The condition of one child (case 5) worsened and after two years his parents made a considered decision to live in a rural area and to make no further contact with medical services. The condition of two children (patients 1 and 4) has remained virtually unchanged.

DISCUSSION

The young child who presented with encopresis was considered to be exhibiting an acute reaction to stress. The transient nature of the symptom and the failure to find any abnormality on clinical examination or on neuropsychological testing supported this view. He will be excluded from further discussion.

The other five children require more consideration. They presented because of failure to progress at school and because of changes in their personality towards impulsiveness. On examination three exhibited some involuntary movement disorders. In five patients, psychological testing supported the clinical findings of intellectual difficulties. The combination of emotional and motor dyscontrol and intellectual difficulties impaired the children's ability to learn in the classroom. One child had clear manifestations of Huntington's disease.

The children's distress at the consequences of the poor control over their behaviour is similar to the preservation of insight in young adults in the early stages of the disease, noted by Caine and colleagues.[6] These children had been adequately cared for by their parents, whether or not the parent at risk had manifested the disease. They came from homes which provided adequately for them. Their siblings, so far as could be judged, were asymptomatic. There did not appear to be any particular disturbances in their environment that would explain the onset and the nature of their symptoms and signs. Some of their at-risk cousins came from more disturbed backgrounds, yet, at around the same age, were asymptomatic.

The clinical findings from these children suggest the possibility that Huntington's disease may be active at a much earlier age than has been commonly assumed. This is not to say that emotional reactions to the family history, to parents' illnesses or their own difficulties did not exist in these children, or in the children's parents. But the findings suggest that it may be inappropriate to view disturbances in behaviour in children-at-risk as necessarily being emotional or conduct reactions to family stress.

On the basis of the findings it was necessary, in managing these children, to take into consideration their learning difficulties in the classroom. Their teachers were advised and special educational methods devised to circumvent the disabilities or to ameliorate their effects on learning. This was in addition to the individual and family psychotherapy or counselling, which was utilized as required and in addition to the occasional use of thioridazine and haloperidol to modify agitated or impulsive behaviour. These clinical findings may also have implications for prophylaxis.

If it is possible to find prepubertal markers of the disease, reliable genetic counselling can be given to children at risk. There has been an active search for markers for screening tests. Thorough clinical examinations of children-at-risk with objective measurements of any signs they exhibit, coupled with long-term follow-up, may provide significant information for future prophylactic measures.

ACKNOWLEDGEMENTS

I wish to acknowledge the help and encouragement I received from Dr Robinson, Dr Whitehead and Dr Law. I have utilized some of their clinical observations. I also thank: the Director, Mental Health Services of Western Australia, for his permission to publish this paper; Dr R. Ellison, consultant psychiatrist for reviewing it; Dr P. Silberstein for referral; and other members of our team who have helped with these families. The article is dedicated to the children.

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BODY WEIGHT AND DIETARY FACTORS IN HUNTINGTON'S DISEASE PATIENTS COMPARED WITH MATCHED CONTROLS

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Med. J. Aust., 1981, 1: 407–409.

A longitudinal study using medical records has confirmed that, even when eating high energy diets, loss of body weight is characteristic of Huntington's disease patients in comparison with a group of matched control subjects. Further analysis showed that although some Huntington's disease patients initially may gain weight rapidly after a period in hospital, they eventually lose weight to below their admission levels. This pattern was not seen in the control group. The findings are discussed in terms of striatal pathology.

CHOREA and progressive dementia, the principal symptoms of Huntington's disease, do not usually become evident until adult life. A few authors have suggested that progressive loss of body weight is an early symptom of Huntington's disease.[1-3] If this is the case, body weight changes may be important as a diagnostic indicator of disease state, or of the therapeutic effectiveness of various agents. References to weight loss in Huntington's disease are usually subjective statements based on clinical findings. However, Oepen presented results from 217 cases examined post-mortem in which a striking prevalence of cachexia and marasmus was found in Huntington's disease patients.[4] Unfortunately, there has not been a detailed and controlled study performed on the body weights of such patients over the course of their illness. The present study was undertaken to compare these possible changes in Huntington's disease patients with a matched control group, in an effort to determine if, indeed, body weight loss is symptomatic in Huntington's disease.

PATIENTS AND METHODS

The medical records of seven female and four male patients with Huntington's disease as confirmed by clinical assessment and family histories were used in this study. A control group of 13 patients (five male) matched for sex, age, height, duration of stay in hospital and psychiatric medications was chosen from the same hospital unit (Riverview Hospital, British Columbia, Canada). Ten of the control patients were diagnosed as having organic brain syndromes either with presenile dementia (two patients), brain tumour (two patients), cerebral anoxia (two patients), alcoholism (one patient), brain trauma (one patient), viral encephalitis (one patient) and subarachnoid haemorrhage (one patient). The other three control patients were diagnosed as having alcoholism, schizophrenia or presenile dementia (one patient each). All patients were in hospital continuously from their admission date until the date of this study (September, 1978). Body weight records were analysed only over the period spent in the hospital. For the purpose of analysis, diets were grouped into three categories: general; reducing; and double portions. The general diet contained approximately 9211 kilojoules daily. Food was presented in regular, pureed, minced, high roughage, low residue, high protein or soft forms. The reducing diets were presented in similar forms, but usually consisted of between 5024 kilojoules and 7536 kilojoules. The double portion diet is self-explanatory. Patients that were not able to feed themselves properly were fed by a hospital staff member. There were no reliable differences between groups in the number of times patients were fed by staff members.

All patients were receiving medications for psychiatric disorders during their period in hospital. The drugs were primarily phenothiazines, tran-

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TABLE 1
*Body Weight Changes in Huntington's Disease and Control Patients**

Patient Group	Number of Patients	Age (Years)	Height (cm)	Duration of Stay in Hospital (Years Between Admission and Survey Periods)	Admission Body Weight (kg)	Survey Body Weight (kg)	Survey as Proportion of Admission Body Weight
Control	13	58.0 ± 2.0	166.5 ± 3.1	9.5 ± 1.6	61.5 ± 3.2	59.5 ± 3.4	97.9% ± 5.1
Huntington's disease	11	57.0 ± 2.1	164.2 ± 1.9	9.4 ± 1.7	56.5 ± 3.7	47.1 ± 3.1‡	84.0% ± 3.6†

* Data represent mean ± standard error. Age is expressed as current age, and height is expressed as admission height.
† Significantly different from controls, $P<0.05$.
‡ Significantly different from controls ($P<0.02$) and significantly different from admission weight ($P<0.002$).

quilizers, sedatives and antidepressants. There was no substantial difference between the drugs used by the control patients and Huntington's disease patients. Paired and unpaired Student's t-test were used to evaluate the significance of the data.

RESULTS

As depicted in Table 1, there were no significant differences between Huntington's disease and control patients in mean age ($t=0.35$, df=22, $P>0.10$), height ($t=0.64$, df=22, $P>0.10$) or duration of stay in hospital ($t=0.04$, df=22, $P>0.10$). Similarly the mean body weight of both groups at the time of admission did not differ significantly ($t=1.05$, df=22, $P>0.10$). However, mean body weight measured at the end of the period in hospital (survey body weight) was significantly lower in the Huntington's disease group ($t=2.67$, df=22, $P<0.02$). Further analysis of survey mean body weight showed that only the Huntington's disease group significantly dropped in body weight compared with their admission values (Huntington's disease group, $t=4.08$, df=10, $P<0.002$; control group, $t=0.71$, df=12, $P>0.10$), and compared with the control group, as expressed as a proportion of admission body weight ($t=2.16$, df=22, $P<0.05$).

It was found that, after admission, a little over half the patients in each group increased their body weight (Table 2). Analysis of these patients revealed that this mean increase in body weight did not differ significantly between groups ($t=0.97$, df=12, $P>0.10$). However, the duration of time to reach maximum body weight was significantly less in the Huntington's disease group ($t=2.22$, df=12, $P<0.05$). In the patients who gained body weight in hospital, all the Huntington's disease subjects lost weight after reaching their maximum body weight, whereas only 62.5% of the control patients lost weight. It is of interest that the patients in the control group who did not lose weight were all female. No further differences in sex or other discernible characteristics could be found in body weight changes, primarily because of the small number of subjects in each group.

TABLE 2
*Analysis of Huntington's Disease and Control Patients Who Increased Body Weight After Admission**

Patient Group	Proportion of Total Patients	Proportion of Weight Increase	Number of Years to Maximum Weight
Control	55%	16.3% ± 4.4	6.4 ± 1.4
Huntington's disease	62%	23.0% ± 5.4	2.5 ± 0.8†

* Data represent means ± standard error of the mean; this analysis is only of those patients who increased weight after admission.
† Significantly different from controls ($P<0.05$).

At the time of admission there were essentially no differences in the type of diet fed to either group of patients. All the Huntington's disease and 11 of the control patients were on general diets. The other two control patients were fed reducing diets. When the last one-third of the period in hospital was analysed it was found that approximately one-half of the patients in both groups were predominantly on general diets (Table 3). The remaining patients of the control group were on reducing diets and those of the Huntington's disease group were on double portion diets. During this period only one Huntington's disease patient was on a reducing diet (7536 kilojoules). There were no essential differences in the form of the diet presented to each group. It was also found that during the last half of the period in hospital, almost every patient in each group was given pureed, minced or soft forms of their diet.

DISCUSSION

In agreement with previous reports[1-4] the present study indicates clearly that loss of body weight is a progressive and characteristic symptom in most Huntington's disease patients. Furthermore, such body weight loss was not seen in a group of matched control patients with various neurological disorders. Interestingly, it was found that approximately one-half of the patients in both the Huntington's disease and control groups increased body weight after their admission to hospital. This probably reflected poor dietary and eating conditions before being admitted to hospital. While the amount of weight gained did not differ between groups, it appeared that the Huntington's disease patients reached their maximum body weight much sooner than controls. This may be related to an increased appetite since, as Bruyn describes it: "His (the Huntington's disease patient's) interest in the world narrows down and simple bodily functions become a major focus of interest. The well known gluttony thus becomes an understandable phenomenon".[2] Even though some of the Huntington's disease patients rapidly increased body weight after admission they soon lost this and continued to lose weight to below admission levels. This pattern was not seen in the control patients. Similarly, many Huntington's disease patients were fed very high energy diets in an attempt to keep their body weight loss to a minimum. The hyperkinesis while the patient is awake could explain the need for a higher energy intake. Increased energy expenditure from hyperkinesia, however, may not adequately account for the continuous weight loss in the later stages since it is quite common for the disease to progress towards hypokinesis (the Westphal variant),[2] as was seen in some of the present HD patients.

Originally, Facon *et alii* suggested that the cachexia observed in Huntington's disease patients was a result of hypothalamic damage, specifically in the dorsal paramedian nucleus.[5] Bruyn, on the other hand, found neuronal loss in the lateral hypothalamus,[6] an area which plays a role in body weight maintenance in animals.[7] It is also likely that these body weight changes reflect multifocal damage occurring in Huntington.s disease patients' brains, in-

TABLE 3
*Type of Diet Patients Were Predominantly Fed During the Latter Part of the Period in Hospital**

Patient Group	Type of Diet		
	General	Reducing	Double Portion
Control	54%	46%	0%
Huntington's disease	46%	9%	46%

* Data are expressed as a proportion of the total number of patients in the control ($n=13$) and Huntington's disease ($n=11$) groups. The data are taken from approximately the last one-third of the period in hospital for each patient.

cluding the cortex,[2 8] globus pallidus, and subthalamic nucleus.[2 9] These areas have all been shown to affect ingestive behaviour in animals.[10-13]

Unfortunately, it was not possible to obtain a comparable group of matched control subjects with other extrapryamidal disorders who resided under the same environmental conditions as the present HD patients. However, it is likely that the differences demonstrated in the HD patients may be true for several disorders of the basal ganglia. The fact that specific disruption of the dopaminergic nigrostriatal tract in rats, which degenerates in Parkinson's disease, severely impairs feeding and body weight regulation, supports this assumption.[14 15]

Recently, it has been shown that kainic acid-induced lesions of striatal neurons in rats, which produce remarkable neuropathological and psychopathological similarities to Huntington's disease[16 17] resulted in marked body weight loss.[15 18] Furthermore, this body weight loss is closely related to the amount of striatum damaged.[19] It is possible that the progressive loss of body weight found in Huntington's disease patients may be related to the progressive degeneration occurring in their striatum. However, it is also possible that the mechanisms may involve extraneuronal factors such as hyperpyrexia, food absorption and endocrine changes. For example, increased choreiform activity produced by striatal neuronal degeneration may increase body temperature which, over a long period of time, could result in decreased body weight. This seems unlikely since analysis of body temperature in the present population of patients over the course of the study did not show differences between Huntington's disease and control subjects (Sanberg, unpublished data). In light of the various neuroendocrine changes which have been observed in HD patients,[2 20 21 22] it may be worthwhile evaluating a possible causal relationship between these changes and body weight loss.

Edmonds presented interesting data showing a relationship between dietary conditions in HD patients and death resulting from respiratory disease.[23] He showed that 10 patients with difficulty in swallowing died of bronchopneumonia within about three months after they were changed to a fluid or semifluid diet. Furthermore, he reported two patients having a "ravenous appetite, being excessively greedy and being unclean eaters" who died of asphyxia due to inhalation of food. Edmonds concluded that the "increased incidence of respiratory deaths in long standing cases of Huntington's chorea is probably the result of aspiration of fluids (predisposing to bronchopneumonia) or foods (predisposing to death either from asphyxia or bronchopneumonia), secondary to the involuntary movements affecting swallowing".[23] It is tempting to speculate that the body weight differences between HD and control patients could simply be due to deglutition difficulties. However, this seems unlikely since in the present study assistance in terms of the type of diet and feeding was given to patients in order to keep energy intake as constant as possible. Apparently, though, it is quite important that great care should be taken when feeding HD patients exhibiting dysphagia.

In conclusion, since body weight symptomatology in Huntington's disease may be related to its neuropathology, especially striatal degeneration, it may be an important measure for evaluating the effectiveness of various therapeutic agents, or for estimating the degree of striatal pathology. Only a few investigators have attempted to increase or even measure body weight changes in Huntington's patients after administration of various drugs.[24 25] In view of the present results, body weight changes deserve further attention as possible diagnostic indicators of disease state in Huntington's disease.

ACKNOWLEDGEMENTS

The writers appreciate the excellent assistance of Ms A. Larson and Ms L. McSweeny in collecting the present data and giving advice on matters pertaining to the medical records. Appreciation is also extended to Professor E. D. Bird, Professor E. G. McGeer, Dr I. G. Morgan and Dr W. P. Bellingham for helpful comments and to Ms B. Piper for typing the manuscript. This work was completed in partial fulfilment of the Doctor of Philosophy degree by the first writer.

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There is a relatively common condition known as ankylosing spondylitis. It is reported that in club rheumatologists say "ank spond" with a practised unction. Indeed the disease had many synonyms, one of the better known being Bekhterev-Strümpell-Marie syndrome. Bekhterev was a graduate of St Petersburg, where later he was to grace the chair of Medicine. Described as rugged in physique and personality, for a while he competed with Pavlov. He saw patients till late into the night; a midnight appointment was not uncommon. Von Strümpell, born in the Baltic, first studied philosophy and psychology, studied medicine at Dorpat but moved to Leipsig where he graduated and where later he was to occupy the chair. At high school he played chamber music and describes in his autobiography his embarrassment during a Mozart overture hearing the orchestra play along in prestissimo while he still held the half notes of the first measures. Known now principally for his contributions in Neurology he is described as "modest, kind, serene and optimistic, a man of the highest moral standards." Throughout his life he remained devoted to music. He believed teaching the most precious contribution a man could make to his time. Marie was a Parisian, disciple of Charcot and finally took his chair in Neurology. He was so sensitive to formalin that he would look at a brain only through a window. He influenced the Parisian school profoundly and beneficially. "His great wealth made him independent; his honesty made him respected; his innate courtesy and dignity made him friends and disarmed his opponents." — BEN HANEMAN.