CARCINOMA OF THE URINARY BLADDER

AN EVALUATION OF SURGERY AND IRRADIATION IN THE TREATMENT OF THIS DISEASE

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Carcinoma of the urinary bladder demands in its treatment not only the skill and judgment of the surgeon, but also a thorough knowledge of its pathology and the characteristics of its response to radium and roentgen therapy. With the establishment of clinics for the study and treatment of carcinoma, and registries for the tabulation of results, excellent statistical analyses will be forthcoming to serve the physician in his choice of treatment for the individual patient.

A group of 60 unselected patients treated at the Hospital of the University of Pennsylvania between 1924 and 1931 is the subject of this report. Only those patients with a microscopic diagnosis of carcinoma are included; this necessitated the exclusion of 75 case histories in which histological corroboration of the diagnosis was lacking. Of the 60 patients, 9 were untraced after leaving the Hospital. These are included in the report and are considered as having died in less than one year.

General Summary of Treatment of Sixty Patients

1. Surgery and roentgen therapy combined ....................... 27 patients
2. Surgery and radium therapy combined .......................... 5 patients
3. Surgery alone .................................................. 15 patients
4. Inoperable: roentgen therapy only .............................. 8 patients
5. Untreated: end stages of the disease ........................... 5 patients

Since the group of 60 patients is too small for individual deductions, we have confined our interest to the general results in cases treated by surgical methods only, and in those managed by a combination of surgery and preoperative and postoperative roentgen therapy. Several interesting observations were made. One of the most striking concerns the comparatively poor results, computed on a statistical basis, with surgery alone in comparison to the better life expectancy when surgery was combined with irradiation.

The classification of therapy adopted is in accordance with that employed by the Carcinoma Registry of the American Urological Association. There is, however, one additional form of technic which has been used in this clinic over a period of years, namely, diathermy, which was originally described by Corbus. This procedure involves the usual suprapubic opening of the bladder and excision of the tumor. A flat electrode is next applied to the denuded area and to the normal surrounding tissue for a distance of 3 cm. This procedure is applicable to both sessile and pedunculated growths.

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The group of patients is too small and the data are too inadequate to permit relating the end-results to the amount of external radiation given each patient. The greatest amount of radiation given was seven series with a total of 8200 r to each of two or three portals over a period of one and one-half years. This patient had an extensive and inoperable grade III carcinoma and was alive and well four years after the diagnosis had been made. Another patient with inoperable disease, also alive and well four years after the diagnosis had been made, received three series with a total of 5000 r to each of four portals. On the other hand, one patient with an extensive and inoperable adenocarcinoma was alive and well ten years after the diagnosis had been made, having received only two series with a total of 1600 r to each of two portals.

Summary of Surgical Procedures Used in the Treatment of 15 Patients

1. Complete cystectomy with ureteral-intestinal anastomosis ..................... 2 patients
2. Resection of the bladder wall ................................................... 3 patients
3. Suprapubic cystotomy, excision of the tumor, and application of diathermy as described above ......................................................... 8 patients
4. Cystoscopic fulguration ................................................................. 2 patients

Summary of 27 Cases Treated by Combined Surgical and Roentgen Therapy

1. Resection of the bladder wall and external irradiation ............................ 6 patients
2. Suprapubic cystotomy, excision of the tumor and the application of diathermy. External irradiation ......................................................... 15 patients
3. Cystoscopic fulguration and external irradiation .................................... 2 patients
4. Treated surgically at other hospitals and referred to the University Clinic for roentgen therapy ............................................................ 4 patients

We feel, however, that in general the life expectancy of these patients bears a direct relationship to the amount of external radiation received. We believe, also, that the amount of radiation which has been given in the past has been too small. The total average amount of 2400 r, spread over an average of 2.5 series, is well below the level of skin tolerance. Again, in the light of recent biological research and clinical experience, the saturation principle of Kingery and Pfahler, which was used in the treatment of this group of patients, may not be the optimal principle in external irradiation. We are planning, therefore, to alter our technic and increase our dose to each portal with a view to increasing the total dose to the tumor zone well above that which has been used in this group.

All of the patients included in this report were treated by methods which employed approximately the same physical factors. A mechanically rectified circuit was used in the treatment of the earlier patients, while a constant potential, valve tube rectified circuit was used in those treated later. The peak kilovoltage of the former was 200, while the latter operated at 160 kilovolts constant potential. The current varied from 4 to 15 ma. (in the more recent cases). The filter generally employed was 0.5 mm. copper and 2.0 mm. aluminum; 2.0 mm. copper was occasionally used. With this later technic (160 kv. constant potential, 15 ma. filament current, 0.5 mm. copper and 2.0 mm. aluminum filter, 50 cm. target skin distance), the effective wavelength was 0.17 Angström units, the half-value a layer of 0.88 mm. copper, and the output 45 r per minute. All of the intensity and dose measurements are as measured in air. The average size of the field was $17 \times 17$ cm.
These patients were generally treated through three portals: one anterior and two posterior, cross-firing on the bladder. The treatments were given in accordance with the saturation principle of Kingery and Pfahler and each series lasted about three weeks. The average dose to each field was 1000 \( r \). Each patient had about two and one-half series of treatments, the second series being given in from six to eight weeks after the first or as symptoms and cystoscopic findings indicated. The average total dose to each field for the full two and one-half series of treatments was 2400 \( r \).

**Figure 1**

A. Five-year survivals by groups.
B. Comparison of five-year survivals in the group in which surgery alone was employed with the five-year survivals in the group in which combined surgery and irradiation were employed, this latter group representing 100 per cent in all periods.

**Statistical Comparison of Surgery and Combined Surgery and Irradiation**

The survival curve for the entire group of 60 patients with carcinoma of the bladder was computed from the case and follow-up records and represents the number of patients alive, whether or not there was disease present, at the end of one, three, and five years. Patients not followed were considered dead at the time of the last follow-up note. In Fig. 1, A, this curve is represented by the solid line. Similar curves, represented by dotted and broken lines, show the survivals in the group of 15 patients treated by surgery alone.
and the group of 27 patients treated by combined surgery and irradiation. The data upon which the curves are based are presented in Table I.

**Table I: Group Survival**

<table>
<thead>
<tr>
<th>Survival period</th>
<th>Group A Entire group</th>
<th>Group B Surgery only</th>
<th>Group C Combined surgery and irradiation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>60 (100%)</td>
<td>15 (100%)</td>
<td>27 (100%)</td>
</tr>
<tr>
<td>One year</td>
<td>32 (53%)</td>
<td>7 (47%)</td>
<td>21 (78%)</td>
</tr>
<tr>
<td>Three years</td>
<td>16 (27%)</td>
<td>3 (20%)</td>
<td>11 (41%)</td>
</tr>
<tr>
<td>Five years</td>
<td>9 (15%)</td>
<td>1 (7%)</td>
<td>6 (22%)</td>
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</table>

The comparison of the group survival when surgery alone was employed with the group survival when surgery and irradiation were combined is made in Fig. 1, B. Here the survival by periods of the latter group is considered as 100 per cent in all periods and the survival by periods of the former group is computed on a percentage basis. For example, consider the one-year survivals in groups B and C (Table I). Let 78 per cent in group C represent 100 per cent. Then the ratio of 47 per cent in group B to 78 per cent in group C = \( \frac{x}{100} \), and \( x = 60 \) per cent. Three such determinations were made, giving 60 per cent for one-year survival, 49 per cent for three-year survival, and 32 per cent for five-year survival. The curve in Fig. 1, B, was drawn from these points.

The difference in group survival between patients treated by surgery alone and those treated by combined surgery and irradiation is great and, we believe, significant. The ratio of survivals in the former group to survivals in the latter group diminishes continuously over the period studied and at the end of five years is only 32:100.

**Conclusions**

One fact of outstanding interest in the analysis of these cases of bladder carcinoma is the marked difference between the survivals in the group of patients treated by surgery alone and the survivals in the group of patients treated by combined surgery and external roentgen irradiation. We believe that this difference is explainable on no other basis than the difference in the treatment of these two groups.

From the study of these patients we reach the following conclusions regarding the future management of cases of carcinoma of the bladder.

1. Cystoscopy should be correlated with pneumocystography or contrast cystography.
2. A biopsy specimen should be obtained if possible.
3. All patients in whom a diagnosis of carcinoma of the bladder has been made should first have a course of irradiation.
4. After a sufficient time interval has elapsed to allow the normal tissues to recover from the radiation effects, but before the neoplasm has resumed active growth, radical surgery should be employed. This time interval is about six weeks. We believe that in cases in which the lesion is anything
more than a small pedunculated carcinoma nothing short of an open operation can be adequate. If facilities are available, radon seeds, gold filtered and of small radon content, should be implanted.

5. The course of external roentgen irradiation should be repeated after convalescence.

6. External irradiation, in patients who are inoperable, frequently proves of great palliative value in controlling bladder distress and hemorrhage.

7. An efficient follow-up system is indispensable.

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