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LARGE AND SMALL VESSEL VASCULAR COMPLIANCE (C) AS MEASURED BY RADIAL ARTERY PULSE WAVE CONTOUR ANALYSIS IN HEALTHY SCHOOL AGE CHILDREN

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Background: The pathogenesis of childhood hypertension (HTN) has yet to be elucidated. Vascular C, an important component of BP, can be measured noninvasively by the use of radial artery pulse contour wave analysis. While in adults C decreases with increasing age (normal >17 ml/mmHg x 100 in 15-19 yo to >9 in the elderly), little is known of these values in children.

Objective: To determine normative data for large (C1) and small vessel (C2) compliance in healthy school aged children as a baseline for future studies of childhood HTN.

Methods: 89 subjects from area schools participated. Weight, height, and casual BP (CBP) were measured and BMI calculated. (mean age 12.2 yrs; 47M, 29 Caucasian, 45 Hispanic, 5 AA, 10 others; mean BMI 23 with 29 subjects >90th percentile). C1 and C2 were measured using the HDI/PulseWave CR-2000 Cardiovascular Profiling Instrument (Eagan, MN). Subjects in supine position had a wrist stabilizer placed on the right arm with sensor placed over the radial artery. Measurement was taken once optimal waveform obtained. This was repeated twice and the mean±SD used for data analysis.

Results: The technique was well tolerated by subjects without adverse events. Mean C1 for the population was 14±5.4 ml/mmHg x 100 and C2 was 8.3±2.6. No difference was noted in C1 or C2 between genders or between Caucasian and Hispanics. Weight (r=0.54>BMI (r=0.46)>Height (r=0.3) all correlated significantly with C1 and C2 (p<0.001). 29 children were noted to have syst and 11 diast HTN by CBP. While no difference in mean C1 for subj. with syst. HTN (14±4.8 vs normotension) (14.7±4.9, p=0.12) was noted; C2 was significantly lower (7.6±2.2 vs 8.8±2.7, p<0.05) for syst HTN and both C1 (10.5±2.7 vs 14.7±4.9, p=0.007) and C2 (6.3±1.8 vs 8.7±2.5, p<0.003) were lower in subj. with diast. HTN. It was noted also that both C1 and C2 were significantly higher for obese vs non-obese subjects. (C1:16.1±6.4 vs 13.1±3.8, p=0.007)(C2:10.2±2.9 vs 7.6±1.9, p<0.0001).

Conclusions: Vascular profiling in children showed a mean C1 and C2 lower than reported in young adults. While no differences in gender or race were noted, C1 and C2 were expectedly lower in HTN but higher in obese children. Vascular profiling will be a valuable tool in non-invasively elucidating mechanisms of childhood HTN.

Key Words: Hypertension, Vascular Compliance, Pediatrics

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EARLY DEVELOPMENT OF DIABETIC NEPHROPATHY IN ADOLESCENT TYPE 2 DIABETES MELLITUS (T2DM)

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T2DM is increasing in prevalence and presenting at an earlier age as obesity affects a greater percentage of adolescents. Diabetic nephropathy, previously thought to occur only in adults afflicted with T2DM for decades, is being discovered at an ever-earlier age.

A twelve year old female with T2DM diagnosed 18 months previously was found to have both hypertension(HTN) and proteinuria. This patient was of Caribbean Hispanic descent and had a family history of T2DM. She was midpubertal, weighed 65.2 kg, and had a body mass index of 25.3 kg/m². Acanthosis nigricans was present on physical exam. Antibodies to glutamic acid decarboxylase were negative. A normal HgbA1C (<0.4%) was achieved and maintained with glipizide and metformin within 2 months after diagnosis. Prior office blood pressures(BP) and spot urine microalbumin to creatinine ratios were both intermittently high. She underwent ambulatory blood pressure monitoring (ABPM) and provided a 24 hour urine sample in order to better define the extent of her HTN and microalbuminuria. She was found to have sustained systolic HTN, with daytime and nocturnal BP loads of 81%. Diastolic BP load was 44% in the daytime and 6% at night. Dipping status was normal. A 24 hour urine had 371 mg of protein (9.2 mg/m²/hr). With this degree of HTN and proteinuria she was classified at this young age with diabetic nephropathy, and the angiotensin receptor antagonist losartan was prescribed. On losartan 100mg orally once per day her 24 hour protein excretion dropped to 234 mg (5.8 mg/m²/hr) and her BP normalized, with a daytime systolic load of 33.3%, daytime diastolic load of 5%, nocturnal systolic load of 6.3%, and nocturnal diastolic load of zero.

This patient illustrates that diabetic nephropathy may develop in adolescents with T2DM after a relatively brief duration of disease. In addition, traditional methods of diagnosis, notably casual BP measurements and spot urine samples, may underestimate the actual burden of target organ damage. Further studies incorporating methods such as ABPM should be conducted in a large population in order to define the magnitude of this problem in adolescent T2DM and to identify criteria for the initiation of treatment with angiotension converting enzyme inhibitors and/or angiotensin receptor antagonists to prevent progression to end stage renal disease.

Key Words: Type II diabetes mellitus, ambulatory blood pressure monitoring, adolescent

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EFFECT OF BIRTH WEIGHT ON BLOOD PRESSURE IN EARLY ADOLESCENCE

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The purpose of this investigation was to examine the theory that low birth weight, as a marker of intrauterine environment, is a determinant of higher blood pressure in later life. A prospective longitudinal study was conducted in which a sample (N=250) of subjects that were examined in the newborn period, were re-examined at age 12-14 years. Low birth weight (<2500 Gms) was present in 31% of the sample. The adolescent exam was conducted during a home visit, and included measurements of blood pressure (BP) obtained by auscultation and oscillometric methods, anthropometrics, health status, and health behaviors. The relationships between the newborn parameters and the childhood parameters were analyzed by correlation analyses and multiple regression analyses. Data were analyzed on 132 males and 118 females. 58% were African American, 28% were Caucasian, 12% were Hispanic. Mean age at adolescent exam was 12.3 yrs. Mean BP was 111 ± 11/65 ± 9 mmHg. Correlation coefficients of birth weight with all BP measures were non-significant, except for the first auscultated diastolic BP (r = .143, P = .036) and this was a positive relationship. As a measure of “thinness” at birth, ponderal index (PI) at birth (adjusted for gestational age and adolescent age), was also correlated with adolescent BP measures, with no significant correlation coefficients detected. Multiple regression analyses for possible effect of birth parameters on child systolic BP detected no significant effects of birth parameters. A small effect was detected for diastolic BP that included the birth variables of PI, length, and head circumference (r² = .093, P = .023) but the relationship of PI and length with later BP was positive. Data on a sample that includes a substantial portion of low birth weight individuals would be needed to fully explore the relationship of birth weight to childhood BP.
birth weight cases (31%) indicate that birth weight does not correlate negatively with BP at age 12 to 14 years. The birth parameters that were detected to have some contribution to later BP showed a positive relationship, which is contrary to the low birth weight theory. These results indicate that childhood factors have a greater effect on subsequent BP than do intrauterine factors.

Key Words: Birth Weight, Blood Pressure, Adolescents

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SUCCESS OF BLOOD PRESSURE (BP) CONTROL IN THE PEDIATRIC AMLODIPINE TRIAL
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The pediatric amlodipine (AM) trial, which was the largest randomized, placebo-controlled pediatric antihypertensive trial conducted to date, demonstrated that AM significantly reduced systolic BP in children with hypertension (HTN). Since the goal of HTN treatment is to control BP, we examined the trial results to determine whether the doses of AM used in the trial were sufficient to achieve BP control, and whether the success of BP control depended on the underlying etiology of HTN.

268 children with HTN (systolic or diastolic BP >/= 95th percentile for age, gender height) were enrolled and randomized to AM treatment. In Phase I, subjects received either 2.5 or 5.0 mg of AM once-daily; in Phase II, one-third of subjects underwent placebo withdrawal while the others continued to receive AM. Each phase lasted 4 wk. 184 subjects (68.7%) had secondary HTN, including renal disease (n=67), obesity (18), drug-induced (13), vascular disease (11), multiple causes (62) and other (13). 96.2% had systolic HTN and 27.7% had diastolic HTN at enrollment. Baseline systolic BP (SBP) in the subjects with primary HTN was 111±8% of Task Force norms, compared to 110±10% for those with secondary HTN (P=0.30). Pretreatment diastolic BP (DBP) was 91±14% of Task Force norms for those with primary HTN and 92±16% for those with secondary HTN (P=0.45). Success of BP control, defined as BP </= to the 95th percentile at the final study visit, is summarized below:

<table>
<thead>
<tr>
<th>SBP Control</th>
<th>DBP Control</th>
<th>SBP &amp; DBP Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>All causes</td>
<td>34.5%</td>
<td>55.1%</td>
</tr>
<tr>
<td>Primary HTN</td>
<td>33.3%</td>
<td>45%</td>
</tr>
<tr>
<td>Secondary HTN</td>
<td>35.2%</td>
<td>59.1%</td>
</tr>
</tbody>
</table>

There were no differences in the proportion of patients controlled according to etiology of HTN (primary vs. secondary). Results of all analyses were similar when obesity HTN was reclassified as primary HTN. We conclude that during the pediatric AM trial, SBP control was achieved less often than DBP control, and that control of both SBP and DBP was relatively infrequent. The success of BP control was not affected by the underlying cause of HTN. Since a relatively low percentage of subjects achieved complete BP control during the trial, doses of AM higher than the ones used in the trial may be necessary for optimal management of hypertensive children with AM.

Key Words: amlodipine, children, clinical trial

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ADDRESSING PEDIATRIC HYPERTENSION IN RESIDENCY TRAINING PROGRAMS
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Overweight and obesity have reached epidemic proportions in all age groups within the U.S. Higher blood pressures are correlated with higher levels of body mass index in all age groups. Many of the outcomes associated with obesity that previously were thought of as diseases of adults are now affecting children in increasing numbers. The processes associated with cardiovascular risk factors begin at an early age and represent a heightened need for awareness of these issues in the pediatric population.

This project focuses on increasing the awareness, evaluation, and management of hypertension and other CVD risk factors in the pediatric population by family medicine and pediatric residents. The purposes of this poster presentation are to describe (1) baseline knowledge of hypertension and other CVD risk factors; (2) current methods of assessment and evaluation of these risk factors; and (3) current trends in medication utilization in pediatrics by these residents pre- and post-educational programs delivered by the University of Mississippi Medical Center Division of Hypertension.

Mississippi leads the nation in prevalence rates of obesity and diabetes, clearly associated risks for the development of CVD. Data support the need for additional education and awareness of CVD risk factors in the pediatric population at multiple levels. Increased attention in pediatrics is imperative because of the very early onset of CVD risk factors. Identification of children at high risk may prevent or slow the development of future complications. Using methods tested in this project, multi-level educational programs addressing these issues are being developed for statewide dissemination.

Key Words: pediatric hypertension, risk factors, assessment

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MASKED HYPERTENSION IN ADOLESCENTS

The objective of the present study was to analyze the significance of masked hypertension in adolescents assessed by the relationship with left ventricular mass. Nineteen children (aged 11.4±2.9) normotensive by office BP (Task Force BP in Children, Pediatrics 1996;98:649-658) and with systolic ambulatory hypertension (Lurbe et al, Am J Hypertens 2000;13:265) during 3 years of follow-up were included. Twenty-four hour ABPM (Spacelabs 90217) was performed every year. At the time of the last ABPM, left ventricular mass index (LVMI, g/m²) was calculated by echocardiography. Thirteen normotensive children by both office and ambulatory BP with the same age, sex and follow-up were included as controls. LVMI was significantly higher in cases as compared to controls (34.2±7.2 vs 29.3±4.8; p=0.038). The correlation coefficients between LVMI and office and awake SBP were 0.24 (p = ns) and 0.45 (p<0.05), respectively. The figure shows the percentile distribution of left ventricular mass index (Daniels, Blood Press Monit 1999;4:165-170) in cases and controls. In conclusion, masked hypertension in adolescents indicated an increase in LVMI, an early marker of cardiovascular risk.

Key Words: masked hypertension, significance of ambulatory blood pressure, left ventricular mass