Basic Research

Induction-concurrent chemoradiotherapy versus induction chemotherapy and radiotherapy for locoregionally advanced nasopharyngeal carcinoma

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[Abstract] Background and Objective: Induction chemotherapy and radiotherapy or concurrent chemoradiotherapy are the most two effective treatments for patients with locoregionally advanced nasopharyngeal carcinoma (NPC). This study was to compare the efficacy of induction-concurrent chemoradiotherapy versus induction chemotherapy and radiotherapy for patients with locoregionally advanced NPC. Methods: From August 2002 to April 2005, 408 patients were randomly divided into the induction-concurrent chemoradiotherapy (IC/CCRT) group and the induction chemotherapy and radiotherapy (IC/RT) group. Patients in both groups received the same induction chemotherapy, including two cycles of 5-fluorouracil (5-FU) plus cisplatin (5-FU/50 mg/m², d1-5; cisplatin AUC=6). All the patients underwent radiotherapy one week after completing the induction chemotherapy. The patients in the IC/CCRT group also received cisplatin (AUC=6) on day 7, 28, and 49 during radiotherapy. Eight patients did not meet the inclusion criteria and were excluded. The remaining 400 cases were analyzed. Results: Grade III/IV toxicity was found in 28.4% of the patients in the IC/CCRT group and 13.1% in the IC/RT group (P < 0.001). After a median follow up time of 3.9 years, the three-year overall survival was 75.9% and 83.4% (P = 0.12) in the IC/CCRT and IC/RT groups, respectively. No significant differences in the failure-free survival rate, the locoregional control rate, and the distant control rate were found between the two groups. Conclusion: The IC/CCRT program does not improve the overall survival rate in patients with locoregionally advanced NPC compared with the IC/RT program.

Key words: nasopharyngeal neoplasm, chemotherapy, radiotherapy

Nasopharyngeal carcinoma (NPC) is a distinct geographical disease with a high incidence in Southern China, Hong Kong, and Southeast Asia. The etiological factors are suggested to be closely related to genetics, Epstein Barr virus (EBV) infection and environmental factors.1,2 The pathological types and the response rates to radiotherapy and chemotherapy vary among different ethnic groups.3

Radiotherapy is the mainstay treatment for NPC. With the advances in imaging and radiation technologies, the efficacy of radiotherapy for NPC
has been greatly improved in recent years, resulting in better locoregional control of the disease. However, the five-year overall survival rate in the NPC patients is still hovering between 59% to 75%.

The treatment failure is mainly caused by distant metastasis, followed by local recurrence. Distant metastasis has therefore become a prominent factor that impacts the treatment outcome.\(^5\)\(^-\)\(^9\)

NPC is also sensitive to platinum-based chemotherapy. The combinations of chemotherapy and radiotherapy include induction chemoradiotherapy (IC/RT), concurrent chemoradiotherapy (CCRT), and adjuvant chemotherapy. Meta-analyses conducted by Langendijk et al.\(^10\) and Baujat et al.\(^11\) indicate that the combination of chemotherapy and radiotherapy provides better survival benefits than radiotherapy alone, although the benefit is limited. CCRT showed the best survival benefit among the three combination modalities, in terms of overall survival. For prevention of distant metastasis, IC/RT is slightly better than concurrent and adjuvant chemotherapy for the prevention of distant metastasis. A pooled data analysis by Chua et al.\(^12\) in 2005 showed that IC/RT improves five-year relapse-free survival and 5-year disease-specific survival compared with radiotherapy.

To date, IC/RT and CCRT are the most two effective treatments for patients with locoregionally advanced nasopharyngeal carcinoma (NPC). However, it remains unknown whether sequential application of IC/RT and CCRT would lead to further improvement of the survival rate. Therefore, in 2002, we designed a stratified, randomized, controlled clinical trial for patients with stage II/IV NPC using the Chinese 1992 staging system\(^13\) to compare the survival rates of IC/CCRT and IC/RT groups.

Patients and Methods

Eligibility criteria

Patients who fulfilled all the following criteria were included in the study:

- Pathologically diagnosed nonkeratinizing or undifferentiated carcinoma of the nasopharynx (World Health Organization types II or III)
- Aged 18 to 65 years
- No history of radiotherapy, chemotherapy or oncological surgery
- Performance status score: 0 to 2 points
- Clinical stage II or IV
- A leukocyte count (WBC) \(\geq 4.0 \times 10^9/\text{L}\)
- Total bilirubin (TBIL) and alanine aminotransferase (ALT) <2 times of the normal value, creatinine (Cr) <1.5 times of the normal value

Patients were excluded from the trial for any of the following exclusion criteria:

- Patients have an uncontrolled infection
- Patients with preceded other anti-cancer therapy
- Pregnancy and lactation
- Prior malignancy
- Unsuitable for chemotherapy due to impaired functions of kidney, liver, lung or heart.

Pretreatment evaluation and randomization. Before treatment, every patient received a general physical examination, enhanced contrast computed tomography (CT) scan and/or magnetic resonance imaging (MRI) of the nasopharynx, skull base and neck, nasopharyngeal endoscopy, chest X-rays, abdominal ultrasonography, emission CT (ECT) bone scanning of whole skeleton, complete blood count (CBC), and liver and kidney functional tests. The clinical trial protocol was approved by the Research Ethics Committee of Sun Yat-Sen University Cancer Center, Guangzhou, China. All patients signed the informed consent. New Drug Statistical Treatment 8.0 software\(^14\) was used to generate a random number table for stage II or IV, and all the patients were stratified to stage II or IV and then randomly divided into the IC/CCRT or IC/RT groups according to the random number.

Radiotherapy. A conventional two-dimensional technique was used for radiotherapy. All patients were irradiated using a cobalt-60 g-ray or linear accelerator 6–8 MV photon-irradiation. Faciocervical portals were exposed to 36–40 Gy during the first course for primary carcinoma. Facio-cervical splitting portals were used during the second course. When the oropharynx was involved, the faciocervical portals were used in two courses, and the postcervical triangular regions were irradiated by the 8–12 Mev electric beam in the second course.

Depending on the different organs invaded by the tumor, the anterior nasal region (6–8 Gy), the parapharyngeal region (6–8 Gy) or the skull base region (6–8Gy) was irradiated. The accumulated radiation doses were 66–78 Gy to the primary tumor, 60–70 Gy to the involved areas of the neck. Conventional fractionated radiotherapy (2 Gy once daily, five times per week) was applied in all cases.\(^15\)
Chemotherapy. In the IC/CCRT group, two cycles of flouxuridine (FuDR) + carboplatin (FuDR 750 mg/m² d1–5; carboplatin AUC=6) were administered. Patients received radiotherapy one week after completing the second cycle of chemotherapy. Patients also received carboplatin (AUC=6) on day 7, 28, and 49 during radiotherapy.

In the IC/RT group, two cycles of FuDR + carboplatin (FuDR 750 mg/m² d1–5; carboplatin AUC=6) were given. Patients received radiotherapy one week after completing the second cycle of chemotherapy.

Adequate carboplatin was given to patients only if the neutrophil count was ≥ 1.5 x 10⁹/L and the platelet count was ≥ 100 x 10⁹/L. If the neutrophil count was < 1.5 x 10⁹/L or the platelet count was < 100 x 10⁹/L, chemotherapy was postponed until the neutrophil count rose to ≥ 1.5 x 10⁹/L and the platelet count became ≥ 100 x 10⁹/L. If after two weeks, the neutrophil count was still < 1.5 x 10⁹/L or the platelet count was < 100 x 10⁹/L, chemotherapy was discontinued.

If the liver or kidney function was higher than the inclusion criteria, the next cycle of chemotherapy was not initiated. The chemotherapy could be postponed up to two weeks. If the liver and kidney function did not meet the standards after two weeks, no further chemotherapy was given. In addition, chemotherapy was terminated in the event of patients’ refusal or physician’s concern that chemotherapy might affect RT.

Patient assessments and follow-up. Efficacy was evaluated according to the World Health Organization (WHO) standard and assessment of the acute toxicity of chemotherapy or radiotherapy was based on the NCI-CTC AE 2.0 standard. Patients were followed up every three months for three years after the treatment, and every six months afterwards. Physical examination of the head and neck, nasopharyngeal endoscopy, chest X-rays, abdominal B ultrasound, EBV serological testing, MRI/CT, and ECT were performed during the follow-up. The location and the earliest detection dates of tumor relapse and metastasis were recorded. The patients with locoregionally relapsed and/or metastatic diseases were treated (i.e., reirradiation, surgery, and chemotherapy) as much as possible according to the patient’s conditions.

Estimation of sample size. The five-year survival rate of locoregionally advanced NPC was increased from 60% in the IC/RT group to 75% in the IC/CCRT group. A 5% two-sided significance level of significance is used with a power of 80%. The difference was needed to be detected in 344 cases (172 in each group). The patient number was increased to 408 by 19%, when other factors such as withdrawal and follow-up failure were taken into account.

Statistical analysis. The primary endpoints were overall survival (OS), failure-free survival (FFS). The secondary endpoints were distant failure-free survival (D-FFS) and local regional failure-free survival (LR-FFS). Statistical software SPSS13.0 was used (SPSS Inc., Chicago, IL). χ² analysis was used for ranked data and the rate testing. The means of continuous variables were compared using Student’s t test. The survival rates were calculated using the Kaplan-Meier method and compared with the log-rank test. Multivariate analyses were performed with Cox regression models and the factors analyzed included sex, age, T stage, N stage, overall stage, the total dose and time of radiotherapy, and chemotherapy methods. A two-tailed P value of less than 0.05 was considered statistically significant. The last follow-up was March 2008 with a median follow-up period of 3.9 years.

Results

Patient characteristics. From August 2002 to April 2005, 408 NPC patients were enrolled in this study. Eight patients did not meet the inclusion criteria, which included three patients in each group who had distant metastasis before the treatment and two patients in the IC/RT group whose pathological type were WHO I. Therefore, 201 cases in the IC/CCRT group and 199 cases in the IC/RT group were analyzed (Fig. 1).

No significant differences were found between the two groups upon comparison of baseline characteristics. No significant differences in the radiotherapy dose or time were found between the two groups (Table 1).

Treatment and compliance. All patients completed the full course of radiotherapy. Four patients (2%) in the IC/CCRT group completed only one cycle of induction chemotherapy, including one patient with tuberculosis, two patients with impaired
liver function, and one patient who refused to receive chemotherapy. In the IC/CCRT group, during the radiotherapy, 35 patients (17.4%) did not undergo any chemotherapy, 37 patients (18.4%) completed one cycle of chemotherapy, 88 patients (43.8%) completed two cycles of chemotherapy, and 39 patients (19.4%) completed three cycles of chemotherapy. The reasons for patients not completing chemotherapy during radiotherapy after two cycles of induction chemotherapy included: hematological toxicity (127 cases), liver dysfunction (two cases), patients' refusal (25 cases), and miscalculation of treatment timing (two cases). In addition, the chemotherapy regimen of two patients (1%) was changed in the induction or RT course.

In the IC/RT group, 187 patients (94%) completed the full course of two-cycle induction chemotherapy. Six patients (3%) completed only one cycle induction chemotherapy due to hematological toxicity (two cases), liver damage (two cases), hemorrhagic colitis (one case), and financial reasons (one case). The chemotherapy regimen of six patients (3%) was changed (Table 2), mainly because of disease progression.

**Acute toxicities.** All patients completed radiotherapy without treatment-related death. During the induction chemotherapy, the rate of grade III toxicity was ≤ 2.5%, including liver damage, low white blood cell and platelet counts and anemia. No significant differences were found between the two groups.

During the period of radiotherapy, arbitrary grade II/IV toxicity was found in 28.4% of patients in the IC/CCRT group and 13.1% in the IC/RT group (P < 0.001); grade II/IV toxicities included leukopenia (15.9% vs. 2.5%, P < 0.001) and anemia (4% vs. 0.5%, P = 0.045). No significant differences in thrombocytopenia, liver and kidney dysfunction, vomiting, neck dermatitis, or mucositis were found between the two groups (Table 3).

**Clinical response.** After two cycles of FudR + carboplatin induction chemotherapy, the effective rate (CR+PR) was 85.1% and 81.9% in the IC/CCRT and the IC/RT group, respectively (P = 0.561) (Table 4). Three months after radiotherapy, 2% patients in the IC/CCRT group had local or regional residuals whereas no residuals were found in the IC/RT group.

**Survival.** Two patients died from intercurrent causes in the IC/CCRT group, including one lung
Table 1  Clinicopathological characteristics of patients with nasopharyngeal carcinoma and radiotherapy parameters

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>IC/CCRT (n=201)</th>
<th>IC/RT (n=199)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yrs)</td>
<td></td>
<td></td>
<td>0.553</td>
</tr>
<tr>
<td>Mean</td>
<td>42.7</td>
<td>43.3</td>
<td></td>
</tr>
<tr>
<td>SD</td>
<td>10.0</td>
<td>10.0</td>
<td></td>
</tr>
<tr>
<td>Sex (%)</td>
<td></td>
<td></td>
<td>0.851</td>
</tr>
<tr>
<td>Male</td>
<td>156(77.6)</td>
<td>156(78.4)</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>45(22.4)</td>
<td>43(21.6)</td>
<td></td>
</tr>
<tr>
<td>WHO classification (cases, %)</td>
<td></td>
<td></td>
<td>0.399</td>
</tr>
<tr>
<td>II</td>
<td>18( 9.0)</td>
<td>23(11.6)</td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>183(91.0)</td>
<td>176(88.4)</td>
<td></td>
</tr>
<tr>
<td>T stage (cases, %)</td>
<td></td>
<td></td>
<td>0.698</td>
</tr>
<tr>
<td>T1-2</td>
<td>30(14.9)</td>
<td>27(13.6)</td>
<td></td>
</tr>
<tr>
<td>T3-4</td>
<td>171(85.1)</td>
<td>172(86.4)</td>
<td></td>
</tr>
<tr>
<td>N stage (cases, %)</td>
<td></td>
<td></td>
<td>0.317</td>
</tr>
<tr>
<td>N0-1</td>
<td>104(51.7)</td>
<td>93(46.7)</td>
<td></td>
</tr>
<tr>
<td>N2-3</td>
<td>97(48.3)</td>
<td>106(53.3)</td>
<td></td>
</tr>
<tr>
<td>Clinical stage (cases, %)</td>
<td></td>
<td></td>
<td>0.498</td>
</tr>
<tr>
<td>III</td>
<td>117(58.2)</td>
<td>109(54.8)</td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>84(41.8)</td>
<td>90(45.2)</td>
<td></td>
</tr>
<tr>
<td>Total irradiation dose (Gy)</td>
<td></td>
<td></td>
<td>0.789</td>
</tr>
<tr>
<td>Mean</td>
<td>71.9</td>
<td>71.9</td>
<td></td>
</tr>
<tr>
<td>SD</td>
<td>2.8</td>
<td>2.5</td>
<td></td>
</tr>
<tr>
<td>Overall radiotherapy treatment time (d)</td>
<td></td>
<td></td>
<td>0.519</td>
</tr>
<tr>
<td>Mean</td>
<td>52</td>
<td>53</td>
<td></td>
</tr>
<tr>
<td>SD</td>
<td>5</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

SD, standard deviation; IC, induction chemotherapy; CCRT, concurrent chemoradiotherapy; RT, radiotherapy.

infection and one myocardial infarction. Three patients died of radiotherapy-related toxicity in the IC/RT group, including two cases of brain stem injury and one case of nasopharyngeal ulcer bleeding. The 3-year survival rate was 75.9% in the IC/CCRT group and 83.4% in the IC/RT group (Fig.2, P=0.12). (Tables 5 & 6). The 3-year FFS was 69.4% in the IC/CCRT group and 69.8% in the IC/RT group (Fig.3). No statistical difference in LR-FFS or D-FFS (Fig.4) was found between the two groups. The 2-year survival time after the failure of treatment (SAF) was 19.6% and 43.4% in the IC/CCRT and the IC/RT group, respectively, which was statistically significant (P=0.046).

Survival of stage III and stage IV patients. The 3-year OS of stage II patients was 78.2% in the IC/CCRT group and 87.0% in the IC/RT group (Fig. 5, P=0.08). No statistical significance was found between the two groups regarding to the FFS, LR-FFS, D-FFS or SAF, although these endpoints were shorter in the IC/CCRT group than in the IC/RT group (Table 7). To the stage IV patients, no significant differences were found in the above endpoints between the two groups.

Discussion

Our results showed that IC/CCRT failed to improve the OS, FFS, LR-FFS and D-FFS comparing with IC/RT. Further study on the SAF showed that the 2-year SAF was 19.6% and 43.4% (P=0.046) in the IC/CCRT and IC/RT group, respectively, indicating that more cycles of chemotherapy in the first time of treatment influences the survival after relapse. IC/RT yielded a 3-year local failure-free survival (L-FFS) rate of 90.7% and a 3-year regional failure-free survival rate (R-FFS) of 97.3%. The potential to further improve the locoregional control on this basis is limited, which may be one of the reasons that IC/CCRT did not improve the survival rate compared with IC/RT.

Some of the previously reported large, randomized, controlled trials using concurrent or concurrent plus adjuvant chemotherapy showed similar results that Results from Lin et al (Taiwan, 2003),8 Wee et al (Singapore, 2005),9 Chan et al. (Hong Kong, 2005),10 Lee et al (Hong Kong, 2005)11, Lee et al (Hong Kong, 2006),12 have shown the decreasing trend of magnitude of OS benefit after chemotherapy, which was 18%,8 15%,10 11%,10 0%,15 5%,10 respectively, suggesting that along with the advances in imaging and radiotherapy technology, the efficacy of radiotherapy for NPC has
Induction-concurrent chemoradiotherapy versus induction chemotherapy and radiotherapy for locoregionally advanced nasopharyngeal carcinoma

Table 3 Patients experiencing the maximum acute toxicities

<table>
<thead>
<tr>
<th>Acute toxicity</th>
<th>IC/CCRT (%)</th>
<th>IC/RT (%)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Grade 3</td>
<td>Grade 4</td>
<td>Grade 3</td>
</tr>
<tr>
<td>Leukopenia</td>
<td>1.5</td>
<td>0</td>
<td>15.9</td>
</tr>
<tr>
<td>Anemia</td>
<td>0.5</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Thrombocytopenia</td>
<td>0.5</td>
<td>0</td>
<td>3.5</td>
</tr>
<tr>
<td>Vomiting</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Hepatic impairment</td>
<td>1.5</td>
<td>0</td>
<td>0.5</td>
</tr>
<tr>
<td>Renal impairment</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Mucositis</td>
<td>-</td>
<td>-</td>
<td>5.5</td>
</tr>
<tr>
<td>Skin reaction</td>
<td>-</td>
<td>-</td>
<td>3.5</td>
</tr>
<tr>
<td>Other acute toxicity</td>
<td>-</td>
<td>28.4</td>
<td>0</td>
</tr>
</tbody>
</table>

IC course: induction chemotherapy course; RT course: radiotherapy course

Table 4 Response rates to the induction chemotherapy

<table>
<thead>
<tr>
<th>Response</th>
<th>IC/CCRT</th>
<th>IC/RT</th>
<th>All patients</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>cases (%)</td>
<td>cases (%)</td>
<td>cases (%)</td>
<td></td>
</tr>
<tr>
<td>CR+PR-</td>
<td>171(85.1)</td>
<td>163(81.9)</td>
<td>334(83.5)</td>
<td></td>
</tr>
<tr>
<td>NC+PD-</td>
<td>26(12.9)</td>
<td>33(16.6)</td>
<td>59(14.8)</td>
<td>0.561</td>
</tr>
<tr>
<td>Not evaluated</td>
<td>4 (2.0)</td>
<td>3(1.5)</td>
<td>7 (1.7)</td>
<td></td>
</tr>
</tbody>
</table>

CR: complete remission; PR: partial remission; NC: no change; PD: progressive disease

been greatly improved in recent years.

In this study, the distant metastasis rates were 25.9% and 26.1% in the IC/RT and IC/CCRT group, while the rates of patients suffering from both locoregional recurrence and distant metastasis were only 4.5% and 3.5%, respectively. These facts suggest that locoregional recurrence-induced distant metastasis is not the main reason for distant failure after a comprehensive treatment. Distant micrometastases could occur before initiation of the treatment.\(^{25}\) Even if advanced radiotherapy and multiple cycles of chemotherapy can be used to achieve a high locoregional control rate (>93%), the distant metastatic rate remains high (>25%),\(^{7,8}\) which is consistent with our findings.

In recent years, studies have shown that for patients with T1-4N2-3M0 and T3-4N0-1M0 diseases, chemoradiotherapy could not reduce the distant metastasis rate compared with radiotherapy alone.\(^{21-22}\) Although chemoradiotherapy improved LR-FFS, it did not improve D-FFS,\(^{21}\) indicating that even if locoregional recurrence-induced distant metastasis is further reduced, multi-cycles of chemotherapy could not reduce micro-metastasis-induced distant metastases.

In the present study, patients in the IC/CCRT group showed good compliance to induction chemotherapy and 97% of the patients completed full two cycles of induction chemotherapy. However these

Figure 2 Comparison between induction-concurrent chemoradiotherapy (IC/CCRT) and induction chemoradiotherapy (IC/RT) on the overall survival.

Figure 3 Comparison between IC/CCRT and IC/RT on the failure-free survival.
patients had relatively poor compliance to concurrent chemoradiotherapy during radiotherapy; 39 patients (19.4%) completed full three cycles of chemoradiotherapy, 127 patients (63.2%) completed at least two cycles of chemotherapy, and 164 patients (81.6%) completed at least one cycle of chemotherapy. The reasons for poor compliance of patients may be caused by the following two reasons: although carboplatin causes less damage to the liver and kidney, it has stronger hematological toxicity than cisplatin, and the hematological toxicity of carboplatin is difficult to recover totally, which accounts for its dose-limiting toxicity; doctors had a concern that chemotherapy might prevent patients from completing the course of radiotherapy, they stopped the second

![Image](image_url)

**Figure 4** Comparison between IC/CCRT and IC/RT on the (A) locoregional and (B) distant failure-free survival.
Figure 5  Comparison between induction-concurrent chemoradiotherapy (IC/CCRT) and induction chemoradiotherapy (IC/RT) on the overall survival of patients with stage III (A) and stage IV (B) nasopharyngeal carcinoma.

Table 7  Analyses on tumor control of stage III/IV diseases

<table>
<thead>
<tr>
<th></th>
<th>Stage III</th>
<th></th>
<th>Stage IV</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>IC/CCRT</td>
<td>IC/RT</td>
<td>IC/CCRT</td>
<td>IC/RT</td>
</tr>
<tr>
<td>OS</td>
<td>(n=117)</td>
<td>(n=109)</td>
<td>(n=84)</td>
<td>(n=90)</td>
</tr>
<tr>
<td>3-year AR (%)</td>
<td>78.2</td>
<td>87</td>
<td>72.5</td>
<td>80.1</td>
</tr>
<tr>
<td></td>
<td>1.66</td>
<td></td>
<td>1.17</td>
<td></td>
</tr>
<tr>
<td>95% CI</td>
<td>0.94–2.94</td>
<td></td>
<td>0.66–2.06</td>
<td></td>
</tr>
<tr>
<td>FFS</td>
<td>70.5</td>
<td>77.7</td>
<td>67.9</td>
<td>60.0</td>
</tr>
<tr>
<td></td>
<td>0.26</td>
<td></td>
<td>0.64</td>
<td></td>
</tr>
<tr>
<td>95% CI</td>
<td>0.81–2.14</td>
<td></td>
<td>0.55–1.44</td>
<td></td>
</tr>
<tr>
<td>LR-FFS</td>
<td>88.9</td>
<td>94</td>
<td>86.3</td>
<td>84.0</td>
</tr>
<tr>
<td></td>
<td>0.20</td>
<td></td>
<td>0.85</td>
<td></td>
</tr>
<tr>
<td>95% CI</td>
<td>0.73–4.17</td>
<td></td>
<td>0.5–2.33</td>
<td></td>
</tr>
<tr>
<td>D-FFS</td>
<td>73.7</td>
<td>81.4</td>
<td>78.8</td>
<td>69.9</td>
</tr>
<tr>
<td></td>
<td>0.23</td>
<td></td>
<td>0.29</td>
<td></td>
</tr>
<tr>
<td>95% CI</td>
<td>0.81–2.33</td>
<td></td>
<td>0.41–1.31</td>
<td></td>
</tr>
<tr>
<td>SAF</td>
<td>18.2</td>
<td>46.8</td>
<td>21.7</td>
<td>41.2</td>
</tr>
<tr>
<td></td>
<td>0.167</td>
<td></td>
<td>0.166</td>
<td></td>
</tr>
<tr>
<td>95% CI</td>
<td>0.83–2.77</td>
<td></td>
<td>0.83–2.69</td>
<td></td>
</tr>
</tbody>
</table>

Footnotes as in Table 6.

chemotherapy was 84%, which confirms that carboplatin is effective for the treatment of NPC. Moreover, the drug delivery methods that were in accordance with the AUC ensured delivery of individualized doses. Yau et al.26 believed that during concurrent chemoradiotherapy, replacement of cisplatin by carboplatin might account for the poor prognosis. This study was a small sample size, non-randomized trial. In 18 (24%) patients, cisplatin was replaced by carboplatin mainly due to borderline renal functions. However, results from a large sample size, randomized study26 confirmed that carboplatin is an effective drug used during radiotherapy for NPC. The 3-year overall survival of the patients in the cisplatin vs. carboplatin group was 77.7% vs. 79.2% (P=0.9884). Therefore, we believe that the efficacy of carboplatin is not different from cisplatin during radiotherapy for NPC.
Conclusion

Compared with induction chemoradiotherapy, the induction-concurrent chemoradiotherapy dose not improve the overall survival rate of the patients with locoregionally advanced NPC.

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References

