

Analysis of 600 Major Operations in Patients Over 70 Years of Age*

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Introduction

THE INCREASING NUMBER of aged persons in our population is generally appreciated and the responsibilities of the surgeon to the older patient have been emphasized in a number of appropriate publications in recent years. The concept of physiologic age is very important in this regard, and the consideration of each patient without undue emphasis upon chronologic age is widely accepted.

The arbitrary selection of an age limit for the geriatric group is not applicable to every patient. Probably it is of no importance to the surgeon who must deal with the individual patient in terms of his problems. For the purposes of this paper we have selected the age of 70 years as the lower limit of the "geriatric" group. According to the United States Department of Commerce,¹ the population of the United States increased by 26 million persons between April 1, 1950 and July 1, 1959. This was an over all increase of 17.2

per cent. The most marked gains during this period are noted among the very young and the elderly age groups (Fig. 1). During this period there was an increase of 3.2 million persons over 65 years of age. The median age of the American population has increased from 22.9 years in 1900, to 29.3 years, in 1959. On July 1, 1959, there were estimated to be 9,633,000 persons in this country over the age of 70 years. Projected increases in this age group indicated that the total number of persons 70 years of age or older would be 9,902,000 by 1960, and 15,880,000 by 1980.² This projected increase in our geriatric population coupled with the fact that major illnesses requiring operative treatment are common in the elderly should focus the attention of the surgeon upon this increasingly important problem.

Although the methods of preoperative and postoperative care and the operations employed in managing geriatric patients are standard, there are some basic differences in their care as compared to younger patients. Our purpose in reporting this series of patients, therefore, is not to introduce new concepts in the care of the elderly patient, but to re-emphasize some principles which are particularly applicable to the geriatric age group, and to report our experience in this regard. We will place major emphasis upon mortality data, and present a detailed consideration of certain common associated diseases, and postoperative morbidity.

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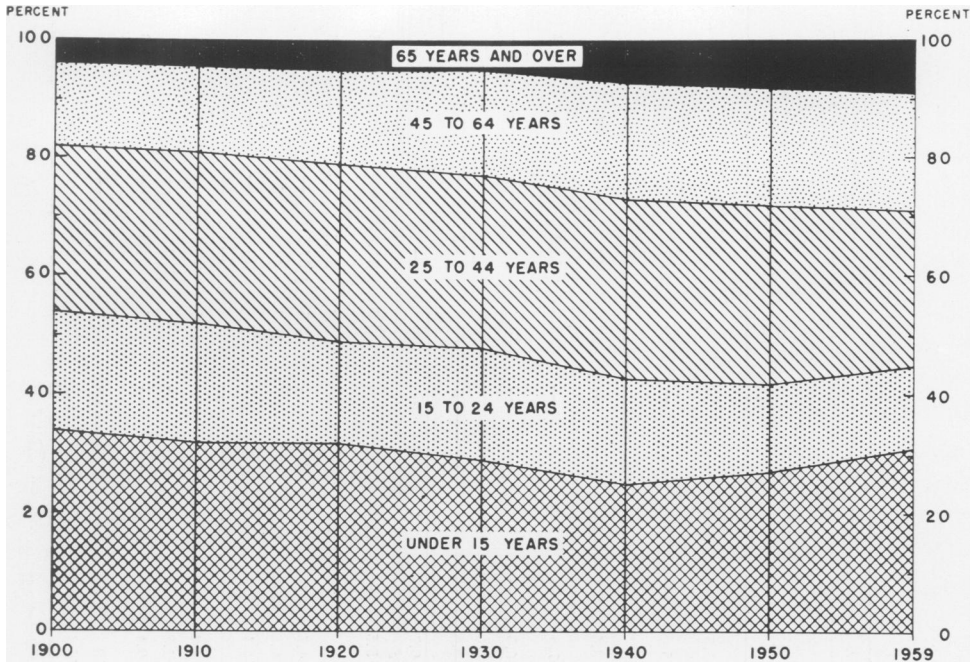


FIG. 1. Percentage distribution by age of the population of the United States—1900 to 1959 (figures after 1940 include members of Armed Forces abroad).

Material

The King County Hospital, Seattle, Washington, is a large general hospital which serves the indigent and welfare patients of a population area of 900,000. In addition it serves as the major trauma center for the same geographic area. During the inclusive period of 1955 to 1958, there were 48,421 hospital admissions, and 7,150 major operations of all types were performed (Table 1). In order

TABLE 1. *King County Hospital*

Total admissions, 1955-1958	48,421
Total major operations, 1955-1958	7,150
Major general surgical operations in patients over 70	600

to gather the material for this study, operative records for this four-year period were examined and the clinical records of every patient over the age of 70 years who underwent a major general surgical procedure

was selected for the study. Excluded were: elective hernia operations, hemorrhoidectomies, varicose vein operations, amputations, sympathectomies, minor excisions and plastic operations. Major urologic, gynecologic, neurosurgical, and orthopedic procedures were also excluded.

The hospital records for these patients (over 70 years of age) were then analyzed, and a total of 600 (8.5% of all the major operations) were found to be available for the study. A number of records which fulfilled the criteria outlined, were not available for study. Because the records of every patient who died following an operation were available, and because a number of those who survived their operations were not available, this tends to increase the over all mortality for the series. However, only those records which were personally examined by the authors are included in this report.

Each record was screened for the following data: the patient's age, sex, pre-

operative diagnosis, operative findings, operation performed, anesthetic agent used, cardiovascular status, intercurrent diseases, electrocardiographic findings, complications, and autopsy findings in the patients who died and were autopsied.

The oldest patient in the group was a 102-year-old man who had emergency plication of a bleeding gastric ulcer. The average age was 78.3 years. The age distribution is shown in Figure 2.

Analysis

There were 123 hospital deaths following the 600 operations studied—an over all mortality of 20.5 per cent. The detailed analysis of 600 patients records yielded a vast quantity of numerical data, which is difficult to present except in graphic form. Table 2 contains all the pertinent categorical data derived from the study. For each general category of operation performed we have shown the incidence of associated illnesses, the type or types of anesthetic agent used, the complications encountered during the postoperative period (arbitrarily grouped in general systemic categories) and causes of death. All of these figures are expressed in percentages. It should be noted that the incidence of associated diseases is high in almost every group. Also of interest is the extensive use of nitrous oxide and muscle relaxants in these patients. We are not qualified to discuss this aspect of the care of these patients, except as it relates to their operative care, but in general we found this type of anesthesia to be quite satisfactory.

Gastric Surgery. Tables 3 and 4 summarize our experience with elective and emergency operations upon the stomach and duodenum. It should be noted that the incidence of complications is high in all of these groups and, with few exceptions, it is high regardless of the specific operation performed. This is related to two facts. First, all complications encountered, even minor temperature elevations, are included

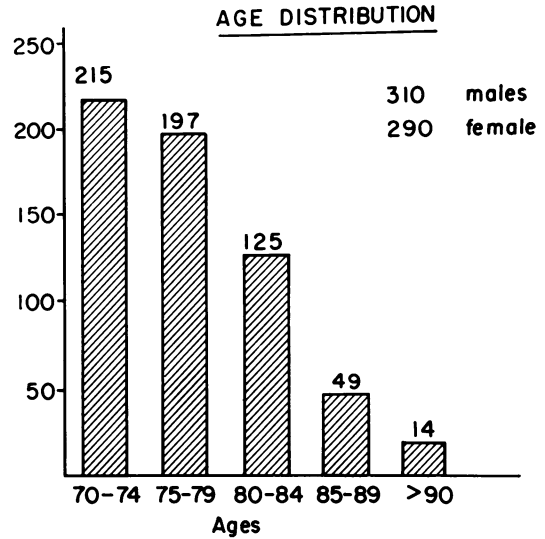


FIGURE 2.

and second, the patients in this series are expected to have a high complication rate because of their age and frequently poor socio-economic status.

Very high mortality rates were encountered in emergency gastric operations. Emergency gastrectomy was performed primarily for massive gastroduodenal hemorrhage and for selected patients with perforated duodenal or gastric ulcers. A breakdown of the five deaths (33% mortality) in the 15 cases with emergency gastrectomy indicated that the more serious of the two indications for emergency gastrectomy was hemorrhage (4 deaths—45% mortality—in 9 cases), rather than perforation (1 death—16% mortality—in 6 cases). This high mortality rate has prompted a re-appraisal of the surgical treatment of these problems in the elderly patient at the King County Hospital. We are strongly inclined to adopt direct suture of the ulcer bed with vagotomy and pyloroplasty for massively bleeding duodenal ulcers in the elderly patient, reserving resection for younger, better-risk patients.

The mortality quoted for primary closure of perforated ulcers (62.7%) is influenced in part by selection, because a number of

TABLE 3. *Gastric Surgery*

Category	Age	No. Pts.	No. Died	% Mort.	% Cardiac dx	% Abn. ECG	% Complications
Subtotal resection BI-BII	75.5	22	5	22.7	68.1	59	41.6
50% resection + BI vagotomy	72.6	13	3	23.1	30.7	38.4	45.8
Vagotomy + GJ or pyloroplasty	79.3	15	2	13.3	73.3	60	39.9
Totals		50	10	20			

the better candidates were subjected to primary gastric resection. It is interesting, however, that Tanner¹⁰ reports an almost identical mortality for closure of perforated duodenal ulcers in elderly patients of about the same age.

The category labelled "Miscellaneous Emergency Operations" includes a variety of unrelated procedures such as plication of bleeding ulcers, and revision of obstructed anastomoses.

In this general group of operations, vagotomy combined with pyloroplasty or gastrojejunostomy was associated with the lowest mortality (13.3%), while emergency operations were associated with mortalities at least twice as high.

Operations done for carcinoma of the stomach included one total gastrectomy, a number of palliative sub-total resections, as well as bypassing operations.

All the foregoing considerations have influenced us to use less extensive operations in the elderly patient. Certainly for bleeding gastric ulcer, or bleeding from diffuse mucosal erosion one must perform a resectional operation, but for bleeding from a chronic duodenal ulcer, it seems wisest only to plicate the ulcer bed with vagotomy and pyloroplasty. Regardless of the operation performed, the surgeon must be prepared for a high postoperation complication rate and lessen this likelihood with intensive postoperative care.

TABLE 4. *Gastric Surgery*

Category	Age	No. Pts.	No. Died	% Mort.	% Cardiac dx	% Abn. ECG	% Complications
Emergency gastrectomy	76.8	15	5	33	20	73.3	46.2
Closure perf. ulcer	83	8	5	62.7	50	37.5	87.5
Miscellaneous emergency	77.6	6	2	33.3	50	33	50
Ca stomach	77	45	14	31.3	31.3	31.3	62.2
Total		74	27	35.1			

TABLE 5. *Bowel Obstruction*

Category	Age	No. Pts.	No. Died	% Mort.	% Cardiac dx	% Abn. ECG	% Complications
Benign small bowel obstr.	77.8	41	4	9.7	46.3	48.7	58.3
Hernias	79.4	36	9	25.0	61.1	58.3	57.8
Malignancy	79.4	10	3	33.3	70	40	50.0
Totals		87	16	18.4			

Intestinal Obstruction. Patients admitted with intestinal obstruction have been arbitrarily divided into three groups, shown in Table 5. Excluded from the entire series were patients who were admitted with clear-cut large bowel obstruction, who received only decompressing colostomy. Those patients who had a colostomy followed by definitive or palliative resection are included under the category of colon and rectum, and only the definitive procedure is counted as a major operation.

In the intestinal obstruction group we have included only patients with benign adhesive small intestinal obstruction, placing incarcerated or strangulated hernias in a separate group, and patients with far-advanced obstruction due to malignancy as a third group. In the latter group only patients who had bypassing operations or resections are included, again excluding those in whom only colostomy was performed.

We attribute the low mortality in the

group of benign adhesive obstructions (9.7%) to an aggressive approach to this problem. Prolonged intubation and medical management are not advocated. Supportive care with the administration of whole blood and fluids sufficient to restore blood pressure and pulse rate to within normal limits is intensively applied, then the patients are explored and the obstructive lesion relieved. This approach reduces the incidence of pulmonary complications associated with prolonged nasogastric intubation and allows earlier ambulation and alimenation, which may in themselves be life-saving in the elderly patient.

The higher mortality associated with intestinal obstruction secondary to incarcerated or strangulated hernias (25%) probably is related to the fact that bowel resection is more frequently required and the mortality of that procedure is then added to that of celiotomy.

The criteria for selection of patients is in part responsible for the high mortality

TABLE 6. *Colon*

Category	Age	No. Pts.	No. Died	% Mort.	% Cardiac dx	% Abn. ECG	% Complications
Ca rectum and colon	77.7	82	13	15.8	36.5	35.3	46.4
Acute appendicitis	75.5	22	3	13.6	40.9	32	45.3
Diverticulitis colon	74.4	11	1	9.1	63.6	81.8	9.1

TABLE 7. *Biliary Surgery*

Category	Age	No. Pts.	No. Died	% Mort.	% Cardiac dx	% Abn. ECG	% Complications
Elective	77.1	103	8	7.8	48%	51	29.6
Emergency	76.9	61	14	22.9	59	45.9	52.2
Malignancy	77.7	31	10	32.3	25.8	38.7	38.6
Totals		195	32	16.4			

in patients with obstruction due to malignancy (33%). Only those patients who had extensive, far-advanced obstruction were included.

Colon Surgery. Table 6 summarizes our experience with colon surgery in aged patients. We have considered these patients in three groups.

The group treated for carcinoma of the colon or rectum all had definitive or palliative resections, since no patients with colostomy only are included. This group comprises a fairly large portion of the entire series, reflecting the high incidence of malignant lesions of the colon and rectum in this age group. Considering the magnitude of the operations performed, the mortality was quite low (16%). Thirty-one of the 82 operations performed were hemi-colectomies, 28 were anterior resections, ten were abdomino-perineal resections, nine had colostomies, performed after exploration had proved the lesions to be unresectable; two pull-through operations were done, and one Kraske resection for a low-lying villous adenoma was performed.

The group of patients with appendicitis had a moderately high mortality (14%), emphasizing the serious nature of this disease in the elderly debilitated patient. The aged patient frequently has far-advanced appendicitis and secondary complications when first seen, and yet may have relatively few clinical signs. Often these patients present with a clinical picture of intestinal obstruction, but with minimal evidence of peritoneal irritation or inflammation. This fact further justifies early exploration of the elderly patient with an acute process suggesting intestinal obstruction. Sepsis accounted for a high percentage of the deaths in this group.

The low mortality (9%) and complication rates (9%) in those patients operated upon for complications of diverticulitis are difficult for us to explain adequately.

Biliary Tract Surgery. Table 7 shows our results in biliary-tract operations. Elective procedures included cholecystectomy and/or common duct exploration, including sphincterotomy. The group of emergency operations includes the foregoing as well as

TABLE 8. *Miscellaneous*

Category	Age	No. Pts.	No. Died	% Mort.	% Cardiac dx	% Abn. ECG	% Complications
Misc. abd. op.	78.3	27	11	40.7	44.4	44.4	69.5
Ca breast	75	35	1	2.9	68	42.5	28.5
Vascular	77.3	11	3	27.2	27.2	18.1	45.3
Abd. catastrophe	78	6	6	100	66.6	83.3	100

TABLE 9

Authors	Years	Min. Age	Over All Mortality	Emergency Mortality
K.C.H.	1955-58	70	20.5	26.2
Clagett	1939-40	65	9.0	37.0
Welch	1943-47	70	20.7	39.0
Hay	1931-38	70	16.6	31.0
Wilkins	1955-56	65	16.6	—
Cutler	1947	60	—	44.0
Gilchrist	1945-55	70	11.1	—

all of the cholecystostomies, and the category "Malignancy" contains all operations performed upon the biliary tract for carcinoma of the ducts, pancreas, or periampullary region. These were largely exploratory in nature, most with shunting procedures, although a few definitive resections were performed.

The group of elective operations for benign biliary-tract diseases was a very large one, reflecting the high incidence of these problems in the aged, and was associated with a quite low mortality (8%), and a fairly low morbidity (30%) when compared to some of the other groups within this series. The mortality in emergency biliary tract operations (23%) is significantly higher than in the elective group, as one would expect.

Miscellaneous Operations. Table 8 summarizes the data for a heterogeneous group of operations which bear no relationship to each other. The vascular procedures were

all resections of aneurysms, endarterectomies, or major bypass operations, and were accomplished with a moderate mortality (27%) considering the severity of the problems involved.

The patients in the group entitled "Abdominal Catastrophy" all proved to have mesenteric artery occlusion, and all of those patients died. Since all had abdominal exploration, and in several instances attempts were made to relieve the arterial occlusion, they are included in the series. These patients were frequently moribund when first seen, but were always explored because of the possibility of short-segment infarction which could be successfully resected.

The miscellaneous group of operations also included splenectomy, hiatus hernia repair, traumatic abdominal injury (stabbing, gunshot wounds, and closed trauma), and similar operations which are performed too infrequently in this age group to warrant individual consideration.

TABLE 10

Authors	Intest. Obstruction	Stomach		
		Elective	Emergency	Malignancy
K.C.H.	18.4	22.7	33	31.3
Clagett	71.0	—	—	—
Hay	55.0	11.0	—	33.0
Anglem	—	15.2	—	—
Wilkins	—	10.8	52.9	—
Gilchrist	—	13.6	20.0	—
Tanner	—	15.0	—	33.0

TABLE 11

Authors	Biliary tract		Acute Appendix	Colon
	Elective	Emerg.		
K.C.H.	7.7	22.9	13.6	15.8
Clagett	8.0	—	20.0	11.6
Welch	7.6	—	—	19.0
Hay	5.5	50.0	25.0	40.0
Wilkins	7.3	33.3	—	13.1
Cutler	—	62.0	40	—
Gilchrist	5.0	20.0	—	9.4

There was a very low mortality in patients subjected to radical mastectomy for carcinoma of the breast (3%), and the complication rate was considerably lower than in the abdominal operations (29%).

Comparative Studies

Tables 9, 10, and 11 present the mortality data from the present series in comparison with other similar reported series. The figures quoted were selected for comparison because of roughly similar criteria of selection and numbers of cases reported. It should be emphasized, however, that none of these groups is strictly comparable to our own. Some include younger patients, others include private patients, and some of the reports were published before the antibiotic era. Similarly, a number of these series included operations which we have elected not to include, such as elective hernia repair, sympathectomy, amputations, and hemorrhoidectomies.

Discussion

One would expect that in a group of elderly patients with a high incidence of associated systemic illnesses, major abdominal surgery would have a high morbidity, and this study tends to support that prediction. Almost 50 per cent of the entire group had a clinical diagnosis of organic heart disease, and 43 per cent had abnormal electrocardiograms. This brings up the question

of the importance of preoperative electrocardiography. Certainly everyone agrees that elective operations should not be planned in the patient with decompensated heart disease, but what of the patient with well-controlled disease, and/or an abnormal electrocardiographic tracing? In our opinion, the clinical status of the patient is far more important than the electrocardiogram, and its principal value is in the postoperative period when there may be great difficulty in determining the relative importance of blood loss, myocardial infarction, and other factors in the etiology of unexplained hypotension. If one has an electrocardiogram taken preoperatively, for comparative purposes, this problem may be easily resolved.

Sepsis of all types and cardiovascular disease accounted for the majority of deaths. In some instances differentiation between these two categories is difficult.

The high incidence of complications of major severity again should warn the surgeon who operates upon the elderly patient to anticipate these problems and to exercise appropriate prophylaxis. This raises the controversial question of the "prophylactic" use of antibiotics. A large number of the patients reported here received "prophylactic" antibiotic therapy, but no analysis of this in relation to the incidence of wound infection or generalized infection has been made. It is the present policy of the authors, however, not to use prophylactic antibiotics,

except in those patients who have peritonitis and/or wound contamination at operation, or other infectious processes, such as bronchopneumonia or urinary tract infection.

The problem of pulmonary infection associated with nasogastric intubation has been alluded to in the discussion of intestinal obstruction, but further mention of this complication is indicated. Recently we have made increasing use of temporary tube gastrostomy in patients in whom it is expected that prolonged intestinal decompression will be needed. Not only does this simple procedure largely eliminate the pulmonary complications of nasogastric intubation, but also it provides very adequate gastric drainage by virtue of the larger lumen tube which can be used. Another very practical point to be considered is that the gastrostomy requires far less nursing attention for adequate function. The tube is connected to straight drainage, without suction, and simple irrigation several times daily is all that is required.

Early ambulation is very important. Every patient, with the exception of those with vascular grafts, is ambulated on the first postoperative day, and thereafter. Ambulation should also be encouraged preoperatively. Our patients are frequently admitted to the hospital several days before their operation is planned, in order to allow attention to associated illnesses, and to complete their evaluation. It is common for the elderly patient, when admitted to the hospital, to remain in bed unless encouraged to be up and about the ward.

Summary

The surgical records of the King County Hospital, Seattle, Washington were reviewed for the period of 1955 through 1958. From a total of 7,150 such operations, 600 were performed in patients 70 years of age or older.

The details of these 600 operations were

analyzed with respect to the variable incidence and influence of associated illnesses, anesthetic technic, specific operative procedure performed, and the many variables of postoperative care.

While surgical operations of considerable magnitude can be safely performed in patients over the age of 70, diseases of certain systems carry a higher mortality and morbidity than others. Specifically, emergency gastroduodenal procedures of the "standard" variety are very lethal in the elderly, indicating a more limited operation than that employed in younger patients.

Accurate total preoperative appraisal of the geriatric surgical patient, carefully controlled anesthesia, early, accurate, and minimal, but adequate surgery, combined with intensive postoperative care, including a few special features will serve to minimize morbidity and mortality in the elderly patient.

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