parasite develop. This has been done by helicopters with non-persistent insecticides such as temephos. The strategy assumes that if transmission can be arrested for longer than the life span of the parasites, then when spraying stops and the flies return there will be no reservoir of infection to reinfect them.

Unfortunately, the insecticide programme has not completely arrested transmission, and the target area is bordered by infected people living in untreated forest areas. The forest strain of *Onchocerca* has been assumed to be less pathogenic than the savanna strain, but there are doubts. So the fear is that when spraying stops the disease will return.

Any antiparasitic chemotherapy that could be used for mass treatment would enormously enhance the effectiveness of the control programme by reducing the reservoir of infection immediately, but neither of the drugs in widespread use is suitable for this purpose. Diethylcarbamazine is a piperazine compound with great activity against microfilariae, but treatment with it is often associated with a severe allergic reaction to the death of the baby worms—the Mazzotti reaction—with fever, pruritus, adenitis, iritis, and hypotension. Furthermore, since it has no effect on the adult worms the microfilariae soon return as a result of continued production by the females. A course of intravenous injections of suramin (a complex urea derivative) will kill the adult worms and accelerate the death of microfilariae, but it may cause a fatal generalised disease to which there is no antidote. So there is a desperate need for more effective antiparasitic chemotherapy in onchocerciasis both for individual and for mass treatment. Carefully conducted trials at the Onchocerciasis Chemotherapy Research Centre in Tamale, northern Ghana, have shown that metriphonate, mebendazole, and levamisole do not provide the answer needed,[1,2] and control of the Mazzotti reaction produced by diethylcarbamazine has proved pharmacologically intractable.[3,4]

It has been encouraging, therefore, that the new drug ivermectin can dramatically reduce the numbers of microfilariae in the skin without causing the severe Mazzotti reactions caused by diethylcarbamazine. The initial reports were in lightly infected patients,[5] but more recently the drug has been shown to be effective in patients with heavy infections—and only a single oral dose is needed.[6] Ivermectin is a compound produced when the macrocyclic lactone avermectin is subject to fungal metabolism. It has been recognised as an important veterinary broad spectrum antiparasitic drug since 1980.[7] As has so often been the case, the veterinary surgeons have shown the physicians the way.

The surprising effect of ivermectin on onchocerciasis is its prolonged microfilaricidal activity combined with the low incidence and mild severity of the Mazzotti reaction which follows its administration. It seems to lack effect on the adult worms. Nevertheless, ivermectin seems to provide us with a very useful tool which, when combined with vector control measures, will greatly enhance the prospects of eradication of this horrid disease. Periodic mass treatment alone would probably eliminate serious ocular lesions, and the drug should be welcomed as the first major advance in onchocerciasis for several decades.

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Hypertension in children

The United States National Heart, Lung, and Blood Institute recommended in 1977 that all chidren over the age of 3 years should have their blood pressure recorded annually.[1] The intention was to encourage the discovery of those with secondary (and potentially reversible) hypertension and possibly also those likely to develop essential hypertension in adult life. In the years since that recommendation was made interest in the early clinical course of essential hypertension has increased in parallel with new clinical and epidemiological data. We may now reasonably re-examine whether children ought to be screened for hypertension, how the condition is to be defined, its relations to future adult hypertension and hence impaired health, and the criteria for treatment—all topics which were discussed at a recent workshop convened by the National Heart, Lung, and Blood Institute.[2]

Blood pressure in children increases progressively with age, the increase being more considerable for systolic pressure, so that any definition of normal and abnormal blood pressure must take age into account. Furthermore, the method of measurement (with respect to such factors as posture and cuff width) should be standardised and identical with that used for the reference population. National Heart, Lung, and Blood Institute charts give 95th percentile levels of seated blood pressure in 3, 6, 9, and 12 year olds of 112/78, 116/79, 125/82, and 135/87 mm Hg, respectively. Since blood pressure at all ages is normally distributed and the ultimate fate of children whose blood pressure is consistently above these levels is unknown "hypertension" defined in this way is arbitrary and may be a misnomer. Indeed, the institute has cautioned against labelling a child as hypertensive, preferring instead the more euphemistic term "high normal" blood pressure.

What, then, is known of the epidemiology of blood pressure in childhood, and what inferences may be made regarding the possible progression of high normal blood pressure to established hypertension? The data come from various studies in the United States (notably those from Muscatine, Ohio,[3] and Bogalusa, Louisiana,[4] the Netherlands,[5] and New Zealand.[6] Blood pressure in children correlates predominantly with indices of body mass and obesity.[3,4,7,8] Other associations are with parental blood pressure, resting heart rate, salt intake, sex, and sexual maturity. "Tracking" of blood pressure—that is, maintenance of rank order within the distribution over time—is present during childhood but its predictive power is low. In the Muscatine study raised blood pressure was found initially in 13% of 6622 schoolchildren but persisted in fewer than 1%, many of whom were obese.[9] Similar findings have been reported from Dallas.[10] In a more recent study only 45% of children remained within the highest

quintile for blood pressure over a four year follow up.[8] Those who entered this quintile during the study were initially heavier and fatter than their peers and had lower heart rates.

Possibly, therefore, those children who appear consistently at the high end of the pressure distribution may represent the future adult hypertensive population, but this is still uncertain. Further supportive evidence has come from a study that showed that sustained hypertension emerged in over half of adolescents with "borderline" levels of pressure over three to four years.[11] Several other studies have shown echocardiographic evidence of increased thickness of the septum and the left ventricular posterior wall without loss of cardiac function in children in this age group with raised blood pressure, though these differences may merely reflect the increased weight and ponderosity of the "hypertensive" groups.[12 13] Similar findings have been reported in college students and young adults with mild hypertension and these groups also show both functional cardiac abnormalities and correlations between raised blood pressure and future morbidity.

It is therefore tempting (but possibly misleading) to view these studies overall as showing the gradual evolution of hypertension. Cardiac output (determined echocardiographically) is normal or decreased in children with higher blood pressures; these findings do not support the presence of an early hyperkinetic phase in the development of hypertension.[14 15] In theory, the rate of increase in blood pressure in individual children might be related to the absolute level of pressure at any given time, a phenomenon clumsily termed "horse racing." Recent work by Hofman has excluded this process in childhood.[16]

Measurement of the blood pressure should be routine in all children with non-trivial complaints. In asymptomatic and apparently healthy children one preschool reading and one taken in early adolescence may be enough, but more frequent readings should be taken in children who are overweight, in those with a family history of hypertension or cardiovascular disease, and in those in whom the blood pressure is at or around the 95th percentile. In our opinion the original advice from the National Heart, Lung, and Blood Institute to review all children annually is unwarranted. The clinical approach to the child with raised blood pressure should be determined partly by the age of the child, since secondary forms of hypertension become less common with increasing age. Secondary hypertension should always be excluded in children with abnormal findings on physical examination, proteinuria, haematuria, or in those with very high pressures; nearly all children with a diastolic pressure above 120 mm Hg have an underlying cause regardless of age.[17]

The treatment of juvenile hypertension remains a blend of environmental manipulation and pharmacotherapy. The presumption that loss of weight leads to a reduction in blood pressure has not been formally tested in children. This has been well documented in adults, however, and overweight children may reasonably be encouraged to lose weight. The parts played by salt intake in the pathogenesis of hypertension and of salt restriction in its treatment are controversial in both paediatric and adult practice. The impressive randomised trial of sodium intake in infancy reported by Hofman *et al* strongly suggested a sinister role for salt even in children,[18] but the results of studies of salt restriction during childhood and adolescence have been disappointing and do not provide grounds for advising therapeutic salt restriction.[19 20] Treatment with drugs is not indicated in children with borderline hypertension who are free of symptoms and who do not have evidence of vascular damage. In those with higher pressures requiring treatment we would currently favour a β adrenergic blocking agent or labetalol as first choice drugs. The underlying principle should be to use the simplest regimen and the lowest possible doses, given that compliance may be poor, especially in adolescents.

The recent National Heart, Lung, and Blood Institute workshop (as reported by Loggie and coworkers[2]) focused on the need for more epidemiological data on blood pressure in children, the identification of variables predictive of adult hypertension, and further research into the mechanism and causes of hypertension. Without such information it will remain difficult to make other than arbitrary recommendations regarding the management of primary hypertension in childhood.

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