ASSESSMENT OF CHEMO-RADIOThERAPY FOR CARCINOMA OF THE MAXILLARY SINUS

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Abstract The local control rates in 112 patients with squamous cell carcinoma of the maxillary sinus, initially treated at Kyushu University from 1976 to 1991 using radiotherapy alone, FAR-therapy (radiation with 5FU and Vitamin-A) or BUdR-FAR-therapy (BUdR followed by FAR-therapy), were retrospectively analyzed from pathological and clinical standpoints, to ascertain their respective effectiveness. The local control rates of T2 patients treated using radiotherapy alone, FAR-therapy and BUdR-FAR-therapy were 5%, 3% and 20% at Time-Dose-Factor (TDF) 30, 30%, 65% and 74% at TDF 50, and 80%, 99% and 97% at TDF 80, respectively. The local control rates of T3 patients were 1%, 1% and 0% at TDF 30, 18%, 46% and 22% at TDF 50, and 62%, 98% and 90% at TDF 80, respectively. Those of T4 patients were 0%, 0% and 0% at TDF 30, 7%, 13% and 9% at TDF 50, and 36%, 72% and 60% at TDF 80, respectively. The local control rates achieved by chemo-radiotherapy (FAR-therapy and BUdR-FAR-therapy) were higher than those achieved using radiotherapy alone, although the difference was small.

Key Words: Maxillary Sinus Cancer, Radiotherapy, Chemo-radiotherapy

INTRODUCTION

Local control of maxillary sinus cancer is difficult primarily because in most such patients the disease is already in an advanced stage when we get our first opportunity to treat them. The main reason for poor treatment results is failure of local control.

Currently, many investigators in Japan have adopted combined trimodal therapy consisting of surgery, radiotherapy, and intra-arterial regional chemotherapy intended to improve local control rates, although some investigators have questioned the benefit of chemotherapy, including the intra-arterial infusion of anti-cancer drugs.

The purpose of the present study was to evaluate the effectiveness of combined anti-cancer drugs in a chemo-radiotherapy protocol. Following review of our patients’ clinical and pathological results after biopsy or surgery, the radiation dose-response curves of the radiation only group, the FAR-therapy group or the BUdR-FAR-therapy group were evaluated.

PATIENTS, TREATMENT METHODS AND ANALYTICAL METHOD

Patients

From April, 1976 to March, 1991, 112 patients with previously diagnosed but untreated squamous cell carcinoma of the maxillary sinus were initially treated using radiotherapy alone (14 cases), FAR-therapy (61), or BUdR-FAR-
therapy (37) in the Department of Radiology, Kyushu University. These patients' data were analyzed retrospectively.

Selection of the treatment method was not based on histo-pathological findings or tumor extension, but rather on performance status, liver or renal function and availability of the anti-cancer drug BUdR.

All patients were re-staged according to the 1987 UICC T classification. Among 14 patients in the radiation alone group, there were 4 T2, 6 T3 and 4 T4 cases. Among the 61 patients of the FAR-therapy group, there were 11 T2, 25 T3 and 25 T4 cases. Among the 37 patients in the BUdR-FAR-therapy group, there were 1 T1, 5 T2, 22 T3 and 9 T4 cases (Table 1).

Treatment Methods

(1) Radiation

All patients were treated using 60Co-γ rays or linear accelerator 4 MV-X rays, with the use of anterior and lateral portals 5×5~8×8cm2, using a pair of wedge filters. Radiation was administered once daily 5 times per week. The daily dose at the centers of the irradiated volumes was 2 Gy, with for radiotherapy treatment alone, or 1.5-2 Gy for chemo-radiotherapy. The total preoperative radiation dose ranged from 4 to 40 Gy, with most of the patients receiving 20-30 Gy.

Fourteen patients who had poor performance status and/or had liver or renal dysfunction were treated with radiotherapy alone.

If some of the tumor remained after surgery, 20-30 Gy/2-4 Weeks(W) postoperative external radiation was administered, using eye-protection-portsals where possible.

Alternatively, intracavitary radiation using a 137Cs tube was added to the protocol.

(2) FAR-therapy

Vitamin-A, 50,000 units, i.m. were administered before administering 5FU 125-250 mg, mostly intra-arterially or intravenously.

From 1976 to 1982, patients without a good performance status were administered FAR-therapy. Between 1983 and 1991, patients who had a good performance status and did not have liver or renal dysfunction were treated with FAR-therapy.

(3) BUdR-FAR-therapy

BUdR 3,500 mg were administered intra-arterially during 7 days before FAR therapy.

Between 1976 and 1982, patients with good performance status but without liver or renal failure received BUdR-FAR-therapy.

(4) Surgery

Prior to radiotherapy all patients underwent exploratory maxillary antrostomy and catherization via the superficial temporal artery. During radiotherapy, cleansing of the maxillary antrum was performed daily. Salvage operations, consisting of partial or total maxillectomies were performed 2-3 weeks after administering 20-30 Gy radiation during 2 to 4 weeks in most patients.

Statistical Analysis Methods

Local control was defined as pathological or clinical evidence of resolusion of a tumor which had persisted for more than two years. No patients died from other diseases less than 2 years after the beginnings of their treatments. Local control rates were calculated using the double integration method for each radiation

<table>
<thead>
<tr>
<th>Treatment method</th>
<th>T-classification</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T1</td>
</tr>
<tr>
<td>Radiotherapy alone</td>
<td>4</td>
</tr>
<tr>
<td>FAR-therapy</td>
<td>11</td>
</tr>
<tr>
<td>BUdR-FAR-therapy</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>1</td>
</tr>
</tbody>
</table>

FAR-therapy: Radiotherapy with 5FU and Vitamin-A
BUdR-FAR-therapy: FAR-therapy with BUdR
dose of TDF, for each T-stage in each treatment method. It was assumed that any patient whose cancer was not cured pathologically or clinically at TDF 50 would likewise not have been cured if treated at a lower dose; and it was further assumed that any patient whose cancer was cured at TDF 60 would likewise have been cured if treated using a higher dose.

The sigmoid curves of the local control rates were made by probit analysis, except for T2 for the radiotherapy alone group. Since there were few patients, the curve for this group was drawn free-hand.

The patients who underwent postoperative intracavitary radiation were excluded from further analysis of the control rates according to the radiation doses.

The difference in the local control rates at each radiation dose were tested using $\chi^2$ tests. $P<0.05$ was considered significant, and $0.05<p<0.1$ was considered a trend.

**RESULTS**

Figures 1-3 show the relationships between the local control rates and radiation doses according to...
the treatment methods used and the 1987 UICC T-classification.

1) Local control rates of T2 cancer

The local control rate at a dose of TDF 30 in T2 patients who received radiotherapy alone, FAR-therapy and BUdR-FAR-therapy was about 5%, 3 (95% confidence limits 0-24)%, and 20 (0-70)%, respectively. At TDF 50, the rate was about 30%, 65 (50-84)%, and 74 (47-92)%, respectively, and at TDF 80 was about 80%, 99 (92-100)% and 97 (81-100)%, respectively.

2) Local control rates of T3 cancer

At TDF 30, the rate was 1 (0-17)%, 1 (0-5)%, and 0 (0-2)%, respectively. At TDF 50, the rates were 18 (6-38)%, 46 (33-60)%, and 22 (13-35)%, respectively, and at TDF 80, were 62 (41-79)%, 98 (91-100)% and 90 (75-96)%, respectively.

Fig. 2 Local Control Rate for T3 Carcinoma of the Maxillary Sinus.

a: Radiotherapy alone.
b: FAR-therapy.
c: BUdR-FAR-therapy.

Each point was calculated by double integration, and the sigmoid curve was drawn from results calculated by probit analysis in this and the following figures.
3) Local control rates of T4 cancer
At TDF 30, the rates were 0(0-11)%, 0(0-1)% and 0(0-2)%, respectively. At TDF 50, the rates were 7(1-23)%, 13(8-22)% and 9(3-19)%, respectively, and at TDF 80, 36(17-62)%, 72(58-84)% and 60(40-77)%, respectively.

4) Differences in local control rates
The differences in local control rates at each radiation dose for FAR-therapy and BUdR-FAR-therapy were not statistically significant. In T2 cancer patients, the local control rate achieved by chemo-radiotherapy (FAR-therapy + BUdR-FAR-therapy) was higher than that achieved using radiotherapy alone, with a statistical trend at a radiation dose of TDF 30. In T3 cancer patients at TDF 80, there was a statistically significant difference between the local control rate by radiotherapy alone and chemo-radiotherapy ($\chi^2 = 5.92$, d.f. = 1, p = 0.015).

Fig. 3 Local Control Rate for T4 Carcinoma of the Maxillary Sinus.

a: Radiation alone.
b: FAR-therapy.
c: BUdR-FAR-therapy.


DISCUSSION

1. Local Control Rate of Radiotherapy Alone

Table 2 summarizes each investigator's data for treatment of maxillary sinus cancer using radiotherapy alone.

Table 2-1. Local Control Rate by Radiotherapy Alone

<table>
<thead>
<tr>
<th>T-classification</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kurohara(^{(4)}) (1972)</td>
<td>20% (n=15)</td>
<td>3% (n=29)</td>
<td>56% (n=9)</td>
<td></td>
</tr>
<tr>
<td>TDF 66</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>TDF 66-99</td>
<td>38% (n=13)</td>
<td>10% (n=44)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TDF 99-</td>
<td></td>
<td>18% (n=27)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Sisson's stage

Radiation alone n=63

Radiation + Antrostomy n=74

Kubo\(^{(6)}\) (1990)

1987 UICC

1987-1971

TDF 115-132

1972-1983

TDF 82

26% (n=51) (5Y)

Kubo\(^{(6)}\) (1990) studied 1987-UICC stage\(^{(1)}\) T2 patients and

1987 UICC

TDF 60-79

21% (5Y)

TDF 80-89

28% (5Y)

TDF 100-119

17% (5Y)

TDF 120- |

18% (5Y)

Logue\(^{(7)}\) (1991)

1987 UICC

1/2

73% (16/22)

Antrum n=37

Interminate n=79

1987 UICC

Ethmoid n=12

his own stage

41% (15/37)

29% (18/67)

Ahmad\(^{(8)}\) (1981)

his own stage

TDF 100-

37.5% (6/13)

32.1% (9/28)

Invase Sq. c.c. n=55

Undiff. Sq. c.c. n=4

Horiuchi\(^{(9)}\) (1981)

mainly Sq. c.c.

partially anaplastic

50-65Gy/3-4W

44% (19/43) (3Y)

60-70Gy/5-6W

11% (3/27) (3Y)

Amendola\(^{(10)}\) (1981)

1978 AJC

TDF 60-70Gy/30-35F

66%

T2 n=2

/6-7W (TDF99-115)

T4 n=18

Fric\(^{(12)}\) (1982)

2 patients

added ICRT

TDF 99

2/5

TDF 105

1/5

TDF 115

4/5

TDF 120- |

1/3

1978 AJC
showed a 5-year local control rate of 26%. Logue (1991)\(^7\) reported the local control rate to be 1/2 in the 1987-UICC stage\(^7\) or his own stage\(^7\) T1 and 16/22 (73%) in T2.

Our results were nearly the same as those of the above-mentioned author's data, although their T-classification was different.

### Table 2-2. Local Control Rate by Radiotherapy Alone

<table>
<thead>
<tr>
<th>T-classification</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sakai(^5) (1991) TDF 83</td>
<td>16 ± 7% (5Y)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1987 UICC</td>
<td>T1-2N0M0 n=8</td>
<td>T2N0M0 n=14</td>
<td>T4N0M0 n=14</td>
<td></td>
</tr>
<tr>
<td></td>
<td>T1-3M0-1 n=6</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Sq. c. c. n=37</td>
<td>Anaplastic Ca. n=12</td>
<td>Adenoca. n=2</td>
<td>Mucoepidermoid n=1</td>
</tr>
<tr>
<td>Neal(^4) (1992) TDF 93-</td>
<td>47% (2Y)</td>
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<td></td>
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<tr>
<td></td>
<td>Epithelial malignant n=38</td>
<td></td>
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<tr>
<td>MacNab(^1) (1992)</td>
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<tr>
<td>TDF 99-108</td>
<td>n=44</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>TDF 82-89</td>
<td>34%</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>-TDF 82</td>
<td>22</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1987 UICC</td>
<td>T1, T2 7%</td>
<td>T3 35%</td>
<td>T4 58%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sq. c. c. 47%</td>
<td>Adenoca. 15%</td>
<td>Undiff. 11%</td>
<td>Transitional 8%</td>
</tr>
<tr>
<td></td>
<td>Melanoma 4%</td>
<td>Other 15%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jingu (1994)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TDF 30</td>
<td>5% (2Y) 1% (2Y) 0% (2Y)</td>
<td>T2 n=4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TDF 50</td>
<td>30% (2Y) 18% (2Y) 7% (2Y)</td>
<td>T3 n=6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TDF 80</td>
<td>80% (2Y) 62% (2Y) 36% (2Y)</td>
<td>T4 n=4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

showed the local control rate to be 37.5% for his own stage T3 and 32.1% for T4. Horiiuchi (1981) determined the 3-year local non-relapse rate to be 44% at 50-65 Gy/3-4 W (TDF 109-140), and 11% at 60-70 Gy/5-6 W (TDF 99-126), respectively. Although he did not classify patients by T-stage, most of his patients were probably T2 or greater. Amendola (1981) studied 2 1978-AJC stage T2 and 18 T4 patients, and found the cause-specific local control rate to be 66%. Frich (1982) examined the local control rate for 1978-AJC stage T3 and T4 patients, and reported it to be 2/5 at 60 Gy (TDF 99), 1/5 at 65 Gy (TDF 105), 4/5 at 70 Gy (TDF 115) and 1/3 at more than 75 Gy (TDF 120), respectively. Kubo (1990) examined the 5-year local control rate for 51 1987-UICC stage T2 and 85 T3 patients, and found it to be 21% at TDF60-79, 28% at TDF 80-89, 17% at TDF 100-119 and 18% at more than TDF 120, respectively. Kubo (1990) examined the 5-year local control rate for 51 1987-UICC stage T2 and 85 T3 patients, and found it to be 21% at TDF60-79, 28% at TDF 80-89, 17% at TDF 100-119 and 18% at more than TDF 120, respectively. Kubo (1990) examined the 5-year local control rate for 51 1987-UICC stage T2 and 85 T3 patients, and found it to be 21% at TDF60-79, 28% at TDF 80-89, 17% at TDF 100-119 and 18% at more than TDF 120, respectively. Kubo (1990) examined the 5-year local control rate for 51 1987-UICC stage T2 and 85 T3 patients, and found it to be 21% at TDF60-79, 28% at TDF 80-89, 17% at TDF 100-119 and 18% at more than TDF 120, respectively. Kubo (1990) examined the 5-year local control rate for 51 1987-UICC stage T2 and 85 T3 patients, and found it to be 21% at TDF60-79, 28% at TDF 80-89, 17% at TDF 100-119 and 18% at more than TDF 120, respectively. Kubo (1990) examined the 5-year local control rate for 51 1987-UICC stage T2 and 85 T3 patients, and found it to be 21% at TDF60-79, 28% at TDF 80-89, 17% at TDF 100-119 and 18% at more than TDF 120, respectively. Kubo (1990) examined the 5-year local control rate for 51 1987-UICC stage T2 and 85 T3 patients, and found it to be 21% at TDF60-79, 28% at TDF 80-89, 17% at TDF 100-119 and 18% at more than TDF 120, respectively. Kubo (1990) examined the 5-year local control rate for 51 1987-UICC stage T2 and 85 T3 patients, and found it to be 21% at TDF60-79, 28% at TDF 80-89, 17% at TDF 100-119 and 18% at more than TDF 120, respectively.

Our results demonstrated a higher local control rate at a smaller dose than the above-mentioned authors’ data, although the T-classification was different.

2. Local control rate by chemo-radiotherapy

Table 3 summarizes chemo-radiotherapy data.

(1) Stage T2

Kubo (1990) examined the 5-year local control rate in the 1987-UICC stage T2 patients who received radiotherapy with combined 5FU i.a. infusion, and determined it to be 35% at TDF 60-79, 37% at TDF 80-89, 48% at TDF 100-119 and 58% at doses more than TDF 120. She concluded that radiotherapy combined with 5FU infusions tended to cure with smaller radiation doses than did radiotherapy alone.

In the present study, the local control rate of BUdR-FAR-therapy was higher than that of FAR-therapy, although the difference was not statistically significant. However, at TDF 30, the local control rate of chemo-radiotherapy (FAR-therapy + BUdR-FAR-therapy) was higher than that of radiotherapy alone, with a statistical trend. These results were similar to those observed by Kubo.

(2) Stages T3 and T4

Goepfert (1973) reviewed Sissons stage T3 and T4 patients who received radiotherapy and i.a. infusions of an anti-cancer agent, and showed that the 2-year local control rate was 48%. Horiiuchi (1981) determined the local control rate to be 42% at 3 years in patients who received radiotherapy and i.a. infusions, although he did not mention their T classification. Sakai (1983) observed a 40.3% local recurrence rate in patients who received radiotherapy and 46% among those who received i.a. infusions. Also, Sakai (1991) studied patients who received radiation and i.a. infusions without the extensive Denker's operation, and reported a 5-year cumulative local control rate of 33%. This rate was higher than the 16% achieved in his series using radiotherapy alone.

In the present study, the local control rate for T3 patients who received FAR-therapy was higher than that of those who received BUdR-FAR-therapy, although the difference was not statistically significant. However, at TDF 80 the local control rate of chemo-radiotherapy was higher than that of radiotherapy alone, with a statistically significant difference. The local control rate of T4 patients who received FAR-therapy was higher than that of those who received BUdR-FAR-therapy, although there was no statistically significant difference. Furthermore, there was no significant difference in
### Table 3. Local Control Rate by Chemo-radiotherapy

<table>
<thead>
<tr>
<th>T-classification</th>
<th>T1</th>
<th>T2</th>
<th>T3</th>
<th>T4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kubo (^{6,1}(1990))</td>
<td></td>
<td></td>
<td></td>
<td>1987 UICC T2, T3</td>
</tr>
<tr>
<td>TDF 60-79</td>
<td></td>
<td>35% (5Y)</td>
<td></td>
<td>n=133</td>
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<tr>
<td>TDF 80-89</td>
<td></td>
<td>37% (5Y)</td>
<td></td>
<td>5FU i.a.</td>
</tr>
<tr>
<td>TDF 100-119</td>
<td></td>
<td>48% (5Y)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TDF 120-</td>
<td></td>
<td>58% (5Y)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Goepfert (^{12,1}(1973))</td>
<td></td>
<td></td>
<td></td>
<td>Sisson's stage</td>
</tr>
<tr>
<td>TDF 99-115</td>
<td></td>
<td>48% (2Y)</td>
<td></td>
<td>T3 n=8</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>T4 n=14</td>
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<td>Rec. n=1</td>
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<td></td>
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<td>i.a.</td>
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<td>5FU n=21</td>
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<td>MTX &amp; 5FU n=3</td>
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<tr>
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<td>MTX n=2</td>
</tr>
<tr>
<td>Horiuchi (^{9}(1981))</td>
<td></td>
<td></td>
<td></td>
<td>5FU or BLM or BUDR</td>
</tr>
<tr>
<td>40-50Gy/4-5W</td>
<td></td>
<td>42% (25/59) (3Y)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sakai (^{17}(1983))</td>
<td></td>
<td></td>
<td></td>
<td>46% of 191 patients</td>
</tr>
<tr>
<td>TDF 115</td>
<td></td>
<td>60%</td>
<td></td>
<td>5FU i.a.</td>
</tr>
<tr>
<td>Sakai (^{13}(1991))</td>
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<td></td>
<td></td>
<td>1987 UICC</td>
</tr>
<tr>
<td>TDF 82</td>
<td></td>
<td>33% (5Y)</td>
<td></td>
<td>T1-2NOMO n=60</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>T3NOMO n=81</td>
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<td>T4NOMO n=61</td>
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<td>N1-3NOMO-1 n=20</td>
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<td></td>
<td></td>
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<td>5FU i.a.</td>
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<td>without Denker's operation</td>
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<td>Jingu (1994)</td>
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<td></td>
<td></td>
<td>1987 UICC</td>
</tr>
<tr>
<td>TDF 30</td>
<td></td>
<td>3% (2Y)</td>
<td>1% (2Y)</td>
<td>0% (2Y)</td>
</tr>
<tr>
<td>TDF 50</td>
<td></td>
<td>65% (2Y)</td>
<td>46% (2Y)</td>
<td>13% (2Y)</td>
</tr>
<tr>
<td>TDF 80</td>
<td></td>
<td>99% (2Y)</td>
<td>98% (2Y)</td>
<td>72% (2Y)</td>
</tr>
<tr>
<td>TDF 30</td>
<td></td>
<td>20% (2Y)</td>
<td>0% (2Y)</td>
<td>0% (2Y)</td>
</tr>
<tr>
<td>TDF 50</td>
<td></td>
<td>74% (2Y)</td>
<td>22% (2Y)</td>
<td>9% (2Y)</td>
</tr>
<tr>
<td>TDF 80</td>
<td></td>
<td>97% (2Y)</td>
<td>90% (2Y)</td>
<td>60% (2Y)</td>
</tr>
</tbody>
</table>

Y: year, i.a.: intra-arterial, Y: year.
the local control rates achieved using radiotherapy alone and chemo-radiotherapy.

Our results showed that chemo-radiotherapy was effective for early cancer, probably with a radiation dose of more than TDF 50 and less than TDF 80. More specifically, local control of advanced cases of cancer was difficult, even by chemo-radiotherapy. And local control rates at low or high dose levels achieved by chemo-radiotherapy were nearly the same as those achieved by radiotherapy alone, because the sigmoid curve of chemo-radiotherapy merely shifted to the left from that of radiotherapy alone.

3. Impact of chemo-radiotherapy on surgery

Nishio (1986) reviewed results of patients who received 40-50 Gy (TDF 66-82) radiotherapy and underwent macroscopic radical surgery, and concluded that there was no difference in survival rates between the treatment groups with or without i.a. infusions. However, as shown by the data of Sakai (1988) and by Ono findings, the effective radiation dose was smaller in the combined i.a. infusion group than in the group which received radiation alone. Sakai (1988) reported that maxillectomy was performed in 40% of patients who received 70 Gy/35 F/7 W (TDF 115) radiation, and 40.3% of patients who received 50-70 Gy/25-35 F/5-7 W (TDF 82-115) radiation combined with i.a. infusions. Although the maxillectomy rate was the same, the radiation dose of the combined group was less than that of the group which received radiotherapy alone. Ono (1989) reviewed 224 squamous cell carcinomas of the maxillary sinus. He categorized them in two groups: an RSA group which received radiation, surgery and i.a. infusions, and an RS group which received radiation and surgery. He found that 74% of the RSA group and 52% of the RS group evaded total maxillectomy. He documented that the radiation dose of the RSA group was less than that of the RS group, and the total maxillectomy rate of the RSA group was less than that of the RS group.

In the present study, although the difference in the local control rate was small, the sigmoid curve of FAR-therapy or BUdR-FAR-therapy shifted to the left; specifically, for the same local effect, chemo-radiotherapy required a smaller radiation dose than the dose required using radiation alone.

Although graphic representation is not possible, we found that chemo-radiotherapy facilitated macroscopic radical resection of a tumor even when the radiation dose was relatively small, because it rendered the tumor borders more clear.

4. Effects of surgery

Sakai (1983) found a 40.3% local relapse rate in patients who received 70 Gy/35 F/7 W (TDF 115) radiotherapy combined with continuous i.a. infusions and 30.1% in patients who received 50 Gy/25 F/5 W (TDF 82) radiotherapy combined with intra-sinal curettage and infusion. Any radiobiological explanation of why low-dose patients were controlled more effectively than were high-dose patients remains purely speculative, but it might be attributable to the effect of the intra-sinal curettage. Furthermore, Sakai (1991) observed a 33% local control rate in patients who received 50 Gy/25 F/5 W (TDF 82) radiotherapy without extensive Denker's surgical procedures, and 51% in patients who received 50 Gy/25 F/5 W (TDF 82) with extensive Denker's operations. Hence, the role of the Denker's operations is substantial. MacNab (1992) observed the local control rate to be 34% in the group treated with 65 Gy radiation alone, 60% in the surgery + X-ray group and 64% in the X-ray+surgery group, respectively. He favored the role of surgery.

Our patients usually received preoperative radiation of TDF 33-49. Our local control rates of T3 or T4 maxillary sinus carcinoma were less than 50% at a radiation dose of TDF 50. However, our 5-year actuarial cause-specific survival rate of the chemo-radiotherapy group was 61%, and that of the FAR-therapy group was 72%. This difference might be attributable to the intervention of surgery, including reduction surgery.
5. Complications

The severity of acute reactions such as stomatitis, conjunctivitis or dermatitis in patients who received chemo-radiotherapy was somewhat greater than in those who received radiotherapy alone. Therefore, the daily doses of chemo-radiotherapy were less than those of radiotherapy alone.

The incidence of cataract or brain necrosis as late radiation injuries in patients treated with chemo-radiotherapy was nearly the same as in those treated with radiotherapy alone, probably because they could develop even with low doses radiation, and the globe and the brain were possibly protected.

CONCLUSION

The role of chemotherapy when combined with radiotherapy is considerable, although the difference between the local control rates achieved by radiotherapy alone and by those achieved with chemo-radiotherapy is small. Moreover, the role of surgery in the management of maxillary sinus cancer is an important one.

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REFERENCES

要旨：上顎洞癌の放射線治療に併用する化学療法の効果を評価するために、九州大学で1976年から1991年の間に、放射線治療単独、FAR療法、BUDR-FAR療法を行った上顎洞扁平上皮癌112例を、病理学的および臨床的に局所制御率を検討した。T2の放射線治療単独、FAR療法、BUDR-FAR療法での局所制御率は、TDF 30でそれぞれ5%, 3%, 20%, TDF 50でそれぞれ30%, 65%, 74%で、TDF 80でそれぞれ80%, 93%, 97%であった。T3では、TDF 30でそれぞれ1%, 1%, 0%, TDF 50でそれぞれ18%, 46%, 22%, TDF 80でそれぞれ62%, 98%, 90%であった。T4では、TDF 30でそれぞれ0%, 0%, 0%, TDF 50でそれぞれ7%, 13%, 9%, TDF 80でそれぞれ36%, 72%, 60%であった。差は小さいけれども、化学・放射線併用療法は、放射線単独治療より高い局所制御率を示した。