

Screening for hypertension in a high school population

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Summary: Of 15 594 high school students (ages, 15 to 20) whose blood pressure was measured in a screening program, 350 (2.2%) had hypertensive readings (150 mm Hg or more systolic, or 95 mm Hg or more diastolic, or both). The mean blood pressure for the boys was $125.0 \pm 12.1/71.8 \pm 10.9$ mm Hg, and for the girls, $119.8 \pm 10.2/72.3 \pm 9.2$ mm Hg.

The parents of the students with hypertensive readings were advised to send their children to a physician. By 6 months, of the 232 who were followed up, 156 (67.2%) had visited a physician and in 19 cases (12.2%) the physician had confirmed the hypertensive readings. Only one student, an asymptomatic 17-year-old boy whose hypertension had not previously been detected, was found to have secondary hypertension, which was relieved surgically. Of the 18 hypertensive students 4 are currently receiving antihypertensive medication and 8 continue to have their blood pressure monitored.

The mean blood pressures recorded in the physicians' offices averaged 23.7/11.1 mm Hg less than those recorded in the schools. One reason for this was that none of the physicians used pediatric cuffs, but these were required by 62.4% of the students at the screening. Hence, the intravascular blood pressure was probably underestimated in a number of cases in the physicians' offices.

Résumé: Dépistage systématique de l'hypertension dans une population d'étudiants au secondaire

A cours d'un programme de dépistage de l'hypertension portant sur 15 594 étudiants de niveau secondaire (âge variant de 15 à 20 ans), on a découvert 350 (2.2%) dont les pressions étaient hypertendues (au moins 150 mm Hg pour la systolique ou de 95 mm Hg pour la diastolique, ou les deux à la fois). Chez les garçons la pression moyenne était de $125.0 \pm 12.1/71.8 \pm 10.9$ mm Hg et chez les filles, de $119.8 \pm 10.2/72.3 \pm 9.2$ mm Hg.

On conseille aux parents des étudiants hypertendus de

les envoyer consulter un médecin. Après 6 mois, des 232 étudiants qui avaient été suivis, 156 (67.2%) avaient visité leur médecin et dans 19 cas (12.2%) le médecin avait confirmé les pressions hypertendues. Chez un seul étudiant, garçon de 17 ans, asymptomatique et dont l'hypertension n'avait pas encore été découverte, on décela une hypertension secondaire, qui fut soulagée par la chirurgie. Quatre des 18 autres étudiants hypertendus reçoivent couramment une médication antihypertensive et chez 8 autres la pression artérielle est surveillée systématiquement.

Les pressions moyennes enregistrées dans les bureaux des médecins étaient inférieures d'environ 23.7/11.1 mm Hg à celles qui avaient été notées dans les écoles. Une explication à ces différences est qu'aucun des médecins n'avait utilisé de brassard pédiatrique, alors que 62.4% des étudiants l'avaient demandé au dépistage. Il s'ensuit que la pression intravasculaire a été probablement sousestimée dans un certain nombre de cas dans les bureaux de médecins.

Hypertension is the most common chronic disease in Canada^{1,2} and the United States,^{3,4} affecting 15% of all adults. If untreated it is associated with high morbidity and mortality;⁵ one study suggests that the vascular complications of untreated hypertension are a major contributor to 26% of all deaths in middle age.⁶ Yet early treatment of hypertension can dramatically reduce the incidence of these complications.⁷⁻¹⁰

If hypertension is defined as persistent elevation of blood pressure to more than 140 mm Hg systolic or 90 mm Hg diastolic, or both, then up to 11% of adolescents may have this condition.¹¹ One study of 30 children with blood pressures at or above these values who received no treatment showed that 8 died after a mean survival of 21 years and that many others had evidence of vascular damage.¹² And a 7-year follow-up¹¹ of 30 hypertensive adolescents who received no treatment showed that fatal cerebral hemorrhage developed in 2, hypertensive heart disease in 1 and sustained hypertension (≥ 160 mm Hg systolic or ≥ 95 mm Hg diastolic, or both) in 8 (with cardiovascular and cerebrovascular symptoms in 3; asymptomatic in 5); blood pressure readings of more than 140 and/or 90 mm Hg but less than 160 and/or 95 mm Hg persisted in 7; and normotension was manifest in the remaining 12. If hypertension in adolescents is indeed common, if its complications are serious, and if the results of treatment are satis-

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Table I—Blood pressure readings in high-school-aged students in Edmonton, compared with results from other studies

Age (yr)	Present study				Boe <i>et al</i> ¹⁵		Boynton <i>et al</i> ¹⁶			Master <i>et al</i> ¹⁷		
	No. of cases	Blood pressure (mm Hg)			No. of cases	Blood pressure (mm Hg)		No. of cases	Blood pressure (mm Hg)		Blood pressure (mm Hg)	
		Mean	SD	Median		Mean	SD		Mean	SD	Mean	SD
<i>Male, systolic</i>												
15	220	123.9	11.6	124	198	122.8	11.7					
16	2494	124.0	11.9	124	177	126.2	13.0	114	11.8	12.0	118.4	12.2
17	2487	125.0	12.1	124	176	129.2	13.3	1694	121.1	13.2	121.0	12.9
18	2013	126.2	12.1	126	183	131.5	13.7	8344	121.7	13.0	119.8	12.0
19	469	126.0	12.6	126	228	132.6	14.4	6470	122.3	13.0	121.8	15.0
20	99	124.9	12.0	124				5088	122.8	12.6		
Total	7782	125.0	12.1	124								
<i>Female, systolic</i>												
15	274	121.2	10.9	120	188	121.6	12.5					
16	2702	120.0	11.1	120	213	121.5	12.8	159	109.2	12.7	116.1	12.1
17	2652	119.8	10.8	120	316	124.1	11.4	2182	108.8	12.2	116.0	11.5
18	1895	119.7	10.9	120	345	125.1	11.8	7432	108.3	12.4	116.3	11.4
19	231	118.6	11.1	118	363	125.0	12.4	4753	109.9	12.3	115.1	11.9
20	58	119.2	12.6	117				4273	111.0	12.0		
Total	7812	119.8	10.2	120								
<i>Male, diastolic</i>												
15	220	70.3	9.7	70	198	69.3	10.9					
16	2494	68.9	10.3	70	177	69.8	10.9	114	72.7	9.9	72.9	10.3
17	2487	69.6	10.5	72	176	71.6	9.5	1694	72.3	10.4	74.4	9.4
18	2013	71.0	10.4	72	183	73.1	11.9	8344	72.1	10.4	74.4	10.0
19	469	71.2	10.1	74	228	73.7	10.4	6470	72.9	10.5	74.6	10.3
20	99	68.6	9.7	70				5088	73.8	9.9		
Total	7782	71.8	10.9	72								
<i>Female, diastolic</i>												
15	274	73.5	9.3	74	188	61.0	10.0					
16	2702	72.3	9.4	72	213	61.3	8.8	159	67.3	10.7	72.3	9.6
17	2652	73.0	9.1	72	316	62.1	8.7	2182	66.9	10.0	72.0	9.2
18	1895	72.8	8.9	72	345	61.5	9.0	7432	66.6	10.5	71.8	8.6
19	231	72.5	8.7	72	363	61.9	9.8	4753	68.1	10.1	71.1	8.9
20	58	74.2	11.5	74				4273	69.7	9.8		
Total	7812	72.3	9.2	72								

Table II—Blood pressure values by percentile

Percentile	Present study (ages 15 - 20)		Londe ¹⁸ (age 15)		Acheson ¹⁹ (ages 18 - 24)		Master <i>et al</i> ¹⁷ (ages 16 - 19)		Boe <i>et al</i> ¹⁵ (ages 15 - 19)	
	Systolic	Diastolic	Systolic	Diastolic	Systolic	Diastolic	Systolic	Diastolic	Systolic	Diastolic
<i>Male</i>										
80	134	80	138	78	133	80				
85	138	82			135	83				
90	140	84	142	82	140	85	145	90		
95	145	88			144	91			153	91
99	156	92								
<i>Female</i>										
80	130	80	134	79	121	78				
85	132	82			123	79				
90	134	84	140	82	125	81	140	90		
95	138	88			131	84			144	89
99	148	94								

Table III—Prevalence of hypertension using two criteria

Status	≥150 and/or ≥95 mm Hg						≥140 and/or ≥90 mm Hg					
	Male		Female		Total		Male		Female		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
High systolic	187	2.4	58	0.7	245	1.6	709	9.1	234	3.0	943	6.1
High diastolic	31	0.4	42	0.5	73	0.5	116	1.5	157	2.0	273	1.8
High systolic and diastolic	23	0.3	9	0.1	32	0.2	138	1.8	71	0.9	209	1.3
Total with hypertension	241	3.1	109	1.3	350	2.2	963	12.4	462	5.9	1425	9.1
Normotensive	7541	96.9	7703	98.6	15244	97.7	6819	87.6	7350	94.1	14169	90.8
Total number	7782	100.0	7812	100.0	15594	100.0	7782	100.0	7812	100.0	15594	100.0

factory, then detection and treatment of hypertension in adolescents would seem advisable.

This report concerns our experience in screening 15 594 students for hypertension in 18 Edmonton high schools.

Materials and methods

Obtaining permission

The Edmonton public and separate school boards and the local board of health were contacted for permission to conduct the program. The school boards then sent letters to teachers and principals in the 18 high schools explaining the project and asking them to inform the students of the study. School newspapers publicized blood pressure information and the students were told that having their blood pressure taken was voluntary.

Training of technicians

Six women, including two nurses, were employed to carry out the testing. All attended lectures on the anatomy and physiology of the cardiovascular system, the epidemiologic aspects of hypertension, and the principles and benefits of dietary and drug treatment. They also received detailed instructions on how to measure blood pressure and were required to pass a practical test.

Student education

The blood pressure technicians gave the students lectures and demonstrations on hypertension before the screening began.

Method of blood pressure determination

Mercury manometers with blood pressure cuffs of different lengths and widths were used. The ideal cuff width was considered to be 20% more than the diameter of the arm.¹³ The three cuff sizes used were (a) pediatric cuffs (bladder size, 9.5 x 17.5 cm), (b) adult cuffs (bladder size, 12.5 x 24 cm) and (c) obese cuff (bladder size, 15 x 41.5 cm). The diastolic pressure was recorded as the point where the Korotkoff sounds disappeared or, if the sounds failed to disappear, the point at which they became muffled. The blood pressure was measured in the right arm with the student seated.

Criteria for hypertension

At least one reading was taken on every student. If the systolic pressure was 150 mm Hg or more, or the diastolic pressure was 95 mm Hg or more, two more readings were taken 5 minutes apart. If either (or both) of the average values from the three readings was at or exceeded the above-mentioned value the student was considered to be hypertensive.

Follow-up

A letter was sent to the parents of students found to be hypertensive, indicating that their child's blood pressure was elevated and should be rechecked by a physician. The letter also explained what high blood pressure is, that elevations can be transient and related to emotion or exercise, and that only persistent elevations are important. The parents were asked to sign and return by mail a form allowing release of information from their child's physician. If the form was not returned within 1 month, a second form was sent out and a phone call made to the parents.

Immediately after the consent form was received the physician in charge of the student was mailed the student's screening blood pressure data and given guidelines for investigation should the pressure remain elevated. These

guidelines were derived from the United States Hypertension Study Group recommendations¹⁴ and included the following: determination of serum creatinine, potassium, uric acid, cholesterol and blood sugar concentrations; urinalysis and urine culture; electrocardiography; chest radiography; and intravenous pyelography. If the intravenous pyelogram (IVP) was abnormal, if the diastolic blood pressure exceeded 105 mm Hg, or if the history, physical examination or results of laboratory tests suggested secondary hypertension, more extensive investigation, such as determination of urinary metanephrine concentrations, renal angiography or renin-aldosterone studies, was recommended. The physicians were asked to complete and return a questionnaire summarizing their findings.

Results

Blood pressure readings

From 18 high schools 15 594 out of a possible 23 603 students between the ages of 15 and 20 volunteered to have their blood pressure measured. The screening was completed in 4 months.

Pediatric cuffs were required for 62.4% of the students, adult cuffs for 36.4% and obese cuffs for 1.2%.

The mean blood pressure for the 7782 boys was 125.0 ± 12.1 mm Hg systolic and 71.8 ± 10.9 mm Hg diastolic, and for the 7812 girls, 119.8 ± 10.2 mm Hg systolic and 72.3 ± 9.2 mm Hg diastolic; the median value was 124/72 mm Hg for boys and 120/72 mm Hg for girls (Table I). (These values are similar to those reported from other studies.) The blood pressure values at various percentiles are shown in Table II. (These also are similar to those reported from other studies.)

By the criteria of the present study 350 students (2.2% of those tested) had hypertension: 245 (70.0%) had systolic hypertension alone, 73 (20.9%) had diastolic hypertension alone and 32 (9.1%) had both systolic and diastolic hypertension (Table III). There were 105 students with mean diastolic pressures of 95 mm Hg or more, including some with pressures up to 114 mm Hg (Table IV). If we had used the criteria of the United States Hypertension Study Group (≥ 140/or 90 mm Hg), we would have found 1425 students (9.1%) to have hypertension (Table III).

Table IV—Distribution of high diastolic pressures

Sex	Diastolic pressures (mm Hg)				Total
	95 - 99	100 - 104	105 - 109	110 - 114	
Male	24	24	1	5	54
Female	35	12	2	2	51
Total	59	36	3	7	105

Follow-up of students with hypertensive readings

Parents of 232 (66.3%) of the 350 students with elevated blood pressures returned the release forms, and 156 (67.2%) of the 232 students went to their physicians over the next 6 months. Of the 156, only 19 (12.2%) were found to have persistent elevation of blood pressure (150 mm Hg or more systolic, or 95 mm Hg or more diastolic, or both). Of the 19, 9 had systolic hypertension alone, 2 had diastolic hypertension alone (both 98 mm Hg) and 8 had systolic and diastolic hypertension (range, 150 to 220/95 to 125 mm Hg) (0.06, 0.01 and 0.05%, respectively, of the 15 594 students screened). Of the 156 students, systolic hypertension was confirmed in 17 of 102 (16.7%) and diastolic hypertension in 10 of 68 (14.7%).

A summary of the results of laboratory investigations

performed among the 156 students is presented in Table V. The blood urea nitrogen and serum potassium values, urine cultures, 24-hour urine metanephrine or vanillylmandelic acid values, chest radiographs and electrocardiograms (ECGs) were normal in all patients studied. Details of the seven patients with abnormal laboratory findings are shown in Table VI. Five of the seven students had normal mean blood pressures in their physicians' offices.

In student 5 the presence of a gaping right ureteral orifice suggested that previous reflux was the probable cause of the right-sided parenchymal scarring; however, no reflux was demonstrated by cystography. Her blood pressure was consistently normal in the physician's office, and the renin concentration in blood taken from both renal veins was equal, suggesting that the right kidney was not a factor in her labile hypertension.

Student 7 was a slender, asymptomatic 17-year-old white boy whose blood pressures at the time of screening averaged 180/114 mm Hg. In his physician's office the readings ranged from 164/104 to 220/160 mm Hg (mean, 210/125 mm Hg). The blood pressure in the two arms did not differ greatly and the pressures in the two legs averaged 5 to 10 mm Hg higher than those in the arms. The arterioles of the ocular fundi were narrowed but there was no evidence of hemorrhages, exudates, papilledema, silver or copper wiring or arteriovenous nicking. Examination of the heart revealed an accentuated aortic second sound and a left ventricular heave but the point of maximal impulse was within the midclavicular line. There was no delay in the femoral pulses. A high-pitched systolic and diastolic bruit was heard in the epigastric and both hypochondrial regions of the abdomen. Results of all blood and urine investigations were normal (in addition to those listed in Table V, the following determinations were performed: hemoglobin, serum electrolytes, uric acid, cholesterol and triglycerides, and blood sugar). The

Table V—Summary of results of laboratory investigations performed among 156 students who visited their doctor after they were found by screening to be hypertensive

Test	Student's blood pressure status								
	Hypertensive at screening			Hypertensive in doctor's office			Total hypertensive		
	No. performed	No. normal	No. (and %) abnormal	No. performed	No. normal	No. (and %) abnormal	No. performed	No. normal	No. (and %) abnormal
Blood urea nitrogen	36	36	0 (0.0)	15	15	0 (0.0)	51	51	0 (0.0)
Serum creatinine	11	10	1 (9.1)	12	11	1 (8.3)	23	21	2 (8.7)
Serum potassium	11	11	0 (0.0)	10	10	0 (0.0)	21	21	0 (0.0)
Proteinuria 2+	70	67	3 (4.3)	12	12	0 (0.0)	82	79	3 (3.7)
Hematuria (> 5 RBC/hpf)	70	69	1 (1.4)	12	12	0 (0.0)	82	81	1 (1.2)
Urine culture	8	8	0 (0.0)	9	9	0 (0.0)	17	17	0 (0.0)
Intravenous pyelography	14	11	3 (21.4)	11	10	1 (9.1)	25	21	4 (16.0)
Vanillylmandelic acid or metanephrines	5	5	0 (0.0)	7	7	0 (0.0)	12	12	0 (0.0)
Chest radiography	24	24	0 (0.0)	11	11	0 (0.0)	35	35	0 (0.0)
Electrocardiography	9	9	0 (0.0)	6	6	0 (0.0)	15	15	0 (0.0)

Table VI—Summary of abnormal laboratory findings in seven students

Student no.	Age	Sex	Mean blood pressure (mm Hg)		BUN (mg/dl)	Serum Cr. (mg/dl)	Serum K (mmol/l*)	Proteinuria (2+) or more	Hematuria (> 5 RBC/hpf)	Intravenous pyelogram	Comments
			Screening	Doctor's office							
1	16	M	188/84	130/78	—	1.8	—	2+	0	Horseshoe kidneys	No definite cause found for reduced function or proteinuria.
2	16	M	168/72	105/69	20	—	—	3+	0	Normal	No definite cause found for proteinuria.
3	15	M	158/78	140/82	12	1.1	4.2	2+	0	Severe right uretero-pelvic junction obstruction	Right pyeloplasty relieved obstruction. BP normal and unchanged pre- and postoperatively.
4	16	M	152/94	140/72	19	—	—	0	8 RBC/hpf	Normal	Hematuria persisted for 5 months. Urologic investigation being done.
5	17	F	150/90	125/79	17	—	4.0	0	0	Contracted right kidney with scarring of all calyces	Cystoscopy showed gaping right ureteral orifice. Voiding cystogram showed no reflux. Renal vein renin concentrations equal bilaterally. No surgical procedure done.
6	15	F	167/87	151/90	—	1.5	—	—	—	Normal	No definite cause found for elevated serum creatinine value.
7	17	M	180/114	210/125	17	1.0	3.9	0	0	Slight delay in appearance of dye bilaterally	Bilateral renal artery stenosis and coarctation of abdominal aorta above renal arteries. Graft inserted to bypass both renal arterial stenotic areas. BP 120/80 mm Hg after surgery.

BUN = blood urea nitrogen; Cr. = creatinine; K = potassium.
* = meq/l

chest radiograph and ECG were also normal. A rapid-sequence IVP showed normal-sized kidneys, with a slightly delayed nephrogram bilaterally and slightly delayed appearance of the contrast medium in both renal pelves. By 5 minutes, however, dye appeared equally in both pelves. A retrograde femoral angiogram demonstrated coarctation of the abdominal aorta just proximal to the renal arteries, and narrowing of the proximal 2 cm of both renal arteries (Fig. 1). There was also narrowing of the proximal part of the celiac trunk and superior mesenteric artery, the main collateral to the bowel being the marginal artery of Drummond. The ratio of the renin concentrations in the right and left renal veins was 2:1. At operation the renal arteries were found to be narrowed close to the aorta. Dacron grafts were attached end-to-side to both renal arteries and both common iliac arteries, thus bypassing the stenotic areas (Fig. 2). In the postoperative period his blood pressure decreased to 120/80 mm Hg and has stayed at this value for the past 12 months.

Of the 19 students whose mean blood pressure in the physician's office was 150 mm Hg or more systolic, or 95 mm Hg or more diastolic, or both, 6 were discharged with no plans for follow-up, 8 made follow-up appointments, 4 began diuretic therapy and 1 was cured surgically, as described above.

Comparison of hypertensives' average blood pressure at time of screening and in physicians' offices

The records of the 156 students who visited their physicians showed that pediatric cuffs were not used by the physicians for blood pressure measurement. The mean readings in the schools averaged 23.7/11.1 mm Hg higher than those in the physicians' offices. When adult-sized cuffs were used both in the schools and by the physicians the mean readings in the schools averaged 23.4/7.2 mm Hg more than those in the physicians' offices. When pediatric-sized cuffs were used in the screening and adult-sized cuffs were used by the physicians, the differences in pressures averaged 22.7/13.8 mm Hg, the difference in diastolic pressure being significantly more in these circumstances than when similar adult-sized cuffs were used on both occasions ($P = 0.027$). Manometers used by the physicians were of the aneroid type in 32% and of the mercury type in 68%.

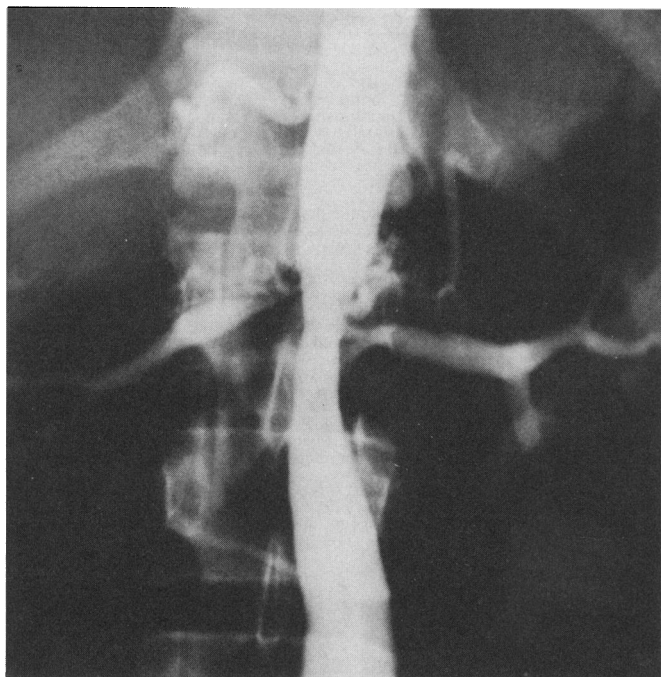


FIG. 1—Narrowing of aorta just proximal to renal arteries and narrowing of proximal 2 cm of both renal arteries.

Discussion

Using our definition of hypertension (persistent elevation of blood pressure to 150 mm Hg or more systolic, or 95 mm Hg or more diastolic, or both) 2.2% of the students tested were hypertensive. The pressures in this definition are higher than the standards used by the United States Hypertension Study Group (≥ 140 and/or 90 mm Hg).¹⁴ Had their criteria been used 9.1% of the students would have been advised to visit their doctors for rechecking (Table III).

There was a 66.3% response to the follow-up letter but 32.8% of those who returned the consent form failed to send their child to the physician within 6 months. This reflects the general public ignorance of the dangers of hypertension.²⁰ Public health nurses could visit people with hypertension and encourage them to seek a doctor's help.

Of the students who visited their doctors only 12.2% had hypertensive mean blood pressures, and overall the readings in the physicians' offices averaged 23.7/11.1 mm Hg less than those at the schools. Such a decrease in pressure from initial testing to subsequent rechecking is not uncommon; in surveys of predominantly adult populations the decrease averaged 16.1/18.0,²¹ 10.1/17.8²² and 11.8/2.5 mm Hg.¹ In a recent study²³ less than 30% of adolescents who were found to have hypertension at an initial screening still had hypertension 7 to 10 days later. To avoid overdiagnosis of hypertension, children should be screened on two or three separate occasions before being sent to their physicians.

One cause for the discrepancy between the screening and the physicians' readings was the use of the three sizes of cuffs in the screening procedure. In the schools 62.4% of the students required pediatric cuffs, but when they visited

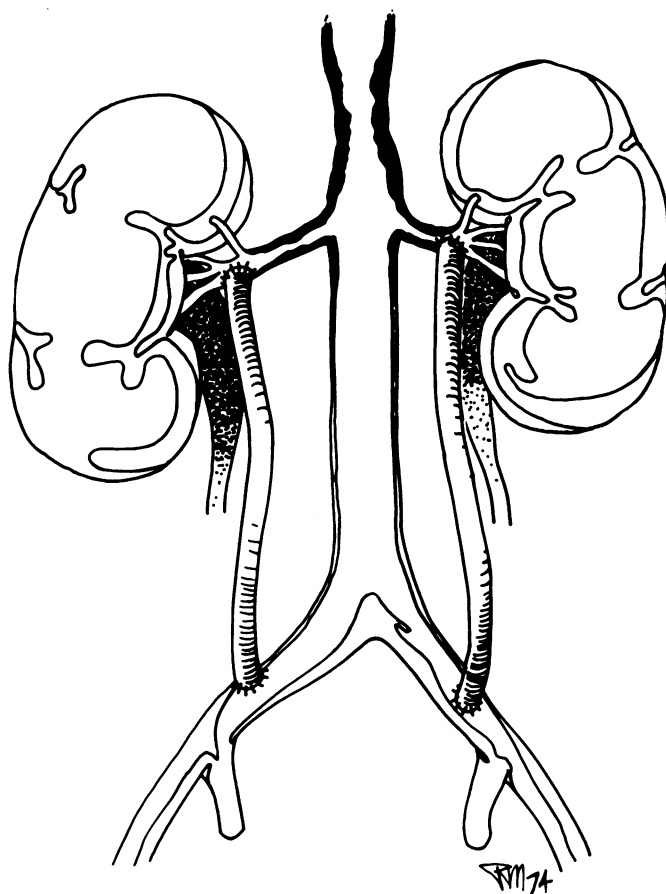


FIG. 2—Dacron grafts attached end-to-side to both renal arteries and both common iliac arteries, bypassing stenotic areas.

their physicians an adult cuff was used, which would be too wide for their arms; consequently the physician would underestimate the actual intravascular blood pressure.¹³ Hence, physicians need to be taught the importance of using the appropriate cuff size to obtain a correct blood pressure measurement. Another cause for the discrepancy may be that aneroid manometers were used by 32% of the physicians, whereas only mercury manometers were used in the schools. Aneroid manometers are often less accurate than mercury manometers and tend to underestimate the blood pressure.^{24,25}

Only 1 of the 19 students with consistent hypertensive readings had proved secondary hypertension. However, for many of the other students the investigation was not detailed enough to rule out secondary causes. The proportion of cases of the secondary type in a group of hypertensive patients depends on the criteria for hypertension. Londe and colleagues²⁶ considered children to be hypertensive when their systolic or diastolic pressures, or both, were repeatedly above the 90th percentile. For a 15-year-old boy this means a pressure of 142 mm Hg or more systolic, or 82 mm Hg or more diastolic, or both; for a 15-year-old girl the corresponding values are 140 and 82 mm Hg. Of the 74 asymptomatic children they investigated only 5 had possible secondary hypertension. When hypertension is more severe, secondary causes are more common. Hull,²⁷ for example, found that in those children with hypertension who had diastolic blood pressures of less than 110 mm Hg, 32% had secondary hypertension, whereas in those with diastolic pressures of more than 120 mm Hg 55.6% had secondary hypertension.

Londe and colleagues²⁶ found that 53% of 74 children with mild hypertension were obese, compared with 14% of 74 matched normotensive children. Others have also noted this association between obesity and adolescent hypertension.¹¹ In our study, however, only 2 of the 19 hypertensive students were obese. One had mild systolic and the other mild diastolic hypertension.

Treatment

How does one decide which adolescent to treat? Freis²⁸ has suggested the following approach to people over 15 years of age with hypertension: If the average diastolic pressure is 105 mm Hg or more on three successive office visits the patient should be treated; if it is between 90 and 104 mm Hg a cumulative point-score system can be used, one point being given for each of the following features: (a) less than 45 years old, (b) male, (c) black, (d) diastolic pressure persistently 95 mm Hg or more, (e) systolic pressure persistently 165 mm Hg or more, (f) history of a major hypertensive complication in the parents, (g) hypercholesterolemia and (h) diabetes. Two points are given if there is target-organ damage (e.g., funduscopic, renal or cardiac). Patients with an average diastolic pressure of 100 to 104 mm Hg should be treated if their score is 2 or more, those with an average diastolic pressure of 95 to 99 mm Hg should be treated if their score is 3 or more and those with an average diastolic pressure of 90 to 94 mm Hg should be treated if their score is 4 or more. Although such a scoring system should only be used as a rough guide, it does stress that factors other than the blood pressure should be considered when deciding if and when to treat a hypertensive patient.

Children destined to have essential hypertension may have higher blood pressures than their peers at a very early stage in life. In the series of Londe and colleagues²⁶ 65% of those whose blood pressure was initially above the 90th percentile had readings at this level 3 to 8 years later. Buck²⁹ found a similar tendency in children who were observed from ages 5 to 12. In Loggie's series of adolescents with borderline hypertension 49% had borderline hypertension 3 to 3½ years later, 35.5% were normotensive and 15.5% then had established hypertension.³⁰ At present there is no supporting evidence for treating a child whose blood pressure is appreciably higher than the mean for his age, but a program to treat obesity, increase physical activity, reduce salt intake and avoid smoking would seem advisable.

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