SURGERY IN THE AGED

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Dedicated to the
memory
of
CAPTAIN VINCENT ASTOR
contributor to the alleviation
of
the sufferings of mankind

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Preface

Surgical therapy among the aged is increasing year by year and the need for a treatise on this subject was indicated by physician response to an article by the senior editor on this subject which appeared in the Bulletin of the New York Academy of Medicine. This article also evoked the interest of the Blakiston Division of McGraw-Hill and they approached him with the idea of a composite volume prepared by the New York Hospital—Cornell Medical College Surgical Staff. The publisher felt that the considerable experience of our staff with this group of patients should be made available to all physicians. Frankly, it was flattering to receive this expression of interest. After a series of interdepartmental conferences, our group concluded that such an undertaking could best be accomplished if each of us considered those subjects which we dealt with in our daily work. Thus gynecology is not included in this volume because in this Center it is within the Department of Obstetrics & Gynecology.

As the material was brought together in the 30 chapters of this book, the importance of surgical therapy for the aged in over-all practice became even more and more evident. Because the proportion of our population 65 years and over is increasing, there is a corresponding increase in the incidence of conditions requiring specific medical care. Surgery is now more frequently indicated and accepted among the older age group than ever before. By precision management both in preoperative and postoperative care, as well as careful adaptation of anesthesia and surgical procedures to the individual, surgical therapy has become safer and easier for the patient. Because there is variability in the capacity of the older age people to withstand the burdens of surgical procedures, be they diagnostic or therapeutic, judgment and skill are essential in correlating what is to be done with the individual and the circumstances then existent.

Within the various areas of surgery dealt with by the 26 authors there are many facets; many of these are common to the overall, but about an equal number are specific to the condition being considered. These are reported from personal experience and observations. It follows, therefore, that much more could be added and still the subjects would not be complete. The objective has been to present the experience of a group working together in a teaching medical center.

Credit is due to each contributor and their long-patient secretaries who have typewritten these pages in addition to their daily work. This cooperative endeavor has thus been a pleasant, albeit at times, an arduous one. Special recognition is well deserved by Mr. Milton Zisowitz for editorial guidance and arrangement, Mr. Frank Robinson for illustrations and Miss Vivian Bowe who has read and corrected proof as well as participated in the completion of the original manuscript.

Finally thanks are expressed to the publisher representatives for inviting us to produce this treatise and for their everlasting patience and guidance in its preparation. We, as authors, have enjoyed working with them.

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Introduction

Frank Glenn

In 1900, the average life span of the 76 million persons in the United States was 50 years. In 1958, the 175 million Americans may look forward to an average life expectancy of 70 years. This trend of the past 58 years has been consistent, and it is reasonable to expect that it will continue. Thus, the composition of our society is changing. Not only is the total population greater, but a larger proportion of this population consists of persons who are 60 years of age or older. These changes challenge those who must study problems of health. One area of inquiry concerns the factors that have been responsible for the greater longevity. A second and equally urgent problem, and one that directly concerns the medical profession, is the provision of medical care for this changing population.

Several factors have contributed to this trend. The development of natural resources has resulted in a general increase in wealth, and living standards have greatly improved. In the past 60 years, there has rarely been a scarcity of food. Housing and living conditions, as well as hygiene and sanitation regulations, have improved in both urban and rural sections of the country. Associated with the great development of the nation's resources and prosperity there has been a remarkable expansion of facilities for research in the biological sciences. These have provided spectacular advances in knowledge which have been translated into better medical care and into progressively improving health programs. There are few disease processes that have not shown a significant decrease in morbidity and mortality since 1900. These factors are prominent among the reasons that approximately 14 per cent of our population, or about 24 million persons, are now 60 years of age or older.

The second challenge to study concerns the medical problems that are presented by these 24 million persons. While it is apparent that the incidence of chronic illnesses is higher in this segment of our population than in the younger groups of patients, their prominence must not obscure the significance of acute diseases that are not related to chronic or degenerative processes. Although cardiovascular disorders and cancer are leading causes of disability and death in the elderly, these individuals are subject to many of the same illnesses that are prevalent among younger patients, such as infection, trauma, and emotional disturbances. Early detection and prompt therapy are as appropriate for the old as for the young.

Obviously the frequency with which chronic or degenerative conditions are encountered in older individuals does influence the management of such patients, particularly when operation is indicated. The margin of safety is greatly diminished as age increases, and therefore precision management is required. In addition, it would appear that in many older patients the control of infection and shock is rendered more difficult because degenerative processes are present. Thus, in the elderly patient, the approach to the primary disease must be considered in conjunction with associated chronic or degenerative illnesses.

In recent years, the hospital population in large institutions such as The New York Hospital has reflected the change in population as a whole. There has been a progressive increase in number of patients beyond the age of 60. Surgeons are being required

to operate upon older patients more frequently, and there is an increase in the age at which surgery is needed. It is now generally accepted that age alone does not preclude surgical treatment.

Certain diseases requiring surgery increase in frequency with age. This is perhaps best exemplified by studies of the incidence of cancer and of biliary tract disease. Many published reports have considered disease processes and their treatment without particular regard to age. Because the response of elderly patients often differs from that of younger persons, it has been felt desirable to present experiences in the management of the aged. The physician who desires to assemble information about the experience of others with this age group must usually search through divers reports and scattered journals. For a number of years, the staff of the Department of Surgery of The New York Hospital–Cornell Medical Center has been accumulating experience in the treatment of the aged. This volume is presented in the hope that it will be of assistance to others in the management of surgical problems in this substantial and ever-increasing segment of our population. The material which is presented in the following chapters is based upon the experience in this institution. Where indicated, this experience has been compared with that of others. Emphasis has been placed upon the frequency of associated conditions, the type of treatment and results, and the complications that may be anticipated.

A review of the operative mortality is perhaps most effective in placing the problem of therapy of the elderly patient in proper perspective. During the 5-year period 1953 to 1957, there were 21,655 operations on the surgical pavilion service (including the surgical specialties). There were 343 deaths after operation, an operative mortality of 1.6 per cent. Of the 343 deaths, 174, or approximately 51 per cent occurred in patients 60 years of age or older. The age differential in operative mortality is even more striking when the analysis is made according to systems. The accompanying table shows that more than three-fifths of the deaths in operations for cancer, fractures, emergency problems, and genitourinary diseases were in patients 60 years of age or older. Another significant observation was made when the mortality in emergency operations was contrasted with that in elective procedures. Fewer than half of the patients who died after elective operations on the general surgical pavilions were older than 60, while 70 per cent of those who died after emergency operations (including fracture) were in or beyond the seventh decade of life.

These figures emphasize the major contribution that the elderly patient presents to hospital mortality and morbidity. Improvement in the care of these patients and reduction of mortality require study of the causes of death and an awareness of the types and frequency of complications that occur during the course of treatment.

OPERATIVE MORTALITY OF THE SURGICAL PAVILION SERVICE, 1953–1957 *

System or category	*Total no. of deaths*	*Deaths, patients 60 and older*	*Per cent 60 and older*
Emergency operations	59	38	64.4
General:			
Cancer	77	52	67.6
Liver and biliary tract	21	7	33.3
Cardiovascular	39	5	12.8
Gastrointestinal	23	11	47.8
Miscellaneous	11	7	63.6
Fracture	18	16	88.9
Neurosurgery	55	12	21.8
Otolaryngology	3	0	0
Urology	34	26	76.5
Plastic	3	0	0
Total	343	174	50.8

* The New York Hospital–Cornell Medical Center.

Part 1

Fundamental Concepts

1

Physiologic and Metabolic Problems

George N. Cornell, Helena Gilder, Albert J. Paquin, and John M. Beal

With the increasing longevity enjoyed by our population has come an expanding interest in the study of the physiology peculiar to the aging organism. Biologists as well as clinicians have been hampered in this study by three frustrations which remain to be resolved. First is the lack of information on alterations in the intracellular processes peculiar to the aging individual. Second is the problem of distinguishing alterations due to the passage of time alone from those due to associated disease, the latter being reversible at least in theory. This is especially true in the patient who manifests such degenerative diseases as generalized arteriosclerosis or emphysema. Third, owing to the fact that the backgrounds of persons reaching the geriatric age are highly variable, gross individual variation is evident in most studies, thus hampering the formulation of any significant general conclusions.

In the following sections the authors will define, so far as present knowledge permits, those physiologic changes common in the elderly patient which have a bearing on his response to operative or accidental trauma, describe the usual metabolic response to trauma in this age group, and, finally, discuss the important factors which influence this response.

PHYSIOLOGIC CHANGES

Certain physiologic alterations are encountered often enough in older patients so that the surgeon who is called upon to treat such a person must have them well in mind and be constantly alert for them. The older patient with a surgical problem represents the sum total of his past experience. Socioeconomic factors, traditions, habits, and intelligence level all affect the individual's response to trauma. Frequently, retired persons must adjust to a diminished income. This single factor may lead to less desirable housing, restriction of social contacts, and a decrease in the quality and quantity of nutriments. This results in a patient who, in addition to his immediate difficulty, shows loss of body vigor due to a decrease in physical activity and a narrowed mental outlook, the end result of circumstances which have had a deleterious effect on both physical condition and personality.

Some of the personality traits which appear to manifest themselves frequently in the elderly patient may interfere with good management. The elderly patient may show varying degrees of depression, somatic delusions, terror, and distrust, especially when ill. Since trust and cooperation are mandatory for good management, such psychic symptoms may retard the patient's recovery. These manifestations should not be mistaken for the delirium and confusion noted in the ill elderly patient, which may be the prodromal signs of a serious metabolic disorder.

Malnutrition is commonly encountered in the geriatric age group. This may be a minor problem brought out only through a very

careful history, or it may present as a full-blown clinical picture characteristic of a severe dietary lack or imbalance of the essential foods. Economic and dental problems may force the elderly patient to replace nutriments containing adequate proteins and vitamins with a cheaper and more easily masticated carbohydrate-rich diet. Additively, in many patients seeking surgical aid, the disease process exacerbates the nutritional deficiencies. The nutritional state of the patient should be evaluated by noting specifically a history of weight loss, hepatomegaly, and unusual concavities in body contour due to a loss of muscle mass. Anorexia and diarrhea with peripheral edema may indicate an advanced stage of malnutrition.

Despite the frequency of malnutrition in the older patient group, studies have revealed that malabsorption problems are unusual in those who are enjoying generally good health. When offered a balanced diet they store protein, but they do resist protein intakes in excess of 100 Gm per day. Hypochlorhydria may be encountered in the geriatric patient, and the incidence of this condition appears to increase with each additional decade of age. This decrease in gastric acidity impedes iron and calcium absorption to some degree and decreases the production of intrinsic factor. However, aside from these minor points, it is unusual to find absorption or motility problems. Therefore, oral feeding is preferred whenever possible in treating metabolic disturbances.

Cardiovascular function in the older patient may show a loss of cardiac reserve, even though symptoms are absent. In one study, 60 per cent of patients over the age of 60 years were found to have moderate to advanced coronary arterial sclerosis. A decrease in basal pulse rate, stroke volume, and cardiac output amounting to about one per cent per year for each year beyond the fiftieth has been demonstrated as characteristic of the geriatric patient. Observations on the electrocardiographic tracings in the older patient have shown that only 1 patient in 10 will show a normal tracing. Myocardial ischemia, conduction and rhythm abnormalities, and left ventricular hypertrophy were noted in 9 out of 10 patients who were beyond the age of 65.

Pulmonary function defects may be present in the elder patient, and when the stress of surgery is superimposed, serious metabolic disturbances may ensue. Vital capacity, maximum breathing capacity, and inspiratory reserve volume decrease with advancing age, while fixed lung space increases. There is a decrease in the area of pulmonary capillary–pulmonary alveolar contact, and diffusion studies have shown a more uneven distribution of gases in the lungs. These defects in pulmonary function increase in each decade beyond the fifth and are the cause of the significant increase in respiratory volume noted in older subjects after controlled exercise. Thus, the older patient must breathe longer and harder to obtain the oxygen he requires, and this alteration in pulmonary reserve handicaps the pulmonary component of acid-base homeostasis.

Oxygen consumption and carbon dioxide production diminish, and a corresponding decrease in metabolic rate has been observed in patients who have attained their fiftieth year. The decrease in basal metabolic rate approximates 3 to 5 per cent per decade of age beyond 50 years. This lowered metabolic rate appears to be unaccompanied by a decrease in thyroid function as far as this is measurable at the present time. Thus, in the older age groups protein-bound iodine and radioiodine uptake values are the same as those found in the young adult age group.

With the exception of the gonads and pancreas, the remainder of the endocrine glands show only slight alterations with aging when older patients are compared with young adults. Following the climacteric in both sexes, there is a significant decrease in the daily 17-ketosteroid excretion. At present, it is felt that this decrease may be accounted for by the decrease of gonadal steroidogenesis in the older patient. While quantitative studies are available to show a decrease in the secretory products of the pituitary and the adrenal

cortex with each decade within the geriatric age period, these decreases do not appear to be physiologically significant. The otherwise healthy aged patient appears to have an adequate reserve as far as the function of these glands is concerned.

The older patient's response to insulin is definitely changed, and there is a reduced response to the insulin tolerance test. Even in the absence of clinically detectable diabetes, the patients of this age group show a decreased tolerance to glucose whether it is given orally or intravenously. This lowered glucose threshold and the decreased response to insulin appear to be due to a decrease in peripheral tissue oxidation or, as we shall see below, to a decrease in the proportion of the body weight taking part in active metabolic processes.

Changes in body composition associated with aging may now be studied using any one of a number of isotope dilution techniques. Applying the dilution method to patients, it is now feasible to measure total body water (TBW) and extracellular fluid volume (ECF). Figure 1-1 represents the total body water determined in the authors' laboratories in 88 patients, with deuterium oxide as the isotope. Despite the wide individual variation, there appears to be a definite decrease in the percentage of body weight contributed by body water beyond the fourth decade. This is especially true in women, where characteristic changes in body composition are associated with menopause. These data are in agreement with other reports of similar studies.

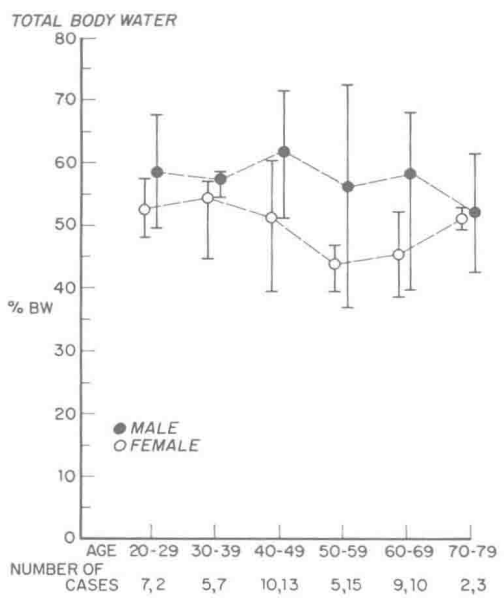

Fig. 1-1. Total body water as percentage of body weight by decade. Circles represent the mean, vertical line the range of values, for each decade and sex.

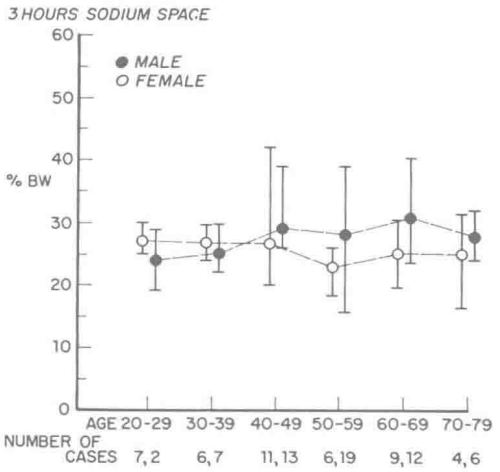

Fig. 1-2. Three-hour sodium space as percentage of body weight by decade. Circles represent the mean, vertical line the range of values, for each decade and sex.

All the methods for measuring the extracellular space have intrinsic limitations. The authors have employed the 3-hour sodium space or dilution volume using radiosodium to measure the extracellular fluid volume. This method gives higher values for the extracellular fluid volume than those obtained with inulin, owing to the migration of part of the isotope to an intracellular position and to transcellular areas of the body. However, in the authors' experience, this method has satisfactorily mirrored changes in the extracellular fluid volume. The results of this determination in 93 patients are presented by decade and as per cent of body weight in Fig. 1-2. The general trend of a slight increase in the extracellular fluid with advancing age has been confirmed by others. The

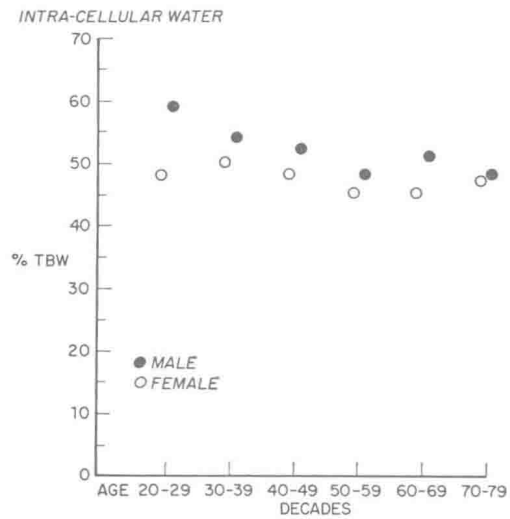

Fig. 1-3. Intracellular water as percentage of total body water by decade. Intracellular water was determined by subtracting sodium space from total body water. *True* intracellular water is lower than that calculated here because extracellular fluid measured with radiosodium is larger than the true. The figure shows a trend only.

corollary to this increase in extracellular fluid volume with an associated decrease in total body water is a decrease in intracellular fluid volume. This trend is apparent in Fig. 1-3, where intracellular water is plotted as percentage of total body water. The decrease in absolute amounts of total body water and intracellular water with advancing age would indicate that the cells themselves have become slightly dehydrated, while the extracellular volume has increased, especially in the elderly male. On the other hand, a reduction of metabolically active cell mass with age is indicated by the decrease in total exchangeable potassium. The finding that cell water is decreased may, therefore, represent merely a diminution in the number of cells, the function of those remaining being unimpaired. The pertinent data on the body water compartments in relation to age are summarized in Table 1-1.

From the determinations for total body water and given the body weight, it is possible to calculate the percentage of body weight contributed by lean tissue and that contributed by body fat. As lean tissue has a relation to total body water, another corollary of the decrease in total body water with aging is a relative increase in the body fat. This increase in the amount of body fat is most marked in females beyond the fifth decade and is characteristic of the tendency of women to accumulate fat during menopause. The recent emphasis on the dangers of taking on fat in aging may change this situation in the future. In general, it would appear that with advancing age the decrease in physical activity is responsible for a decrease in muscle mass and an increase in the percentage of body weight due to fat.

Figures 1-4 and 1-5 describe the blood and plasma volumes in this group of patients. As noted by others, there is a slight but progressive increase in plasma volume in the geriatric age group, accompanied by a decrease of red cell mass.

Renal function in the older age groups appears to share in the attrition of aging noted in other organ systems. Anatomic studies show that the number of histologically intact glomeruli is progressively reduced in the older patients as compared with their younger counterparts. Function studies support this, in that glomerular filtration rate, renal plasma flow, and renal tubular excretory capacity tend to decrease progressively

TABLE 1-1. EFFECT OF AGE ON BODY COMPOSITION *

	Sex	*Decade*				
		30–39	40–49	50–59	60–69	70–79
Body wt, kg.	M	69 (7)	62 (13)	65 (21)	61 (12)	63 (6)
	F	65 (6)	56 (11)	71 (6)	63 (9)	57 (4)
Body water, % of body wt	M	58 (7)	62 (13)	56 (15)	61 (10)	52 (3)
	F	54 (5)	51 (10)	44 (5)	46 (9)	51 (2)
Na^{24} space, % of body wt	M	26 (7)	30 (13)	29 (19)	30 (12)	28 (6)
	F	27 (6)	27 (11)	23 (6)	26 (9)	26 (4)

* See text for methods. Figures in parentheses are numbers of patients averaged.