The Social Distribution of Cancer of the Scrotum and Cancer of the Penis

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In a paper (1) from this Institute published 20 years ago attention was drawn to the very distinct social distribution of cancer of the scrotum. The data were derived from the death certificates of the 921 cases of cancer of the scrotum and cancer of the penis, reported from England and Wales in 5 years (1913, 1914, 1921-23). As neither the numbers of males engaged in the various occupations nor the age distributions were then available, a preliminary survey was attempted by calculating the ratio of the cases of these two forms of cancer to one another. Data that have come to light since then, showing that the incidence of cancer of the penis is comparatively uniform in the different Social Classes (Table V), make clear that this basis of comparison was not so defective as it appeared at the time. The occupations of the 921 persons were grouped in 8 classes (Table I), of which the first 3 comprised those where there is special exposure to known carcinogenic materials.

In the first 3 of these classes cancer of the scrotum is more frequent than that of the penis, as one would expect. The ratio, cancer of the scrotum:cancer of the penis is 1:20 in the agricultural workers, who are mostly agricultural laborers, and is nearly 8 times greater, or 1:2.6, in the nonagricultural laborers (Class 6a). Those engaged in lighter manual labor (Class 6b) have a lower proportion of scrotal cancer than have those performing the heaviest work (Class 6a). The clerical and light manual workers (Class 7) have a low ratio of scrotal cancer (1:9.2). The suggestions drawn from these results may be stated here in the words of the earlier paper.

"Roughly, it seems safe to say that the heaviest work, such as that of classes 4, 5 and 6a, is done by those who wash least; these three classes consist very largely of town dwellers and show a high proportion of scrotal cancer. The two classes which show the lowest proportion are the clerical and light manual workers who, either from choice or professional necessity, wash a good deal; and the agricultural workers who, although they may be no more cleanly than town dwellers of similar social standing, are not exposed to the dirt of towns, which consists largely of soot. Thus, if one assumes that cancer of the penis is distributed fairly equally among all classes of workers, it would seem possible that cancer of the scrotum is influenced by exposure to coal smoke; in other words, possibly all town dwellers are in some very slight degree liable to chimney-sweeps' cancer."

Class 7 evidently required further study. The rough classification adopted might have included in this class men who in earlier life had been exposed to carcinogenic agents; e.g., in the textile industry. And the absence of the highest, that is to say richest, professional occupations among the cases of scrotal cancer became apparent. A special study of this matter, covering the 25 years 1911 to 1935, was made, and the result included in a paper in a publication that is now hard to obtain (3). We have now extended the study to include the 30 years, 1911-40, and have obtained the following results.

The total number of deaths in this period from cancer of the scrotum is 1,752. In order to study the question, implied in the passage quoted above, whether cancer of the scrotum occurs independently of external factors, one may first subtract from this total the 723 cases in workers of occupations in which there is admittedly a liability to this form of cancer owing to exposure to tar, pitch, and lubricating oils (Table II).
Cancer Research

TABLE II: CANCER OF SCROTUM, ENGLAND AND WALES, 1911 TO 1940

<table>
<thead>
<tr>
<th>Class</th>
<th>Occupation</th>
<th>Total</th>
<th>Approximate Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total Cases</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Scrotum</td>
<td>Penis</td>
<td>Scrotum</td>
</tr>
<tr>
<td>1</td>
<td>Sweeps</td>
<td>21</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>Textile workers:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>a. Cotton</td>
<td>70</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>b. Others</td>
<td>11</td>
<td>14</td>
</tr>
<tr>
<td>3</td>
<td>Workers (excluding sweeps and textile workers)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>especially likely to be exposed to cancer-producing materials (tar, pitch, and lubricating oils). This class includes workers with tar, pitch, coke and its by-products; fishermen and boatmen; and all drivers, stokers, and cleaners of engines.</td>
<td>32</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>Total, classes 1 to 3 inclusive</td>
<td>134</td>
<td>46</td>
</tr>
<tr>
<td>4</td>
<td>Metal workers</td>
<td>19</td>
<td>73</td>
</tr>
<tr>
<td>5</td>
<td>Coal workers</td>
<td>8</td>
<td>38</td>
</tr>
<tr>
<td>6</td>
<td>Other manual occupations:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>a. Heavier work; e.g., laborer, bricklayer, shipbuilder, carpenter.</td>
<td>60</td>
<td>156</td>
</tr>
<tr>
<td></td>
<td>b. Lighter work; e.g., coachman, soldier, packer, bootmaker, painter.</td>
<td>18</td>
<td>112</td>
</tr>
<tr>
<td>7</td>
<td>Clerical and light manual work. All employers, managers, shopkeepers, and foremen were placed in this class. Light manual workers include shop assistants, servants, printers, and watchmakers.</td>
<td>17</td>
<td>157</td>
</tr>
<tr>
<td>8</td>
<td>Agriculture</td>
<td>4</td>
<td>79</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>260</td>
<td>661</td>
</tr>
<tr>
<td></td>
<td>Subtract Classes 1, 2, and 3</td>
<td>134</td>
<td>46</td>
</tr>
<tr>
<td>Classes 4 to 8 inclusive</td>
<td></td>
<td>126</td>
<td>615</td>
</tr>
</tbody>
</table>

Seventeen occupations, belonging to Social Classes I and II, and to Groups xxiii, xxiv, and xxv, were chosen in which there is least likelihood of exposure in earlier life to carcinogenic agents; thus such occupations as the fighting services, engineers, ship designers and surveyors, analytical and research chemists, were excluded (Table III). Of these 17 occupations, 13 belong to Social Class I and 4 to Social Class II.

The total number of 1,752 fatal cases of cancer of the scrotum may be regarded as coming from a population of 13,893,848 males (occupied, unoccupied, and retired) aged 14 years and over (mean of 1921 and 1931 census). One may subtract from the total of 1,752 cases those that are presumably of occupational origin; i.e., the total from Table II, and the numbers engaged in these occupations \(^1\) may be subtracted from the total population:

\[
1,752 - 723 = 1,029
\]

\[
13,893,848 - 501,372 = 13,392,476
\]

\(^1\) The populations engaged in some of these occupations cannot be estimated very exactly, but a considerable error in the correction attempted here does not affect seriously the final result.

section of the population, Class III, skilled artisans and analogous workers, and Class V, labourers and other unskilled callings, while Classes II and IV are intermediate, comprising occupations of mixed types, or types not easily assignable to the classes on either side."

The occupations are classified further into 31 groups, with 3 of which we are concerned here, namely:

- xxiii Commercial, finance and insurance occupations (excluding clerks).
- xxiv Persons employed in Public Administration and Defence (excluding professional men, clerical staff and typists).
- xxv Professional occupations (excluding clerical staff).
This leaves a residue of 1,029 possibly nonoccupational cancers of the scrotum coming from a population of 13,392,476.

At this rate the 17 professions in Table III, numbering 289,985 men, should yield 22 fatal cases of scrotal cancer. Actually, 1 case only was found; namely, that of a Chief Clerk, Royal Artillery Records Office, belonging to Social Class II in Group xxiv. Special enquiry into the history of this man showed that he had been a Sergeant Major (Artillery Clerk) and agricultural laborers, shepherds, gardeners) should, in proportion to their number (917,911), yield 68 cases of cancer of the scrotum, but the actual number is 41.

The paper of 1925 quoted above was among the earlier of those dealing with the social, as distinct from the purely occupational, distribution of cancer. The first considerable study of this subject based upon the occupational mortality of males in England and Wales in 1910-12 was published in 1923 by the late Dr. T. H. C. Stevenson, Superintendent of Statistics in the General Register Office, London (7). But as he himself pointed out, the grading of the male population into Social Classes that was then available was unsatisfactory for his purpose, for it rested upon an industrial rather than upon an occupational basis, and hence tended to include persons of higher and lower social position in the same categories. Moreover, Stevenson was able at that time to deal only with the total mortality from cancer of all organs; hence the influence of social position, which affects especially the incidence of cancer upon the more exposed sites, was not made clear.

A much more elaborate study, based upon the 1921 census, was published from the General Register Office, London (7).

TABLE III

| Occupation Group | Social Class | Males, occupied and retired, Mean of 1921 and 1931 Census. *
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>xxiii</td>
<td>I</td>
<td>Bankers, bank officials (heads of departments, managers and inspectors) 1 4 7 5 7</td>
</tr>
<tr>
<td></td>
<td>&quot;</td>
<td>Stock brokers and stock jobbers                    6 8 8 8</td>
</tr>
<tr>
<td></td>
<td>&quot;</td>
<td>Insurance officials (heads of departments, managers and inspectors) 2 2 2 6 4</td>
</tr>
<tr>
<td>xxiv</td>
<td>II</td>
<td>Civil Service Administrative, executive, and higher clerical officers † 2 2 5 7 5</td>
</tr>
<tr>
<td>xxv</td>
<td>I</td>
<td>Clergymen (Anglican Church)                       2 3 5 0 6</td>
</tr>
<tr>
<td></td>
<td>&quot;</td>
<td>Ministers of other religious bodies                1 1 7 5 7</td>
</tr>
<tr>
<td></td>
<td>&quot;</td>
<td>Roman Catholic priests and monks                   3 6 1 7</td>
</tr>
<tr>
<td></td>
<td>&quot;</td>
<td>Judges, stipendiary magistrates, barristers †      3 6 2 2</td>
</tr>
<tr>
<td></td>
<td>&quot;</td>
<td>Solicitors                                        1 7 2 4 9</td>
</tr>
<tr>
<td></td>
<td>&quot;</td>
<td>Physicians, surgeons, registered medical practitioners 2 7 7 4 2</td>
</tr>
<tr>
<td></td>
<td>&quot;</td>
<td>Dentists                                          1 0 4 7 9</td>
</tr>
<tr>
<td></td>
<td>&quot;</td>
<td>Teachers (not Music Teachers)                     8 3 5 2 5</td>
</tr>
<tr>
<td></td>
<td>&quot;</td>
<td>Teachers of music                                 5 1 6 5</td>
</tr>
<tr>
<td></td>
<td>&quot;</td>
<td>Architects                                        1 0 1 3 2</td>
</tr>
<tr>
<td></td>
<td>&quot;</td>
<td>Chartered and incorporated accountants            1 1 0 2 7</td>
</tr>
<tr>
<td></td>
<td>&quot;</td>
<td>Authors, editors, journalists, publicists         1 4 1 8</td>
</tr>
<tr>
<td></td>
<td>&quot;</td>
<td>Librarians (not booksellers)                      1 4 9 2</td>
</tr>
<tr>
<td>Total, Social Class I</td>
<td>177,228</td>
<td>112,757</td>
</tr>
<tr>
<td>Social Class II</td>
<td>289,985</td>
<td></td>
</tr>
</tbody>
</table>

* The figures of the 1921 Census refer to ages 12 and over, and those of the 1931 census to ages 14 and over, but in occupations of this type the difference is of no importance.

† This figure is from the 1931 census only. In the 1921 census these occupations were classified differently.
The parts of the body affected by cancer were divided into two classes, namely,

Exposed sites  (1 and 3 in Table IV)
Other sites  (2 and 4 in Table IV)

The incidence in the 5 Social Classes of cancer of the pooled exposed and other sites is shown in Table IV, together with some examples of the results for individual sites.

The incidence upon the exposed sites increases as one descends the social scale; e.g., in the case of the tongue, from 48 per cent to 165 per cent of incidence upon all males. The social grading is very pronounced

TABLE IV: OCCUPIED AND RETIRED CIVILIAN MALES AT AGES 20 TO 65 YEARS, 1921 TO 1923

<table>
<thead>
<tr>
<th>Social Class</th>
<th>Cancer of All sites</th>
<th>Cancer of Exposed sites</th>
<th>Cancer of Other sites</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>80</td>
<td>92</td>
<td>99</td>
</tr>
<tr>
<td>II</td>
<td>102</td>
<td>104</td>
<td>100</td>
</tr>
<tr>
<td>III</td>
<td>101</td>
<td>109</td>
<td>102</td>
</tr>
<tr>
<td>IV</td>
<td>101</td>
<td>107</td>
<td>102</td>
</tr>
<tr>
<td>V</td>
<td>101</td>
<td>102</td>
<td>102</td>
</tr>
</tbody>
</table>

for all sites above the pylorus, and is not observed in the remainder of the alimentary tract.

Cancer of the scrotum and penis is not mentioned in this statement on the social distribution of cancer. In the next Decennial Supplement, based on the 1931 Census, and published in 1937 (5), a graph, reproduced below (Fig. 1), is given of the pooled data for these two forms of cancer, which are described in the text as showing “an unmistakable social class gradient.” This graph shows a considerable gradient, ascending from Social Class I to V. The data for each form separately, derived from the years 1930-32, upon which this graph is based, appear in Table 8 on page 350 of the Supplement, and are quoted in columns C and D of our Table V. If one calculates the number of persons corresponding to 1 case of each of these forms of cancer, one obtains the results given in columns E and F. This method of examination of the figures is of course not wholly satisfactory, as no account is taken of possible differences in age distribution in the 5 classes, but this factor does not affect the simple comparison of cancer of the scrotum and penis. The figures in columns E and F show a

TABLE V: CANCER OF PENIS AND SCROTUM. ENGLAND AND WALES, 1930 TO 1932

<table>
<thead>
<tr>
<th>Social Class</th>
<th>Population, males, 1931 census, ages 16 and upwards</th>
<th>Cancer of penis</th>
<th>Cancer of scrotum</th>
<th>Cancer of penis</th>
<th>Cancer of scrotum</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>B</td>
<td>C</td>
<td>E</td>
<td>F</td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>278,367</td>
<td>11</td>
<td>25,306</td>
<td></td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>1,569,127</td>
<td>82</td>
<td>19,135</td>
<td>98,050</td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>5,498,648</td>
<td>233</td>
<td>23,600</td>
<td>57,280</td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>1,992,679</td>
<td>95</td>
<td>20,975</td>
<td>55,330</td>
<td></td>
</tr>
<tr>
<td>V</td>
<td>1,845,570</td>
<td>68</td>
<td>27,140</td>
<td>31,280</td>
<td></td>
</tr>
<tr>
<td>Unoccupied</td>
<td>157,770</td>
<td>7</td>
<td>22,539</td>
<td>78,885</td>
<td></td>
</tr>
<tr>
<td>All</td>
<td>11,184,391</td>
<td>489</td>
<td>22,872</td>
<td>54,010</td>
<td></td>
</tr>
<tr>
<td>Active and retired</td>
<td>11,342,161</td>
<td>496</td>
<td>22,866</td>
<td>54,270</td>
<td></td>
</tr>
</tbody>
</table>

very distinct social gradient in the case of cancer of the scrotum, and the absence of any uniform gradient in that of cancer of the penis. This difference is not seen in the graph (Fig. 1) where the two sets of
DISCUSSION

These two forms of cancer can be wholly eliminated; that of the penis by circumcision in infancy (but not in later life, according to the Moslem practice\(^3\)), and that of the scrotum through the conditions of life attainable by the richest classes. Cancer of these two regions caused 230 deaths in 1937 in England and Wales alone (6). Cancer of the scrotum provides the extreme instance of the effect of social status on the incidence of cancer upon exposed sites, and one regrets that this was not recognized during the lifetime of Stevenson, to whom students of cancer as it occurs in man owe so much. The absence of social gradient in the case of cancer of the penis suggests that ordinary cleanliness per se is not here the determining factor, as it may be in cancer of the scrotum. Probably a large number of cases of penile cancer are associated with phimosis, a condition independent of social status and personal habits.\(^4\) A certain degree of negligence in cleanliness, involving infrequent retraction of the prepuce, may even protect the glans from the extrinsic factors that induce cancer of the scrotum. In connexion with the study of these two forms of cancer, we have for many years been watching for any instances of cancer of the scrotum in native races and nonindustrialized countries; the lack of any such cases even in countries where cancer of the penis is extremely common shows the difference in the etiology of the two diseases, and illustrates again the misleading results that arise from classifying them under a common heading.

SUMMARY

One case only of cancer of the scrotum occurred in England and Wales in 30 years in 17 occupations of the highest professional class; this one case was that of a person who in earlier life had belonged to a lower social class. The number of cases to be expected among the same number of persons, not specially exposed to carcinogenic materials, in the general population would be about 22. Hence it appears that this form of cancer could be eliminated by social factors. As cancer of the penis does not show this social distribution, these two types should not be pooled for statistical purposes. Data on the occurrence of cancer of the scrotum in native races and nonindustrial populations would be of great interest.

ACKNOWLEDGMENT

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REFERENCES

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