LIFE EXPECTANCY AND INCIDENCE OF MALIGNANT DISEASE

IV. CARCINOMA OF THE GENITO-URINARY TRACT

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In previous communications the life expectancy of patients with cancer of the breast (1), oral cavity (2), and gastro-intestinal tract (3) has been discussed. In the present paper the life expectancy of patients with carcinoma of the genito-urinary tract will be considered. The discussion will include cancer of the vulva, vagina, cervix and fundus uteri, ovary, penis, testicle, prostate, bladder, and kidney. All cases of cancer of these organs admitted to the Collis P. Huntington Memorial and Pondville Hospitals in the years 1912–1933 have been reviewed personally.

It must again be stressed that these hospitals are organized strictly for the care of cancer patients. All those with cancer that apply are admitted for treatment; many of them have only terminal care. Only those cases in which a definite history of the date of onset could not be determined or in which the diagnosis was uncertain have been omitted in the present study. In compiling statistics on age and sex incidence all cases entering the hospitals before Jan. 1, 1936, have been included. The method of calculation of the life expectancy curves was fully described in the first paper (1). No attempt to evaluate the number of five-year survivals has been made, since many of the patients did not receive their initial treatment in these hospitals.

CARCINOMA OF THE VULVA

With the exception of cancer of the fundus of the uterus, carcinoma of the vulva is the least malignant of the malignant tumors of the female genital tract. Of the 135 patients observed in the Huntington and Pondville hospitals, 25 per cent were dead 17 months after onset, 50 per cent in 30 months, and 75 per cent in 65 months. Five years after onset 72 per cent were dead. Two patients (1.4 per cent) were lost, having been traced less than 2 years after onset.

Statistics on carcinoma of the vulva are not numerous because of the rarity of the disease. In fact, all reported series are concerned with 5-year cures. For the sake of comparison we are forced, therefore, to employ such reports, since large enough series of unselected cases are not available in the existing literature. Schreiner and Wehr (4) found 18 per cent of 72 patients living 5 years after treatment, while 11 per cent were free of disease at that time. Taussig (5), among 49 cases, had 22.6 per cent 5-year cures, all obtained by radical surgery. Tausch (6) had 39 patients of whom 19 per cent lived 5 years.

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586
One hundred and sixty-three patients with carcinoma of the vulva entered the hospitals before the year 1936 and are included in the age incidence series. In about a third of the cases the onset of the carcinoma occurred below the age of 58, and in approximately a third between the ages of 61 and 69. The median age of the entire group was 64 years. This is unusually high in comparison with other cancers. Pack and LeFevre (7) found the average age of their group with carcinoma of the vulva was 60 years, "the oldest average age among the tumors of the female genitalia, . . . surpassed by only three other tumors of different regional distributions." Our youngest patient was 28 years of age at onset, and our oldest 88.

Carcinoma of the vagina is the most malignant of the common tumors of the female genital system. The life expectancy is slightly less than that of carcinoma of the cervix. Ninety-five patients were seen in the years 1912–1933. Of these, 25 per cent were dead in 13.5 months, 50 per cent in 24 months, and 75 per cent in 36 months. Five years after onset 82.5 per cent were dead. Six patients were lost (5.5 per cent), having been followed less than one year from onset.

In the age incidence series 109 cases are included. The median age at onset was 56 years, while Pack and LeFevre reported the average age in their
series as 52 years. Our youngest patient was 25 years of age at onset, the oldest 80. Approximately a third of the cases occurred between the ages of 55 and 60 and a quarter of the cases thereafter.

There were available for life expectancy studies 2259 cases of cervical carcinoma. A few cases of adenocarcinoma of the cervix were included; the remainder were of squamous-cell origin. Of the group, 67 were untreated. Sixty-six cases (2.9 per cent) were not traced, having been followed less than two years from onset of the disease.

Untreated Cases: Of the 67 untreated patients 25 per cent were dead in 9 months, 50 per cent in 14 months, and 75 per cent in 21 months after onset of the disease. One patient died 66 months after onset. The median age was 51 years.

The figures compare with a mean (i.e., average) duration of 15.2 months, and a median duration of 6.7 months in 75 cases reported by the British Ministry of Health (8). A much larger series was included in an earlier report from the same source (9), 1749 cases. Of that group 25 per cent were dead in 11 months, 50 per cent in 15.5 months, and 75 per cent in 23 months. The average duration of life was 20.9 months.

The correlation between the curves of untreated carcinoma of the cervix and rectum is so close that they can be nearly superimposed.

Treated Cases: Treated cases numbered 2192. A few had radical operations but nearly all were treated by radium or x-rays or both. Twenty-five
per cent of the patients were dead in 15 months, 50 per cent in 27 months, and 75 per cent 48 months after onset. This indicates that treatment in the median case will prolong life for 13 months.

Five years after onset 17.5 per cent of all patients were alive. The average delay to treatment was 6 months. Five years and 6 months after onset 15.5 per cent were alive.

Many series have been reported that can be compared with this. Healy (11) found that among all cases admitted to the Memorial Hospital
in the years 1918 to 1930 the median length of life was 21 months, though
5 years after onset 22 per cent of the patients were alive. This indicates a
higher absolute curability in his group, possibly due to the larger percentage
of primary cases seen by him. The ratio of primary to secondary cases at
the Memorial Hospital was 4.5 to 1, compared with 1.8 to 1 at Pondville (12).
Keene (13) found a total gross five-year salvage of 15.4 per cent in the
University of Pennsylvania Hospital in 1913–1926. Philipp (14), report-
ing the University of Berlin Hospital cases, found the absolute five-year cure
rate to be 26.5 per cent, among 1778 cases seen from 1913 to 1925.
Voltz (15) reported 1723 cases seen from 1913 to 1926, with a five-year
survival rate of 18.5 per cent. Heyman (16) had 21.3 per cent five-year
cures in 1537 cases observed in the Radiumhemmet.

Age and Life Expectancy: The treated patients have been divided into
three age groups: 412 patients were less than 40 years of age at onset of the
disease; 1451 between 40 and 60; 329 over 60. Reference to Fig. 3 will
show that the median length of life for the youngest group was 18.5 months;
for the ages 40–60, 24 months; and above 60, 30 months. The relation
of life expectancy to age is plotted on logarithmic tables for the sake of con-
venience. The normal life expectancy, calculated from the Massachusetts
Life Tables for 1910 for females at the median age of each of the three groups,
is plotted for comparison. It will be seen that in the youngest age group
three years after onset of carcinoma of the cervix 77 per cent of all patients
are dead. Normally 4 per cent of all women 36 years of age are dead 3
years later. Thus there are 19.3 times as many patients dead with cancer
of the cervix as normally would be dead after that time interval. The
calculations may be carried out in the same manner, and a table constructed
as follows:

<table>
<thead>
<tr>
<th>Age</th>
<th>3 years after onset</th>
<th>5 years after onset</th>
<th>7 years after onset</th>
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<td>19.3</td>
<td>14.0</td>
<td>11.1</td>
</tr>
<tr>
<td>40–60</td>
<td>13.6</td>
<td>10.4</td>
<td>7.5</td>
</tr>
<tr>
<td>Over 60</td>
<td>5.0</td>
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<td>3.2</td>
</tr>
</tbody>
</table>

These figures indicate that carcinoma of the cervix is definitely most malig-
nant in the youngest age group and least malignant in the old. This relation-
ship to age is similar to that of carcinoma of the breast.

Frommolt and Weninger (17), from a study of the cases admitted to the
University of Berlin clinics, concluded that the prognosis of carcinoma of the
cervix in patients under 30 years of age is clearly less favorable than in
older women. Healy states that there are very few five-year cures in
patients less than thirty.

Age Incidence: There are 2780 cases included in the age incidence series.
Approximately a third of the patients were below the age of 45, and about
a third in the following decade. The median age was 49, while in Pack and
LeFevre's series the average age was 48. The youngest patient was 21 years
of age at onset, and the oldest 88.
LIFE EXPECTANCY AND INCIDENCE OF MALIGNANT DISEASE

CARCINOMA OF THE FUNDUS UTERI

There were 203 cases of adenocarcinoma of the fundus of the uterus available for life expectancy studies. Four cases (2.0 per cent) were lost, having been traced less than a year from onset; 25 per cent were dead 24 months after onset; 50 per cent in 40 months; 75 per cent 78 months after onset. Five years after onset 65 per cent were dead. This indicates that cancer of the fundus is the least malignant of the carcinomas of the female genital system. The life expectancy is almost the same as with carcinoma of the breast.

The percentage of cures of carcinoma of the fundus indicated above is lower than is generally reported. This may be due to a higher incidence of inoperable and secondary cases in our series. Masson (18) had 642 treated cases, with 48.6 per cent five-year cures. Smith (19) had 181 cases at the Women's Free Hospital, with 51.3 per cent of the patients alive 5 years, and 34.1 per cent alive 10 years after operation. Of Meigs' 44 cases, from the Massachusetts General Hospital (20), 68.1 per cent were alive 5 years after operation. Heyman had 156 cases at the Radiumhemmet; the absolute curability was 46.6 per cent at 5 years.

Adenoacanthoma of the uterus is a mixed epidermoid and adenocarcinomatous growth. There were 30 cases in which this diagnosis was made. Twenty-five per cent of these patients were dead in 18 months, 50 per cent in 30 months, and 75 per cent in 54 months after onset. Five years after onset 77 per cent of this group were dead. These figures, while not statistically significant because of the small number of cases, indicate that this form of carcinoma has a life expectancy intermediate between that of carcinoma of the cervix and carcinoma of the fundus of the uterus. Meigs reached the same conclusion from his study of the cases in the Massachusetts General Hospital.

Age Incidence: There were 331 cases of adenocarcinoma of the fundus, including the adenoacanthomas. The median age was 61 years, while the average age in Pack and LeFevre's series was 55. About a third of the cases had their onset between the ages of 55 and 63. The youngest patient was 27, and the oldest 82 at onset.

The comparative frequency of carcinoma of the cervix as compared with fundus carcinoma is 8.4 to 1 in our series, a much higher proportion than is found in active operative clinics such as the Women's Free Hospital, where it is 4.46 to 1. Of the cancers of the fundus, 6.6 per cent occurred below the age of 40, while of cancers of the cervix, 19.7 per cent occurred before that age. Of carcinomas of the fundus, 39.6 per cent occurred after the age of 60, while of the cervical cancers, 16.6 per cent occurred after that age. According to our series of cases, cancer of the cervix is 25 times as frequent below the age of 40 as cancer of the fundus, and 3.5 times as common after the age of 60.

CARCINOMA OF THE OVARY

There were 159 cases of carcinoma of the ovary, exclusive of Krukenberg tumors. Three patients were not traced more than a year after onset (1.9
per cent); 25 per cent were dead 14 months after onset, 50 per cent in 22 months, and 75 per cent 45 months after onset. Five years after onset 84 per cent were dead.

As with carcinoma of the fundus the number of five-year survivals is distinctly less than in active operative clinics. Masson had 753 cases, with 48.8 per cent of the patients alive 5 years after operation. Of Norris and Murphy's 153 patients, 53.8 per cent were alive 3 years or more after operation (21). There were 67 cases included in Meigs' report, and 19.4 per cent of his patients were free of disease 5 years after onset.

The comparison of different series of case reports is exceedingly difficult. There is a wide variation between the number of patients alive 5 years after the last treatment and those free of disease at that time. Thus Lynch (22) reports that of his total series of 62 patients 35.5 per cent were alive 5 years after the first treatment but only 11.8 per cent had had no evidence of recurrence for 5 years. In this respect cancer of the ovary is similar to cancer of the breast, since in both instances there are a large number of recurrences between 5 and 10 years after treatment.

Age Incidence: There were 186 cases admitted to the hospitals before the year 1936. The median age was 48 years, compared with an average age of 45 years in Pack and LeFevre's series at the time of onset of the disease. Approximately a third of the cases occurred below the age of 43, and a second third in the next decade. The incidence dropped sharply after the age of 60. The youngest patient was 11 years of age, while 9 were under 25 years of age at onset. All of the patients with carcinoma of the female genital tract below the age of 20 had carcinoma of the ovary.

Carcinoma of the Penis

There were 76 cases of carcinoma of the penis. Twenty-five per cent of the patients were dead 25 months after onset, and 50 per cent in 75 months. Five years after onset 47 per cent were dead, and at 10 years 60 per cent. This seems to be, therefore, the least malignant of all the carcinomas studied. The life expectancy with carcinoma of the penis is quite similar to that of carcinoma of the lip. The percentage of patients alive 5 years after onset is the same in the two groups, while 10 years after onset 27 per cent of the patients with cancer of the lip compared with 40 per cent of those with cancer of the penis are alive. Nine patients (11.8 per cent) were not traced, having been followed less than a year from onset.

From the Mayo Clinic, Bowing and others (23) traced 140 out of 195 patients; of this number 32, or 22.8 per cent, lived 5 years or more. Dean (24) found the average length of life in 33 patients known to have died of cancer to be 3.1 years.

Age Incidence: The median age of the 90 patients who entered the hospitals before 1936 was 58. One third were below the age of 52, about a third from 52 to 65, and the final third older. The youngest was 25 years of age at onset, and the oldest 80. Bowing found that 32.3 per cent of 195 patients were between 50 and 60 at onset. This agrees also with the figures of
Leighton (25). The average age at the first symptom was 50 in Dean's series of 120 cases. Colby and Smith (26), in 50 cases, had an average age of 59, with a third of the patients between 40 and 50. It is interesting to note that the average age of 52 patients with penile cancer in Siam, according to Noble (27), was 49.6 years.

**Carcinoma of the Testicle**

There were 58 cases of carcinoma of the testicle. Twenty-five per cent of the patients were dead in 12 months, 50 per cent in 24 months, and 75 per cent in 69 months after onset. Five years after onset 72.5 per cent were dead. Eight patients (13.8 per cent) were not traced more than a year from onset.

Hinman (27A) collected 100 cases of radical operations for carcinoma of the testicle, and found 17 per cent 5-year cures. Dean (28) had 29 per cent five-year cures in 170 cases. The average length of survival from the first symptom in 114 patients who died of teratoma was 24 months.

Seventy-six patients were available for incidence studies. Of these, 73 per cent had an onset below the age of 40. Smith (29) reports 32 per cent of his series between 20 and 30 and 26 per cent between 30 and 40. The average age in 167 cases collected by Pack and LeFevre was 35, while 74 per cent occurred below the age of 40.

**Carcinoma of the Prostate**

There were 204 cases of cancer of the prostate. Of this number, 165 were treated and 39 were untreated.

**Untreated Cases:** Of the 39 untreated patients, 25 per cent were dead in 8 months, 50 per cent in 12 months, and 75 per cent in 21 months. The last patient in this group died 7 years after onset of symptoms. Four of these 39 cases were occult carcinomas, detected for the first time at autopsy. Rich (30), in a careful study of routine autopsy specimens, found carcinoma of the prostate in 14 per cent of consecutive autopsies on males 50 years of age or over in the Johns Hopkins Hospital. In nearly two-thirds of the cases the tumor was not recognized clinically. The British Ministry of Health found the average duration of life in 30 untreated cancers of the prostate to be 16.6 months after onset of symptoms.

**Treated Cases:** Of the 165 treated patients, 25 per cent were dead in 15 months, 50 per cent in 26 months, and 75 per cent 41 months after onset of symptoms. Five years after onset of symptoms 89 per cent were dead.

Crile (31) reported 336 cases of cancer of the prostate from the Cleveland Clinic. Nine of the patients were living 5 years or more. Ferguson (32) reported 506 cases of cancer of the prostate which he divided into three groups. He stated that the disease is the least malignant in patients over 65 years of age, the survival in untreated cases being 30 months to many years. In patients between the ages of 55 and 60 the prognosis is slightly poorer, the average length of life in the untreated being 18 months. In the group below 55 years of age the average length of life is 6 months. Other factors must be taken into account to determine the individual prognosis.
Our series of cases is not large enough to determine the life expectancies of different age groups.

**Age Incidence:** The median age at onset of 235 cases was 65. The youngest patient was 37 years of age, the oldest 90. Barringer (33) presents the statistics of several large groups of cases, of which 40 to 50 per cent occurred between the ages of 60 and 70, with an approximately equal distribution on either side of that group. The average age in Pack and LeFevre's series of 334 cases was 63 years. Bumpus' (34) average age, for 1000 cases, was 65 years. In Pack and LeFevre's series, two-thirds of all the patients were over 60 years old and the average age was the highest of all tumors included in their study. In our series, 44.3 per cent of the patients were between the ages of 64 and 72 years. The incidence is distinctly lower before and after this interval.

**Carcinoma of the Bladder**

There were 176 cases of cancer of the bladder. Of this group, 148 were treated and 28 untreated. Of the untreated patients, 25 per cent were dead in 7 months, 50 per cent in 14 months, and 75 per cent in 30 months. Five years after onset 90 per cent were dead. The last patient died 8 years after onset of symptoms. The number of cases is too small to warrant statistical conclusions. The series closely resembles, however, one of 33 untreated cases collected by the British Ministry of Health, in which the average duration of life was 18.8 months.

Of the treated patients, 25 per cent were dead 14 months, 50 per cent 27 months, and 75 per cent 42 months after onset. Five years after onset 82 per cent were dead. Smith and Mintz (35) in a series of 150 unselected cases had 11 five-year survivals. They state that the number of 5-year cures varies from 15 to 30 per cent in different clinics. The Bladder Carcinoma Registry of the American Urological Association (36) gives the end-results of 658 cases of carcinoma of the bladder operated on at least 5 years before. The crude survival rate at 5 years was 23 per cent. It must be recognized, however, that this is a selected group of cases.

**Age and Sex Incidence:** There were 202 cases of cancer of the bladder studied for age and sex incidence. The median age was 61; 21.3 per cent of the patients were females. Of the 202 cases, 66.4 per cent occurred between 49 and 69 years of age; 21 per cent occurred after this age period, and the remainder before. The youngest patient was 24 years of age at onset, the oldest 88.

Tumors of the bladder in the Registry of the American Urological Association totalled 902, 76.25 per cent of the patients being males. The peak age was between 60 and 64, which period accounted for 17.37 per cent of the entire group; 61.78 per cent of the patients were between 50 and 69; 56 were below the age of 30, and 10 above the age of 80. The youngest patient was 17. In Pack and LeFevre's series of 453 cases, the average age at onset was 57 years and 77.8 per cent were in males. Gardner (37) collected 1702 cases, in which the average age was 50 years. Smith and Mintz had 91.5 per cent males in their series of 150 cases. Their youngest patient was
Fig. 4.

Fig. 5.
CLAUDE E. WELCH AND IRA T. NATHANSON

35, their oldest 80. Slightly over a third of the patients were between 60 and 69.

Carcinoma of the Kidney

There were 45 cases of carcinoma of the kidney, including hypernephromas. Twenty-five per cent of the patients were dead in 10 months, 50 per cent in 22 months, and 75 per cent in 37 months after onset. Five years after onset 86.5 per cent were dead. Two cases (4.5 per cent) were lost.

Hand and Broders (38) in a study of 193 cases from the Mayo Clinic found the average postoperative life of patients both dead and alive to be 58 months. The average duration of symptoms before operation was 24 months. They believe the life expectancy is less in the young than in the old. Judd and Hand (39) reported a series of 367 cases, all observed from 1901 to 1925 in the Mayo Clinic, many of which are included in the above group. Of this number 283 had nephrectomies and were traced. Seventy-four patients were living 5 years or more after operation. Among 47 cases subjected to exploration and traced, the average length of life was 18.1 months. Judd and Hand are of the opinion that renal-cell cancer runs a more rapid course in women.

Muir and Goldsmith (40) quote Garceau as having found that only 19 per cent of 74 patients with carcinoma of the kidney treated by nephrectomy survived 3 years or more. They state further that Thompson-Walker, summarizing Garceau's findings, placed the average duration of life after the first symptom at 3.5 years. Even with operative treatment only 7 to 10 per cent live to the end of the fourth year.

Age Incidence: Among the 59 cases observed before 1936, the median age was 54. Seven patients, or 11.8 per cent, were females, which is definitely below the percentage reported in larger groups. Judd and Hand had an average age of 51.76 years, and 31.8 per cent of their group were females. Of Pack and LeFevre's 50 cases of hypernephroma two-thirds were in males, and the period of highest incidence was between 52 and 57. In our series, 30.6 per cent of the cases occurred between 52 and 57.

Conclusions

1. The median length of life in untreated carcinoma of the cervix is 14 months, of the bladder 14 months, and of the prostate 12 months.

2. The median length of life in all treated carcinomas of the vulva is 30 months, vagina 24 months, cervix 27 months, fundus of the uterus 40 months, and ovary 22 months.

3. The life expectancy of young patients with carcinoma of the cervix is less than that of older groups.

4. Adenoacanthoma appears to be intermediate in malignancy between cancer of the cervix and of the fundus of the uterus.

5. The median length of life in treated carcinoma of the penis is 75 months, of the testicle 24 months, prostate 26 months, bladder 27 months, and of the kidney 22 months.

6. Sex and age incidence are discussed.
Bibliography

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