The Spectrum of Coronary Heart Disease in a Community of 30,000
A Clinicopathologic Study

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An accurate estimation of the incidence of death from coronary heart
disease in the United States has not been accomplished in a completely satisfactory manner.\(^1\)\(^2\) White\(^3\) and Mainland\(^4\) showed that it is not possible to determine accurately the incidence of coronary heart disease from consecutive hospital necropsy series, since this incidence is a reflection of the hospital population, which in turn is a biased sample. Incidences based on death-certificate statistics not confirmed by necropsy are also inadequate for this purpose and are subject to obvious limitations.

A unique opportunity to avoid these objections exists in Rochester, Minnesota, a community of 30,000 people that has its medical care furnished largely by the Mayo Clinic. Because of this relationship, necropsies are performed in more than two thirds of all deaths at all ages that occur in the community regardless of when or where death took place. Thus, deaths at home, sudden deaths in the city, and deaths in nursing homes, as well as hospital deaths and deaths that will invite the interest of the coroner all have a better than 65 per cent chance of being investigated at necropsy by one pathologic service. Such a necropsy rate for all deaths in the entire community circumvents the inadequacies of death-certificate statistics and the bias of selected series in determining the incidence and mode of death from coronary heart disease.

Methods
A total of 1,326 deaths occurred among those persons whose permanent address was listed within the city of Rochester, Minnesota, and whose death occurred between 1947 and 1952, inclusive. Table 1 categorizes the total deaths according to the age at death, sex, place of death, and respective percentage of necropsies. It should be noted that the total number of deaths in adult males and females was nearly the same, that the total number of hospital and nonhospital deaths among adults in the study were 563 and 463, respectively, and that the total number of adult deaths was 1,026. The over-all necropsy incidence was 73 per cent. The incidence of necropsies in adults dying in the hospital was 67 per cent, and that in nonhospitalized adults was nearly identical (68 per cent). All permissions for necropsy were obtained on an impartial basis by physicians who were assigned to the Section of Pathologic Anatomy of the Mayo Clinic and were previously unfamiliar with the cases. All necropsies were performed by the same section, which has preserved its records and specimens. The majority of patients had been observed clinically for variable periods prior to death by staff physicians of the Mayo Clinic. Information concerning the others was obtained from the family physician or the family at the time of death. Information necessary for evaluation of each case was obtained from the clinic or hospital notes, necropsy protocols, and gross and histologic re-examination of the hearts. At the time of necropsy, the coronary arteries were examined by the multiple cross-section technic at intervals of approximately 3 mm., and the ventricles were cut into five transverse slices. The myocardial lesions were diagrammed on ventricular maps as shown in figure 1, a technic similar to the method described by Sheldon and Sañen.\(^5\)

Definitions
Grade of Coronary-Artery Sclerosis
Grade 1 sclerosis indicates the presence of minimal atherosclerosis or normal arteries; grade 2 sclerosis represents from 25 to 50 per
cent narrowing of the arterial lumen; grade 3 sclerosis represents from 51 to 99 per cent narrowing; grade 4 sclerosis represents complete occlusion of the arterial lumen by atherosclerosis.

**Acute Myocardial Infarct**

This is a zone of myocardial necrosis that measures more than 2 cm. in at least one dimension and that by gross and histologic appearance is less than 4 weeks of age.

**Healed Myocardial Infarct**

This is a confluent zone of fibrous tissue in the myocardium that measures more than 2 cm. in at least one dimension; the gross and histologic appearance must be such as to indicate that the underlying acute myocardial infarct occurred at least 4 weeks previously. The criteria outlined by Mallory and associates\(^6\) were used in estimating the age of the myocardial infarcts.

**Fibrosis and Small Scars**

Hearts having grossly visible scars not more than 2 cm. in their greatest dimension were classified as showing fibrosis.

**Acute Coronary Failure (Sudden Death)**

This group represents those patients with coronary-artery disease who died suddenly in the absence of myocardial rupture or pulmonary embolization, with death apparently resulting from ventricular fibrillation or asystole.

**Results**

**Degree of Coronary Sclerosis**

The degree of coronary-artery sclerosis and the number of deaths caused therefrom are summarized in table 2. This information is based on the 691 necropsies on persons 20 years of age or older, or "adult cases." Coronary sclerosis grade 1 or less was present in 178 (26 per cent) of these 691 adults, and coronary sclerosis grade 2 to 4 was present in 513 (74 per cent).

**Cause of Death**

As determined by the clinical records and necropsy findings, 221 of these 691 adult patients died of coronary disease and 470 died of noncoronary causes. Included in the latter group were 292 who had coronary sclerosis grade 2 to 4. At necropsy it was found that 40 per cent of the men and 22 per cent of the women died of coronary heart disease, giving an over-all incidence of 32 per cent; the incidence based on the 965 necropsies comprising all ages was 29 per cent for males and 16 per cent of females. The male:female ratio for the incidence of fatal coronary heart disease was 2.2:1 for the adults and 1.8:1 based on the entire group.

**Age at Death**

The deaths from coronary heart disease in each decade of life are shown in figure 2. The peak incidence of death in men occurred 1 decade (60 to 69 years) earlier than that in women (70 to 79 years). When these data are compared to the 292 noncoronary deaths in adults with coronary sclerosis grade 2 to 4 (fig. 3), one sees that death from coronary-artery disease shortened the life of the men by 1 decade but had no such effect on the women. The mortality curves for the two groups of men are similar in contour, but the
CORONARY HEART DISEASE

Table 2

Coronary Sclerosis in 691 Adults: 1947-1952

<table>
<thead>
<tr>
<th>Coronary sclerosis, grade</th>
<th>Patients</th>
<th>Type of deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sex</td>
<td>No.</td>
</tr>
<tr>
<td>1</td>
<td>Men</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>Women</td>
<td>103</td>
</tr>
<tr>
<td>2-4</td>
<td>Men</td>
<td>298</td>
</tr>
<tr>
<td></td>
<td>Women</td>
<td>215</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>691</td>
</tr>
</tbody>
</table>

*All persons 20 years of age or more studied at necropsy.

Table 3

Mode of Death in 221 Patients Dying of Coronary Heart Disease

<table>
<thead>
<tr>
<th>Mode of death</th>
<th>Patients</th>
<th>Per cent of:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Coronary deaths (221)</td>
</tr>
<tr>
<td>Acute coronary failure*</td>
<td>94</td>
<td>43</td>
</tr>
<tr>
<td>Men</td>
<td>73</td>
<td></td>
</tr>
<tr>
<td>Women</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>Acute myocardial infarction</td>
<td>87</td>
<td>39</td>
</tr>
<tr>
<td>Men</td>
<td>55</td>
<td></td>
</tr>
<tr>
<td>Women</td>
<td>32</td>
<td></td>
</tr>
<tr>
<td>Congestive heart failure*</td>
<td>32</td>
<td>19</td>
</tr>
<tr>
<td>Men</td>
<td>19</td>
<td></td>
</tr>
<tr>
<td>Women</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>Thromboembolism*</td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>Men</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Women</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Total coronary deaths</td>
<td>221</td>
<td>100</td>
</tr>
</tbody>
</table>

*These three categories include only those patients who died of these mechanisms, which were not complications of or associated with acute myocardial infarction.

curve of coronary deaths is shifted to the left (younger age area) by 1 decade (fig. 4).

Death among persons less than 30 years of age is not often attributable to coronary heart disease; therefore the causes of death for patients who were 30 years of age or older were analyzed. From the total sample of 513 patients who died and at necropsy showed coronary arteriosclerosis of grade 2 to grade 4, 170 patients were 30 to 64 years of age at death and 343 were 65 years or older. A comparison of the two age groups shows that 92 (54 per cent) of those 30 to 64 years of age and 129 (38 per cent) of those 65 or more years of age died of coronary heart disease. In the younger group, 80 of the 92 patients who died of coronary heart disease were men (63 per cent of all men 30 to 64 years of age who died). In the group of patients 65 or more years of age having arteriosclerosis of grade 2 to 4, 41 per cent of the men and 34 per cent of the women died of coronary heart disease. Only 12 women less than 65 years of age died of coronary heart disease: one (a diabetic) was 34 years of age, one was 48 years of age, five were in the sixth decade, and five in the seventh decade.

Type of Death in Patients Dying from Coronary Disease

The mechanism of death in the 221 patients who died of coronary heart disease in this study was divided into four main types (table 3). Acute coronary failure accounted for the greatest incidence of deaths, being the mode of death in 94 patients (43 per cent). The second commonest type of death was acute myocardial infarction, which was present in 87 patients, or 39 per cent of the coronary deaths. A total of 32 patients (14 per cent) died of congestive heart failure, and eight
patients (4 per cent) died of thromboembolism.

Cause of Death in Patients with Acute Myocardial Infarction

An analysis of the 87 patients who died during acute myocardial infarction is presented in table 4. The main cause of death was congestive heart failure in 30 per cent of these patients, myocardial rupture in 24 per cent, acute coronary failure or sudden death in 23 per cent and thromboembolism in 14 per cent. Eight patients had severe systemic illnesses in addition to the acute myocardial infarction, which made it difficult to decide whether the patient would have died had the myocardial infarction not been complicated by the associated systemic disease. The 21 cases of myocardial rupture included three in which the rupture was of the ventricular septum rather than of the free myocardial wall.

Cause of Death in Patients with Healed Myocardial Infarction

An analysis of the 152 patients with healed myocardial infarction found at necropsy is presented in table 5. Of this group, 37 (24 per cent) died from noncoronary disease and 115 (76 per cent) died from coronary disease. The three leading causes of death in the 37 patients with healed infarction who died of other than coronary causes were cancer in 24 per cent, cerebrovascular disease in 19 per cent, and pulmonary emboli in 16 per cent. Among the 115 patients dying of coronary heart disease, acute coronary failure accounted for 48 deaths (42 per cent), whereas 38 persons (33 per cent) had acute myocardial infarction and then died, 18 per cent died of congestive heart failure, and 7 per cent died of thromboembolism.

Cause of Death in Patients with Myocardial Fibrosis

There were 144 patients who died whose hearts at necropsy revealed only small patchy zones of myocardial fibrosis. In this group, 43 deaths (30 per cent) were attributed to coronary disease, with 32 patients dying of acute coronary failure and 11 of congestive heart failure.

Aspects of Acute Coronary Failure

Of the 114 persons who died suddenly (acute coronary failure), 12 per cent had a normal myocardium, 42 per cent had healed infarcts, 9 per cent had acute infarction alone, 9 per cent had both healed and acute infarcts, and 28 per cent had fibrosis of scars measuring not more than 2 cm. Coronary-artery disease was sufficient to produce either gross myocardial scarring or sudden death from acute coronary failure (without apparent myocardial necrosis) in 37 per cent of the entire 965 necropsies, or 52 per cent of the

Figure 1

Myocardial "map" used to locate zone of myocardial infarction. (Reproduced with the kind permission of the publishers from Achor, R. W. P., Futch, W. D., Burchell, H. B., and Edwards, J. E.: Arch. Int. Med. 98: 162, 1956.)

Figure 2

Deaths from coronary heart disease for each decade of life.
691 adults. In other words, more than half of all the adults studied at necropsy in Rochester, Minnesota, had some evidence of heart disease produced by sclerosis of the coronary arteries. Analysis of the place at which death occurred in the 114 patients who died of acute coronary failure shows that 77 (67 per cent) died at home (65 after light to moderate activity and 12 during rest or sleep), 18 (16 per cent) died in the hospital, 10 (9 per cent) died in a public place or street, and nine (8 per cent) died while at work.

Comparison of Patients Dying from Coronary and Noncoronary Causes

Some clinicopathologic associations are summarized in table 6 between the 221 patients who died of coronary heart disease and the 292 patients with coronary-artery sclerosis who died of other diseases. Notable is the low incidence of angina pectoris in both groups and the relatively high incidence of intracardiac mural thrombi in the 221 patients dying of coronary heart disease. Thirty-two per cent of the patients dying of coronary heart disease had at least one new coronary-artery thrombus, 33 per cent had at least one old coronary-artery thrombus, 18 per cent had at least one complete coronary-artery occlusion from sclerosis, 1 per cent had evidence of coronary embolization, and 5 per cent had at least one coronary-artery occlusion caused by hemorrhage into an atheromatous plaque.

Discussion

The purpose of this study was to determine the incidence of death from coronary heart disease based on necropsy studies comprising an adequate sample of all deaths in an entire community. This would preclude bias found in the selected and consecutive necropsy series that reflect hospital populations. A hospital population differs greatly from a community population with respect to coronary heart disease because of the large percentage of patients with coronary heart disease who die in locations other than hospitals. In this study, 84 per cent of the 114 acute coronary deaths and 48 per cent of all the coronary deaths occurred in locations other than the hospital. The necropsies in this study represented 73 per cent of all deaths in the community of Rochester whether they occurred in the hospital or elsewhere. Therefore, it is considered to include a representative sample of the population. Based on consecutive necropsy series, estimates in the literature for the frequency of healed and new myocardial infarcts have ranged from a low of 3.9 per cent to a high of 13.3 per cent.7-15 In this study, 21 per cent of the 965 hearts demonstrated acute or healed infarction, another 15 per cent had scars not more than 2 cm. in diameter or patchy fibrosis, and 1.5 per cent of the patients died of acute coronary failure prior to the development of gross myocardial lesions. The 221 deaths from coronary heart
Table 4

<table>
<thead>
<tr>
<th>Cause of death</th>
<th>Men</th>
<th>%</th>
<th>Women</th>
<th>%</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Congestive heart failure</td>
<td>15</td>
<td>27</td>
<td>11</td>
<td>34.5</td>
<td>26</td>
<td>30</td>
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<tr>
<td>Rapid death</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td></td>
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<tr>
<td>Slow death</td>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Rupture of myocardium</td>
<td>10*</td>
<td></td>
<td></td>
<td></td>
<td>11†</td>
<td></td>
</tr>
<tr>
<td>Acute coronary failure</td>
<td>18</td>
<td>33</td>
<td>2</td>
<td>6.0</td>
<td>20</td>
<td>23</td>
</tr>
<tr>
<td>Thromboembolism</td>
<td>5</td>
<td>9</td>
<td>7</td>
<td>22.0</td>
<td>12</td>
<td>14</td>
</tr>
<tr>
<td>With congestive failure</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>3</td>
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<tr>
<td>Without congestive failure</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Systemic complications</td>
<td>7</td>
<td>13</td>
<td>1†</td>
<td>3.0</td>
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<td>9</td>
</tr>
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<tr>
<td>Infected brain infarcts</td>
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<tr>
<td>Pyelonephritis</td>
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<tr>
<td>Duodenal-ulcer hemorrhage</td>
<td>1</td>
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<td></td>
</tr>
<tr>
<td>Carcinoma of lung</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ruptured aortic aneurysm</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td>55</td>
<td>100</td>
<td>32</td>
<td>100</td>
<td>87</td>
<td>100</td>
</tr>
</tbody>
</table>

*Includes one case of interventricular septal rupture rather than free perforation into the pericardium.
†Includes two cases of interventricular septal rupture.
‡Duodenal-ulcer hemorrhage.

disease in this study represented 24 per cent of all the necropsies; perhaps more meaningful than this would be the 32 per cent incidence of such disease for all persons 20 years of age or older examined at necropsy. Coronary heart disease was the cause of death in 151 (41 per cent) of the 373 adult males and 70 (22 per cent) of the 318 adult females. Both of these figures are considerably higher than estimates previously presented in the literature.

The data concerning death from coronary heart disease in previous clinical studies have shown variable ratios up to nine males for every female dying of this disease. The ratios in this study agree with previously reported low ratios. For the entire series, the male:female ratio was 1.8:1, and the ratio was 2.2:1 for the adult series. With regard to the average age of death from coronary heart disease, this study agrees with the majority of previous reports, which indicate that this average is in the seventh decade of life for men and in the eighth decade for women.

Master and associates did not find any correlation between physical activity and death from coronary-artery disease. Although a particular stress may precipitate a fatal heart attack, it appears from our study that physical stress is not significantly important in causing death.

In the 691 necropsies on adults, 513 hearts (74 per cent) showed narrowing of at least one segment of a coronary-artery lumen by 25 per cent or more of its diameter, and 47 per cent of the hearts had more than half of the coronary lumen compromised by sclerosis in at least one area. Two thirds of these patients with more than 50 per cent narrowing of the coronary artery died as a result of this disease.

The leading mode of death from coronary heart disease in this study was acute coronary failure, or sudden death. Slightly more than half of all deaths from coronary disease in this series occurred in this manner. Sudden death from coronary heart disease was much more common in men than in women. In this study, approximately half of all men dying from coronary-artery disease died of acute coronary failure and another 25 per cent died of congestive heart failure; the deaths in the remaining quarter were evenly divided between thromboembolic disease and myocardial rupture. The women who died of coronary heart disease could be divided into three equal groups with regard to the mode of death: one third died of congestive heart failure and
one third of acute coronary failure; the deaths in the remaining third were equally divided between acute myocardial rupture and thromboembolic disease. Patients in this study who died in acute cardiovascular collapse or shock were placed in the category of congestive heart failure, because all of them showed pulmonary edema and other evidences of congestive heart failure at necropsy. Rupture of the interventricular septum occurred in three patients, accounting for 1.4 per cent of the 221 deaths from coronary disease.

Angina pectoris was diagnosed during life in one third of the patients who died of coronary disease but in only 7 per cent of those who died of noncoronary diseases. The sex of the patient did not influence the frequency of angina pectoris. Two important aspects relative to angina pectoris are apparent: (1) only a minority of patients with severe coronary-artery disease may manifest the classic symptoms of this disease and (2) angina pectoris means extensive coronary-artery disease with at least one complete occlusion likely and means death from coronary heart disease in the majority of patients. White and Bland,\textsuperscript{17} found that 82 per cent of 213 patients with angina pectoris died a cardiac death and that the average duration of life after the onset of angina was 4.9 years. Block and co-workers,\textsuperscript{18} in a study of 6,882 cases of angina pectoris, found an average survival of 4.6 years after the onset of the angina. The 10-year survival in their series was 37 per cent; 15 per cent had died by the end of the first year, and half of the patients lived 5 years. In the present Rochester study, 77 per cent of the patients with angina pectoris died of coronary heart disease.

A thrombus was found in one of the four cardiac chambers in 28 per cent of our patients dying of coronary heart disease; this figure agrees with the range reported in the literature of 22 to 47 per cent.\textsuperscript{19, 20} However, our series differed from others because it included hearts without myocardial damage or with only minimal lesions. Ventricular aneurysms were present in 7 per cent of the patients dying of coronary disease as compared to a range of 3 to 20 per cent in other reports. Again the incidence is low in our study because hearts with little or no myocardial damage were included. The commonest mode of death in the 15 patients with a myocardial aneurysm was, as might be expected, congestive heart failure. Only a third of these pa-

\begin{table}
\centering
\caption{Cause of Death in 152 Patients with Healed Myocardial Infarcts More Than 2 Cm. in Diameter}
\begin{tabular}{|c|c|c|c|c|c|}
\hline
Group & Cause of death & Men & & Women & & Total \\
\hline
Healed infarcts— 37 cases & & & & & & \\
noncoronary deaths & Cancer & 5 & 25 & 4 & 23 & 9 & 24 \\
 & Cerebrovascular disease & 2 & 10 & 5 & 29 & 7 & 19 \\
 & Pulmonary emboli & 3 & 15 & 3 & 18 & 6 & 16 \\
 & Pneumonia & 5 & 25 & 0 & 0 & 5 & 14 \\
 & Miscellaneous & 4 & 20 & 0 & 0 & 4 & 11 \\
 & Ruptured aortic aneurysm & 1 & 5 & 2 & 12 & 3 & 8 \\
 & Thromboemboli* & 0 & 0 & 2 & 12 & 2 & 5 \\
 & Congestive failure* & 0 & 0 & 1 & 6 & 1 & 3 \\
 & Total & 20 & 100 & 17 & 100 & 37 & 100 \\
\hline
Healed infarcts— 115 cases & Acute coronary failure & & & & & \\
noncoronary deaths & (sudden death) & & & & & \\
 & Acute myocardial infarction & 23 & 30 & 15 & 40 & 38 & 33 \\
 & And then heart failure & 10 & 7 & 9 & 2 & 18 & 3 \\
 & Acute coronary failure & 9 & 2 & 2 & 3 & 6 & 7 \\
 & Fatal thromboembolism & 2 & 3 & 2 & 3 & 6 & 7 \\
 & Rupture of myocardium & 2 & & & & & \\
 & Congestive heart failure & 14 & 18 & 7 & 18 & 21 & 18 \\
 & Thromboembolism & 4 & 5 & 4 & 10 & 8 & 7 \\
 & With heart failure & 3 & & 3 & & & \\
 & Total & 77 & 100 & 38 & 100 & 115 & 100 \\
\hline
\end{tabular}
\footnotesize{*Unrelated to the coincidental myocardial infarction.}
\end{table}

\textit{Circulation, Volume XXV, January 1962}
Table 6

**Associated Clinicopathologic Conditions in 221 Coronary Deaths and 292 Noncoronary Deaths**

<table>
<thead>
<tr>
<th>Clinicopathologic findings</th>
<th>Coronary deaths (221)</th>
<th></th>
<th>Noncoronary deaths (292)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
<td>No.</td>
<td>%</td>
</tr>
<tr>
<td>Angina pectoris</td>
<td>71</td>
<td>32</td>
<td>20</td>
<td>7</td>
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<tr>
<td>Hypertension</td>
<td>110</td>
<td>50</td>
<td>137</td>
<td>47</td>
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<tr>
<td>Diabetes</td>
<td>20</td>
<td>9</td>
<td>32</td>
<td>11</td>
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<tr>
<td>Ventricular aneurysm</td>
<td>15</td>
<td>7</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Mural thrombi</td>
<td>62</td>
<td>28</td>
<td>23</td>
<td>8</td>
</tr>
<tr>
<td>Left ventricle</td>
<td>44</td>
<td>20</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Right ventricle</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Left atrial appendage</td>
<td>5</td>
<td>2</td>
<td>9</td>
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</tr>
<tr>
<td>Right atrial appendage</td>
<td>11</td>
<td>5</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>Coronary occlusion</td>
<td>197</td>
<td>89</td>
<td>28</td>
<td>9</td>
</tr>
<tr>
<td>New thrombus</td>
<td>71</td>
<td>32</td>
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<td>1</td>
</tr>
<tr>
<td>Old thrombus</td>
<td>73</td>
<td>33</td>
<td>15</td>
<td>5</td>
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<td>Grade 4 sclerosis</td>
<td>40</td>
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<td>Hemorrhage into plaque</td>
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<td>5</td>
<td>9</td>
<td>3</td>
</tr>
</tbody>
</table>

Patients had hypertension, and only one heart contained an aneurysm of the posterior wall. Aneurysms of the ventricular wall almost never rupture, as has been noted in all series reported.21

Pulmonary embolism was present in 11 (5 per cent) of the patients with fatal coronary heart disease. Other authors have indicated that pulmonary emboli complicate 3 to 20 per cent of myocardial infarcts. Rheumatic valvulitis is said to be seen uncommonly in conjunction with coronary heart disease but the clinician must be aware of their occasional association; it is difficult to make this diagnosis, especially in the elderly patient. Two per cent of our patients dying of coronary heart disease had rheumatic valvulitis; in addition, 12 (5 per cent) of the 221 patients dying of coronary disease had calcific aortic stenosis. Gardner and White22 stated that 6 per cent of 513 patients with coronary disease had rheumatic valvulitis and that 7 per cent of 436 patients with rheumatic valvulitis had coronary heart disease.

**Summary**

The high rate of necropsy in deaths among permanent residents of Rochester, Minnesota, provided a unique opportunity to study the prevalence of coronary heart disease and the frequency and mode of death resulting from this disease. In this community of approximately 30,000 population, necropsy was done in 73 per cent of all resident deaths during the years 1947 through 1952. Included in this group were 691 necropsies that represented 67 per cent of the 1,026 deaths of persons 20 years of age or older.

Coronary heart disease caused death in 221 patients (23 per cent of all necropsies and 32 per cent of all necropsies on adults). These 221 coronary deaths in adults represented 41 per cent of the men and 22 per cent of the women. The coronary deaths were attributed to acute coronary failure (sudden death) in 94 patients (43 per cent), acute myocardial infarction in 87 patients (39 per cent), congestive heart failure in 32 patients (14 per cent) and thromboembolism in eight patients (4 per cent). The 87 patients dying during acute myocardial infarction died of congestive heart failure (30 per cent), myocardial rupture (24 per cent), acute coronary failure (23 per cent), and thromboembolism (14 per cent), with the remaining 9 per cent dying.
of a combination of acute myocardial infarction and additional serious systemic disease.

The greatest number of deaths from coronary heart disease occurred during the seventh decade of life in men and the eighth decade in women. At least one coronary artery exhibited from 25 to 100 per cent obstruction from atherosclerosis in 513 hearts (74 per cent of the adult necropsies).

These necropsies, representing two thirds of all deaths in adults in this community, disclosed that significant coronary-artery disease was present in three of four adults and was the cause of death in four of 10 men and two of 10 women.

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The Spectrum of Coronary Heart Disease in a Community of 30,000: A Clinicopathologic Study
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