Hypertension - when to measure blood pressure in children and how to interpret what you find

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Prague, October 20, 2003

Definition of hypertension

Blood pressure higher than the 95th percentil of normal values according the age or body height and must be found at least 3 times (different session, time gap at least weeks)

<u>Exception:</u> severe hypertension, then one measurement sufficient, immediately appropriate intervention

How to evaluate and interpret the blood pressure

In children always respect the age (height values even better)

BP- <u>interpretation according standard nomograms (percentile values)</u>

Normal =under 90.percentile

High-normal=between 90.-95. “

Hypertension= > 95. „

Grading of hypertension

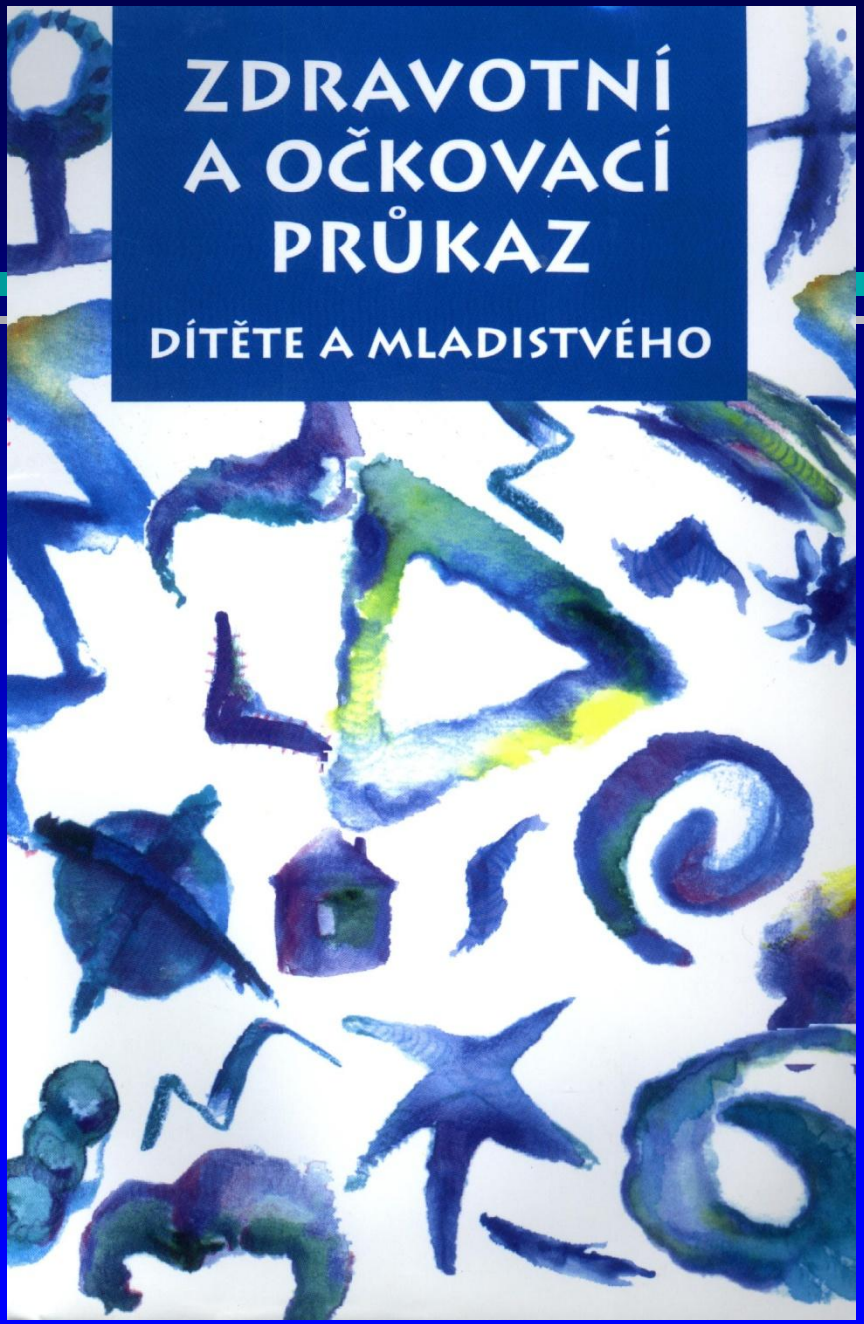
1. borderline HT diastolic BP up 5 mmHg
   higher than 95. percentile
2. significant HT: diastolic BP 5-10 mmHg
   higher than 95. percentile
3. severe HT: diastolic BP 5-10 mmHg>
   higher than 95.percentile

Evaluation of the blood pressure in children

Normal values:

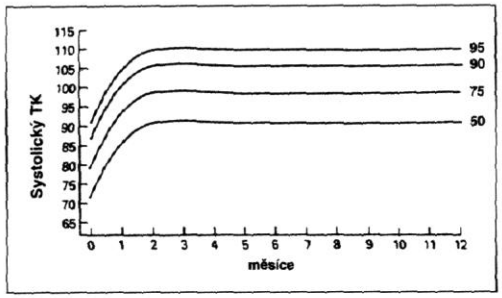
- 1. Second Task Force Report, 1987 (age)
- 2. de Man, 1991 (BP according the age, height)
- 3. Update on the TFR, 1996 (age +height)

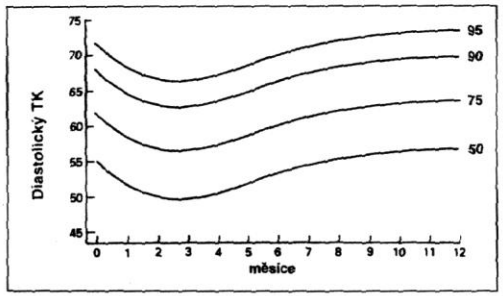
Pediatrics,1987, 79: 1-25, 1996, 98: 649-658


ZDRAVOTNÍ
A OČKOVACÍ
PRŮKAZ
DÍTĚTE A MLADISTVÉHO

PERCENTILOVÉ GRAFY TK U CHLAPCŮ

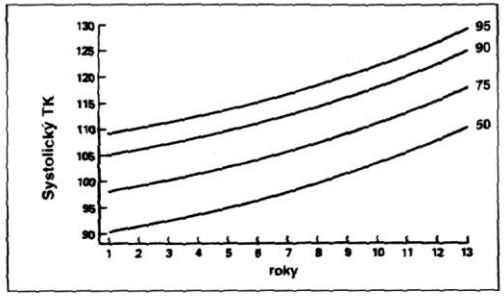
do 12 měsíců

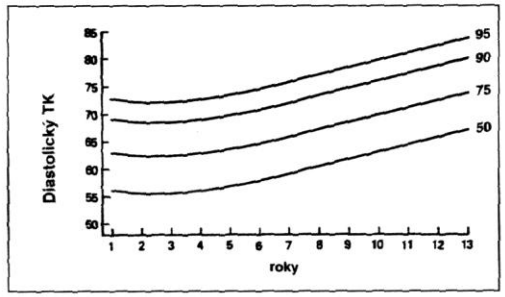




90. percentil													
Systolický TK	87	101	106	106	106	105	105	105	105	105	105	105	105
Diastolický TK	68	65	63	63	63	65	66	67	68	68	69	69	69
Výška v cm	51	59	63	66	68	70	72	73	74	76	77	78	80
Váha v kg	4	4	5	5	6	7	8	9	9	10	10	11	11

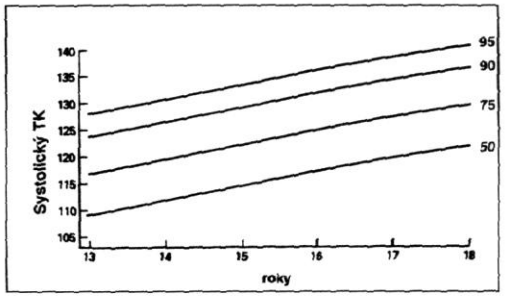
od 1 roku do 13 let

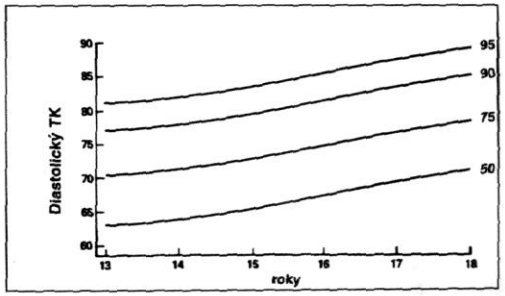




90. percentil													
Systolický TK	105	106	107	108	109	111	112	114	115	117	119	121	124
Diastolický TK	69	68	68	69	69	70	71	73	74	75	76	77	79
Výška v cm	80	91	100	108	115	122	129	135	141	147	153	159	165
Váha v kg	11	14	16	18	22	25	29	34	39	44	50	55	62

od 13 do 18 let





90. percentil						
Systolický TK	124	126	129	131	134	136
Diastolický TK	77	78	79	81	83	84
Výška v cm	165	172	178	182	184	184
Váha v kg	62	68	74	80	84	86

European Societies of Hypertension and Cardiology Recent recommendation 2003

- Guidelines committee recommendations published in *Journal of Hypertension, 2003, 21, 1011-1053*
- Position statement in the elderly, diabetics, impaired renal function

No special position statement in children

USA-Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure

JAMA, May 21, 2003,

Volume 289, No 19, 2534-2573

The Seventh Report of JNC:

USA-guidelines, here a short section on hypertension in children and adolescents stressing the non-pharmacological intervention and healthy life-style

Measurement of blood pressure in adults is a daily routine, but this easy procedure is unfortunately often omitted in children

Techniques of the blood pressure measurement in children and adolescents

- 1. Accidental: in pediatric office (appropriate cuff –2/3 arm- lenght, the width of the cuff is the rubber and not the textile!

Sitting position, the right arm, at heart level, the child must be calm

Techniques of the blood pressure measurement in children and adolescents

A) Auscultation: systolic BP = Korotkoff 1

diastolic BP= Korotkoff 5

What is the „muffling phenomena“ ?

B) Oscillometry =(systolic BP+ MAP) – diastolic BP

C) Doppler-methods

Techniques of the blood pressure measurement

- Having found high blood pressure, please, always measure the BP in low extremities.
- Normally, the BP in low extremities must be higher than measuring the BP on arms! The reason: in fact, the BP is the same, but using a relative narrow cuff (the circumference of thigh is higher than that of the arm) you will find false higher BP-values

Techniques of the blood pressure measurement in children and adolescents

2. Home-measurement (children, parents)

- The same as the accidental measurement, but better results (elimination of the stress in the office, frequent measurement
- Motivation of the patient and his/her family!(does increase the compliance)

Ambulatory Blood Pressure Monitoring (ABPM)

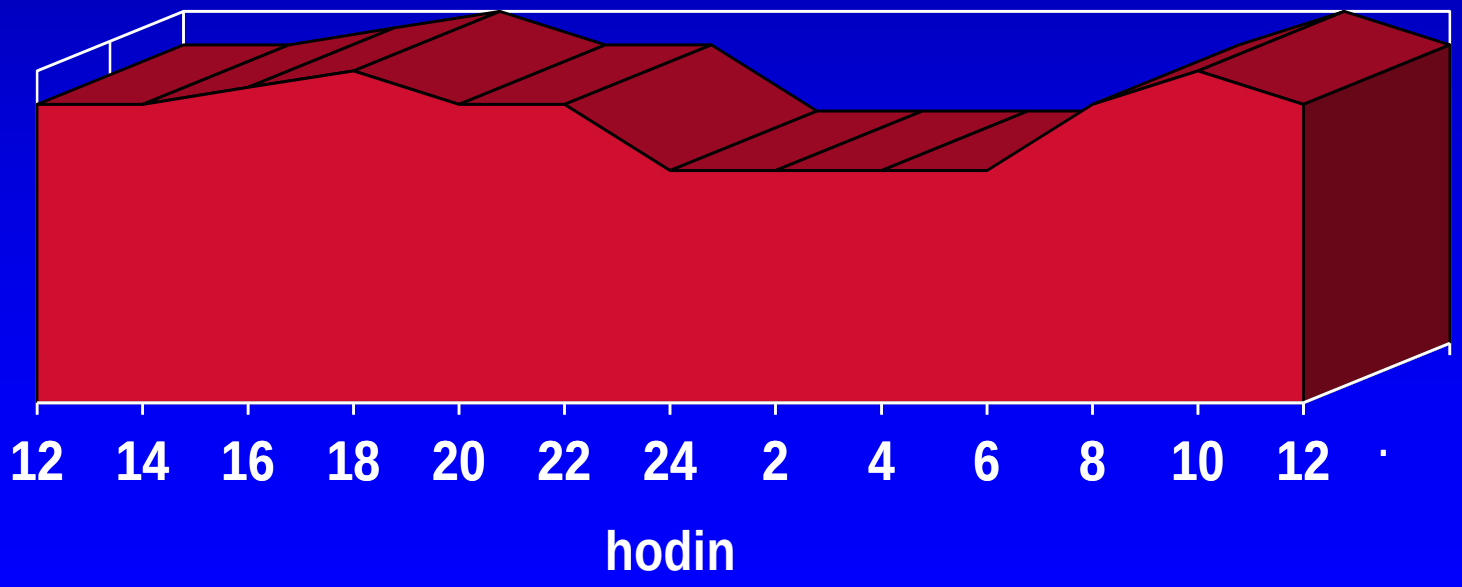
3. **ABPM=24-hours Blood Pressure Monitoring**

Oscillometry, special device, intermittent measurement in given intervals. Better correlation with direct intraarterial technique and organ damage

- **Detection of the white-coat-hypertension and night-hypertension**
- **Disadvantage: high price, some problems measuring the BP in infants and toddlers.**

Typical circadiane BP-values

see the typical physiological dipping during the night



Ambulatory Blood Pressure Monitoring (ABPM)

- ABPM should become a routine procedure in all pediatric hospital departments.
- Nevertheless, it needs special skill and knowledge how to interprete the results
- For evaluation special nomograms necessary, please do not take STFR-value!
- Special nomograms available

How to interpret the ABPM-values?

- **Special nomograms for ABPM available:**
- **Wuhl Elke et al:**
- **Distribution of 24-hours ambulatory blood pressure in children: normalized reference values and role of body dimensions**
- ***J Hypertens 2002, 20, (10):1995, p. 2007***

Blood pressure depends on:

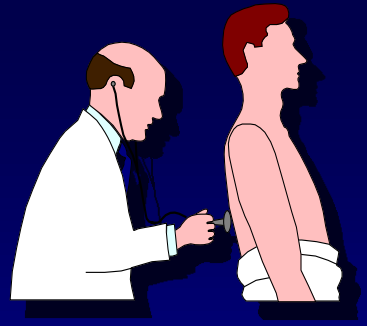
BP value at the initial measurement-

age, gender, height, weight

racial aspects

endogenous factors: genetic predisposition

exogenous factors: ecology, style of life (diet, salt intake, body fitness, smoking..)



Hypertension – an important risk factor for

cardiovascular diseases, increases the morbidity and mortality (coronary ischemia, heart attacks, cerebral strokes, hypertensive nephropathy.

Linkage with development of atherosclerosis

Very often oligosymptomatic and underestimated as a „big killer“

How important is the BP-control:

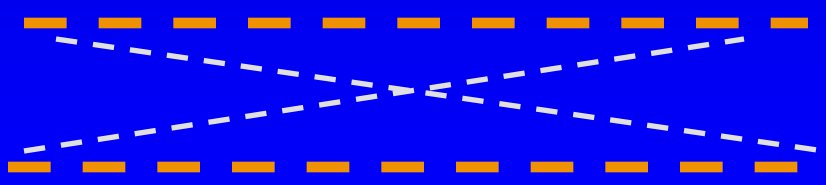
Decrease of BP= significant decrease of morbidity and mortality (diastolic BP minus 5-10mmHg= coronary ischemia less 14%, cerebral strokes less 33-42%!!, mortality decrease 40% (in adult patients with hypertension). Unfortunately lack of similar studies performed in childhood and evaluated later

What is „tracking phenomena“

BP in children follows the same percentile until the maturity (hypothesis= hypertension in adulthood starts in childhood)

Nevertheless, this statement limited,

particularly in younger children, „crossing over“ possible



Late sequalae of hypertension

Dependent on:

- Cause of hypertension
- Range of BP (mild, asymptomatic, severe forms, organ damage
- Age when hypertension arised
- Hypertension intermittent, lasting, day and/or night hypertension

Incidence of hypertension

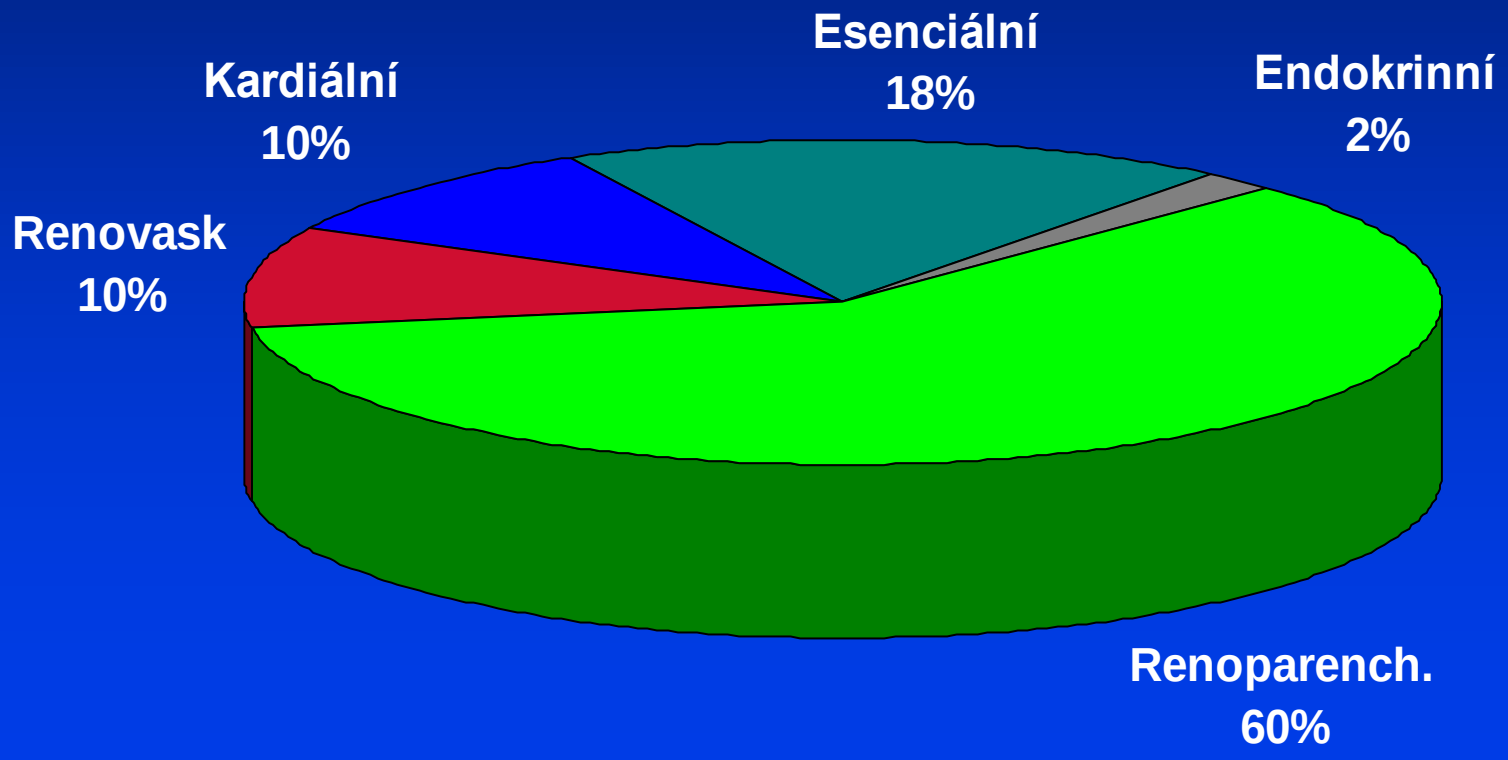
Rate ca 1% of all children !

But in adulthood 10-20%, in adults ca 90% essential hypertension

The spectrum of causes in children is quiet different

Secondary forms prevail in younger children, these are potentionally accesible for an intervention, so diagnostics in early age necessary!

Causes of hypertension in children

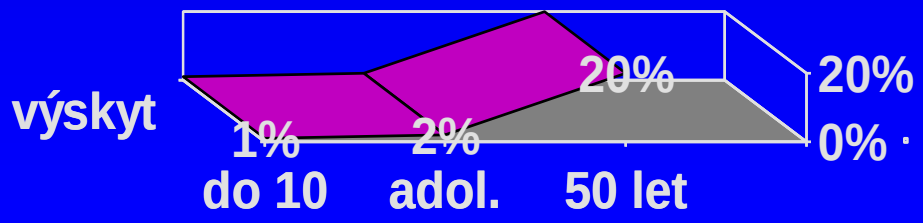


Essential hypertension in children

Diagnosis „per exclusionem“

(excluding the secondary forms)

Etiopathogenesis?:hormonal-metabolic syndrome, insulin resistance, obesity, NaCl intake, body fitness, smoking, style of life, endogenous factors (genes, ACE + EXO factors



Essential hypertension in children

- 1. Border line HT or mild HT
- 2. Positive family history
- 3. Obesity

Adolescents, high heart rate, the measured values vary considerable during the follow-up

Clinical picture of hypertension

- Symptoms vary, very often asymptomatic course
- Symptoms depends on :

  1. age
  2. grading of hypertension
  3. cause of hypertension

  Often symptoms do not lead directly to suspection for hypertension

Clinical picture of hypertension according the age (older children)

Nausea, vomiting,

headache (30%)- occipital

hypertensive encephalopathy,

visus impairment, fatigue, irritability, epistaxis,

abdominal pain

Work-up of a patient with hypertension

- According the history
- grading of HT
- age, organ damage,
- physical findings
- Aim: detect the primary cause and to treat causally
-

Work-up of a patient with hypertension

- Basic physical examination:
- repeated BP-measurement (standard setting), measuring BP in all 4 extremities
- The evaluation mentioned earlier:

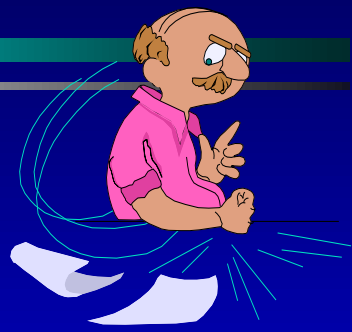
In individuals not appropriate for age= better to take the body height!

„Updated task force report“

Work-up of a patient with hypertension

- Cardiac murmers (coarctation, Botall)
- Heart rate (tachycardia in hyperthyreosis and feochromocytoma)
- abdomen: enlargemnent of kidneys
- abdominal murmers (aortic stenosis, stenosis of renal arteries)

Laboratory investigation



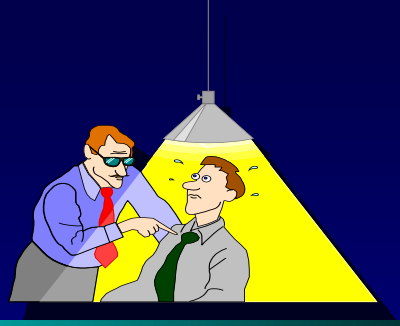
I. step:- basic investigation

Blood count, urinalysis plus sediment, urine culture

Serum creatinine (GFR according Schwartz)

cholesterol (HDL, LDL, triglyceridy, ELFO lipoproteins, blood sugar, Astrup

Further investigation



Renal function (GFR, standardized concentration capacity test (DDAVP), proteinuria, microalbuminuria, markers of tubular damage

chest X- ray, ECG

Fundoscopy

Renal sonography, **ABPM !!**

- **II.step- targeted examination:**
- **Renal cause suspected-radionuclide investigation :**
- **MAG3 (tubular functions, obstruction, obstruktion, separated renal functions (hypo-dysplasie**

  DTPA (GFR, renal perfusion)

  DMSA (renal scarring, ischemic foci, separated assessment)

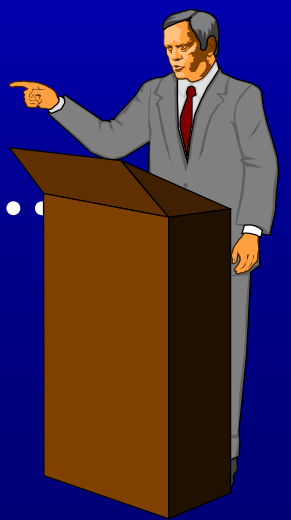
Treatment of hypertension

Secondary hypertension:

Causal - according the diagnosis

Renoparenchymatous: therapy of N, PN, VUR, obstructive uropathy- nephrectomy of dysplastic kidney

renovascular: PTA, cardiosurgery, feochromocytoma, adenoma- resection+ symptomatic treatment with the aim to … control the increased blood pressure



Treatment of hypertension

- **I. non-pharmacological approach**

mild hypertension, mostly essential forms: recommended also in high-nornal HT

According the risk factors:

1. Weight reduction (proved effect)

2. Body fitness (dynamic, sports allowed when HT controlled

I. non-pharmacological intervention

3. Diet

Salt restriction (very often really a „salt addiction“-salt as a drug!), increased potassium intake (fruits, vegetables), caloric restriction in obese patient, restriction of fat intake

Combination of the given factors !!

= healthy style of life

II. Pharmacological intervention

- Previous attempts not succesful, but please do continue them! Symptomatic treatment always in severe hypertension and if organ damage already present !

Pharmacological intervention

- **Aim : BP below the 90.percentile - minimal dosage which are effective, minimal adverse effects, parents and patient compliance**

I.step: monotherapy, low dosage

II.step- increase the dosage

III.step- combination of 2 drugs

Medicaments in hypertension

What drug is the best one for children ?

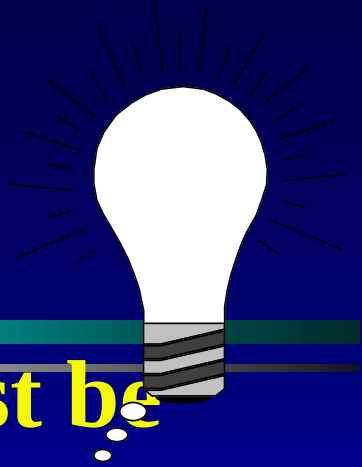
? ? ? ? ? ? ? ? ? ?

There are no controlled pediatric studies with different antihypertensive drugs

Choices similar as in adults, but effective doses for children are often smaller and should be adjusted stepwise carefully.

ACEI- and angiotensin receptor-blockers should not be used in pregnant and sexually active girls.

Conclusions I.



Every child with hypertension must be examined with the aim to detect the cause of high blood pressure

When possible, the causal therapy

The causes of high BP in children are age-dependent! During early childhood secondary hypertension prevails (mostly due to nephro-/uropathy), later increased incidence of essential hypertension

Conclusions II.

Blood pressure measurement must become a routine on the level of pediatric primary care also in preschool children!

Standardized evaluation using nomograms

The best solution: including the nomograms in the „Health and Vaccination Records“!

Instruction in families at risk for cardiovascular morbidity/mortality (high-normal values in children!)

Family compliance essential!

Conclusions III.

Essential hypertension

does not start with the 18th birthday!!!

- **Special care in adolescents with positive familial history, particulary in individuals with „high normal values“**
- **In this age category avoid the risk factors (smoking, obesity, high salt iand fat intake)**
- **ABPM= routine in pediatric hospital care**

Conclusions IV.

- The primary care pediatrician´s role and his judgement concerning the prevention, detection, evaluation and treatment of hypertension remains paramount
- Empathy of pediatricians, families and children/adolescents builds0 trust and is a potent motivator!

Thank you for your attention