Open-Heart Surgery on the Elderly
Results in 54 Patients Sixty Years of Age or Older

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and Denton A. Cooley, M.D.

During the past decade an improved operative risk for open-heart surgery has been observed for both children and adults. Mortality for open-heart surgery in the older age groups, however, has been difficult to assess because of the reluctance of physicians and surgeons to recommend operation for elderly patients. Encouraged by improved results from general surgical procedures in the elderly, we have performed open-heart operations on patients in this age group, as have other surgical teams.1-4 Certainly the most profound disturbance of body function occurs when extracorporeal circulation is utilized in the surgical treatment of cardiovascular disease. To evaluate the feasibility of open-heart surgery in patients of advanced years and to elucidate those factors that contribute to morbidity and mortality, we have reviewed our results with patients more than 60 years old who were undergoing cardiovascular operations using cardiopulmonary bypass.

Group Studied and Results

During the 8-year period from January 1, 1957, to December 31, 1964, 54 patients, 60 years of age or more, underwent open-heart operations utilizing temporary cardiopulmonary bypass. Forty-four (82%) were operated on during the last 2-year period of the study, and 27 (50%) of this series were operated on during the last year (fig. 1).

Only two patients in this series had congenital heart lesions, and both were 60-year-old males (fig. 2). One had a large atrial septal defect, and the other, subaortic stenosis caused by a fibrous diaphragm. The septal defect was closed with a Dacron patch, and the subaortic diaphragm was excised. The remaining 52 patients had acquired cardiac lesions. Twenty-eight patients had diseased aortic valves as their primary lesions. Two underwent valvotomy, and 26 had valve replacement. Eleven patients presented with left ventricular aneurysm. Eight of the 11 had mitral valve disease and underwent valve replacement. Four patients had aneurysm of the ascending aorta with aortic regurgitation. All had excision of the aneurysm with Dacron graft replacement. Three of these had com-

![Number of Operations Performed Per Year](chart)

**Figure 1**

Open-heart operations performed per year on 54 patients 60 or more years old.

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comitant replacement of the aortic valve with caged-ball prosthesis, and one had aortic annuloplasty. One patient had bivalvular com-

missurotomy for combined aortic and mitral stenosis.

Three patients were more than 70 years of age at the time of surgery (fig. 3). The oldest patient in the series was a 73-year-old man who presented with a left ventricular aneurysm. Forty-four patients (82%) were between the ages of 60 and 65 years at the time of surgery. Only 10 patients were 66 years or older (18%). The mean age for the group was 63 years.

Eleven patients died within 2 weeks of operation yielding a hospital mortality of 20% (table 1). Four of these hospital deaths occurred on the operating table; two of these were of patients with postinfarction left ventricular aneurysms. One was a 61-year-old man who died as a result of an acute retrograde dissection starting at the tip of the cannula in the right iliac artery with the onset of perfusion. The other, a 60-year-old man, died on the operating table after excision of a ventricular aneurysm when he was unable to sustain a satisfactory cardiac output after

Figure 2
Indications for open-heart operation on 54 elderly patients.

Figure 3
Age of 54 patients undergoing open-heart operations from 1957 through 1964.
discontinuation of cardiopulmonary bypass. The third operating-room fatality occurred in a 63-year-old man who had a mitral valve replaced 4 years after closed mitral commissurotomy. Postmortem examination revealed a widely dilated tricuspid annulus and moderate aortic stenosis. The fourth death in the operating room occurred in a 61-year-old man who underwent aortic valve replacement as an emergency operation. He entered the operating room without palpable or audible blood pressure and with extreme dyspnea. After perfusion, cardiac output was inadequate to sustain life.

Of the seven additional deaths that occurred in the hospital, four of these followed aortic valve replacement in patients who were 60, 61, 63, and 65 years of age at the time of operation. Death occurred within 24 hours of operation in two patients, and after 3 and 5 days in the remaining two. Myocardial infarction was the cause of death in two of these patients. No cause of death could be established at autopsy in the third patient. The fourth patient who died after aortic valve replacement did so after a Magovern sutureless prosthesis eroded into the right atrium and produced an intramyocardial hematoma which occluded the right coronary artery.

The three remaining patients who died in the hospital during the postoperative period did so following operation for ventricular aneurysm, aortic stenosis, and acute dissecting aneurysm. The patient with left ventricular aneurysm died 28 hours after operation. He was 73 years old, and the oldest patient in the series. Cardiac output was poor during his entire 28-hour postoperative period and culminated in fatal pulmonary edema. The patient who died following open aortic valvotomy was a 60-year-old male who expired on the sixth postoperative day. This patient had had closed transventricular mitral and aortic commissurotomies 4 years prior to the open procedure. Postmortem examination revealed an acute coronary occlusion as the cause of death. The last hospital death occurred in a 62-year-old male who was in shock due to an acute dissecting aneurysm of the ascending aorta, acute aortic insufficiency with left ventricular failure, and an acute dissection of the abdominal aorta. While using cardiopulmonary bypass, an aortic annuloplasty was performed with repair of the ascending aorta. After termination of bypass, laparotomy was performed. The abdominal aorta was transected and reunited after obliterating the false lumen with circumferential suture. An aortofemoral bypass graft was then inserted. This patient had a remarkably uneventful course for 7 days then died suddenly. Autopsy revealed that the descending thoracic aorta had ruptured. Suture lines were intact.

The five late deaths in this series followed discharge from the hospital at intervals ranging from 18 days to 3 years (table 1). Two of these patients had had left ventricular

<table>
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<th>Indication for operation</th>
<th>Cases</th>
<th>Hospital deaths No.</th>
<th>Hospital deaths %</th>
<th>Late deaths No.</th>
<th>Total deaths %</th>
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<tr>
<td>Totals</td>
<td>54</td>
<td>11</td>
<td>20</td>
<td>5</td>
<td>16</td>
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</table>

Table 1
Mortality following Open-Heart Surgery on 54 Patients, Sixty Years of Age or More
aneurysms resected, and three, aortic valve replacements. Both patients with ventricular aneurysms died of acute coronary occlusion; one 3 years after operation, and the other, 15 months following it.

One of the three late deaths following aortic valve replacement occurred 3 months after the patient’s discharge and was due to acute dissection of the aorta beginning in the ascending portion and continuing to the bifurcation. Another patient died 18 days after surgery, and autopsy revealed acute coronary occlusion. The last death occurred suddenly 4 months after aortic valve replacement and an uneventful early convalescence. Autopsy showed that the Starr-Edwards ball valve had become detached from the aortic annulus and had prolapsed into the ventricular chamber.

Discussion
A combination of factors has resulted in an increase in lifespan of the average American from 47 years in 1900 to 70 years in 1960.\textsuperscript{5} Partially responsible for this increase are advances in the diagnosis and medical therapy of cardiovascular disease, which is the leading cause of death in this country.\textsuperscript{6} Treatment of heart failure by medications, however, falls short of the therapeutic ideal when this failure is produced by an isolated mechanical problem, such as a stenotic aortic valve. The surgical correction of mechanical impediments to cardiovascular function promises to result in further improvement in the duration and quality of life of elderly patients.

As more individuals survive to age 60 years and beyond, pathology common in the elderly will be seen more frequently.\textsuperscript{7–10} Aortic valve disease and ventricular aneurysm are particularly common in this age group, and the 39 patients with these lesions comprise 72% of the present series of 54 patients.

Advanced coronary artery disease would be considered likely to complicate the management of elderly patients and, to some extent, this was true in this series. Four of the 11 hospital deaths and three of the five late deaths were caused by acute coronary artery occlusion. Atherosclerotic stenosis of the orifices of coronary arteries may increase the technical difficulty of certain open-heart operations by interfering with cannulation for coronary perfusion. Selection of a cannula of the appropriate size and its careful insertion, possibly with the performance of a localized endarterectomy, minimize this hazard.

The 20% hospital mortality in this series of 54 patients includes all open-heart operations in patients 60 years or older who have been treated since 1957. This mortality compares favorably with the death rate (19%) among patients in all age categories from 36 to 73 years who underwent open excision of ventricular aneurysm in this surgical unit.\textsuperscript{11} Mortality in this series of elderly patients has dropped to 11% for those operated upon in 1964. All patients in this series were in the class III or IV category of the New York Heart Association’s classification. Many were accepted as salvage cases because their terminal conditions were not responding to vigorous medical therapy. We anticipate that mortality will continue to decrease as surgical technics, valve prostheses, and equipment are improved.

Summary
Data on 54 patients, 60 years of age or more, who had open-heart surgery are reported. This series is comprised of all patients in this age group who were treated surgically from January 1, 1957, to December 31, 1964. Eighty-two per cent were operated on in the past 2 years.

The most common indications for operation were left ventricular aneurysm and aortic valve disease (39 patients). The ages of the patients in this series ranged from 60 to 73 years, with a mean age of 63. Operative mortality was 20% for the entire series and 11% in the last year reported (1964).

It is concluded that advanced age should not be a deterrent to the selection of surgical therapy for elderly patients with heart disease provided that the proper indications exist. Open-heart surgery may be performed in the elderly with mortality that compares favorably with that encountered in younger individuals with similar lesions.
References

Murmurs: Physiological, Functional, and Organic

It must be more than twenty-five years since Graham Steel* startled me out of a deeply-cherished belief by stating that "no one ever dies from mitral regurgitation." By this he meant that, when the heart failed and there was a mitral systolic murmur present, heart-failure had occurred, not because of the regurgitation, but because there were present other factors which provoked it, such as some myocardial disease or impairment. This was so opposed to the conception of heart-failure by back pressure which I had been taught to accept that I carefully observed my patients to see whether or not it was true; and now I can fully endorse Graham Steel's* dictum.—Sir James Mackenzie: Principles of Diagnosis and Treatment in Heart Affect.ions. London, Oxford University Press, 1916, p. 100.

*Spelling as in text.
Open-Heart Surgery on the Elderly: Results in 54 Patients Sixty Years of Age or Older
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Circulation. 1966;33:540-544
doi: 10.1161/01.CIR.33.4.540
Circulation is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
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Print ISSN: 0009-7322. Online ISSN: 1524-4539

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