The Role of Socioeconomic Factors in Cerebral Atherosclerosis

BY RUTH B. LOEWENSON, PH.D., GEORGE C. FLORA, M.D., AND A. B. BAKER, M.D., PH.D.

Abstract: The Role of Socioeconomic Factors in Cerebral Atherosclerosis

This report presents an analysis of autopsy material from 3,942 cases of age 20 and older in whom the circle of Willis was scored for the severity and the extent of atherosclerosis. Several criteria were used to assess the effect of socioeconomic factors on cerebral atherosclerosis; these consisted of the financial hospital status of the patient, the place of residence, and occupation and physical activity. In the female patients it appeared that the indigent cases had a slightly higher prevalence of cerebral atherosclerosis than the private cases. In the males a difference in prevalence was found between urban and rural cases, the urban males showing higher scores. A comparison between a group of patients with mostly sedentary occupations and a group with more physically active occupations revealed no difference in atherosclerosis scores.

ADDITIONAL KEY WORDS
financial hospital status autopsy urban/rural residence circle of Willis physical activity

All human society can be internally differentiated to some degree by criteria such as income, housing, place of residence, diet, occupation, physical activity, climate, etc. Any single one of the above factors, or a combination thereof, can be used to study the effect of socioeconomic status on atherosclerosis. To evaluate accurately the possible effect of such factors would require a carefully planned prospective study on a large segment of the population. Such studies are difficult to conduct and only a few have been reported. They deal chiefly with the effect of selected aspects of the various socioeconomic factors on coronary atherosclerosis. No studies have been carried out on the effects of socioeconomic factors on cerebral atherosclerosis. In view of the absence of literature on this subject we considered it worthwhile to report the findings on cerebral atherosclerosis in certain socioeconomic groups in an autopsy study; we are, however, fully aware of the inherent shortcomings in the use of autopsy data.¹

Our material consists of 5,033 consecutive autopsies in which atherosclerosis of the circle of Willis was coded for extent and severity by the coding technique of Baker and his associates.² The historical data were abstracted from the patient's chart. Thus, information on socioeconomic status was obtained retrospectively and can be analyzed only in broad categories of certain socioeconomic factors. The 3,942 adult cases of this series were used to study the relationship between these selected factors and the severity of cerebral atherosclerosis.

For the analysis of the data cumulative percentage distributions of the vessel scores were computed for each sex and ten-year age group. From these distributions the twenty-fifth, fiftieth (median) and seventy-fifth percentiles were determined and these percentile points were plotted at the midpoints of the ten-year age intervals. The curves connecting these percentile points give an indication of the prevalence of the disease and they are used for the comparison of the extent of atherosclerotic involvement among various socioeconomic

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Supported by Grant NB-3364 from the National Institutes of Health.

Stroke, Vol. 2, July-August 1971
**SOCIOECONOMIC FACTORS AND CEREBRAL ATHEROSCLEROSIS**

**TABLE 1**

*Number of Cases by Place of Residence and Financial Status*

<table>
<thead>
<tr>
<th>Age</th>
<th>Indigent</th>
<th>Private</th>
<th>Rural</th>
<th>Private</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Males</td>
<td>Females</td>
<td>Males</td>
<td>Females</td>
</tr>
<tr>
<td></td>
<td>Indigent</td>
<td>Private</td>
<td>Rural</td>
<td>Private</td>
</tr>
<tr>
<td></td>
<td>Males</td>
<td>Females</td>
<td>Males</td>
<td>Females</td>
</tr>
<tr>
<td>20-29</td>
<td>131</td>
<td>69</td>
<td>24</td>
<td>10</td>
</tr>
<tr>
<td>30-39</td>
<td>117</td>
<td>94</td>
<td>39</td>
<td>26</td>
</tr>
<tr>
<td>40-49</td>
<td>215</td>
<td>174</td>
<td>73</td>
<td>74</td>
</tr>
<tr>
<td>50-59</td>
<td>356</td>
<td>228</td>
<td>111</td>
<td>68</td>
</tr>
<tr>
<td>60-69</td>
<td>397</td>
<td>244</td>
<td>65</td>
<td>50</td>
</tr>
<tr>
<td>70-79</td>
<td>369</td>
<td>207</td>
<td>51</td>
<td>27</td>
</tr>
<tr>
<td>80+</td>
<td>144</td>
<td>97</td>
<td>14</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>1,729</td>
<td>1,113</td>
<td>377</td>
<td>260</td>
</tr>
</tbody>
</table>

Wealth as a Criterion for Socioeconomic Status

The reported studies have produced conflicting observations. Kent and his associates studied a Manhattan, New York, population using income as a measure of socioeconomic status. They found that there was a higher coronary death rate in the lower income group. Stamler, working with a Chicago group, observed no effect of income on coronary deaths except in white males of the lower income class, similar to the findings of the foregoing study. Gordon and his co-workers reviewed 3,400 consecutive autopsies at the Massachusetts General Hospital and found that the degree of coronary atherosclerosis was significantly greater in the private patients of high income levels. Mathur, in a study at Agra, India, reported similar findings; he found a greater incidence of coronary heart disease in the high socioeconomic class.

In our study, the financial status of the patients was determined by their hospital status: “indigent” or "private." The indigent patients were those who required county aid to subsidize their hospital stay. Place of residence was another factor chosen for analysis. It was found that the majority of the patients, namely 3,479, were urban in origin, and, therefore, only cases with urban residence were used to evaluate the effect of wealth on cerebral atherosclerosis. There were too few rural-private cases to calculate percentiles by age-sex groups. The sample sizes for the various categories, by age and sex, are given in table 1.

Figure 1 indicates that there is no consistent difference in the average amount of cerebral atherosclerosis in the indigent male population as compared to the private males. The age group 40 to 49 shows the indigent cases having slightly higher scores and the two oldest age groups show the private cases having...
slightly higher atherosclerosis scores. There is a fairly strong suggestion, however, that the indigent female population may have somewhat more cerebral atherosclerosis than the private female patients.

**Urban Versus Rural Residence as a Criterion for Socioeconomic Status**

For the comparison of urban and rural populations the following definitions were used: a community with a population of less than 2,500 was considered "rural," a town or city with a population over 2,500 was called "urban." In general, there are definite contrasts between rural life and urban life such as differences in stresses of living, in occupation, physical activity, etc.; however, in many instances, classification by place of residence does not coincide with the classifications implied by the other variables.

Kjelsberg and Stamler\(^7\) compared the frequency of cardiovascular-renal disease in Chicago and in rural Illinois. They observed relatively higher rates for Chicago than for other municipalities and rural areas. Gover and Pennell\(^8\) also observed that the coronary heart disease deaths were higher in urban than in rural areas.

Since we had found slight differences in cerebral atherosclerosis between private and indigent cases the larger indigent group alone was used for a comparison of atherosclerosis scores between urban and rural populations. Figure 2 indicates that there seems to be somewhat more cerebral atherosclerosis in the urban male population than in the rural males in the ages from 50 to 80. It should be noted that, in the age group where this relationship does not hold, the number of rural subjects is very small and hence the percentiles are subject to great variability. Such a relationship does not seem to hold true for the female population. However, we must again be cautious of interpretation since the numbers of rural females in each age group are small.

**Occupation and Physical Activity as a Criterion of Socioeconomic Status**

Occupation is one of the most specific criteria for classifying the socioeconomic status of an individual. However, it does have some shortcomings, particularly in a retrospective study. Often it is difficult to define the actual occupation. Furthermore, a person’s last occupation may not always represent his life-long occupational history. Frequently, occupations are divided into five classes, namely, professional, managerial, skilled, semiskilled, and unskilled. It can generally be accepted that the first two classes are higher in social status than the last three classes. Most studies tend to suggest that there is a direct relationship between the higher social class status and the occurrences of coronary heart disease.\(^9\)\(^\text{-13}\)

Morris\(^14\) in 1953 observed that London bus drivers and government clerks were more likely to die of coronary heart disease than conductors on the buses or than postmen. He concluded that physically active occupations or jobs have a lower incidence of coronary heart disease. Morris and Crawford\(^15\) analyzed the frequency of coronary disease in 3,800 middle-aged men who were classified according to physical activity required by their jobs. Ischemic heart disease was more frequent and more

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**FIGURE 2**

Distribution of vessel scores by age and sex for urban-indigent and rural-indigent patients.
SOCIOECONOMIC FACTORS AND CEREBRAL ATHEROSCLEROSIS

TABLE 2
Number of Cases by Occupational Groups—Males

<table>
<thead>
<tr>
<th>Age</th>
<th>Sedentary</th>
<th>Physically active</th>
<th>Occupation not given</th>
<th>Retired</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-29</td>
<td>13</td>
<td>48</td>
<td>86</td>
<td></td>
</tr>
<tr>
<td>30-39</td>
<td>32</td>
<td>63</td>
<td>73</td>
<td></td>
</tr>
<tr>
<td>40-49</td>
<td>35</td>
<td>109</td>
<td>158</td>
<td></td>
</tr>
<tr>
<td>50-59</td>
<td>66</td>
<td>209</td>
<td>215</td>
<td>8</td>
</tr>
<tr>
<td>60-69</td>
<td>42</td>
<td>232</td>
<td>224</td>
<td>25</td>
</tr>
<tr>
<td>70-79</td>
<td>30</td>
<td>187</td>
<td>207</td>
<td>63</td>
</tr>
<tr>
<td>80+</td>
<td>8</td>
<td>61</td>
<td>83</td>
<td>32</td>
</tr>
<tr>
<td>Total</td>
<td>226</td>
<td>909</td>
<td>1,046</td>
<td>128</td>
</tr>
</tbody>
</table>

severe in light occupations than in the heavy and active ones. McDonough and his co-workers also found that coronary heart disease was related to physical activity. Owners of small farms who performed more physically demanding work had considerably less coronary heart disease than owners of large farms with mechanized equipment. On the other hand, Chapman and his associates in a study of 2,252 civil service employees in the city of Los Angeles observed that the physical demands of the job did not appear to have any influence on the occurrence of coronary disease.

Although we have a fairly large sample, not enough cases of each profession or occupation were available to make valid comparisons. Therefore, the cases were grouped into seven categories, namely, professional, technical, managerial, small independent business, white collar workers, skilled labor, semiskilled and unskilled labor, and a miscellaneous group. However, even these groupings did not offer sufficient numbers in certain categories to allow for an adequate comparative study. Finally, we made an attempt to classify our cases into two groups, those engaged in relatively heavy physical activity (small independent business, skilled labor, and semiskilled and unskilled labor) and those engaged in relatively sedentary activity (professional, technical, managerial and white collar). Using males only, the former group contained 909 individuals and the latter 225. In 1,046 cases the occupation was not given and 128 cases were listed as retired; 106 cases in miscellaneous categories were omitted from the analysis (table 2). Figure 3 shows that, on the average, there was essentially no difference in the degree of cerebral atherosclerosis between these two occupational groups. Within the limits of our classification physical activity did not appear to reduce the frequency or severity of cerebral atherosclerosis. In this respect our results do tend to differ from those observations reported for the coronary vessels.

Summary and Conclusions
Cerebral atherosclerosis appears to be somewhat more prevalent in the indigent female as compared to the wealthier female patient. In the male, this difference does not seem to be present.

Cerebral atherosclerosis appears to be somewhat more prevalent in the urban than in the rural male population. No such difference was observed in the female, although these findings are only suggestive owing to small sample sizes.

Cerebral atherosclerosis does not appear to be influenced by occupation as defined by our crude classification, regardless of the physical activity involved.

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Stroke. 1971;2:378-382
doi: 10.1161/01.STR.2.4.378

Stroke is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
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Print ISSN: 0039-2499. Online ISSN: 1524-4628

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