Surgery for Irradiation Damage to the Digestive Tract.

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SUMMARY: The surgical outcome of radiation injury to the gut was evaluated on the basis of clinical experience. The main affected gut was the rectum in frequency. In most cases, colostomy was selected and the affected gut was left as it was. Some suffered from bleeding episode and 4 had carcinoma arising from radiation injury.

In conclusion, early resection of affected guts associated with clinical symptoms is recommended as the treatment of radiation-injured gut.

INTRODUCTION

It is accepted that radiation therapy may produce some degrees of the intestinal injury which has been classified into two categories, acute and late complications. The former consists of congestion, thickness and bleeding diathesis of the intestinal mucosa and the latter comprises of massive bleeding, ulceration, stenosis and fistula formation. The aim of this study is to clarify the incidence of radiation injury to the gut and the necessity of surgical treatment on the basis of our clinical experience with radiation injury to the gut.

MATERIALS AND METHODS

During the past 30 years from 1959 to 1988, thirty-seven patients complained of some trouble associated with previous radiation therapy. Eight out of 37 had fistula, formation, that is, rectovaginal fistula in 4, rectovesical fistula in 1, rectovesicovaginal fistula in 2 and vesico-vaginal fistula in 1 respectively as shown in Table 1. The locations of the gut which was affected by radiation were the rectum in 25, the rectosigmoid colon in 5, the sigmoid colon in 2, sigmoid colon + transverse colon + ileum in 1, the ileocecum in 2 and the small intestine in 2. Most frequently affected site was the rectum. Table 2 shows the primary

<table>
<thead>
<tr>
<th>affected location</th>
<th>fistula formation</th>
</tr>
</thead>
<tbody>
<tr>
<td>rectum</td>
<td>25 rectovaginal 4</td>
</tr>
<tr>
<td>rectum, sigmoid colon</td>
<td>5 rectovesical 1</td>
</tr>
<tr>
<td>sigmoid colon</td>
<td>2 rectovesicovaginal 2</td>
</tr>
<tr>
<td>sigmoid colon + transverse colon + ileum</td>
<td>1</td>
</tr>
<tr>
<td>ileocecum</td>
<td>1</td>
</tr>
<tr>
<td>small intestine</td>
<td>2</td>
</tr>
</tbody>
</table>

Total 37 8

Table 1. Affected location and lesions of the gut by irradiation

<table>
<thead>
<tr>
<th>Primary disease</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carcioma of the uterus</td>
<td>32</td>
</tr>
<tr>
<td>Operated</td>
<td>13</td>
</tr>
<tr>
<td>Non-operated</td>
<td>19</td>
</tr>
<tr>
<td>Ovarial tumor</td>
<td>2</td>
</tr>
<tr>
<td>Vaginal cancer</td>
<td>1</td>
</tr>
<tr>
<td>Retroperitoneal tumor</td>
<td>1</td>
</tr>
<tr>
<td>Testicular tumor</td>
<td>1</td>
</tr>
</tbody>
</table>

Total 32

Table 2. Primary diseases required irradiation
disease which required radiation. The main
disease was uterine carcinoma, including the
cases of proposed surgery in 13 out of 32. Table
3 shows the cases who required surgery and the
methods of operation. The surgery was mainly
carried out to relieve the symptoms related to
radiation injury to the lesion of the rectosigmoid
region. On the other hand, the operation
methods to eradicate the lesions were selected
for the small intestine in 4 but one.

The main symptoms required surgery were
bleeding, bowel obstruction, fistula formation
and transformation to malignancy as shown in
Table 4. The duration from the time of radiation
to operation ranged from 4 months to 13 years,
indicating a wide range of distribution. The
symptom of bleeding occurred in an early stage
within one year after initiation of radiation or
at least within 5 years and also transformation
to malignancy associated with radiation-
induced lesions appeared with the elapsed time
of more than 10 years. The complaints of bowel
obstruction and fistula formation were seen
throughout the period.

The degrees of radiation injury to the gut
were classified into the four categories as
reported by Sherman. The candidates of
surgery for the lesions in the rectosigmoid colon
included the patients who corresponded to
Sherman classification II to IV as shown in
Table 5. Most underwent colostomy without a
resection of the site affected by radiation.

Six out of 32 patients had resection of the sites
affected by radiation. However, two underwent
resection of the affected rectosigmoid colons
following preceeding colostomy. In this series,
affected rectosigmoid colons made the removal
difficult. The more severe the degree of
radiation injury to the rectosigmoid colons, the
lower resectability for the lesions was achieved.

The Surgical outcome was fair except for
bleeding episodes which occurred in a few cases.

Table 6 showed 4 cases with carcinoma
induced by radiation. All received over 45 Gy
dosage of irradiation except one in whom the
radiation dosage was uncertain. The time
interval from termination of radiation to
detection of carcinoma ranged from 11 to 23
years. The main complaints were bloody stool
with defecation trouble. These lesions were

resected and histologically confirmed as
carcinomas with special patterns of histologic
finding influenced by radiation which was
characterised with vasculitis and fibrosis in the
submucosal layer originated in the radiation
field.

**DISCUSSION**

It is well known that irradiation in the
abdomen causes the intestinal injury. The
frequency is reported as being 2 to 7 percent.
As reported by Friedman, it is accepted that
tolerable radiation dosage of normal tissues is
42 Gy for the small intestine, 45 Gy for the
transverse colon and 80 Gy for the rectum

<table>
<thead>
<tr>
<th>Sherman classification</th>
<th>Operation method</th>
</tr>
</thead>
<tbody>
<tr>
<td>I 0</td>
<td>Colostomy 0</td>
</tr>
<tr>
<td>II 16</td>
<td>Miles op 11</td>
</tr>
<tr>
<td>III 8</td>
<td>lysis of adhesion 6</td>
</tr>
<tr>
<td>IV 6</td>
<td>( ): Colostomy and Miles by II stage op.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Causes</th>
<th>1y</th>
<th>5yrs</th>
<th>10yrs</th>
<th>&lt;10</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>bleeding</td>
<td>7</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>14</td>
</tr>
<tr>
<td>obstruction</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>12</td>
</tr>
<tr>
<td>fistula</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>malignant disease</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>12</td>
<td>11</td>
<td>5</td>
<td>11</td>
<td>39</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Operation method</th>
<th>rectum sigmoid</th>
<th>colon lesions</th>
<th>small intestine lesions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colostomy</td>
<td>27</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Miles's op.</td>
<td>6</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Reuse of adhesion</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Gut resection</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Bypass op.</td>
<td>0</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Gut resection+colostomy</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>34</td>
<td>5</td>
<td>0</td>
</tr>
</tbody>
</table>
respectively. It is believed that the rectum has a high tissue tolerance for radiation. Nevertheless, we are confronted with a high frequency of damage of radiation to the rectum as indicated in this series. Radiation injury is composed of acute and chronic injuries. Requirement of surgery is mainly made for the relief of complaints caused by chronic damage to the gut.

Colostomy as the operation method is generally performed to alleviate complaints. The surgical outcome is not necessarily satisfactory because organic damage to the gut is progressed, and no longer regressed, some are suffering from continuous or intermittent bleeding episode. If a resection of the affected gut is attempted to exclude such a late complication, surgical stress of a resection of the affected gut will become grave in combination with alternation of the urinary tract and pelvic exenteration.

There were some other reports regarding carcinoma associated with radiation injury. High frequency of radiation-induced carcinoma following irradiation for uterine cancer was reported. In this series, 4 carcinomas were originated from previous irradiation. The criteria of radiation-induced carcinoma is that 1) cancer occurs in the field of previous irradiation 2) the tumor-burden colons has irradiation damage and histologic injury 3) the time interval appearing carcinoma should be more than 10 years. All four patients fulfilled these criteria. Therefore, it is accepted that early resection is the best treatment for the affected rectum to prevent late bleeding and occurrence of carcinoma from the affected guts as far as no local and distant metastasis as well as not widely extending lesion may exist with the underlying premise of preservation of the natural anus.

As a surgical method, anterior resection could not be recommended because of wider field of irradiation. In general, the operation method of pull-through is preferred as reported by Deans. At surgery histologic examination by frozen sections is necessary to determine the extent of resection except in the patients with preoperatively anal hypofunction due to anal diseases.

REFERENCES