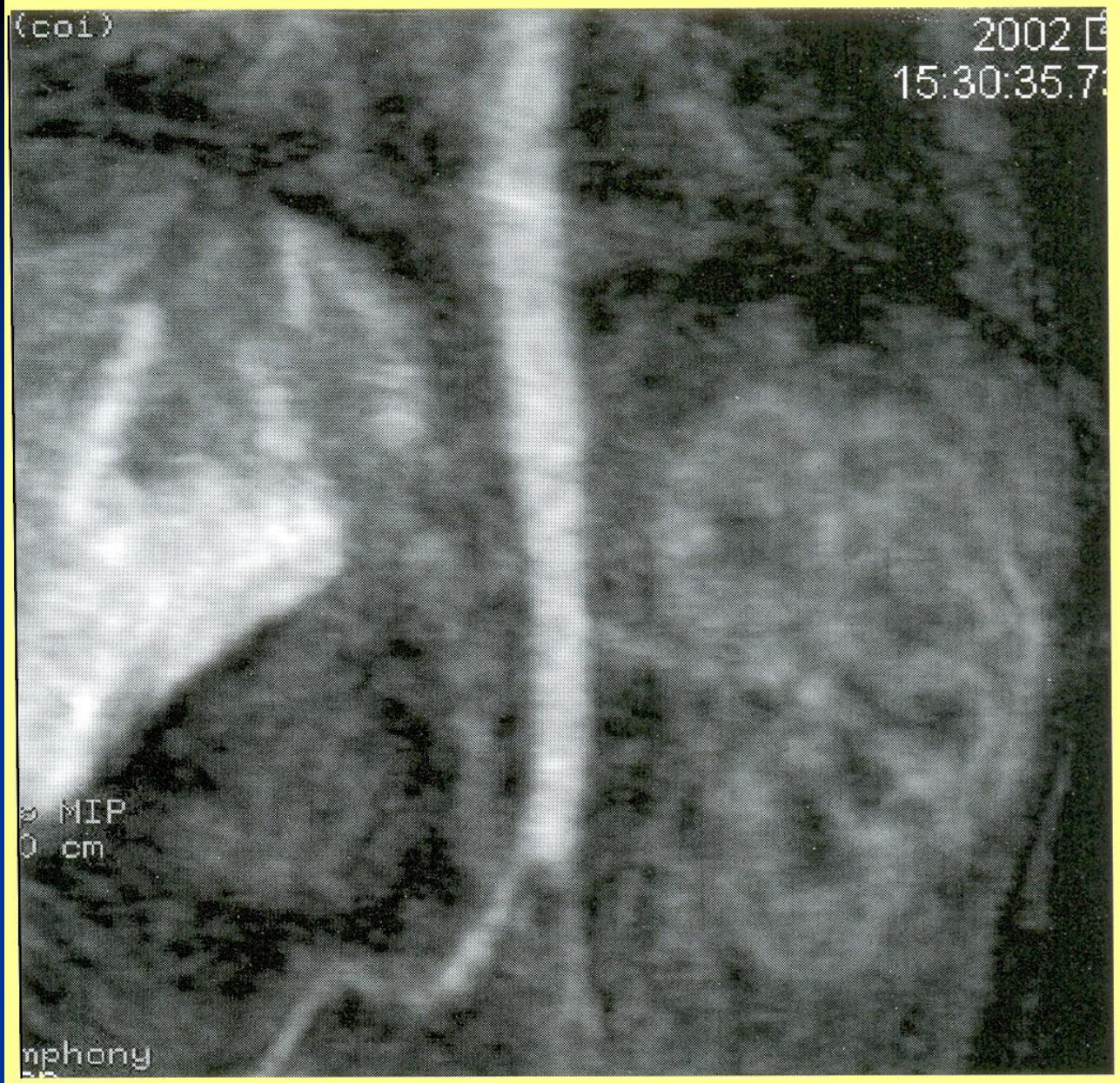


Fig. Abdominal aortic magnetic resonance angiography. The left renal artery and left kidney are clearly delineated. The right renal artery and kidney are not visible

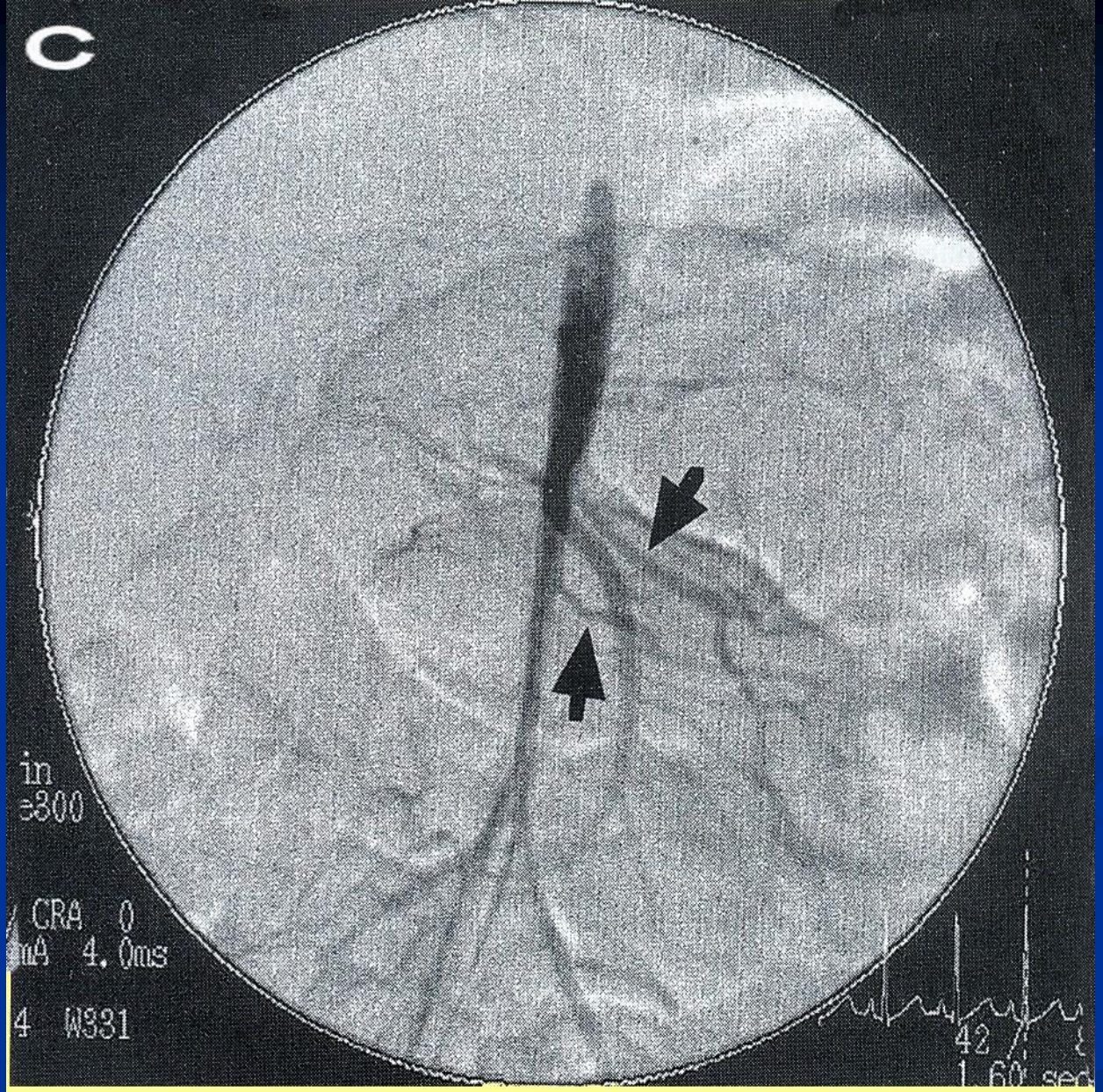


Fig C

At 7 months of age, the 2 left renal arteries again were constricted. A second PTA of the 2 left renal arteries was performed, and both arteries (especially the upper one) were dilated again (arrows; C).

Table 6. CLINICAL SIGNS AND SYMPTOMS OF NEONATAL HYPERTENSION

- Asymptomatic
- Cardiorespiratory
  - Cutaneous mottling
  - Tachypnea
  - Tachycardia
  - Congestive heart failure
    - Hepatomegaly
    - Pulmonary edema
    - Rapid weight gain
    - Left ventricular hypertrophy
  - Decreased or absent femoral pulses
- Neurologic
  - Lethargy
  - Coma
  - Tremors
  - Apnea
  - Opisthotonos
  - Seizures
  - Hemiparesis
  - Hypotonicity
  - Hypertonicity
  - Asymmetric reflexes
  - Facial palsy
  - Cerebral hemorrhage
- Ophthalmologic
  - Hypertensive retinopathy
- Renal
  - Kidney enlargement
  - Oliguria/anuria
  - Polyuria
  - Hematuria
  - Proteinuria
  - Azotemia
  - Hyponatremia
- Failure to thrive

Evaluation of neonatal hypertension

- History
- Physical examination
- Urinalysis
- Serum electrolytes, Ca, PRA
- Renal ultrasound
- Doppler of renal veins and arteries
- Aorta and inferior vena cava
- MAG – 3
- Scanning DMSA
- Renal angiography
- Indagation for pheochromocytoma or endocrine disorder

TABLE 3. *Definitions of blood pressure categories in children*[a]

Blood pressure category	Definition
Normal	Systolic and diastolic blood pressures less than the 90th percentile for sex and age.
High normal	Average systolic and/or diastolic blood pressure between the 90th and 95th percentiles for age and sex.
Hypertension	Average systolic and/or diastolic blood pressures equal to or greater than the 95th percentile for age and sex, with measurements obtained on at least three occasions.

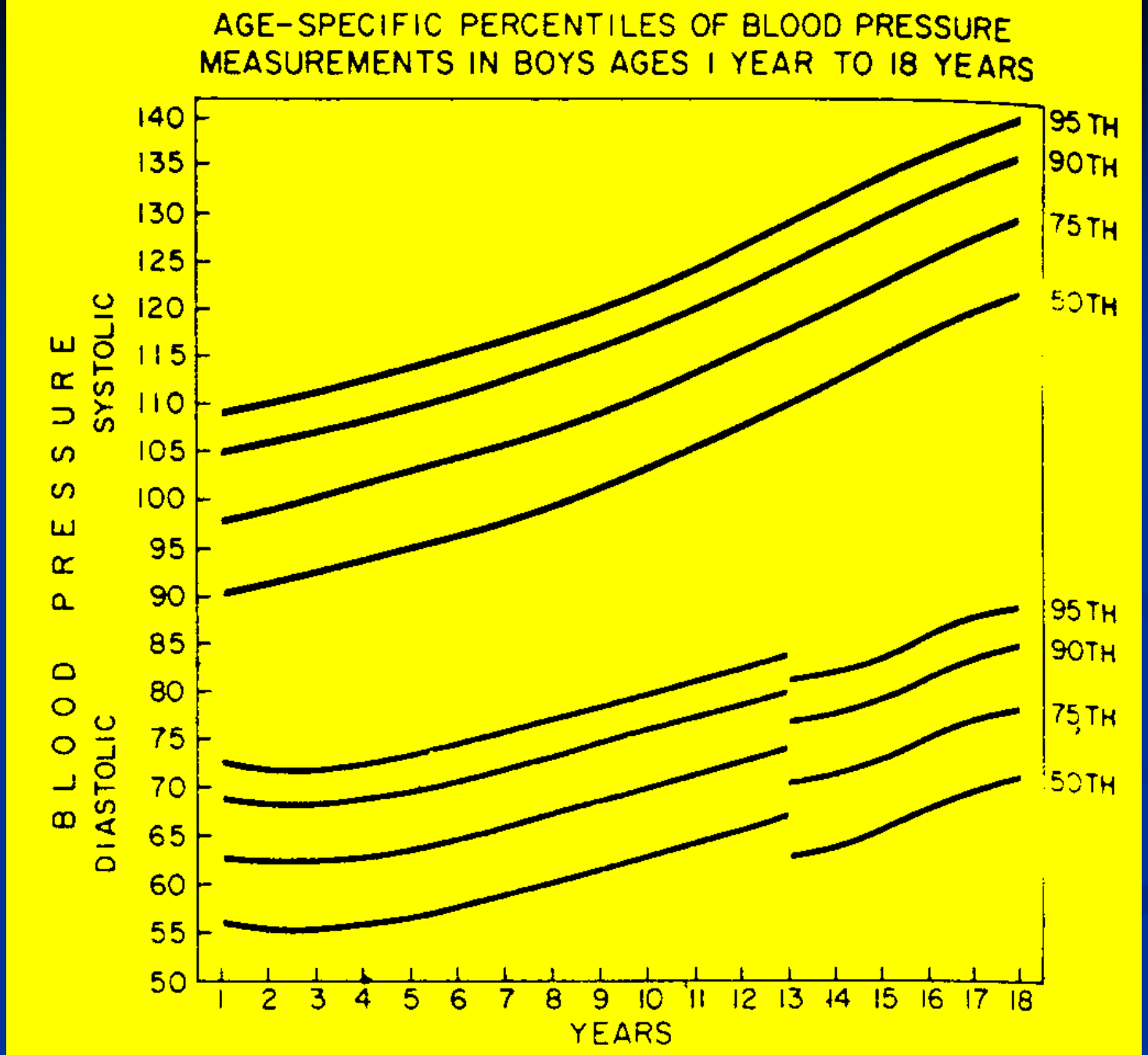
[a] Adapted from the Report of the Second Task Force on Blood Pressure Control in Children—1987 (8).

Table 16.1. 95th Percentile of Blood Pressure in Boys and Girls 3 to 16 Years of Age, According to Height[a]

Blood Pressure	Age, Years	Height Percentile for Boys				Height Percentile for Girls			
		5th	25th	75th	95th	5th	25th	75th	95th
Systolic, mm Hg	3	104	107	111	113	104	105	108	110
	6	109	112	115	117	108	110	112	114
	10	114	117	121	123	116	117	120	122
	13	121	124	128	130	121	123	126	128
	16	129	132	136	138	125	127	130	132
Diastolic, mm Hg	3	63	64	66	67	65	65	67	68
	6	72	73	75	76	71	72	73	75
	10	77	79	80	82	77	77	79	80
	13	79	81	83	84	80	81	82	84
	16	83	84	86	87	83	83	85	86

Data from National High Blood Pressure Education Program Working Group on Hypertension in Children and Adolescents. Update on the task force report (1987) on high blood pressure in children and adolescents: a working group report from the National High Blood Pressure Education Program. *Pediatrics* 1996;98:649–658.

[a]The height percentiles were determined from standard growth curves.


AGE-SPECIFIC PERCENTILES OF BLOOD PRESSURE
MEASUREMENTS IN BOYS AGES 1 YEAR TO 18 YEARS
BLOOD PRESSURE
SYSTOLIC
DIASTOLIC
140
135
130
125
120
115
110
105
100
95
90
85
80
75
70
65
60
55
50
95 TH
90TH
75TH
50TH
95 TH
90TH
75TH
50TH
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
YEARS

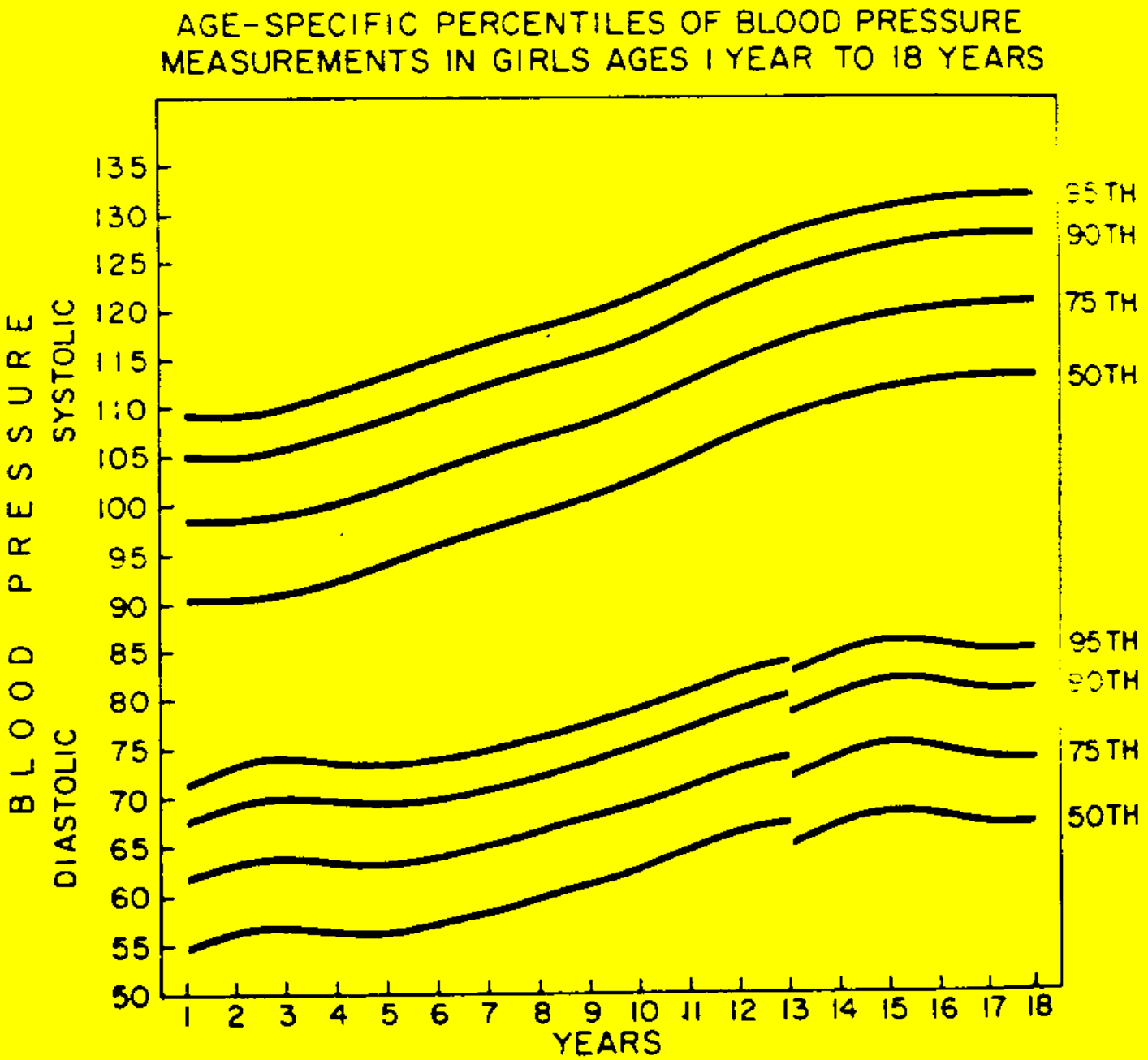

AGE-SPECIFIC PERCENTILES OF BLOOD PRESSURE
MEASUREMENTS IN GIRLS AGES 1 YEAR TO 18 YEARS
BLOOD PRESSURE
SYSTOLIC
DIASTOLIC
135
130
125
120
115
110
105
100
95
90
85
80
75
70
65
60
55
50
95TH
90TH
75TH
50TH
95TH
90TH
75TH
50TH
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
YEARS

Table 16.6. Causes of Hypertension in Children and Adolescents

- Renal
  - Bilateral involvement
    - Glomerulonephritis, acute or chronic
    - Hemolytic-uremic syndrome
    - Acute renal failure
    - End-stage renal disease
  - Bilateral or unilateral involvement
    - Malformations (bilateral polycystic kidneys, hypoplasia, ureteropelvic junction obstruction)
    - Pyelonephritis with or without hydronephrosis
    - Renal arterial disorders
      - Renal artery stenosis
      - Takayasu's disease
      - Neurofibromatosis
      - Thrombosis, embolus
  - Tumors: Wilms's, juxtaglomerular tumors
  - Trauma
- Cardiovascular
  - Coarctation of the aorta
  - Hypoplasia of abdominal aorta
- Endocrine
  - Adrenal
    - Cushing's syndrome
    - Congenital adrenal hyperplasia
  - Aldosteronism
    - Primary; glucocorticoid remediable
    - Apparent mineralocorticoid excess
  - Pheochromocytoma
- Central nervous system
    - Infections, space-occupying lesions
    - Dysautonomia (Riley Day syndrome)
- Burns
- Orthopedic injuries and procedures; traction
- Drug ingestion and abuse
  - Sympathomimetics (including amphetamines)
  - Glucocorticoids
  - Cyclosporine
  - Rebound hypertension with withdrawal of antihypertensive agents
  - Heavy-metal poisoning (lead, mercury)

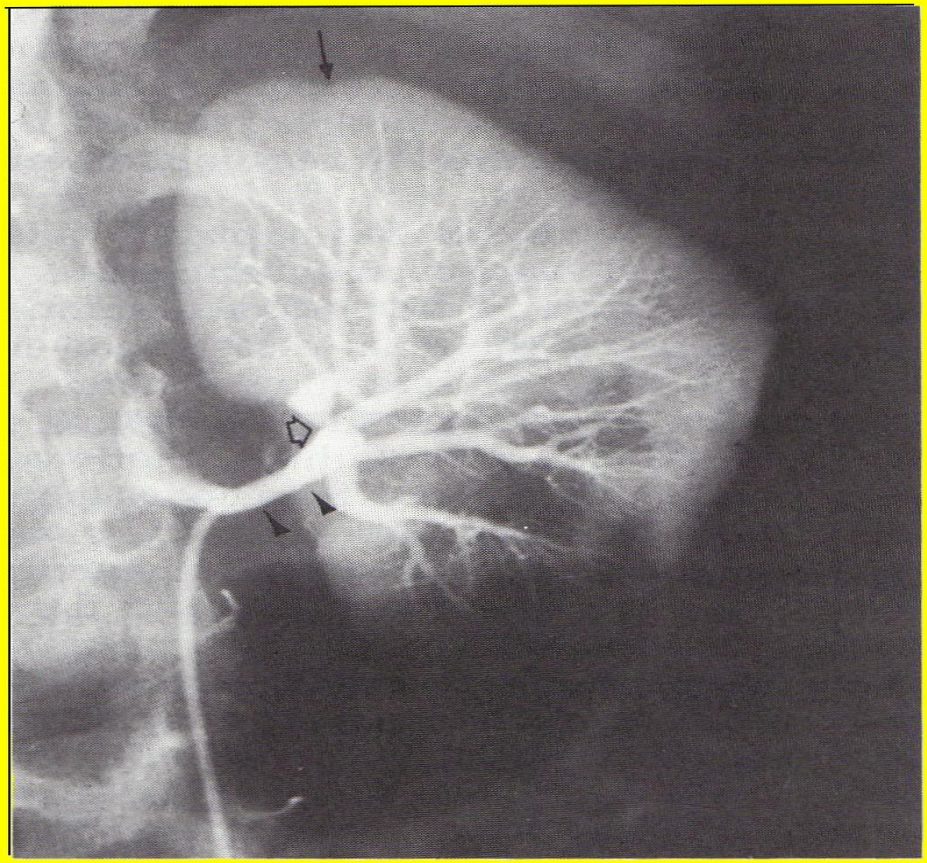


Figure 4. This 4.5-year-old girl with renal artery stenosis presented with severe hypertension and headaches. Results of renal sonography were normal. Renal arteriography was requested. During selective injection of the left renal artery, a severe, focal stenosis at the origin of an upper pole lobar artery was demonstrated *(open arrow).* There is also more subtle, irregular narrowing of the main renal artery *(arrowheads),* consistent with fibromuscular dysplasia. A notchlike defect in the upper pole of the kidney represents a parenchymal infarct *(arrow).*

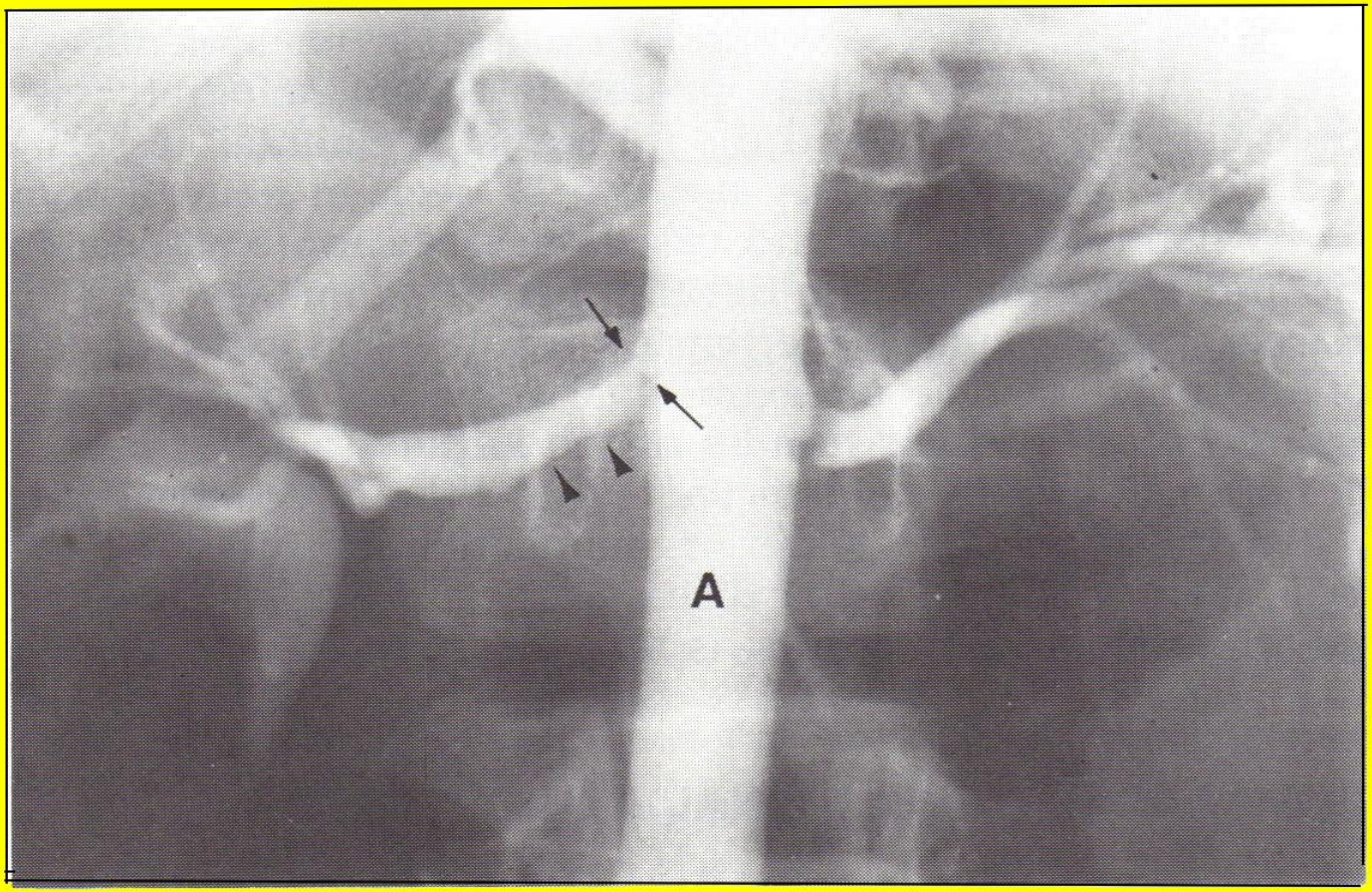


Figure 5. This 12-year-old girl with renal artery stenosis and neurofibromatosis developed severe hypertension (diastolic pressures from 130 to 145 mm Hg). Severe stenosis of the aortic ostium of the right renal artery *(arrows)* with diffuse narrowing of the remainder of the main right renal artery *(arrowheads)* was demonstrated during renal arteriography. A = aorta.

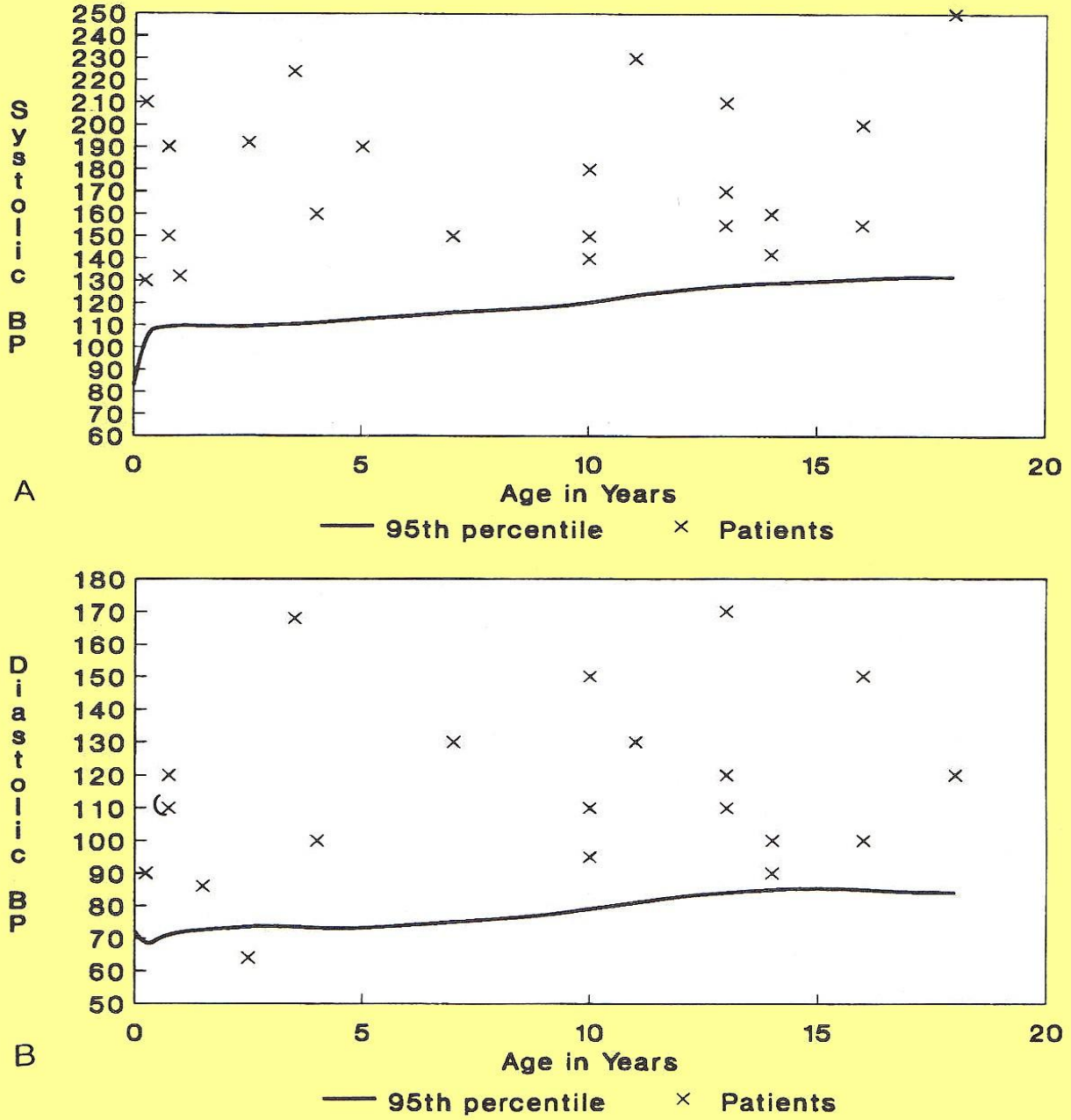


Figure 1. Levels of blood pressure in pediatric renal artery stenosis. *A,* Systolic BP in renal artery stenosis. Girls, birth to 18 years. *B,* Diastolic BP in renal artery stenosis. Girls, birth to 18 years.

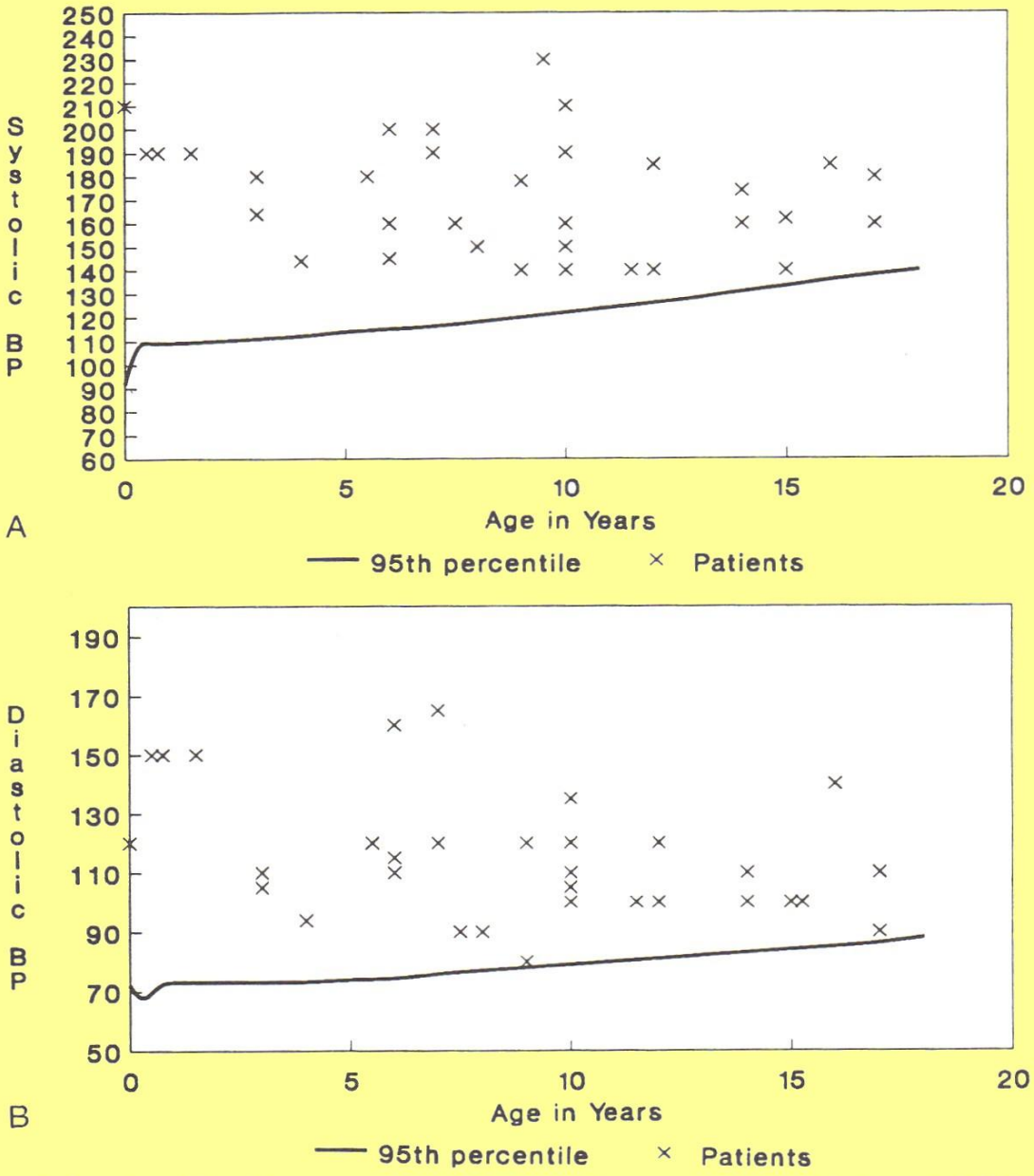


Figure 2. Levels of blood pressure in pediatric renal artery stenosis. *A,* Systolic BP in renal artery stenosis. Boys, birth to 18 years. *B,* Diastolic BP in renal artery stenosis. Boys, birth to 18 years.

TABLE 7. *Symptoms and signs of hypertension in children and adolescents*

Failure to thrive (i.e., growth retardation)
Nausea and/or vomiting
Lethargy
Irritability
Headache
Visual problems
Cardiac failure
Seizures
Stroke
Facial palsy

Table 16.5. Evaluation of Asymptomatic Children and Adolescents with Persistently Elevated Blood Pressure Levels

- History
  - Family
    - Primary hypertension and/or its complications
    - Familial obesity, hyperlipidemia
    - Genetic disorders associated with hypertension
    - BP elevations in siblings
  - Patient
    - Past or present history of events that influence BP (e.g., radiation to kidney, recurrent urinary tract infection, drugs with pressor properties)
    - Dietary intake; calories, sodium
- Physical examination
  - Vital signs: pulse, height, weight
  - BP in the right upper arm (by convention) and one leg
  - Clues to secondary causes: coarctation, Cushing's syndrome, abdominal mass or bruits
  - Target organ damage: funduscopic, cardiac
- Laboratory studies (limited)
  - Urinalysis
  - Hematocrit
  - BUN/creatinine; electrolytes
  - Lipid levels
  - Echocardiography

Diagnostic evaluation of the hypertensive child

- Complete blood count
- Serum electrolytes, creatinine, urea nitrogen, calcium, uric acid, cholesterol
- Urinalysis
- Urine culture
- Plasma renin activity (PRA)
- Renal ultrasound
- Isotopic renogram
- Echocardiogram
- Urine collection for catecholamines
- Plasma and urinary steroids
- Ambulatory blood pressure monitoring (ABPM)
- DTPA with Capoten
- Renal arteriography

Table 16.11. Causes of Hypertensive Emergencies in Pediatrics

Renal
Acute glomerulonephritis
Chronic renal failure and ESRD
Hemolytic uremic syndrome
Reflux nephropathy
Renal artery stenosis
Systemic lupus erythematosus
Transplant rejection
Nonrenal
Coarctation of the aorta
Drug ingestion
Pheochromocytoma
Volume overload

Table 16.10. Features of Hypertensive Emergencies in Pediatrics

Symptoms
- Headache
- Blurred vision, scotoma, transient blindness
- Lethargy, coma, seizures
- Abdominal pain

Signs
- Height and/or weight < 3rd percentile
- Evidence of cerebrovascular accident
- Periorbital edema
- Facial palsy
- Hypertensive retinopathy
- Congestive heart failure

TABLE 9. *Frequency of hypertension in selected renal diseases at time of initial presentation*

Renal disease	Percentage of patients with hypertension
Acute post-streptococcal glomerulonephritis	75–80
Nephrotic syndrome	26
Minimal change	21
Focal segmental glomerulosclerosis	36–50
Membranoproliferative glomerulonephritis	42–51
Membranous nephropathy	6–50
Hemolytic–uremic syndrome	49–73
Chronic pyelonephritis	14–35
Henoch–Schönlein purpura	14
IgA nephropathy	6

Table 1. RENAL PARENCHYMAL DISORDERS ASSOCIATED WITH PERSISTENT HYPERTENSION IN CHILDHOOD

Common*
Reflux nephropathy (chronic atrophic pyelonephritis)
Chronic glomerulonephritis
Renal dysplasia
Renal transplant complications
Uncommon*
Obstructive uropathy (congenital or acquired)
Renal cystic disease
Polycystic kidney disease (recessive or dominant)
Medullary cystic disease (juvenile nephronophthisis)
Multicystic dysplastic kidney
Renal compression (Page kidney)
Renal "hypoplasia" (segmental or global)†
Renal tumor
Renal vein thrombosis
Other chronic medical renal disease

*Common or uncommon as causes of hypertension during childhood.
†In most cases, renal "hypoplasia" probably represents severe, early reflux nephropathy.[2, 30]

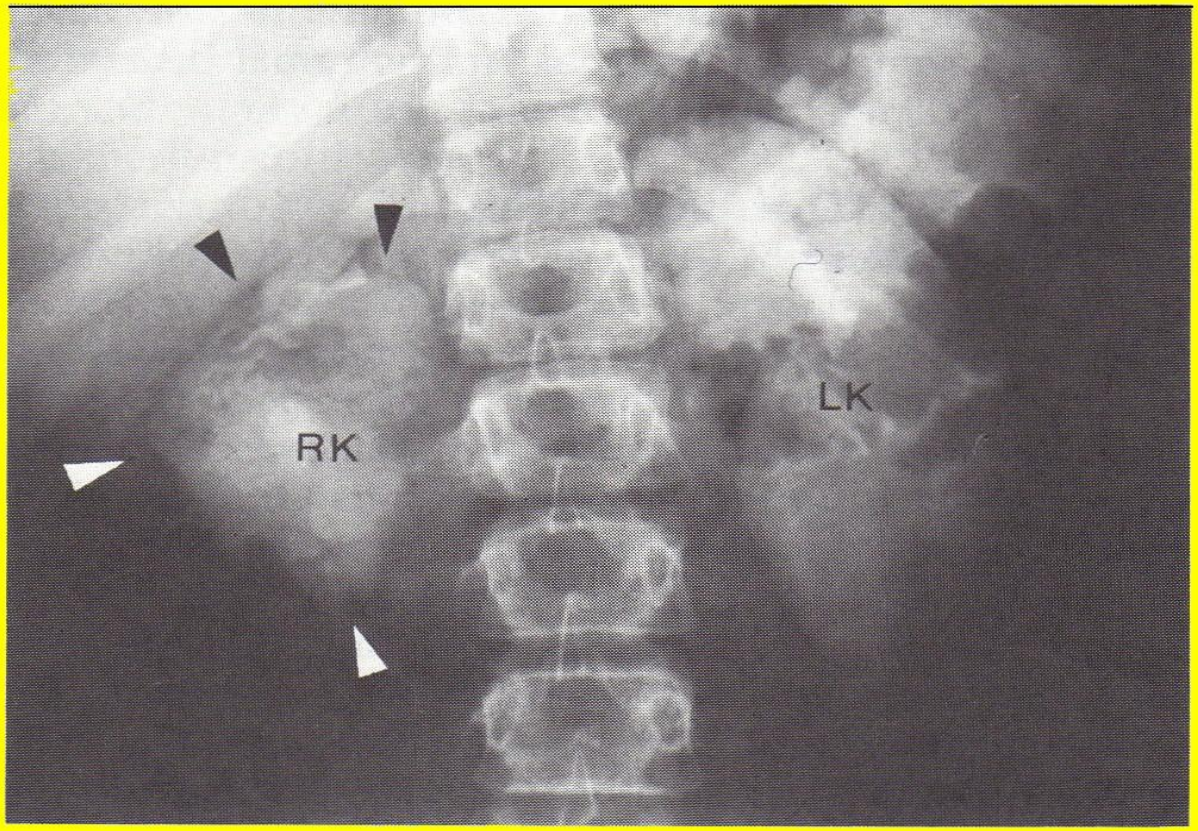


Figure 1. This 10-year-old girl with reflux nephropathy presented with severe symptomatic hypertension (blood pressure 190/120). Serum creatinine was normal. Urine contained trace protein and 5 to 7 red blood cells with no casts. She had no documented history of urinary tract infection. Intravenous pyelogram (20 minutes after injection) showed an atrophic right kidney (RK) with severe parenchymal scarring *(arrowheads)*, consistent with reflux nephropathy. The left kidney (LK) appeared normal. Right grade 2 vesicoureteral reflux was later demonstrated at cystography.

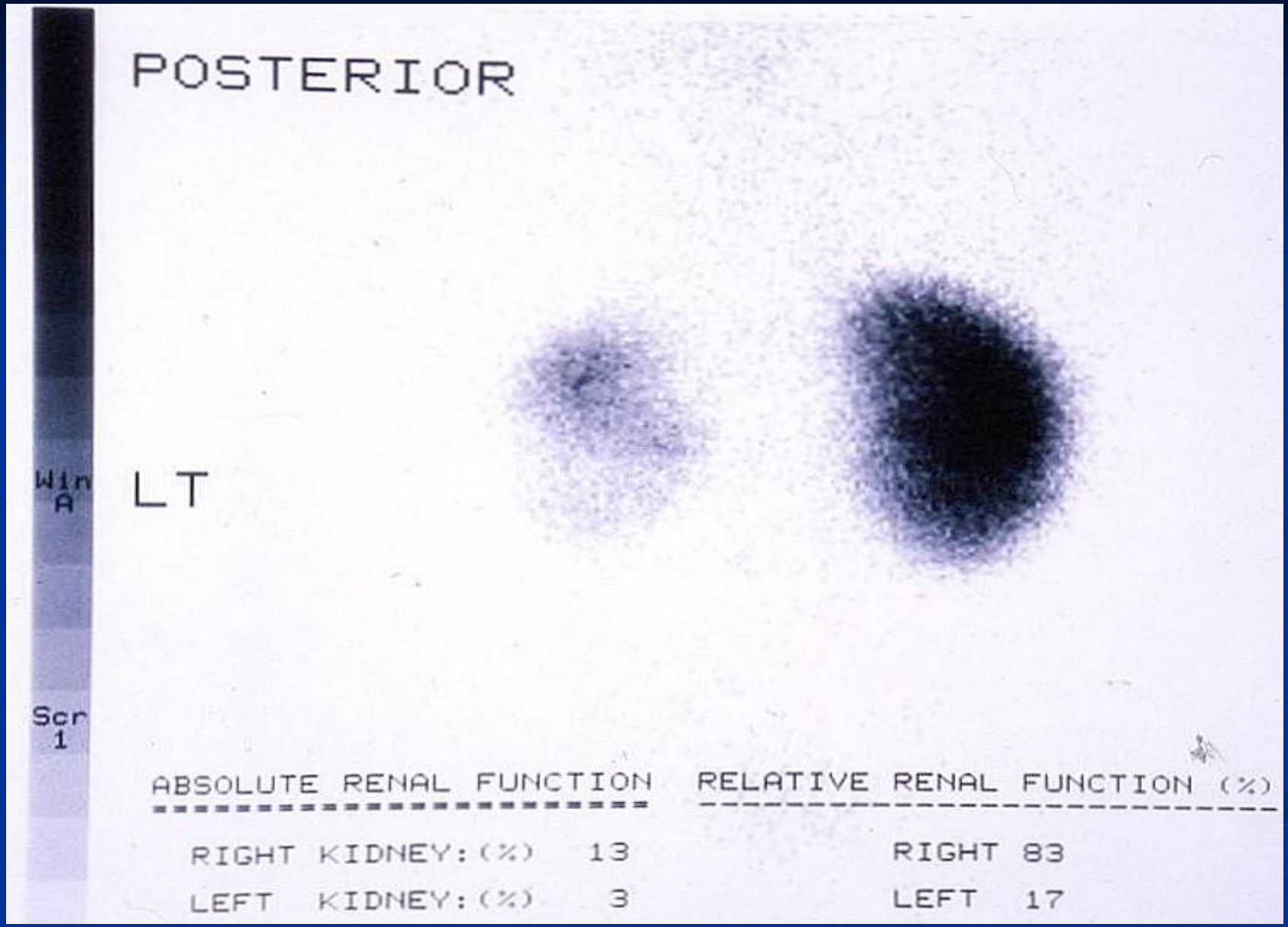
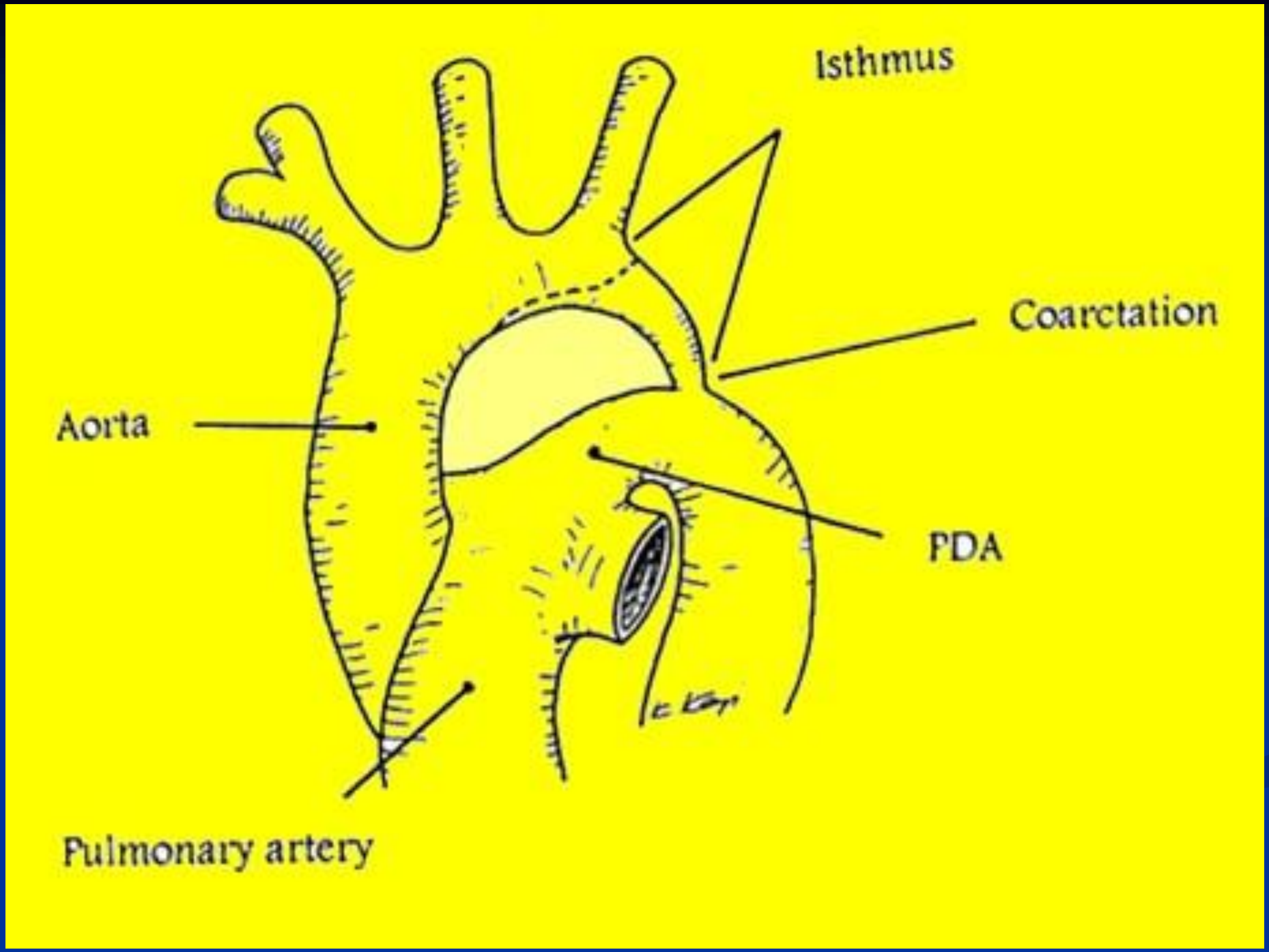
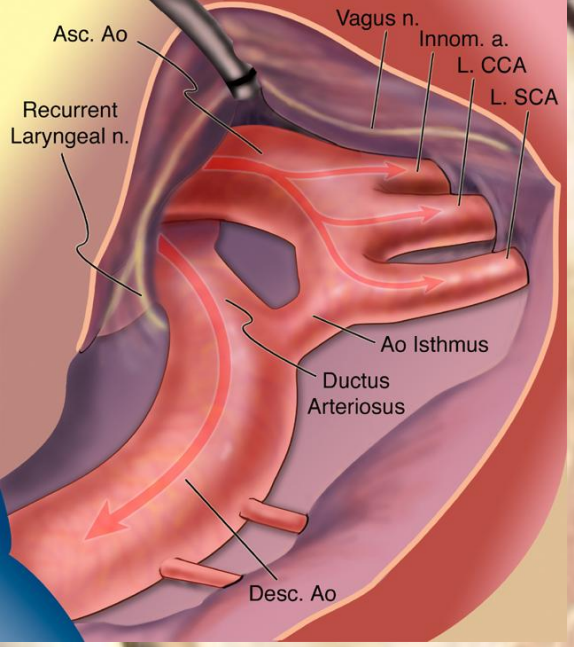

POSTERIOR
LT
Win A
Scr 1
ABSOLUTE RENAL FUNCTION
RELATIVE RENAL FUNCTION (%)
RIGHT KIDNEY: (%) 13
RIGHT 83
LEFT KIDNEY: (%) 3
LEFT 17

Table 1. CARDIOVASCULAR CAUSES OF HYPERTENSION IN THE PEDIATRIC PATIENT

1. Coarctation of the aorta
2. Arteriovenous fistulas
3. Patent ductus arteriosus
4. Aortic insufficiency
5. Mitral insufficiency
6. Syndromes (Takayasu's, Williams, and Eisenmenger's)


Isthmus
Coarctation
Aorta
PDA
Pulmonary artery



εγκ. τόξο

Αρ. καρωτ.

λαρυγγ.

PDA

CoA

υποκλ

Κατ. αορτή

μεσοπλ. αρτ.

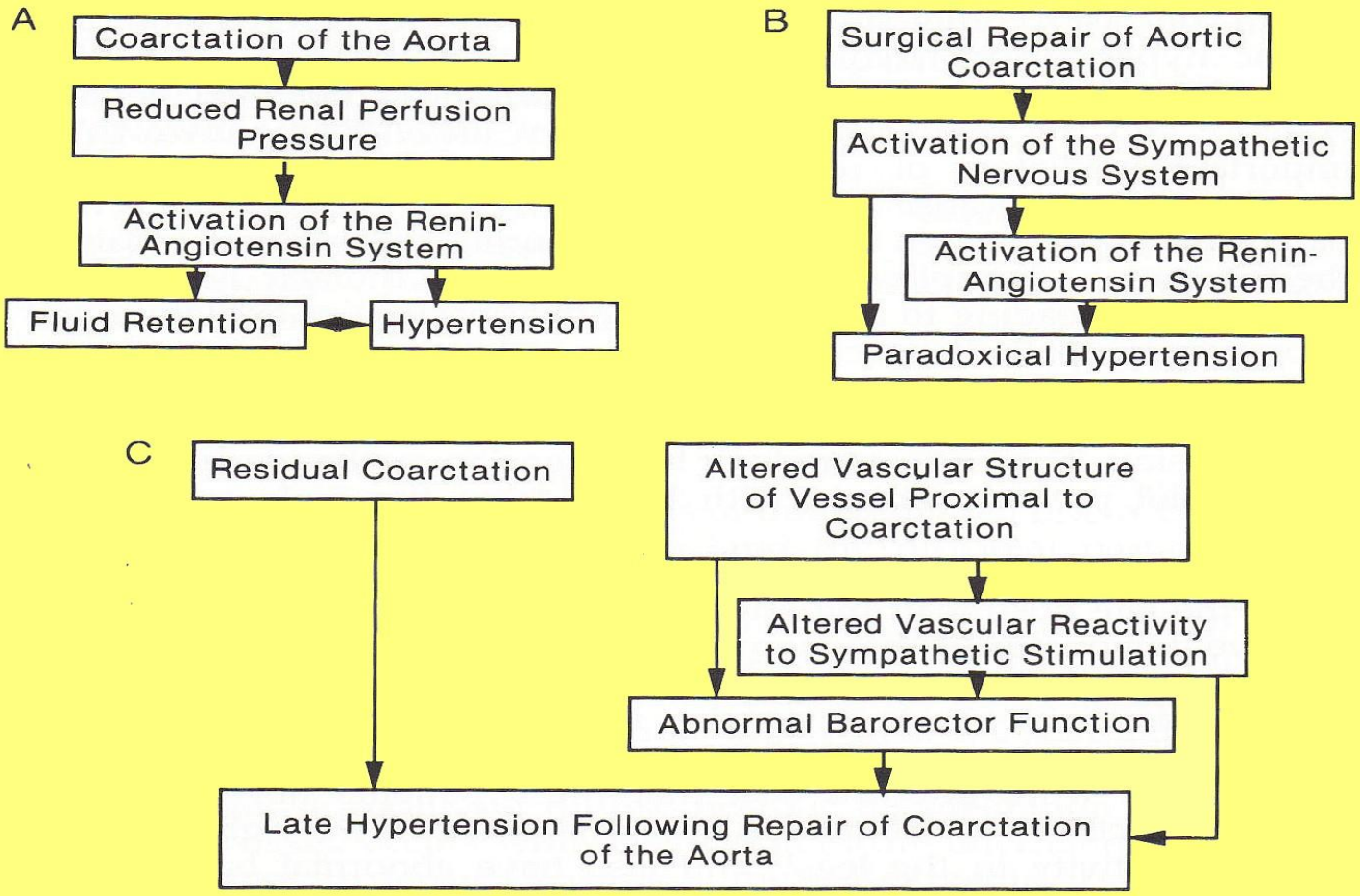


Figure 1. Representation of the mechanisms responsible for the three types of hypertension observed in patients with coarctation of the aorta. *A,* The proposed mechanism for hypertension in patients with unoperated coarctation of the aorta. *B,* Proposed mechanism for paradoxic hypertension that is observed in the acute postoperative period after surgical repair of coarctation of the aorta. *C,* The proposed mechanism for late hypertension that is seen in patients months or years after repair of coarctation of the aorta.

Table 1. PEDIATRIC ENDOCRINE DISORDERS ASSOCIATED WITH HYPERTENSION

Adrenal
Medulla: Catecholamine excess: pheochromocytoma, neuroblastoma
Cortex: Mineralocorticoid excess: hyperaldosteronism
congenital adrenal hyperplasia
17 α-hydroxylase deficiency
11 β-hydroxylase deficiency
apparent mineralocorticoid excess
Glucocorticoid excess: Cushing's syndrome
Sex hormone excess
Exogenous steroids

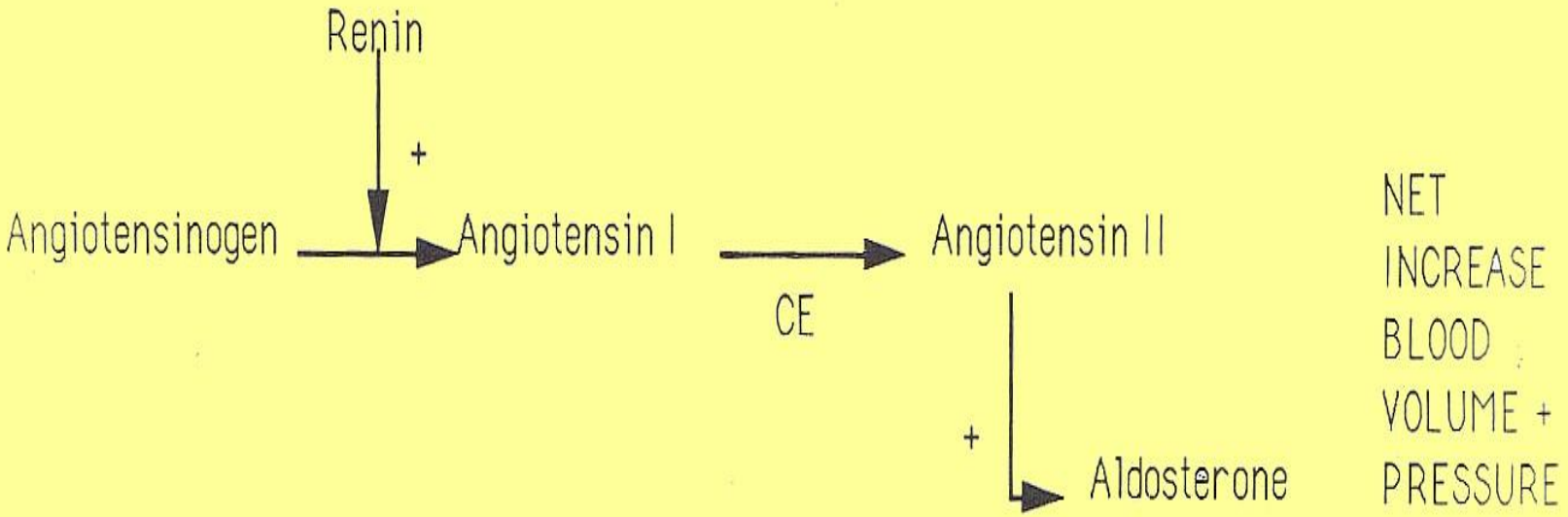
Thyroid
Hypothyroidism
Hyperthyroidism

Parathyroid—Vitamin D
Hypercalcemia: Primary hyperparathryoidism
Vitamin D intoxication
Williams syndrome
Malignancy

Gonads
Exogenous steroids: birth control pill, anabolic steroids
Endogenous steroid excess: tumors

Diabetes Mellitus

Miscellaneous
GH excess, insulin resistance, obesity
Turner's syndrome



STIMULATES RENIN SECRETION

decreased effective blood volume
decreased blood pressure
increased prostaglandin

STIMULATES ALDOSTERONE SECRETION

increased Angiotensin II
increased serum potassium
increased ACTH

Figure 1. Simplified renin-aldosterone pathway. CE = converting enzyme. $^{+}$ = stimulation.

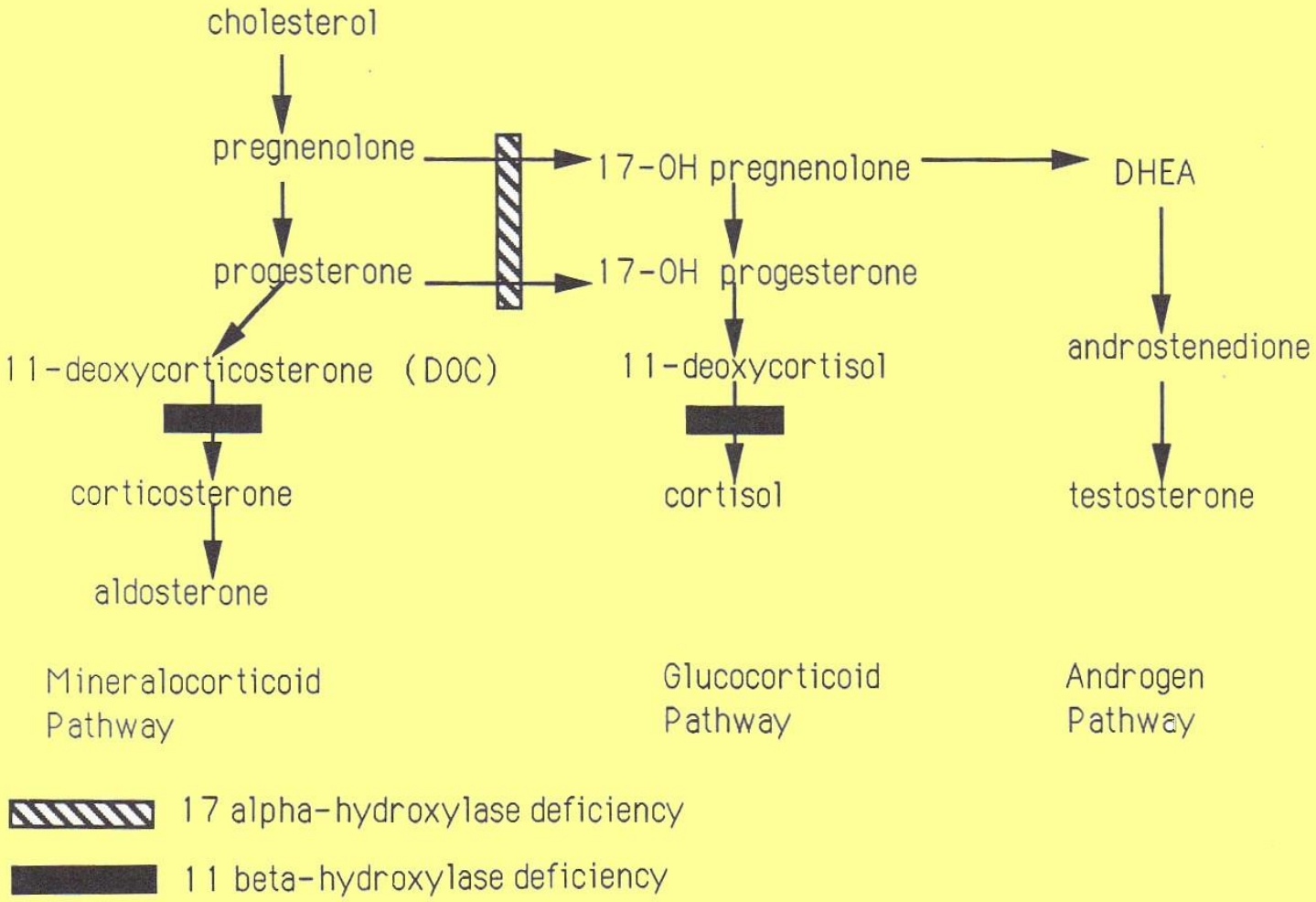


Figure 2. Simplified adrenal steroid pathway. OH = hydroxy.

Table 3. SUMMARY OF ENDOCRINE CONDITIONS ASSOCIATED WITH HYPERTENSION

Condition	Significant Features
Hyperthyroidism	Increased heart rate, systolic hypertension, warm skin, brisk deep tendon reflexes, weight loss, family history of autoimmune disease. Newborn whose mother has Graves' disease
Hypothyroidism	Decreased growth, fatigue, cold intolerance, increased diastolic pressure, family history of autoimmune disease
Hypercalcemia	Stigmata of Williams syndrome, elfin facies, constipation, malaise, fatigue, abdominal pain, vitamin D usage, tumor, family history
Sex Hormones	Use of birth control pill or anabolic steroids
Diabetes Mellitus	Long-standing type I diabetes (15–20 years)
Adrenal	
Pheochromocytoma	Headache, sweatiness, sustained hypertension, family history, neurocutaneous syndromes
Hyperaldosteronism	Hypokalemia symptoms—weakness, cramps, suppressed plasma renin
Hypermineralocorticoidism	Hypokalemic symptoms—virilization (11 β-hydroxylase deficiency) or lack of puberty (17 α-hydroxylase deficiency)
Cushing's Syndrome	Obesity, lack of linear growth, striae, round plethoric facies
Exogenous corticoid use	Underlying illness

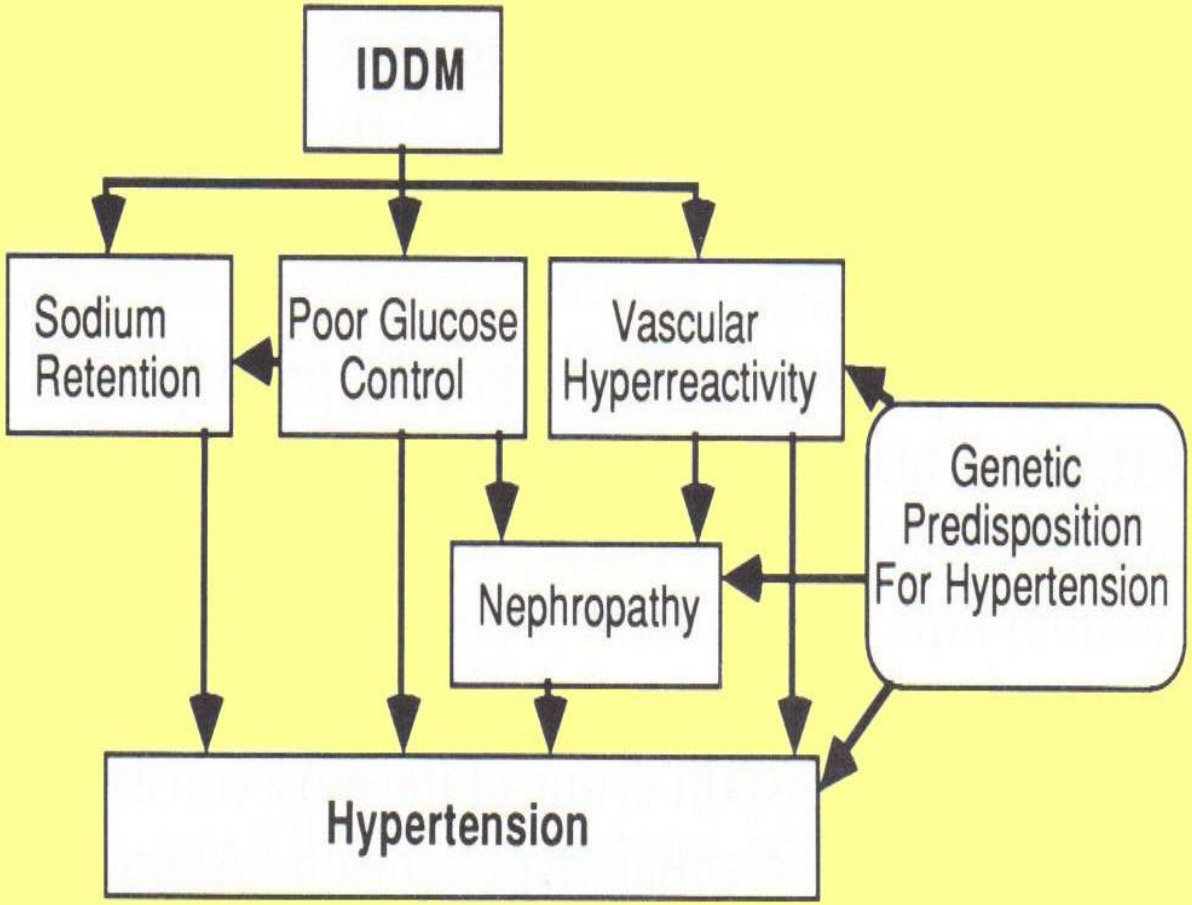


Figure 1. Representation of how insulin-dependent diabetes (IDDM) may result in the development of hypertension.

Table 1. RELATIONSHIP BETWEEN ALBUMINURIA AND HYPERTENSION IN INDIVIDUALS WITH INSULIN-DEPENDENT DIABETES

Albuminuria	mg/24 hr	Number	BP≥ 160/95
Normal	<30	562 (59%)	19%
Micro	31–299	215 (22%)	30%
Macro	>300	180 (19%)	65%
		957 (100%)	

From Parving HH, Hommel E, Mathieson E, et al: Prevalence of microalbuminuria, arterial hypertension, retinopathy, and neuropathy in patients with insulin dependent diabetes. BMJ 296:156–160, 1998; with permission.

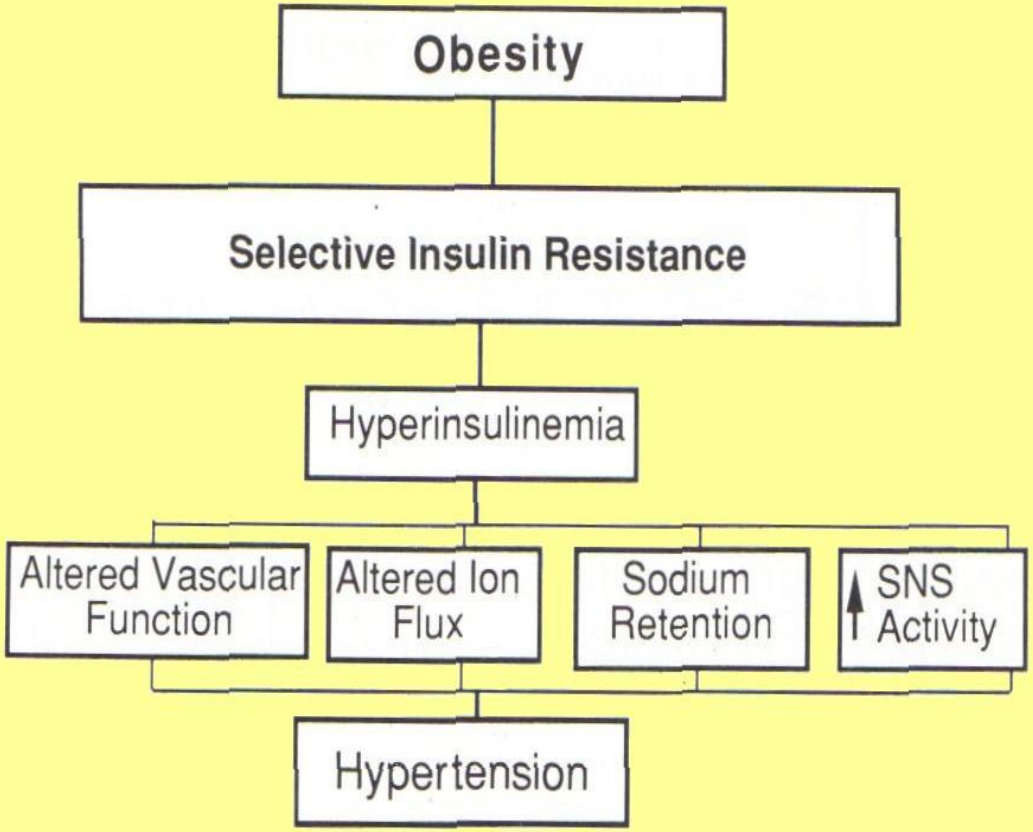


Figure 2. Representation of how obesity and the resultant insulin resistance might result in hypertension. SNS = sympathetic nervous system. (*From* Rocchini AP: Insulin resistance and blood pressure regulation in obese and nonobese subjects. Hypertension 17:837–842, 1991; with permission of the American Heart Association, Inc.)

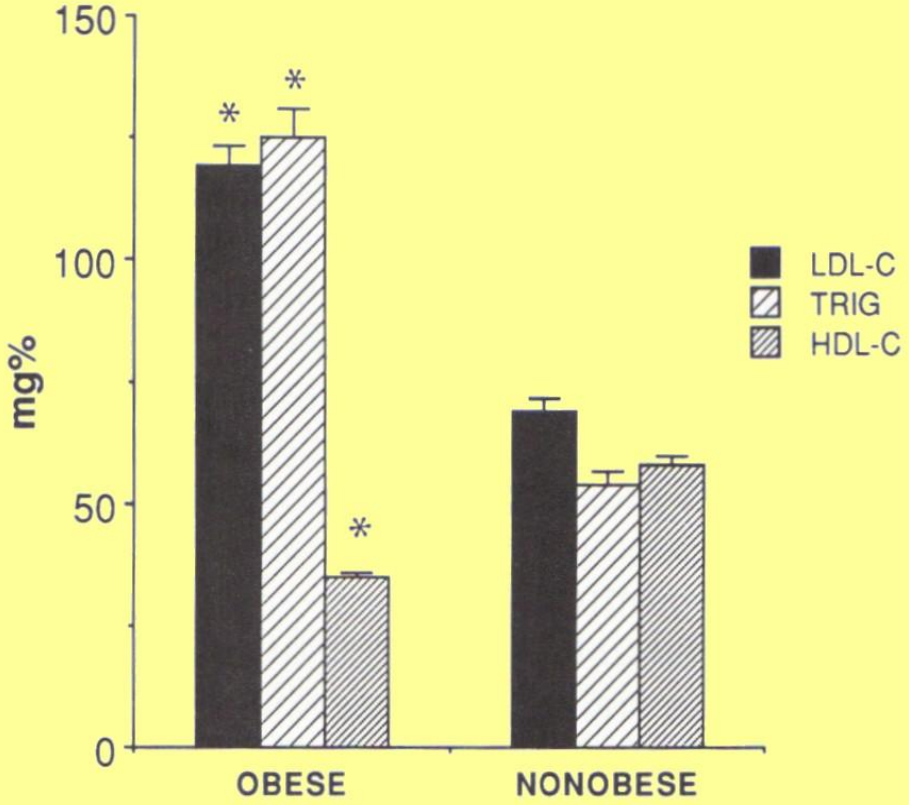


Figure 4. The lipoprotein profile of 175 obese and 60 nonobese adolescents (aged 10–18 years) is depicted. Compared with the nonobese adolescents, obese adolescents have significantly elevated total cholesterol, LDL-cholesterol (LDL-C), and triglyceride (TRIG) and reduced HDL-cholesterol (HDL-C) levels. $P < 0.01$ obese vs nonobese *(asterisk).*

Quando faciamo indagine per la hypertensione arteriosa secondaria nei Giovani ?

Table 3. CLUES TO THE ETIOLOGY OF SECONDARY HYPERTENSION IN CHILDREN ON PHYSICAL EXAMINATION

	Physical Finding	Suggests
Level of blood pressure	>140/100 at any age	Secondary hypertension
	Leg blood pressure ≤ arm blood pressure	Coarctation of the aorta
Size or growth	Poor growth, pallor	Chronic renal disease
Body habitus, features	Short stature, features of Turner syndrome	Coarctation of the aorta
Skin findings	Many café-au-lait spots or neurofibromas	Renal artery stenosis, pheochromocytoma
Pulses	Decreased or delayed pulses in legs	Coarctation of the aorta
Vascular bruits	Bruits over large vessels	Arteritis
	Bruits over upper abdomen	Renal artery stenosis
Abdomen	Flank or upper quadrant mass	Renal malformation, renal or adrenal tumor
Secondary sexual characteristics	Excessive virilization or inappropriate for age	Adrenal disorder
Miscellaneous	Edema	Renal disease
	Excessive sweating	Pheochromocytoma

Ragazzi di eta prebuberale, con stadio II di Hypertensione arteriosa, con simptomatologia clinica di malatie systematiche, quando hanno PA > 95th Percentile, dovremmo esaminare questi ragazzi per Hypertensione arteriosa secondaria

Quando un ragazzo presenta improvissamente aumento della PA > 95th Percentile, or quando presenta diminuzione del peso corporeo e non esiste Hypertensione arteriosa nella famiglia, dovra essere esaminato per Hypertesione arteriosa secondaria

(Rebec)

Metendo Holter 24 ore nei ragazzi con Hypertensione arteriosa secondaria, abbiamo visto una aummento della PA diastolica durante il giorno e della PA sia sistolica e diastolica durante la notte

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Table 16.8. Treatment of Neonatal Hypertension

Drug	Dose[a]	Route	Comments
Furosemide	0.5–2.0 mg/kg q6–8 h	IV or PO	Hypokalemia and alkalosis; chronic use is associated with hypercalciuria and nephrocalcinosis; if combined with ACE inhibitors, increases risk of acute renal failure
Nitroprusside	0.5–5.0 μg/kg/min	IV	Useful emergency agent but requires ICU and monitoring of BP; thiocyanate levels at least every 24 h to avoid toxic levels
Captopril	0.01–0.25 mg/kg/dose q12h	PO	Low-dose captopril may avoid renal failure: more potent with longer duration of action than in older children; monitor for hyperkalemia and increase in serum creatinine
Enalaprilat	5–10 μg/kg/dose q8–24h	IV	Side effects include oliguria, decreased GFR, hyperkalemia
Labetolol	1 mg/kg/dose q1–4h	IV	
Nifedipine	0.25–0.5 mg/kg	PO	

[a]Lowest starting dose is given.

Table 7. RECOMMENDED DOSAGES OF ANTIHYPERTENSIVE DRUGS IN THE NEONATE

Drug	Starting Dose	Maximum Dose
Furosemide	1 mg/kg/dose PO, IV, IM	
Chlorothiazide	10–30 mg/kg/dose PO	
Hydralazine	0.2–0.5 mg/kg/dose PO, IV, IM, Q 6–12 hr	8 mg/kg/day
Propranolol	0.25 mg/kg/dose PO Q 6–8 hr	5 mg/kg day
	0.01 mg/kg/dose IV Q 6–8 hr	0.15 mg/kg Q 6–8 hr
Captopril	0.01–0.05 mg/kg/dose PO Q 8–12	2 mg/kg/day
Diazoxide	2 mg/kg/dose IV	5 mg/kg/dose
Nitroprusside	0.25–0.5 mcg/kg/min IV	6 mcg/kg/min
Labetalol	1 mg/kg/dose IV Q 1–4 hr	
	0.5–1 mg/kg/hr IV	
Enalaprilat	5–10 mcg/kg/dose IV Q 8–24 hr	

Table 16.12. Treatment of Hypertensive Emergencies

Drug	Onset of Action	Dose and Route	Comments
Nifedipine	Minutes	0.25–0.5 mg/kg/dose sublingual	Wide experience in children with few side effects
Captopril	Minutes	Infants: 0.01–0.25 mg/kg/dose Children: 0.1–0.2 mg/kg/dose PO	May acutely drop BP and cause acute renal failure
Hydralazine	Minutes	0.1–0.2 mg/kg IV	Tachycardia, headache
Labetolol	Minutes	1–3 mg/kg IV	May drop BP acutely
Nitroprusside	Seconds	1–8 μm/kg/min IV	Drug of choice, requires admission to ICU
Phentolamine	Seconds	0.1–0.2 mg/kg IV	α-blocker, for treatment of pheochromocytoma

TABLE 11. *Antihypertensive drug therapy for hypertensive emergencies*

Drug	Dose
Sodium nitroprusside	0.5–8 μg/kg/min, intravenously
Labetalol	1–3 mg/kg, intravenously
Diazoxide	2–5 mg/kg, intravenously
Hydralazine	0.2–0.4 mg/kg, intravenously
Nifedipine	0.25–0.5 mg/kg, sublingually
Minoxidil	0.1–0.2 mg/kg, orally

Nei casi partikolari di emergenza, quando La PA > 99th Percentile, dovremmo diminuire la PA 25% in 8 ore e dopo di diminuire la PA < 95th Percentile in 48 ore

Quando e come cominciamo therapia per la PA Giovanille?

Se la PA > 95th Percentile + 5 mmHg e il ragazzo è obeso, dovremmo usare inzialmente metodi non therapeutici

- Diminuire il peso corporeo
- ↓ Na 1.2 – 1.5 gr / 24 ore
- Dieta ↑ K, abbodanti frutti e vegetali
- Esercici di movimento(bycicleta, Tennis, Basket, Calzio)

Table 16.9. Antihypertensive Drugs for Therapy of Chronic Hypertension in Children, Listed in Alphabetical Order by Drug Class[a]

Drug	Dose, mg/kg/day		Dosing Interval
	Initial	Maximum	
Adrenergic-blocking agents			
α- and β-blocker, labetalol	1	3	Every 6–12 h
α-blocker, prazosin	0.005–0.1	0.5	Every 6–8 h
β-adrenergic blockers			
Atenolol	1	8	Every 12–24 h
Propranolol	1	8	Every 6–12 h
α-agonist			
Clonidine	0.05–0.1[b]	0.5–0.6[c]	Every 6 h
CCBs			
Nifedipine	0.25	3	Every 4–6 h
Nifedipine XL	0.25	3	Every 12–24 h
ACE inhibitors			
Captopril			
Children	1.5	6	Every 8 h
Neonates	0.03–0.15	2	Every 8–24 h
Enalapril	0.15	Not established	Every 12–24 h
Diuretics			
Bumetanide	0.02–0.05	0.3	Every 4–12 h
Furosemide	1	12	Every 4–12 h
Hydrocholorothiazide	1	2–3	Every 12 h
Metolazone	0.1	3	Every 12–24 h
Sprionolactone	1	3	Every 6–12 h
Triamterene	2	3	Every 6–12 h
Vasodilators			
Hydralazine	0.75	7.5	Every 6 h
Minoxidil	0.1–0.2	1	Every 12 h

[a]Other drugs are available in some classes, but data on dosage in children have not been published.
[b]Total initial dose in milligrams.
[c]Total daily dose in milligrams

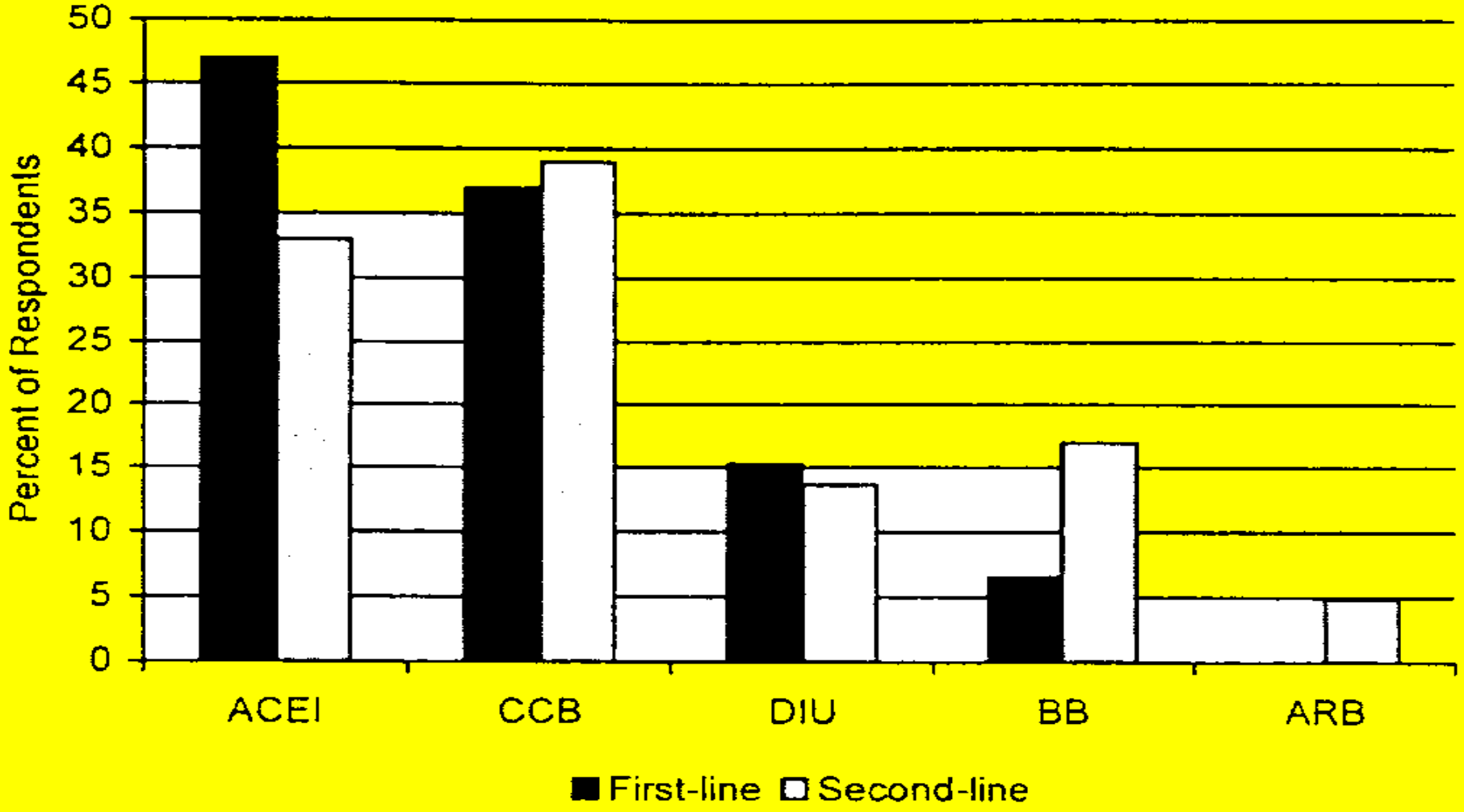

Fig. 4 Treatment of primary hypertension. First and second-line choices for treatment of children with primary hypertension. (*ACEI*, angiotensin-converting enzyme inhibitors; *ARB*, angiotensin receptor blockers; *BB*, beta-adrenergic blockers; *CCB*, calcium-channel blockers; *DIU*, diuretics)

Conclusione

Dovremmo mettere presto la diagnosi, la therapia e la prevenzione di HA primitiva e secondaria giovanille per evitare e dimminuire le complicazioni dal apparato cardiovascolare, nervoso e dai reni

Grazie per la vostra attentione