The Family as Our Patient

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We are frequently asked why the practice of medicine should be directed to the family. Why not to a cell, an organ, or a system? Why not to a town, a county, a state, or the whole nation? What is so special about a family?

The cell has been studied but it is important in man only as a part of an organ, which is important in him as a part of an organ system, and this in turn is important in man only as a part of a whole person. It is a whole person who comes into the office complaining of a headache, a backache, or swelling of the legs.

What are the characteristics of man which make him human? An illness has far greater ramifications than just the perception of discomfort by the person who is dis-eased. There are those to whom he has a responsibility – he fears that he may fail them. There are those who look to him for support – they feel fear and insecurity and they are dis-eased along with him. Future plans which involve others are clouded over with doubt. This man or whole person we mentioned earlier is now a human being because of all the relationships he has about him, all the feelings that exist between others and himself, especially with members of the nuclear family, the simple family, the extended family, and even the community.

The family is the oldest recorded institution of man; it preceded even the church and the state. Every recorded civilization had a nuclear family as its foundation. There is little doubt that the sex urge and the necessity for its being satisfied led men and women to share their lives. But with this sharing of life and needs there was the primitive and very strong instinct to protect and nourish the product of their union. From the beginning there has been more involved than satisfying the sex urge – that could have been done with promiscuity and without responsibility – but this has not been the history of our human family.

Through the ages the family has served the purpose of procreation, continuation of the species, and socialization of the young. As children grew up they were oriented to the world through their family relationships. They first experienced love, care, had their needs met, realized sex differences, learned to work, learned to relate to members of an extended family, the community, and a wider circle of people through the family. After they were so oriented they matured, found a mate, and started the cycle all over again, all to be repeated thousands of times in the history of mankind.

Through the ages there have been many variations on this general theme of the nuclear family, but never a single society without it. There has been polygamy, polyandry, monogamy, adopted children, divorce, and remarriage, but this basic unit of man's living that satisfies his basic needs and instincts lives on. There have been experiments of commune living, of centralized child rearing, and many other models, but the simple family continues.

I am aware that some say the family is a vanishing institution. The divorce rate is quoted to support this view. The rate is higher than I would like to see but it represents a wish to be happily married, not to be unmarried. A high percentage of divorced persons remarry and find happiness – and fulfillment; and they become a part of this cycle of procreation and orientation that began at the very beginning.

Historically, it is not unwise to predict the family will continue. I believe the family will continue to be the basic building block of society – that unique, happy institution in which the individual becomes humanized by becoming a part of a society, and in which the society becomes humanized by focusing on the needs and contributions, the joys and sorrows, of individuals.

It is the relationships within the family that make health so treasured and disease so dreaded, for it is our loved ones who are also affected. If our vision of illness is only broad enough to encompass the whole man concept only as a solitary individual, we completely miss the larger and

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more beautiful picture of human concern and feeling for each other. It is, in the last analysis, our relationships with others which make our lives happy and meaningful, which give us our humanity.

There is ample evidence that much of our dis-ease and many of our diseases are related to emotional disturbances. Most of these are related to faulty relationships with others and perhaps most often within the family. To study all the etiological causes of disease in the world and eliminate those based on emotional causes would omit the majority of complaints. A great majority of backaches, headaches, and many other complaints would no longer receive our attention. There is great danger for the patient who receives episodic treatment repeatedly for various somatic complaints when the underlying causative emotional disturbance is not recognized and dealt with properly.

We must provide society with a physician who can ably serve each member of the family and be aware of the important relationships between family members. This means he must have appropriate medical knowledge for understanding every member of the family and be able to provide care for the unborn and the aged. He must be accepted as a member of the extended family so that tender feelings are shared comfortably – from planning for a future child to sharing the grief long after the funeral of a loved one. At the same time this physician must be a competent clinician who is equally comfortable in giving digitalis for congestive heart failure and counseling the tension headache patient who has a family problem. It is this physician who will view the family as his patient as well as the whole person within it.

Acknowledgement

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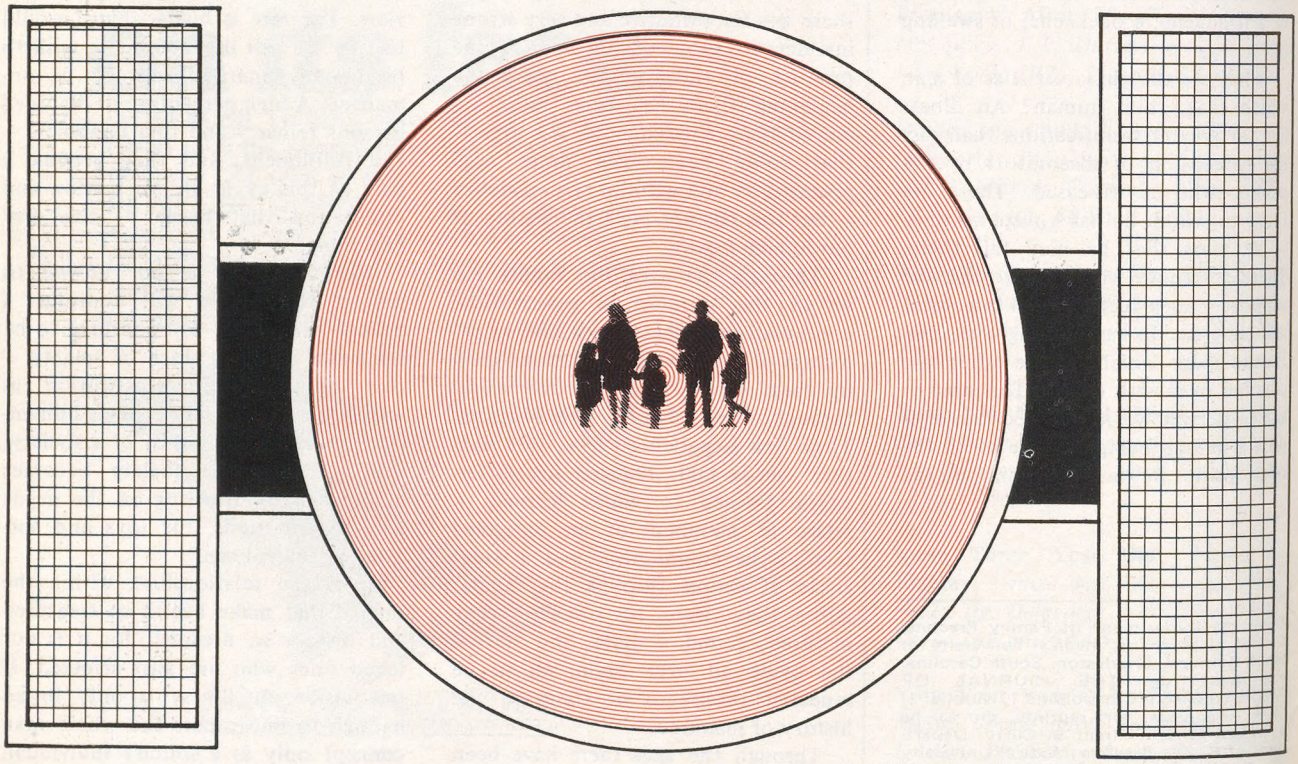

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previously stated, some idea of the magnitude of obesity in adult life may be gained by an examination of this table. In that population, overweight is prevalent at all ages, increasing considerably with advancing age, with the greatest increase occurring from the 20s to the 30s.

Although data do not exist which permit definitive statements regarding the incidence of obesity in the total population at this time, it is apparent that this is an extremely common disorder.

Etiology and Classification

At the simplest level obesity is a disorder of energy balance; it is the consequence of a process in which energy (calorie) intake exceeds energy expenditure. The excess calories are stored as triglyceride in the adipose tissue and as a result, there is an excessive expansion of the tissue.

Expansion of the adipose depot is achieved either through storage of triglyceride in preexisting adipose cells, adipose cellular hypertrophy, or in newly formed adipose cells, adipose cellular hyperplasia. Indeed, two patterns of human obesity have been identified on the basis of the cellular character of the expanded adipose depot (Figure 1): hyperplastic with increased adipose cell number and normal or increased cell size, and hypertrophic, with increased cell size alone.[5-7] Hypercellular obesity most often has its onset early in life, usually before the age of 20 years, most frequently in infancy and at puberty (Figure 2); hypertrophic obesity, on the other hand, usually begins in adult life, after the age of 20 years. It should be stressed, however, that there is overlap in this cellularity-age onset relationship; some with early-onset obesity may have normal numbers of cells, while individuals with adult-onset obesity may be hypercellular. Early onset hypercellular obesity is usually massive in degree; the earlier in life obesity begins, the greater the hypercellularity. Adult-onset hypertrophic obesity, on the other hand is usually milder in degree.

The possible significance of these observations becomes apparent when one considers that weight reduction in all obese patients, regardless of age of onset or degree and duration of obesity, has to date been shown to be achieved solely by a change in adipose cell size;[5-8] cell number remains constant even with massive amounts of weight loss. Thus, hypercellular obesity appears to have the unfortunate consequence of inflicting upon the patient a permanent increase in adipose cell number. This observation is paralleled clinically by the frustrating observation that weight loss in the early-onset massively obest patient is extremely difficult, but if successful, it almost invariably is followed by recurrence on the previous degree of obesity.

The factors responsible for the excessive accumulation of calories in the adipose tissue and its consequent expansion through changes in cell number and size remain to be elucidated. The size of the adipose tissue mass depends upon the relationship of energy supply to energy expenditure. In obesity, energy intake is excessive relative to energy expenditure; the excess energy is stored in the adipose tissue and the adipose depot expands. This imbalance may occur as a result either of increased intake or decreased expenditure of energy. The explanation of this imbalance, and hence of obesity, lies in defining the factors which normally regulate these two processes and which are aberrant in obesity. Although many factors are known to influence caloric intake and expenditure in man, only rarely can a specific factor be related to the development of obesity. Thyroid hormone deficiency, excessive glucocorticoid, and hypoglycemia are among the few factors that we can recognize which may induce obesity. The clinical disorders associated with these abnormalities, however, account for an exceedingly small number of cases of human obesity. Nevertheless, recognition of these disorders as etiologic factors is important since their specific treatment may improve, and on occasion, reverse the obesity.

Unfortunately, in most cases a specific cause of obesity cannot be defined; caloric intake is excessive relative to caloric expenditure to be sure, but the factors responsible for the consumption of more energy than the body needs are unknown. Genetic, hormonal, nutritional, psychologic, cultural, and economic factors all influence caloric intake and expenditure

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in man, and thus, any of these may contribute independently or in combination to the development and perpetuation of the obese state. Human obesity, then, may represent a heterogeneous group of disorders and in this respect may more appropriately be considered as "the obesities." This concept receives some support from the finding of different cellular patterns in the adipose tissue of obese patients, indicating that all obesity may not be alike. Such a view may be of value not only investigatively, by focusing attention on multiple but interrelated potential etiologic factors, but also in the clinical evaluation and therapeutic approach to the patient with obesity. With this in mind, the editorial committee of the Fogarty International Center Conference on Obesity, held in 1973,[9] has recommended a classification of "the obesities" shown in Table 2. This classification has been only slightly modified by the author. In this view consideration is first given to various etiologic factors, including those of neurologic, endocrine, genetic, and drug origin. As already indicated, however, in most instances an etiologic factor cannot be identified. The patient's obesity is then classified anatomically according to the cellular character of the adipose depot. Since cell size and number cannot be determined routinely, the age of onset of obesity, using the guidelines previously discussed, is used to differentiate hypercellular from hypertrophic obesity. Finally, even though a specific etiologic factor cannot be discerned in most patients, it may be possible and useful to define contributory and/or concomitant factors. This classification of "the obesities" may provide a basis for a more organized and rational approach to the obese patient. Although such a view doubtless offers certain conceptual and therapeutic advantages, in the opinion of this author, it seems unlikely that our knowledge of the total problem of human obesity and its treatment will advance greatly until a more integrated understanding of the whole process regulating energy balance, both eating behavior and calorie metabolism and storage, is achieved.

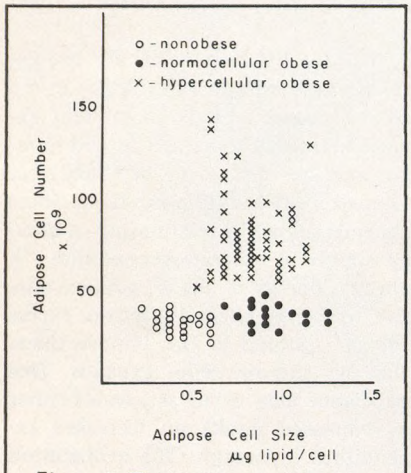

Figure 1. Total adipose cell number from nonobese and obese subjects is plotted as a function of their adipose cell size. Cell size is expressed as the mean of cell sizes from 6 separate fat depots, and cell number estimated by division of total body fat by this mean cell size. (From Salans et al: J Clin Invest 52:929, 1973.)

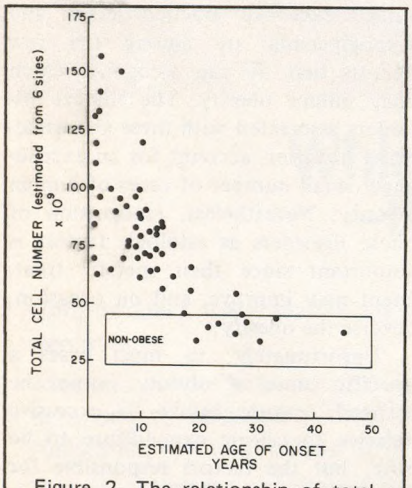

Figure 2. The relationship of total adipose cell number and age of onset of obesity. Cell number is estimated by dividing total body fat by the mean of cell sizes from 6 separate fat depots. The range of cell number in nonobese patients is indicated by the rectangle.

Significance of Obesity-Health Consequences

Obesity is medically important only to the extent to which it carries with it health risks. In this respect there is little doubt that obesity is harmful. The obese individual suffers more from a variety of illness than does the nonobese; abnormalities of carbohydrate and lipid metabolism are more frequent, aggravation of diabetes mellitus, heart disease, and gallbladder disease often occurs, and obesity has significant social, psychologic, and economic disadvantages for many individuals. Because of these relationships and the frequency with which it occurs in the general population, obesity is a public health problem of considerable magnitude.

Although there is general agreement that obesity is associated with these disorders, there is considerable disagreement over whether, and the extent to which, obesity per se is responsible for increased rates of morbidity and mortality. A detailed discussion of this controversy is beyond the scope of this review. In the opinion of this author, however, resolution of this controversy will depend, among other things, upon the ability of future investigations to better define obesity, to distinguish it from overweight unassociated with increased adipose tissue, and to elucidate the pathogenesis of diseases such as atherosclerosis and diabetes mellitus and the influence of obesity upon these pathologic processes. In the present discussion, consideration of the health consequences of obesity will be limited to its association with cardiopulmonary disease.

Atherosclerotic Heart Disease. On the basis of evidence from life insurance company studies, obesity appears to be associated with an excess morbidity and mortality from coronary heart disease.[10] Once again, conclusions from these studies must be limited since the data are based on the association of coronary heart disease with body weight rather than adiposity, and are derived from a selected population of life insurance policy holders who may not be representative of the population as a whole. Several investigators have, in fact, challenged the concept that obesity is a major cause of increased morbidity and mortality from atherosclerotic heart disease, pointing out that the statistical associations between obesity and coronary heart disease become much less impressive when "atherogenic" variables such as age, sex, plasma lipids, and blood pressure are taken into consideration.[11-13] The fact that there may be little net effect of obesity when other risk factors are accounted for does not, however, necessarily mean that obesity is an unimportant contributor to this disorder.

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In this regard, the Framingham, Massachusetts Study, in which over 5,000 men and women of this community have been followed since 1948 for the development of cardiovascular disease, suggests that obesity is, in fact, a major contributor to cardiovascular morbidity and mortality.[14] This study indicates that coronary mortality in general, and sudden death rates in particular, are substantially higher in the obese men of this community than in those who are not obese. In addition, a higher incidence of all the major clinical manifestations of cardiovascular disease is observed among the obese. Of considerable interest is the observation that cardiovascular risk rises in proportion to weight exess (Figure 3); there is an increased risk for all degrees of obesity. The evidence currently available from the Framingham Study suggests that obesity contributes to the development of atherosclerotic heart disease by promoting specific atherogenic risk factors: hypertension, hyperglycemia and diabetes mellitus, and hyperlipoproteinemia. These atherogenic traits, enhanced or promoted by obesity, may be responsible for the excessive cardiovascular morbidity and mortality of obese individuals.

Hypertension has been proposed as an important risk factor for the development of coronary heart disease.[15,16] If and how obesity causes or promotes hypertension is unknown, but the two are often associated. Furthermore, when obese patients with hypertension reduce, the blood pressure usually goes down. For this reason alone, then, obesity should be avoided or corrected.

Hyperglycemia and diabetes mellitus have also been proposed as important risk factors for the development of atherosclerotic heart disease.[17] A close association between obesity, abnormal carbohydrate metabolism, and diabetes mellitus has been well recognized for many years, but to this date the nature of this relationship remains poorly understood. In some patients obesity appears to be part of the syndrome of diabetes mellitus, but in many instances obesity seems to be acting as a primary factor, somehow inducing or precipitating abnormalities in carbohydrate metabolism and insulin secretion which may or may not be manifestations of the diabetic syndrome. One proposed, but as yet unproven, hypothesis to explain these relationships suggests that obesity causes insulin resistance in liver,[18] muscle,[19] and adipose tissue,[20] leading in some way to hyperglycemia and hyperinsulinemia. In this respect it has been significant to observe that weight loss in obese patients is usually associated with an improvement in, and often a restoration to normal of insulin resistance, glucose metabolism, and hyperinsulinemia.[20-22] Whatever the mechanism, it is clear that obesity imposes a burden on glucose metabolism and insulin secretion, and thus contributes to the development of an important cardiovascular risk factor. Once again, it is apparent that obesity should be avoided, or if present, corrected.

Hyperlipidemia is considered to be a major risk factor in the development of coronary heart disease.[15] An association between obesity and hypertriglyceridemia has been observed, suggesting that obesity may be one factor influencing lipid metabolism.[23,24] One as yet unproven hypothesis used to explain this relationship proposes that the hyperinsulinemia of obesity results in accelerated hepatic triglyceride synthesis and, consequently, elevated plasma triglyceride.[22] From the standpoint of this risk factor too, prevention and treatment of obesity are indicated.

Although the increased cardiovascular morbidity and mortality associated with obesity may be mediated through these atherogenic traits, it cannot therefore be considered that obesity itself is an unimportant risk factor. If obesity promotes these

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Table 1. Percentage of Persons Deviating from Best Weight*

AGE (years)	MEN		WOMEN	
	10-19% above best weight	20% or more above best weight	10-19% above best weight	20% or more above best weight
20-29	19	12	11	12
30-39	28	25	16	25
40-49	28	32	19	40
50-59	29	34	21	46
60-69	28	29	23	45

*Adapted from Frequency of overweight and underweight, Stat Bull Metropol Life Ins Co 41:4, Jan, 1960

Table 2. A Classification of the Obesities

A. Etiologic
  1. Hypothalamic-Pituitary
    a. Hypothalamic dysfunction
      1) Tumors
      2) Inflammatory
      3) Trauma and surgical injury
      4) Increased intracranial pressure
    b. Hypopituitarism
  2. Endocrine
    a. Thyroid deficiency: hyperthyroidism
    b. Glucocorticoid excess: Cushing's syndrome
    c. Hyperinsulinemia: exogenous and endogenous source
    d. Gonadal deficiency: primary and secondary
  3. Genetic
    a. Laurence — Moon — Bardet — Biedl
    b. Alstrom's syndrome
    c. Morgagni — Marcel
    d. Prader — Willi
  4. Drugs
  5. Undetermined
B. Anatomic: cell type
  1. Hypercellular
  2. Hypertrophic
C. Contributory and/or concomitant factors
  1. Familial presence of obesity
  2. Physical inactivity
  3. Dietary factors: eating patterns, type of diet
  4. Sociocultural
  5. Psychiatric

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Table 3. An Approach to the Obese Patient

1. Is a Weight Reduction Program Indicated?
   a. Is obesity present?
   b. Consideration of morbidity
   c. Consideration of mitigating factors
2. Is There a Definable, Treatable Cause of Obesity?
   a. Endocrine
   b. Hypothalamic
3. Classification of Obesities of Unknown Etiology
   a. Hypercellular obesity (Juvenile onset)
   b. Hypertrophic obesity (Adult onset)
4. Treatment of Hypercellular Obesity
   a. Prevention
   b. Supportive: dietary, emotional, treatment of associated disorders
   c. Surgical: jejuno-ileal bypass.
5. Treatment of Hypertrophic Obesity
   a. Prevention
   b. Diet: caloric restriction, dietary composition, meal frequency
   c. Exercise
   d. Psychotherapy
   e. Behavior modification
   f. Drug therapy

traits, it is important. Obesity may, in fact, be the primary derangement, causing these atherogenic factors to develop secondarily. Furthermore, obesity may be an important determinant of coronary heart disease through some other, as yet undefined, mechanism. In any case, from a public health standpoint, obesity should be prevented. Moreover, although the direct benefit derived from correcting existing obesity has not been well documented, it is well established that weight loss improves the other risk factors and thus weight reduction may provide a potentially important means for improving cardiovascular health.

Cardiac Function. Detailed studies of the effect of obesity on cardiac function have only recently begun. Most of these have been undertaken in patients with severe, massive obesity. These studies indicate that obesity has a detrimental influence on cardiac functions.[24-28] Obesity increases the work of the heart, presumably as the result of an increased requirement for transport of oxygen to the expanded tissue mass; total body oxygen consumption is increased in patients with chronic, severe obesity. A high output circulatory status is assumed at rest, characterized by increased blood and stroke volume, heart size, and cardiac work. Myocardial hypertrophy, predominantly of the left ventricle, has also been observed, a consequence presumably of prolonged increase in cardiac work. Left ventricular dysfunction may result, as evidenced by elevated left ventricular end-diastolic pressure at rest and exercise, and frank congestive heart failure may occur; Alexander and Pettigrove[28] have reported that heart failure may be a common cause of death in markedly obese patients. Thus, cardiac function can be significantly impaired by massive obesity. Most of these alterations appear to be reversed by weight loss:[29] a reduction in total body oxygen consumption, cardiac output, stroke volume, blood volume, heart size, and the work of the left ventricle has been observed after weight reduction. Elevated left end-diastolic pressure, on the other hand, persists even after profound weight loss, suggesting that severe obesity may induce permanent cardiac dysfunction. Although additional investigations are required to further define the effects of obesity on cardiac function and the possible clinical significance of these effects, particularly in the less extreme obese population, it is apparent that in terms of the heart, obesity is best avoided.

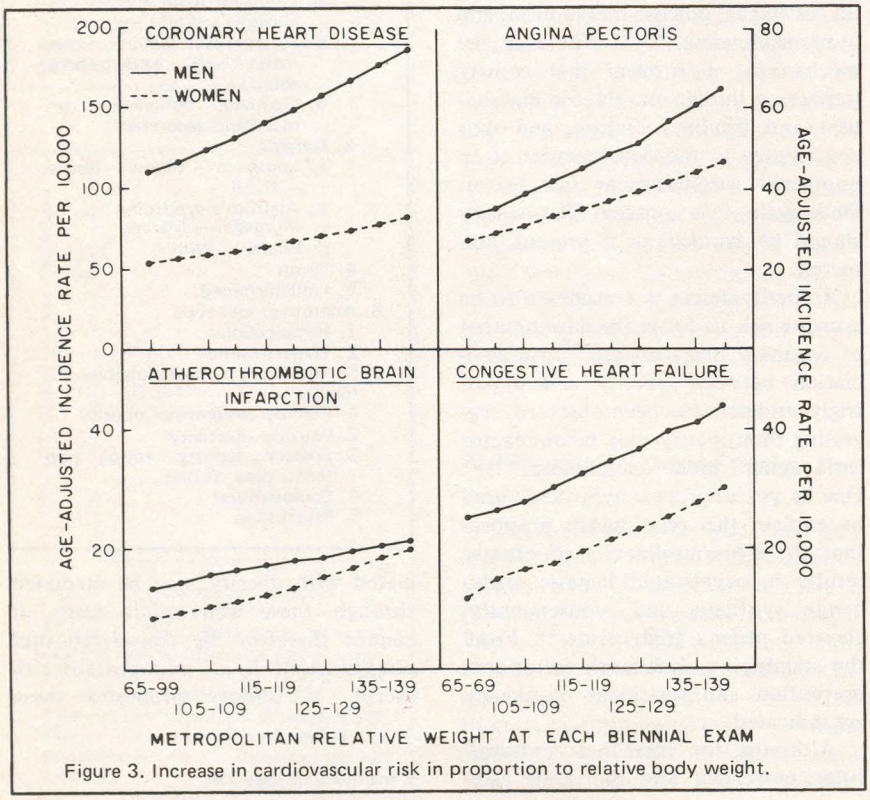

Figure 3. Increase in cardiovascular risk in proportion to relative body weight.

Pulmonary Function. A common clinical complaint of the obese is dyspnea, particularly on exertion. It might be expected, then, that obesity would be accompanied by alterations in pulmonary function. Although this is indeed the case, the surprise is that more obese patients do not suffer from more abnormalities. Obese patients have had perfectly normal respiratory function, at least with respect to the usual tests. Abnormalities of pulmonary function have, however, been observed in many obese individuals, varying in type and degree.[30-35] A significant reduction in expiratory reserve volume and, less often, vital capacity, has been observed in some, but not all, extremely obese patients. Hypoventilation as evidenced by a decreased P_aO_2 and elevated P_aCO_2 has been observed in many, but not all, patients studied with massive obesity. Hypoventilation is usually mild in degree, but it may be so severe as to cause marked hypercapnia and respiratory acidosis, and in

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the extreme, the Pickwickian Syndrome in which somnolence, lethargy, cyanosis, and muscular twitching are striking clinical features. On the other hand, a low P_aO_2 may be present in the absence of hypercapnia. The mechanisms responsible for these abnormalities in pulmonary function and the explanation for their occurrence in varying degrees in the obese population are unknown. The presence of massive obesity of the abdomen and thorax with resultant diminished chest wall compliance and uneven air flow may be responsible for some of these abnormalities. When these factors are combined with an increased ventilatory demand and an uneven ventilation-perfusion relationship, hypoventilation may occur. The state of pulmonary function in an obese patient will depend upon whether, and the extent to which, these factors are operating. It has been proposed that in the Pickwickian Syndrome all of these factors and, in addition, a diminished central nervous system sensitivity to CO_2 are present.[36] This remains highly speculative, however, and additional studies are clearly required. In particular, studies of respiratory function in individuals with mild obesity are needed. In one recent preliminary study significant differences in pulmonary function between moderately obese and nonobese patients could not be discerned.[35]

An Approach to the Obese Patient

In spite of its frequency in the population and far-reaching health consequences, obesity is poorly understood and its treatment sorely inadequate. This situation is likely to prevail until a more fundamental understanding of the whole process regulating energy (food) intake, storage, and expenditure is achieved and as a result, therapeutic measures which specifically influence these processes are developed to effectively prevent and correct obesity. Until then it will not be possible to treat the cause of obesity in most patients; treatment will remain symptomatic and thus, limited. Within these limits, the degree of success in the management of the obese patient will depend upon a realistic definition of the goals of treatment and a national approach to altering the balance between calorie intake and output. The following paragraphs describe one such approach to the obese individual in which the objectives and course of treatment are based on a stepwise evaluation of the nature and likely prognosis of his obesity. Table 3 summarizes this approach.

Is Weight Reduction Indicated?

Because of the large number of individuals involved, and the size of the effort required to initiate and maintain a weight reduction program, it is first necessary to determine whether weight reduction in a given patient is justified. A variety of factors must be considered, including: (1) the distinction between overweight and obesity; (2) the severity of the obesity in terms of its degree and the extent to which it impairs the physical, emotional, and economic health of the individual; (3) the coexistence of other health risk factors such as hypertension, atherosclerosis, and diabetes mellitus; and (4) the presence of conditions such as pregnancy and certain acute illnesses which may contraindicate weight reduction. One example where patient education rather than weight reduction is indicated is in the nonobese individual with an unusual distribution, but normal amount, of adipose tissue on a familial basis.

Is There a Definable Cause?

If a specific cause of obesity can be defined, it can usually be treated successfully. Thus, it is important to consider whether the patient is obese because of hypothyroidism, Cushing's syndrome, or one of the more rare definable causes of obesity. These disorders, however, account for only an exceedingly small fraction of human obesity and rarely are they responsible for massive obesity. Furthermore, the presence of an endocrinopathy in an obese patient does not necessarily establish it as the sole cause of the obesity; specific treatment may cause weight loss, but not restore the patient to normal body weight. This improvement, however, is a highly desirable achievement, and in every obese patient a specific cause should be sought.

Cellular Classification

In the overwhelming majority of obese patients a specific cause cannot be discerned; classification of their obesity into hypercellular and hypertrophic types may however, be useful. This may be of considerable practical importance since it may afford some indication of prognosis, and thus better define the objectives to treatment and the therapeutic approach to be taken. Although it is clearly not feasible to determine routinely adipose cell size and number in patients, a fairly reliable estimation of cell type can be achieved indirectly from knowledge of the age of onset and the severity of the patient's obesity: as previously discussed, obesity of onset before age 20 years is most likely to be hypercellular, while that beginning after age 20 years is highly likely to be hypertrophic. Massive, severe obesity is likely to be hypercellular, while hypertrophic obesity tends to be less severe. There is considerable overlap of the two types between ages 13 and 20, but in general, the earlier the onset in this age range the greater the likelihood of hypercellularity. Having classified the obese patient into cellular type, the various therapeutic approaches can then be considered.

Hypercellular Obesity. On the basis of both the experimental evidence reviewed earlier in this discussion and actual clinical experience, the medical management of the hypercellular obese patient must be viewed with pessimism, at least in terms of weight reduction. Hypercellularity in the adipose depot of the patient with early-onset massive obesity appears to be irreversible, a phenomenon which is paralleled by the frustrating clinical observation that weight reduction in these patients is difficult at best, and almost inevitably followed by regain of weight and restoration of the original state of adiposity. Indeed, the inadequacy of current dietary approaches to the problem of obesity may be due to their inability to effect any permanent change in adipose tissue cellularity in adult life. This observation has, in fact, focused considerable attention on early life and on the factors which regulate adipose cellular division and growth, ie, on a preventative approach. Here there may be some room for optimism since preliminary studies indicate that, at least in experimental animals, nutritional manipulation very early in life can permanently affect the adult size and cellular character of the adipose tissue.[37] Similar nutritional influence

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may operate early in life; in particular, overnutrition at this stage of life may induce adipose hypercellularity and, as a consequence, obesity.

Nevertheless, the evidence currently available indicates that once hypercellular obesity is established it cannot be readily reversed by diet, pills, psychotherapy, or behavior modification. Treatment of this form of obesity by these methods has been uniformly unsuccessful. Furthermore, prolonged unsuccessful attempts at dietary management for this type of obesity may, theoretically at least, be potentially harmful; the cyclic weight loss and regain of weight with associated cyclic fasting and refeeding which many of these individuals experience, may enhance atherogenic risk factors such as hyperlipidemia.[38]

Failure of the medical approach to this type of obesity has led to the introduction of more drastic measures of treatment. Included among these are various surgical procedures, of which gastrointestinal bypass is most widely and successfully used.[39,40] At present jejuno-ileal bypass appears to be the procedure of choice and it has proven to be an effective means of producing and maintaining weight loss. This, however, is not achieved without serious real and potential risk to the patient. The mortality rate associated with this procedure may be as high as five percent and postoperative morbidity may be substantial. Persistant diarrhea, fluid and electrolyte disturbances, severe liver disease, and hepatic failure are a few of the more serious short-term postoperative problems. Since jejuno-ileal bypass has been employed in the treatment of obesity for only a relatively short period of time, its long-term consequences are not known. In view of its potential short- and long-term hazard, in the opinion of this author, gastrointestinal bypass remains an experimental form of therapy for obesity and, like any good experiment in man, should be strictly limited to patients with clearcut medical need, and conducted in a setting where its short- and long-term effects can be monitored very carefully.

In the view of this author, a more acceptable and certainly less drastic approach to the hypercellular obese patient is available, a supportive one. In this approach, less emphasis is placed on weight reduction, and more on minimization of additional weight gain. Supportive care is provided to the patient through prompt and appropriate management of associated medical disorders, emotional support and vigorous attention to the socioeconomic capacity and function of the individual.

It is recognized that the objectives of this approach are severely limited, and that they fail to deal adequately with the basic problem of obesity and its health consequences. It may, however, offer a reasonable alternative to the inadequacy and risk of the other various forms of treatment, at least until our basic understanding of this disorder improves.

The pessimistic view of the problem of hypercellular obesity presented here must be tempered by the fact that research interest in this area, which for so long has been dormant, is now active and extensive. Hopefully, the investigations which result will provide new insights into the nature of this disorder and the basis for its more satisfactory treatment.

Hypertrophic Obesity. Most frequently, obesity is of the hypertrophic variety, and mild or moderate in degree. As with hypercellular obesity, prevention of this type of obesity is preferable to trying to correct it after it is established. On the other hand, hypertrophic obesity should be more amenable to treatment since it is associated with a reversible abnormality, at least in terms of the cellular character of the expanded adipose tissue.

Treatment

Diet. The basis of treatment is dietary, and specifically, calorie restriction. Although the optimal diet for weight reduction has not yet been defined, theoretically it is one which contains the least number of calories, yet provides total or near total preservation of body nitrogen, minerals, vitamins, and other essential factors. A seemingly endless number of diets have been introduced in the quest for "optimal." Many of these diets are based on manipulations of the composition of their calories (the ratio of carbohydrate to fat to protein) and too often their promotion fails to indicate the critical importance of total caloric restriction. At this writing, no firm evidence exists which mitigates against the concept that weight loss depends upon caloric deficit and in turn, that calorie deficit itself depends upon the total number, and not the type of calories consumed relative to calories expended.

The extent to which calories should be restricted in a given individual depends upon the age, body size, and physical activity of the patient. Restriction to 800 to 1,200 calories per day is generally appropriate for a moderately active female; 1,000 to 1,400 calories per day may be more appropriate for men of similar activity. Obviously these values need to be adjusted according to activity, size, and age of the patient.

Total starvation diets have generated considerable interest and popularity in the treatment of obesity. The rationale for this approach apparently lies in the rapid rate of initial weight loss compared to caloric restriction. This benefit, however, is short lasting; weight loss over the long run is similar for the two methods. Moreover, prolonged starvation may actually be undesirable for several reasons. Lean body mass is lost to a significantly greater degree during total starvation than during caloric restriction.[41] In addition, severe ketosis and mild acidosis may accompany prolonged starvation; the effects of these alterations on cellular function, particularly the cells of the central nervous system and the skeleton, are not fully appreciated. For these reasons, calorie-restricted diets rather than total starvation seem preferable. Certainly prolonged fasting should not be undertaken in the absence of close medical supervision, and it is contraindicated in certain patients such as those with diabetes mellitus.

The composition of the calorie-restricted diet has, as indicated, received wide attention in the management of obesity. The "low carbohydrate diet" (zero, or less than 50 g of carbohydrate per day) has received the greatest attention most recently.[42,43] When this diet is successful, it is most likely attributable to anorexia induced by severe ketosis, and to lack of palatability, and thus to a reduction in total caloric intake. As discussed above, since the long-term effects of severe ketosis are not yet known, this approach should be employed with caution; certainly it should not be

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used in the patient with diabetes mellitus, renal disease, or other acidotic states. Even in situations where attention to dietary composition would seem indicated, as for example in some of the hyperlipoproteinemias, calorie restriction and weight loss, irrespective of dietary composition, is sufficient in most instances. If this approach is insufficient, or if the patient is unsuccessful at weight loss, attention to specific alteration in the lipid and carbohydrate content of the diet is then indicated.[44]

In view of these observations, it appears that a reasonable and safe weight reduction diet is one which restricts calories, provides sufficient protein to spare body nitrogen, sufficient carbohydrate to avoid severe ketosis, and sufficient fat to be palatable; ie, a hypocaloric, mixed diet. Such a diet should be divided into three or more meals per day.[38] The effectiveness of this, or any dietary regime may be improved by combining it with the other modalities of treatment not to be discussed.

Exercise. Several real and potential benefits of a daily exercise program make this an important adjunct to the treatment of obesity.[45] Included among these benefits are (1) an increased expenditure of energy, and, therefore, a greater caloric deficit than achieved with dietary restriction alone; (2) a shift in body composition in the direction of increasing lean body mass at the expense of adipose tissue; (3) improvement in cardiac function; (4) improvement in glucose metabolism; and (5) psychologic benefit, particularly with respect to improved self-esteem. For these and other reasons, a daily exercise program, carefully planned and tailored to the patient's abilities and physical condition, is an important part of a long-term weight reduction program. Exercise alone, however, is not an effective means of weight reduction; reduced calorie intake is essential.

Psychotherapy. Obesity is very frequently associated with a variety of emotional disturbances.[46-48] The relationship of these disturbances to obesity has, however, not been fully identified; while psychologic factors may enter into the production of obesity, not all persons are obese as a result of these factors. Thus, psychologic disturbances can contribute to the development and perpetuation of obesity, or they may be the result of the obesity. If psychologic factors are found to play a role in the etiology and maintenance of obesity in a given individual, then psychotherapeutic intervention would clearly be indicated. Usually, however, it is difficult to identify cause and effect relationships in an obese patient. The decision of whether or not psychotherapy should be initiated in a given patient, then, depends upon an assessment of the nature and magnitude of the disturbance. Where psychologic factors are clearly etiologic, individual or group therapy may be of considerable benefit to the obese patient. On the other hand, even if the causal relationship cannot be established, psychotherapy may be a beneficial adjunct to caloric restriction and exercise. Psychotherapy is also indicated where the emotional disturbance is of such magnitude that it significantly interferes with the functional capacity of the individual. In the majority of obese patients, however, psychotherapy appears to add little to caloric restriction and exercise, at least in terms of weight reduction; general emotional support by the physician during the course of weight reduction is usually sufficient.

Behavior Modification. Behavior modification is an approach currently receiving considerable attention as a useful adjunct to caloric restriction and exercise in the treatment of human obesity.[49] This approach is aimed at modifying the eating habits and physical activity of the obese individual and thus helping the patient to regulate his body weight. Although this may well offer the most promising of the psychologic approaches to the management of obesity, its long-term effectiveness remains to be demonstrated.

Pharmacologic Therapy. The role of drug therapy in the treatment of obesity remains to be defined; at present it is the subject of considerable controversy. Not only is there a question of whether the various pharmacologic agents available significantly influence food intake and body weight over the long term, but there is also the problem of addiction and abuse with certain of these drugs, particularly the amphetamines. After analyzing the available evidence on the use of the appetite-suppressant drugs in the treatment of obesity, the editorial board of the Fogarty International Center Conference on Obesity held in 1973 made the following recommendations:[9]

1. Before deciding to use a drug for weight reduction it is important to evaluate the nature of the derangement which led to the obesity in the first place.

2. There would seem to be little indication for the use of appetite suppressing drugs or other medications in obesity unless the patient is clinically obese, has obvious medical need, and/or is motivated to lose weight.

3. An appetite-suppressant drug should only be used as part of treatment, never as the sole therapy, and only with adequate efforts to modify diet, and exercise.

4. Since the available data do not indicate that one drug is more effective than another, those drugs with less potential for addiction or abuse would appear to be the preferable agents.

5. There are no presently available criteria (except history) by which one can detect patients who may become psychologically or physically dependent upon these drugs. Therapy should not be prolonged if weight loss cannot be achieved or continued.

6. An appetite suppressant should never be prescribed or dispensed without a careful explanation of the potential side effects and an indication that its use is purely for symptomatic purposes.

7. Injectable forms of these drugs have no place in the treatment of obesity.

A variety of other drugs including human chorionic gonadotropin, digitalis, diuretics, and thyroid hormone have been widely used in the treatment of obesity. In the opinion of this author, there is no role for chorionic gonadotropin in the treatment of obesity. Digitalis, diuretics, and thyroid hormone should be employed only where specific indications exist: con-

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gestive heart failure, edema, hypertension, and stasis ulcers for digitalis and the diuretics; clinical and laboratory-demonstrable hypothyroidism in the case of thyroid hormone.

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Salt in Cardiovascular Disease

Hugh J. Carroll, MD
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Introduction

The human body is about 55 percent water, of which some 60 percent is intracellular and 40 percent is extracellular. The intracellular fluid (ICF) serves as the milieu for the biochemical reactions that define life, and one of the requirements of this milieu is that the ionic strength be maintained in a relatively narrow range. The ionic strength of the cells is maintained by the presence of salts confined to the intracellular space. The anions are for the most part complex phosphates and proteins that cannot leave the cells because of their size. The cations that maintain electrical balance in the cells consist primarily of potassium, with smaller quantities of magnesium, calcium, and sodium. Through their osmotic activity these salts maintain the volume of the intracellular space. The osmotically active solutes that hold water in the extracellular fluid (ECF) are almost entirely the chloride and bicarbonate salts of sodium. The ECF serves as a cushion to suspend the cells and as a conduit for materials from one organ to another. Particles from the cells of one organ diffuse slowly through the interstitial fluid and penetrate the capillary wall to be carried rapidly in the plasma to another organ where exit through the capillary wall and diffusion through interstitial fluid permit the particles to reach the cell membrane in the target organ. The interstitial fluid and the plasma comprise one phase, the ECF (Figure 1). The plasma is merely that part of the ECF that is held within the blood vessels by the plasma proteins. The critical variable of the ECF is its volume; if it is too low, the volume of plasma will decrease and underperfusion of tissues will result; if the volume of ECF is too large, tissue congestion and pulmonary edema can result. Since sodium salts hold water in the ECF it follows that salt depletion must be accompanied by a deficit of ECF volume [except when renal shutdown or inappropriate secretion of antidiuretic hormone (ADH) allows gross excess of water to accumulate] while accumulation of salt must lead to an increase in ECF volume (except

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in the unusual circumstance of a simultaneous marked dehydration).

Figures 2A, B, and C show the relationship between ECF and ICF as illustrated by a model system in which a solution of sodium salt at 140 mEq (280 mOsm) per liter is separated from a solution of potassium salt at 280 mOsm/liter by a semipermeable membrane (one which would permit the net movement of water but not solute and hence allow application of osmotic pressure). The effect of altering the volume and composition of the ECF will be studied since it is the ECF that is directly changed in man by the gain or loss of water and solutes through the various possible routes: gastrointestinal tract, kidney, skin, lungs, etc.

Effects of Alteration of ECF Upon the Volume and Concentration of the ICF

Gain or loss of isotonic salt solution by the ECF has no other effect than a change in volume of the ECF. Whenever salt leaves the system, ECF volume diminishes, and whenever salt enters the system ECF volume increases. When ECF volume changes, the ICF volume may change in the same direction, in the opposite direction, or not at all. Intracellular volume changes only by the shift of water and this in turn can occur only when water and salt are gained or lost by the intracellular fluid volume in other than isotonic proportions.

We have depicted a system in which sodium salts are restricted to the ECF and potassium salts to the ICF because this model is very similar to the state in the body. In biologic systems, however, there can be an exchange of cations across the cell membrane. Potassium can diffuse into the ECF and Na into the ICF but normally an energy-requiring "Na:K pump" restores the ions to their proper compartments. In a potassium-losing disorder, potassium fails to return to the cell but instead leaves the ECF taking an extracellular anion with it. The sodium that entered the cell when that potassium diffused out remains within the cell to balance the nondiffusable intracellular anion.

Salt Balance in Health and Heart Failure

The concept most relevant to a consideration of salt and water in heart disease is that if the job of sodium salts is to hold water in ECF, any disease that causes salt and water retention will lead to expansion of the ECF, edema, and, in the case of left ventricular failure, pulmonary edema. It will therefore be useful to consider the disposition of salt in man, and the manner in which the kidney attempts to maintain salt balance in health and in heart failure.

Total Body Sodium

The administration of radiosotopic sodium, ^{24}Na, and its subsequent measurement in the plasma, allow an estimation of the size of the sodium pool in the body with which the ^{24}Na exchanges. This pool of "total exchangeable sodium," TENa, represents the physiologically available sodium as contrasted with the structural sodium of compact bone which plays no part in the body fluid economy. In man the TENa content is 44.7 mEq/kg of body weight, or 82.3 mEq/liter of body water. Table 1 contains data concerning the quantities and distribution of water and major electrolytes in the body.[1,2,3]

Given the fact that expansion of the ECF is responsible for the signs and symptoms of congestive heart failure, and given the fact that salt and water are retained because of alteration in renal function, it is appropriate to examine renal function as it relates to normal and abnormal handling of sodium.

Figure 3 illustrates a grossly oversimplified but useful statement of kidney function. The glomerulus filters the blood and admits to the lumen of the nephron, plasma, and all its contents except formed elements and proteins. The wall of the nephron is fitted with receptors for the active transport of some materials to be salvaged and sites that permit the diffusion of other materials to be salvaged. Control mechanisms based on the needs of the body for a salvageable material determine how much of that material will be salvaged at any time. For example, the quantity of filtered phosphate to be excreted is determined largely by the titer of parathyroid hormone in the blood. This titer in turn is determined in part by the effects of an increasing serum phosphate concentration on serum calcium concentration and the ability of hypocalcemia to cause a release of hormone by the parathyroid gland.

Renal Transport of Sodium and Controlling Factors

Normal glomerular filtration rate (GFR) is 120 to 140 ml/minute so that some 200 liters of plasma water containing some 30,000 mEq of sodium enter the proximal tubule daily. Since the usual daily intake and excretion of sodium is about 150 mEq, more than 99 percent of the filtered sodium must be reabsorbed along the length of the nephron; if sodium excretion is to exceed the usual daily loss, as in the case of ingestion of excess sodium, or if sodium excretion is to be less than the usual, as in the case of retention of dietary sodium to make up for a salt-losing acute diarrhea, there will be an appropriate change in the fraction of filtered sodium reabsorbed. Increased or decreased glomerular filtration rate is of less importance in the retention or loss of sodium. Figure 4 describes sites in the nephron where sodium reabsorption can take place. Approximately 70 percent of filtered sodium, including 90 percent of the filtered sodium bicarbonate, is reabsorbed in the proximal tubule designated "pump no. 1." Water is reabsorbed here in isotonic proportions isosmotic to solute. No sodium is reabsorbed in the descending limb of Henle's loop but in the ascending limb and in the more distal reaches of the tubule the remainder of the filtered sodium is reabsorbed. In the ascending limb at "pump no. 2," salt is reabsorbed without water and the fluid entering the distal tubule, therefore, becomes quite dilute. The salt reabsorbed at pump no. 2 together with water drawn osmotically from the descending limb of Henle's loop is taken back into the circulation by the vasa recta. In the distal convoluted tubule and collecting duct, more salt reabsorption takes place and part of the reabsorbed sodium is exchanged for potassium and hydrogen, a process that permits the body to dispose of the daily dietary intake of these ions. The distal reabsorption of sodium and the exchange of sodium for potassium and hydrogen at "pump no. 3" is under the control of aldosterone. The reabsorption of water in the distal system depends on the availability of ADH. This hormone enhances the permeability of the tubule membrane to water and permits water to enter

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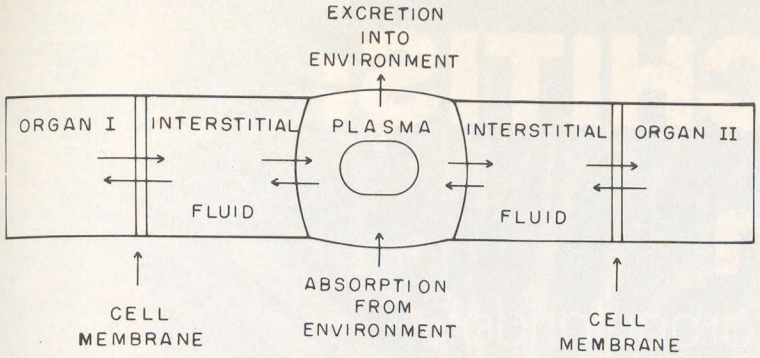

Figure 1. Interstitial fluid plus plasma comprises extracellular fluid. Water and crystalloids pass into and out of the plasma compartment by diffusion and bulk shift governed by Starling's forces. Solutes leave cells by active or passive transport, diffuse through interstitial fluid to plasma and travel in plasma to target organs where diffusion into interstitial fluid delivers solutes to cell membrane.

the interstitial fluid in response to the osmotic pull of interstitial solutes. The ability of the luminal fluid to equilibrate with the interstitium by movement of water across the membrane of the distal convoluted tubule is greater in some species than in others but in all mammals the movement of water across the collecting duct permits maximum osmotic concentration of the urine to approach that of the medullary interstitium. Pump no. 2 is responsible for both the dilution of the urine (by withdrawal of salt without water in the "diluting segment") and also for the concentration of the urine (by the addition of salt without water to the medullary interstitium where it serves as the osmotic force for withdrawal of water from the collecting duct).

Sine the volume of the ECF is its critical variable and since body sodium content controls ECF volume, it follows logically that some function of ECF volume should orchestrate the behavior of the salt-excreting mechanism. The current wisdom assigns this role to the effective arterial volume (EAV), that fraction of the blood volume responsible for nourishing the tissues; it might be described as the stroke volume in motion through the arteries. Decrease in this volume of blood can be shown to alter the behavior of all the mechanisms in the kidney that can cause salt retention. These factors in historical order have been indentified:

1. *Glomerular filtration rate.* With decrease in EAV sympathetic response reduces renal plasma flow and GFR and hence reduces filtered load of sodium.

2. Distal nephron, pump 3. Reduction in EAV, possibly working through pressure or stretch receptors in the afferent arteriole of the glomerulus, leads to an increase in renin production and hence to elaboration of angiotensin and aldosterone.

3. *Proximal convoluted tubule.* Micropuncture studies indicate that reduction in EAV, eg, by hemorrhage, increases reabsorption of salt and water at pump no. 1. Decrease in hydrostatic pressure of peritubular capillaries and decrease in an as yet unidentified salt-losing hormone probably are both involved. For want of a better name this set of mechanisms is referred to as "third factor."[4]

4. Pump no. 2 may be altered by reduction in a salt-losing hormone. In addition, a reduction in EAV selectively reduces perfusion of the cortical nephrons whose short Henle's loop warrants their designation as "salt-losing" nephrons.

Overexpansion of the EAV has effects on these mechanisms approximately the opposite of the effects of reduction in EAV.

Salt and Water Metabolism in Congestive Heart Failure

The pathophysiology of congestive heart failure derives from the tendency of the kidney to retain salt and water when effective arterial volume is reduced due to inadequate ejection of blood from the left ventricle (Figure 5). The retained salt solution lowers the concentration of plasma protein and raises venous pressure and hence causes edema.[5] With the increase in venous pressure, the filling pressure of the heart and the end-diastolic volume (preload) of the left ventricle increase. Distension of the left ventricle leads to a moderate increase of cardiac output but this compensatory mechanism soon reaches a maximum and the cardiac output remains reduced despite marked increase in venous pressure and dilation of the heart.[6] With persistent salt and water retention the tissues become waterlogged and the enhancement of pulmonary interstitial congestion leads to worsening dyspnea and orthopnea. There has been some suggestion, but little proof, that the increase in venous pressure in the renal veins may interfere with the excretion of sodium and may contribute to worsening of the edematous state. This "backward failure" hypothesis is regarded by most investigators as probably having little to do with the pathogenesis of the congested state but further investigation of this role is needed.

Hyponatremia

Despite the retention of great quantities of sodium, the edematous cardiac frequently demonstrates the paradox of modest hyponatremia (serum sodium about 130 mEq/liter) with a concentrated urine (specific gravity 1.020, osmolality 600 mOsm/liter). One or both of two mechanisms may be responsible: (1) delivery of fluid into the diluting segment (ascending limb of Henle's loop) is reduced because of the reduced GFR and the increased proximal reabsorption. Even if the fluid becomes dilute at this site, the quantity of filtrate is very small, and it moves so slowly through the collecting duct that water can be reabsorbed despite the absence of ADH. (2) Tendency of hyponatremia to suppress ADH output may be overcome by the reduction in EAV.

Treatment

Digitalis. The inotropic effect of digitalis increases cardiac output and hence increases the EAV.[7] With increase in EAV the whole set of mechanisms involved in the self-defeating process of salt and water reabsorption is reversed; renal perfusion increases and thereby the filtered load of salt increases; proximal sodium and water

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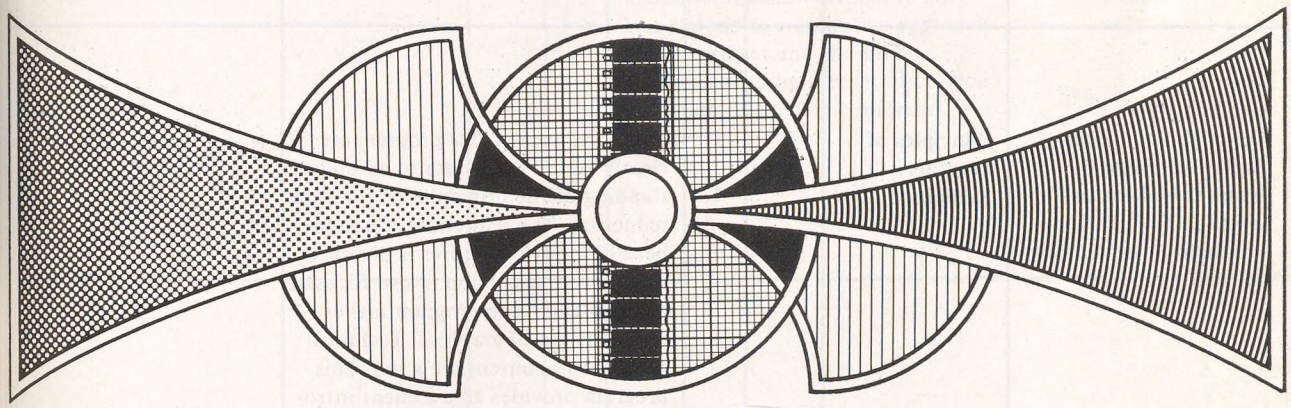
Reviews of Audiovisual Materials

AUDIENCE
1 Family physician
2 Family practice resident
3 Family nurse practitioner/Medex
4 Medical student
MEDIA
A 35 mm slides
B 16 mm film
C Video tape
D Models

The following audiovisual materials have been reviewed by the Audiovisual Review Committee, an *ad hoc* group of the Education Committee of the *Society of Teachers of Family Medicine.* Membership: John P. Geyman, MD, Chairman (University of Washington, Seattle), Richard M. Baker, MD (University of California, San Diego), Thomas C. Brown, PhD (University of California, Davis), Thornton Bryan, MD (University of Tennessee, Memphis), Laurel G. Case, MD (University of Oregon Medical School, Portland), Wendell B. Garren, MD (Geisinger Medical Center, Danville, Pennsylvania), James L. Grobe, MD (Phoenix, Arizona), Warren A. Heffron, MD (University of New Mexico, Albuquerque), Brian K. Hennen, MD (Dalhousie University, Halifax, Nova Scotia), Thomas L. Leaman, MD (Pennsylvania State University, Hershey), I. R. McWhinney, MD (University of Western Ontario, London), Donald C. Ransom, PhD (Sonoma Community Hospital, Santa Rosa, California), Philip L. Roseberry, MD (York Hospital, York, Pennsylvania), Rafael C. Sanchez, MD (Louisiana State University, New Orleans), Robert Smith, MD (University of Cincinnati, Cincinnati, Ohio), William L. Stewart, MD (Southern Illinois University, Springfield), John Verby, MD (University of Minnesota, Minneapolis), Raymond O. West, MD (Loma Linda University, Loma Linda, California), Hiram L. Wiest, MD (Pennsylvania State University, Hershey). Reviews of each type of media were carried out by subgroups of the committee.



SOURCE	PROGRAM	MEDIA	AUDIENCE	COMMENTS	OVERALL APPRAISAL
Network for Continuing Medical Education 15 Columbus Circle New York, NY 10053 ($50.00)	**Local Anesthesia: Three Effective Techniques**	C	1 2 4	The objectives of this program are clearly stated. Three techniques of local anesthesia are described and demonstrated: digital block, regional block, and field block. The program is well documented and illustrated, the content is accurate, and the subject well presented. It represents a good use of audiovisual material and is of excellent technical quality.	Highly Recommended

SOURCE	PROGRAM	MEDIA	AUDIENCE	COMMENTS	OVERALL APPRAISAL
Pfizer Labs 267 West 25th St New York, NY 10001 (No charge on a loan basis)	**Bronchitis and Bronchiectasis: Differentiation and Treatment**	B	1 2 3 4	This film deals with the diagnosis, treatment, and differentiation between chronic bronchitis and bronchiectasis. The indications for bronchoscopy and bronchography are included. Considerable emphasis is placed on the radiologic differentiation of these two problems. Although the content and technical quality of the film are good, it is quite long and is tedious in spots. The subject, however, is definitively covered.	Recommended
National Audiovisual Center National Archives and Record Service Washington, DC 20409 ($65.00)	**Principles of Fracture Reduction**	C	1 2 4	The objectives of this program are clearly stated and relate to an understanding of the principles of fracture reduction. The reduction of a number of kinds of fractures is demonstrated and discussion is also focused on after-care. The program makes excellent use of graphics. Technical quality and content are good. This program provides an excellent introduction to the subject.	Highly Recommended
American Medical Association Film Library 512 Burlington Ave LaGrange, IL 60525 ($10.00 rental)	**The Complete Gynecologic Examination**	B	3 4	This film is directed to the office gynecologic examination, including some special tests that can be performed in the office. Although the technical quality of the film is good, there are many omissions in terms of coverage of the subject. The film is quite superficial, and at best provides only an initial introduction to the subject.	Limited Value

SOURCE	PROGRAM	MEDIA	AUDIENCE	COMMENTS	OVERALL APPRAISAL
Ortho Pharmaceutical Corporation Raritan, NJ 08869 ($178.00)	**Aspects of Sexual Interviewing — The Frigid Wife**	C	1 2 3 4	Preferably viewed as a part of the two-part series which includes "The Frigid Wife's Husband," produced by the same source, this program focuses on the technique of taking a sexual history from a sexually dysfunctional woman. The process of sexual counseling is demonstrated and described. The presentation is well organized and provides definitions and teaching of interview techniques in the management of frigidity. Although the technical quality and content of this program are good, it should probably not stand alone as a definitive approach to this subject and should be supplemented by further discussion in a related teaching conference.	Highly recommended
Medcom, Inc. 2 Hammarskjold Plaza New York, NY 10017 ($120.00, $60.00 per part)	**The Red Eye, Part 1 and Part 2**	A	1 2 3 4	Each part of this two-part series includes 100 35 mm slides and a booklet. This two-part series provides a good overview of the subject. The slides are generally of good quality and are carefully keyed to a booklet. The written material is focused primarily on diagnosis. The program could have been of more value to the family physician by including teaching points related to differential diagnosis and the principles of management. This two-part series would be most useful for review purposes.	Recommended

SOURCE	PROGRAM	MEDIA	AUDIENCE	COMMENTS	OVERALL APPRAISAL
Network for Continuing Medical Education 15 Columbus Circle New York, NY 10053 ($50.00)	**How I Do Subclavian Venapuncture**	C	1 2	The objectives of this program are clearly stated. The program focuses primarily on the technique of subclavian venapuncture. A considerable amount of detail is presented concerning the required equipment and supplies. Although the presentation is by no means dynamic, the technical aspects of the procedure are adequately presented. The program could well be used as an introductory teaching approach to this procedure.	Of some value
Ortho Pharmaceutical Corporation Raritan, NJ 08869 ($178.00)	**The Frigid Wife's Husband**	C	1 2 3 4	Part of a two-part series including "Aspects of Sexual Interviewing – The Frigid Wife," produced by the same source, this program presents a good case study of the husband-wife interaction illustrating family power struggles, and this can be applied to their sexual relationship. The program stresses conjoint therapy which treats the relationship and not the individual patient. The beginning and end of the interview with the husband are shown, then the conjoint session, and finally a review of the dynamics of these sessions. A therapeutic plan is established for the couple which stresses non-sexual as well as sexual elements. The program represents an excellent use of audiovisual media and the case problem is well done.	Highly recommended

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reabsorption is diminished as hydrostatic and oncotic pressures in the peritubular capillaries return to normal; perfusion of cortical nephrons with their short loops allow salt and water excretion to increase; aldosterone production diminishes while, presumably, the elaboration of the salt-losing hormone(s) increases. The delivery of increased amounts of filtrate to pump no. 2 allows the creation of more free water and the excretion of this free water allows the serum sodium to increase even as natriuresis ensues.

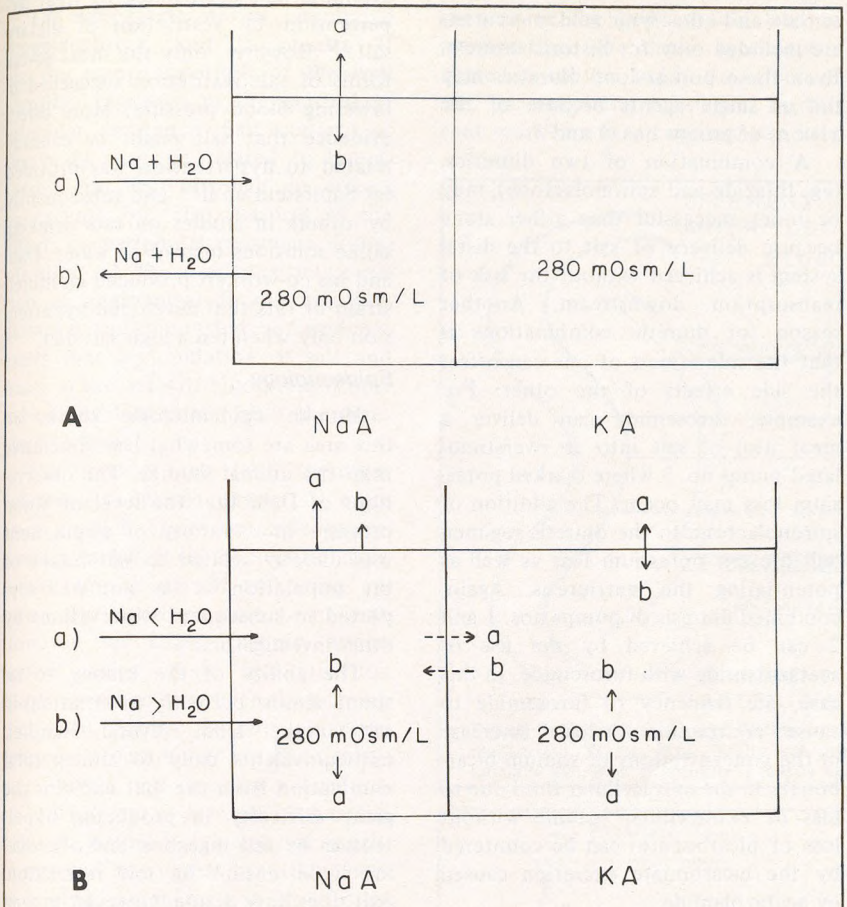

Figure 2. In these figures A represents all of the anions. Solid arrows (a and b) indicate the direction of changes in osmolality and volume of the two compartments and the broken arrows the movement of water between the compartments caused by the change in osmolality of the "ECF" (NaA) compartment. (A) Addition of isotonic fluid to, or removal of isotonic fluid from the ECF. (B) Addition of salt and water to ECF in other-than-isotonic proportions. Addition of salt to the ECF always increases the volume of ECF. If salt is added in excess of water, the ICF volume diminishes due to the osmotic withdrawal of water. If water is added to the ECF in excess of salt, the decline in osmolality of the ECF will allow shift of water with increase in ICF volume.

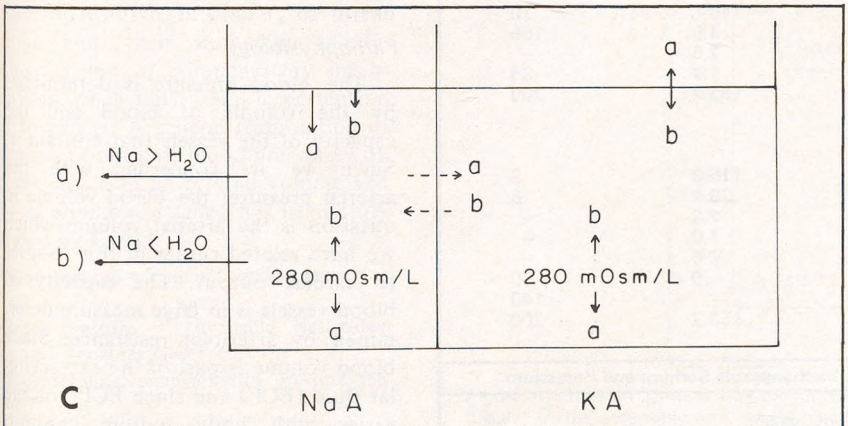

Figure 2C. Withdrawal of salt and water from ECF in other-than-isotonic proportions. Loss of salt from ECF always diminishes ECF volume. If salt is lost in excess of water, the decline in extracellular osmolality necessitates movement of water into the ICF. If more water is lost than salt, the rise in ECF osmolality pulls water from the ICF and partially preserves the volume of the ECF.

Diuretics: Measures Designed to Diminish Quantity of Salt and Water in the Body. (a) Salt Restriction: The patient who is receiving an adequate dosage of digitalis and whose EAV is close to normal may have only a modest tendency toward salt retention. If such an individual is instructed to add no salt at the table and to avoid salty foods, he may remain in salt balance unless his meals are cooked with excessive amounts of salt. When salt intake must be reduced to the point where diet is unpalatable, therapy with diuretics should be undertaken. (b) Diuretics: A diuretic is any substance that increases the output of salt and water by the kidney, usually by inhibiting the reabsorption of filtered sodium. The usefulness of a variety of diuretic compounds and combinations of diuretics derives from the fact that salt is retained by all three nephron pumps, and that the action of a given diuretic is predominantly, if not exclusively, at one site in the nephron.

Site of Action of Diuretics.[8,9] Electrolyte excretion and micropuncture studies indicate that acetazolamide and osmotic diuretics have major effects in the proximal convoluted tubule. As a potent inhibitor of carbonic-anhydrase, acetazolamide causes the excretion of $NaHCO^3$, 90 percent of which is normally reabsorbed in the proximal convoluted tubule. Thiazides, furosemide, and ethacrynic acid have relatively minor effects in the proximal convoluted tubule. Diuretics that interfere with salt reabsorption in the ascending limb of Henle's loop are called "loop diuretics." Since this site is responsible for both concentration and dilution of the urine, diuretics that operate here should inhibit in an overhydrated animal the ability to dilute the urine and, in a dehydrated animal, the ability to achieve maximum urinary concentration. These characteristics are demonstrated by

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furosemide, ethacrynic acid, and the mercurials. Diuretics that inhibit sodium reabsorption at pump no. 3 in the distal convoluted tubule and collecting duct should interfere with the mechanism that secretes potassium and should, therefore, lead to potassium retention. The potassium-conserving diuretics are spironolactone, triamterene, and amiloride. Thiazides and related compounds, eg, chlorthialidone, limit the dilution of the urine but not the process of maximum urinary concentration. Thiazides must operate in the late segment of the loop and early distal convoluted tubule, but, since they cause potassium loss, their actions must stop short of pump no. 3. The site of action of these various diuretics is shown in Table 2.

Diuretic Failure and Rationale for Diuretic Combinations. If a kidney is using all of the three available sodium pumps to reabsorb salt and water, a pump no. 1 diuretic may block reabsorption of sodium only to have it reabsorbed distally. Similarly, a pump no. 3 diuretic may have little substrate since more proximal mechanisms have already removed most of the salt and water. Loop diuretics tend to be more successful than others as single agents because they are neither preceded nor followed by two successive pumps and also because they seem to be more intrinsically potent. The discussion of loop diuretics here refers to furosemide and ethacrynic acid; mercurials are included only for historic interest. Even these potent loop diuretics may fail as single agents because of the actions of pumps nos. 1 and 3.

A combination of two diuretics, (eg, thiazide and spironolactone), may be more successful than either alone because delivery of salt to the distal system is achieved without the risk of reabsorption downstream. Another reason for diuretic combinations is that the side effects of one can offset the side effects of the other. For example, furosemide can deliver a great deal of salt into an overstimulated pump no. 3 where marked potassium loss may occur. The addition of spironolactone to the diuretic regimen will prevent potassium loss as well as potentiating the natriuresis. Again, combined diuresis of pumps nos. 1 and 2 can be achieved by the use of acetazolamide with furosemide. In this case, the tendency to furosemide to cause "contraction alkalosis" (increase in the concentrations of sodium bicarbonate in the extracellular fluid due to loss of extracellular volume without loss of bicarbonate) can be countered by the bicarbonate excretion caused by acetazolamide.

Table 1A. Quantity of Water and Major Electrolytes in the Body (mEq/liter)

	Extracellular Fluid Electrolytes			Intracellular Fluid Electrolytes
Cations	**Plasma**	**Plasma H_2O**	**Interstitial Fluid**	
Na	142	151.9	145	10
K	4.5	4.8	4.5	155
Ca	5	5.3	2.5	—
Mg	2.5	2.7	1.2	35
Total	154	164.7	153.2	200
Anions				
Cl	103	110.2	115.0	2
HCO_3	26	27.8	29.2	8
PO_4	2	2.1	2.0	—
SO_4	1	1.1	1.0	—
Organic Acid	6	6.4	6.0	—
Protein	16	17.1	0	50
PO_4	—	—	—	140
Total	154	164.7	153.2	200

Table 1B. Distribution of Water and Total Exchangeable Sodium and Potassium

Total Exchangeable Sodium = 44.7 mEq/kg Body weight
Total Exchangeable Potassium = 37.3 mEq/kg Body weight
Total Body Water = 540 ml/kg Body weight
Intracellular Water = 324 ml/kg Body Weight
Extracellular Water = 216 ml/kg Body Weight

Salt and Hypertension

Even before a pathogenic role for salt in hypertension was established, attempts had been made to treat hypertension by restriction of dietary salt.[10] However, only the most severe forms of salt restriction succeeded in lowering blood pressure. More direct evidence that salt might be causally related to hypertension was provided by Sapirstein et al[11] and subsequently by others in studies on rats drinking saline solutions instead of water. Dahl and his co-workers produced an inbred strain of rats that developed hypertension only when fed a high salt diet.

Epidemiology

Human epidemiologic studies in this area are somewhat less conclusive than the animal studies. The observations of Dahl that the level of blood pressure in a variety of populations was directly related to salt intake of the population[12] was not well supported in subsequent observations by other investigators.

The ability of the kidney to respond almost perfectly to variations in salt intake from several hundred milliequivalents daily to almost total elimination from the diet explains the great difficulty in producing hypertension by salt ingestion and of reducing hypertension by salt restriction. Salt does have a role, however, in man in the regulation of blood pressure, and this role can best be appreciated in the context of the overall scheme of blood pressure regulation. In the subsequent treatment the primary focus is on those mechanisms where salt is directly relevant; other important control mechanisms are not considered in detail.

Pathophysiology

The blood pressure is determined by the volume of blood and the capacity of the vessels that contain it. Since we are concerned with the arterial pressure, the blood volume in question is the arterial volume which we have related earlier in this chapter to cardiac output. The capacity of blood vessels is in large measure determined by arteriolar resistance. Since blood volume is part of the extracellular fluid (ECF) and since ECF volume varies with body sodium content, there should be a tendency, in the absence of left ventricular failure, for

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an increase in body sodium to produce an increase in cardiac output.

The sympathetic nerves, circulating norepinephrine, and angiotensin II are the most important of the well identified agencies in the control of arteriolar resistance. Salt content of the body may be related to hypertension not only through the effects on volume but also because of the effects on peripheral resistance. Intensification of the vasoconstrictive action of angiotensin II and catecholamines is well supported, and evidence exists that accumulation of salt and water in the walls of blood vessels may reduce the lumen and alter the resistance to flow.

The role of salt (and therefore volume and cardiac output) is quite clear in such states as acute hypertension in salt-loaded anephric man, where removal of salt and water restores the blood pressure to normal. However, in some chronic hypertensive states where salt retention clearly seems to have been the primary aberration, cardiac output and blood volume are commonly normal. Clearly then, subtle and complex procedures are at work and at present it is possible only to define some control mechanisms and to suggest how they may be related. An increase in blood pressure leads to an increase in renal excretion of salt and water with decrease in vascular volume. An increase in cardiac output leads to overperfusion of the tissues and to a rise in arteriolar resistance due to local control factors that regulate regional blood flow.[13] The blood pressure is then the resultant of primary perturbations and their immediate consequences and of compensatory mechanisms which must fail if hypertension is to persist. A general formulation of the relationship of blood pressure with some function of arterial volume and of arteriolar resistance has been aptly stated by Laragh[14].

Blood pressure = Volume × vasoconstriction

or

Blood pressure = (Available Na)(Aldosterone)(Renal response) × (Angiotensin)(Nonangiotensin pressure factors)

Table 3 lists pathogenetic mechanisms and compensatory mechanisms and Table 4 is a set of suggested sequences for the development and maintenance of hypertension in some familiar conditions.

Treatment

In general, the reduction of salt content in the body should lead to amelioration of those mechanisms rooted in volume and in the effects of salt on peripheral resistance. Significant reduction in salt content can only be achieved by diuretics; as was previously noted the renal mechanisms for salt conservation are so effective that only intolerable alterations produce a diet sufficiently low in salt. With the use of diuretics most patients with hypertension can ingest sufficient salt to render their food palatable (2 to 3 gm daily). Reduction in body salt is

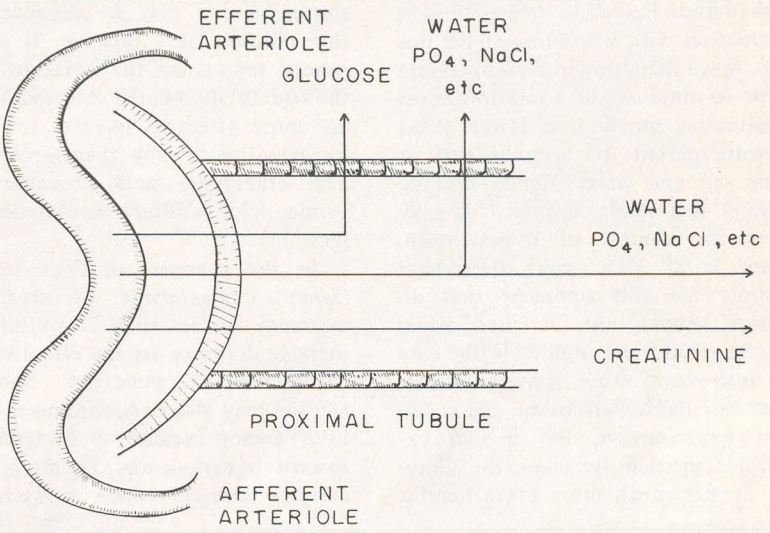

Figure 3. Elements of renal filtration, reabsorption, and excretion. Glucose is totally reabsorbed. Water, PO_4, NaCl, and similar substances are partially reabsorbed and partially excreted. Creatinine is totally excreted.

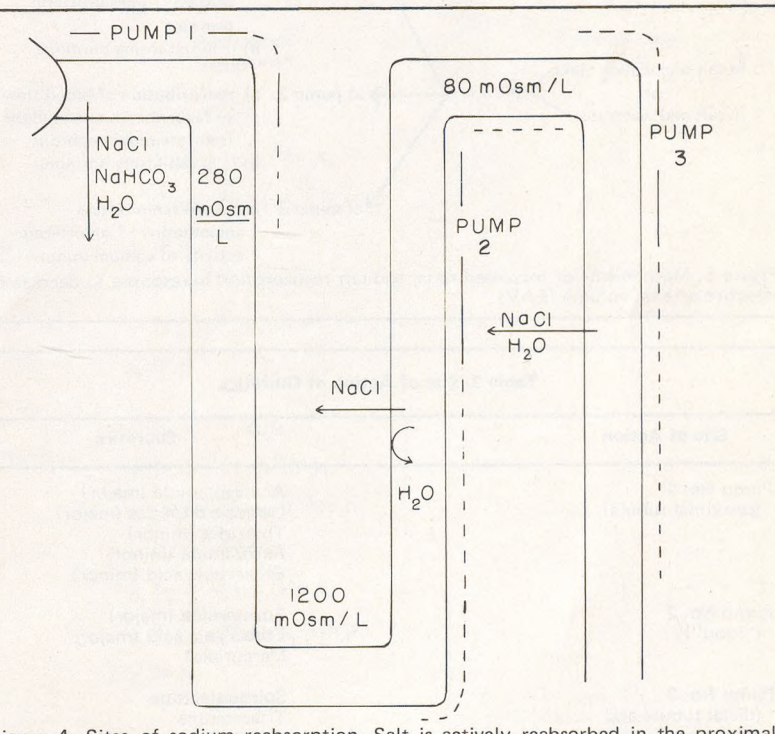

Figure 4. Sites of sodium reabsorption. Salt is actively reabsorbed in the proximal tubule, in the ascending limb of Henle's loop and in the distal system. Water follows isosmotically at pump 1, but at the ascending limb of Henle's loop, the membrane is impermeable to water. In the distal system, water reabsorption depends on the presence of ADH.

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particularly effective as an antihypertensive measure in those conditions in which volume is increased or normal. Where volume is low, further salt depletion as the sole therapeutic measure may be relatively ineffective and cases have even been described where further depletion of salt in malignant hypertension has led to increased renin production with worsening of the disease. Since reduction in blood pressure tends to diminish salt excretion, most nondiuretic agents that lower blood pressure permit the accumulation of some salt and water. Hence, diuretic therapy is a staple in almost all regimens for control of hypertension. There is at least some theoretical support for the argument that diuretics should not be used when plasma renin is elevated as in the case of "high renin" essential hypertension, renal vascular hypertension, and malignant hypertension, but in our experience in such instances, the diuretics appear much more often helpful than harmful. In those instances in which "essential" hypertension is characterized by low plasma renin and possibly by the action of some unidentified mineralocorticoid, opinion concerning the advantages of spironolactone over thiazide is divided and is not compelling.[15] Even in the case of primary aldosteronism the response to high doses (over 200 mg daily) of spironolactone may be enhanced by the addition of a thiazide. It is the general impression that thiazides (and the structurally related chlorthalidone) are more effective agencies for antihypertensive therapy than furosemide and ethacrynic acid, because the former have a direct vasodilating effect.[16,17]

In the presence of renal insufficiency, characterized by creatinine clearance of less than 25 ml/minute, thiazide diuretics are not effective and furosemide is indicated. Spironolactone may also be hazardous in renal insufficiency because of the tendency toward hyperkalemia. Triamterene is another diuretic which is useful in hypertension for its volume-depleting capacity and which shares with spironolactone the danger of hyperkalemia in the presence of renal insufficiency or potassium administration.

The possible effects of diuretics on hypertension may be summarized: (1) direct vasodilating effect: probably true only of thiazides and related compounds; (2) removal of the intensifying effects of salt on vascular reactivity; (3) reduction in volume leading to reduction in cardiac output which leads to reduction in tissue perfusion and hence to reduction in arteriolar resistance.

Clinical Aspects: A Summary

If cardiac output falls due to heart failure, the body tends to retain salt and water in order to raise venous return and hence raise cardiac output. The price paid for this rise in cardiac output is too great: edema, pulmonary congestion, increased work of breathing, dyspnea, orthopnea, etc. Salt and water retention in congestive heart failure can be minimized by restriction in salt intake. When this measure fails because of the patient's inability to cooperate, diuretics are very effective in holding down salt retention and weight gain. In very severe circulatory overload, it is important to restrict salt intake as well as to use diuretics. For example, it would take 30 days to retain 600 mEq of sodium or to gain approximately 9 lbs of weight on a daily diet of 20 mEq of sodium even if there were no sodium excretion at all. However, on the usual dietary intake of salt, 6 to 10 gm (100 to 170 mEq of sodium) per day, it would take just a few days to retain enough salt to develop severe congestive heart failure or pulmonary edema if all or most ingested salt is retained. In hypertensive diseases, salt may contribute to elevated blood pressure by the increased blood volume or by increased reactivity of the arteriolar walls. All regimens except the most severe (and intolerable) salt restriction are ineffective in removing salt from the body in hypertension, and diuretics are part of the therapy of practically all patients. Diuretics are especially important since most types of antilhypertensive agents encourage salt retention by the kidney. In most instances where hypertension is not complicated by heart

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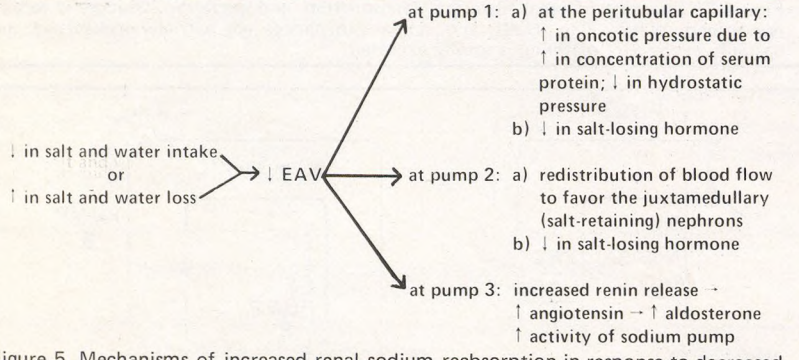

Figure 5. Mechanisms of increased renal sodium reabsorption in response to decreased effective arterial volume (EAV).

Table 2. Site of Action of Diuretics

Site of Action	Diuretics
Pump No. 1 (proximal tubule)	Acetazolamide (major) Osmotic diuretics (major) Thiazides (minor) Furosemide (minor) Ethacrynic acid (minor)
Pump No. 2 ("loop")	Furosemide (major) Ethacrynic acid (major) Mercurials*
Pump No. 3 (distal tubule and collecting duct)	Spironolactone Triamterene Amiloride
Between pumps 2 and 3	Thiazides and related compounds

*Seldom used now because of the need for parenteral administration and the effectiveness of newer oral agents.

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or renal failure it is possible for patients to ingest 2 to 3 gm of salt daily while being treated for hypertension.

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Table 3. Pathogenetic Mechanisms of Hypertension

Pathogenetic Mechanisms		
1. Salt retention	→	↑Vascular volume (V.V)
2. Salt retention	→	↑Vascular reactivity (Vas. R.)
3. ↑Vas. R.	→	↑(Peripheral) Arteriolar resistance (P.R.)
4. ↑V.V.	→	↑Venous return (Ven R)
5. ↑Ven R	→	↑Cardiac output (C.O.)
6. ↑C.O.	→	↑Arterial pressure (B.P.)
7. ↑C.O.	→	↑Tissue flow (T.F.)
8. ↑T.F.	→	↑(Peripheral) Arteriolar resistance (P.R.)*
9. ↑P.R.	→	↑B.P.
Secondary Mechanisms		
10. ↑B.P.	→	↑Renal salt excretion → ↓V.V.
11. ↑B.P.	→	↑Capillary filtration pressure (C.F.P.) → ↓V.V.
12. ↓V.V.	→	↓Ven. R. → ↓C.O.
13. ↑P.R.	→	↓T.F. → ↓Ven. R. → ↓C.O.

*An autoregulatory mechanism to maintain normal tissue perfusion.

Table 4. Pathophysiologic Sequence for the Development and Maintenance of Hypertension

Disease State	Primary Abnormality	Pathogenic Sequence*	Final Changes V.V.†	P.R.‡	B.P.*
1. Primary aldosteronism	Salt retention (Aldosterone)	a. ↑V.V. $\xrightarrow{4,5}$ ↑C.O.	↑		
		b. ↑C.O. $\xrightarrow{7}$ ↑T.F. $\xrightarrow{8}$ ↑P.R.	→	↑	↑
		c. ↑TENa $\xrightarrow{2}$ ↑Vas R. $\xrightarrow{3}$ ↑P.R.			
2. Renovascular hypertension	Salt retention and vasoconstriction (Angiotensin)	a. ↑P.R.	↑		
		b. ↑V.V. $\xrightarrow{4,5}$ ↑C.O.	→	↑	↑
		c. ↑TENa $\xrightarrow{2}$ ↑Vas R. $\xrightarrow{3}$ ↑P.R.	↓		
3. Pheochromocytoma	Vasoconstriction (Catecholamine)	a. ↑P.R.	↓	↑	↑
4. "Low Renin" essential hypertension	?Salt retention (?A mineralocorticoid)	a. ↑V.V. $\xrightarrow{4,5}$ ↑C.O.	↑		
		b. ↑C.O. $\xrightarrow{7}$ ↑T.F. $\xrightarrow{8}$ ↑P.R.	→	↑	↑
		c. ↑TENa $\xrightarrow{2}$ ↑Vas R. $\xrightarrow{3}$ ↑P.R.			
5. Renoprival hypertension	Salt retention	a. ↑V.V. $\xrightarrow{4,5}$ ↑C.O.			
		b. ↑C.O. $\xrightarrow{7}$ ↑T.F. $\xrightarrow{8}$ ↑P.R.	↑	↑	↑
		c. ↑TENa $\xrightarrow{2}$ ↑Vas R. $\xrightarrow{3}$ ↑P.R.			
6. Malignant hypertension	Vasoconstriction (Angiotensis)	a. ↑P.R.	→ ↓	↑	↑

*Abbreviations and numbers are from Table 3.
†If increased salt excretion fails to reduce volume to normal (when peripheral resistance is normal) of sufficiently below normal (when peripheral resistance is elevated), hypertension will persist. Such failure may be due to salt-retaining hormones, gross renal disease, renal vasoconstriction, or subtle and unexplained diminution in the ability of the kidney to excrete salt.
‡Peripheral resistance is probably elevated in all sustained hypertension; if it is not a primary mechanism, it will ensue when increased cardiac output increases tissue flow.

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describes the diagnosis of all etiologic factors concerned with coma and its management. Chapters discuss on-the-scene care; respiratory failure, shock, and coma; diagnostic problems: acute or chronic; diagnostic emergency department procedures; managing the comatose patient; coma of obscure origin; drug overdose; metabolic encephalopathies; and finally there is a chapter dealing with emergency procedures in a "limited care facility." Illustrations in the monograph are rather sparse but the references at the end of each chapter are plentiful.

One can readily recommend this book for both the physician's desk and the Emergency Room.

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University of Kansas
Kansas City

Non-Invasive Cardiac Diagnosis. *Edward K. Chung (ed). Lea and Febiger, Philadelphia, 1976, 319 pp., $18.00.*

This book is excellent and can be recommended to family physicians without reservation. It is attractively bound, and reproductions of x-rays, electrocardiograms, echocardiograms, etc, are of the finest quality. It reads smoothly with logical sequencing of the chapters and good continuity of writing. The diagrams and illustrations are particularly informative and helpful in clarifying the text.

In chapter 1, figures 1-7, there is a mistake. At the top of the figure the second heart sound should be shown more widely split in inspiration as compared to expiration. On page 14, there is a statement that implies that systolic clicks have no known clinical significance. This seems inappropriate in a 1976 textbook in view of the number of articles which appear every month concerning the click-murmur syndrome. In chapter 2, the presentation on carotid sinus stimulation is excellent. Chapters 14 and 15, concerned with digitalis and other cardiac drug serum monitoring, should be required reading for all physicians who deal with these agents. Perhaps, the least important chapter for American family physicians is the one about ballistocardiography, since this procedure is not available in the United States. It is nevertheless a fine discussion and probably useful in completing the subject of this book.

Probably the most timely chapter is that concerning computerized electrocardiography. In this burgeoning field it is quite useful to have a well-synthesized discussion of the subject. Indeed, as stated in the preface, this "book should be extremely valuable to all practicing physicians" and should be a part of the recommended office library.

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Color Atlas of Anterior Segment Eye Diseases. *Ira A. Abrahamson, Jr., Medical Economics Book Division, Oradell, New Jersey, 1974, 154 pp., $27.50.*

This is a neat book. Basically, it is a book of excellent color pictures of eye diseases with a one to three-page written introduction to each section and no further text. I had the occasion to use it twice while preparing this review. It would be a good book for a family physician or a family practice resident to have in the library. It would be useful to any person seeing patients in a primary health care setting.

There are not many words so readability is not a problem. The organization is excellent and the illustrations are superb. It is not a textbook of eye diseases, and contains no information on treatment. Therefore, access to another eye text is necessary. However, in terms of showing what you see in the office as well as what sees you, I recommend this book.

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