Two Cases of Stereotactic Radiosurgical Boost as an Initial Treatment for Young Nasopharyngeal Cancer Patients

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Case 1: A 14-year-old boy with nasopharyngeal cancer (T4N0M0) was treated with stereotactic radiosurgery (SRS) as a boost therapy after conventional radiotherapy. Persistent residual tumor visible with MR remained after conventional radiotherapy comprising 59.6 Gy in total. We therefore performed SRS to add a further irradiation dose while causing minimal damage to adjacent normal tissue. SRS was performed using multiple non-coplanar arcs delivered to the residual tumor, which was defined to add 2 mm margins to the residual tumor. This was 30 cc as defined by CT and MR images. Twenty Gy were administered to the periphery of the planning target volume (PTV), corresponding to the 80% isodose line. No recurrences or late complications have been observed 4 years and 6 months after the SRS. Case 2: A 27-year-old man with nasopharyngeal cancer (T1N0M0) was treated with SRS as a boost therapy following conventional radiotherapy with 55 Gy. The SRS was performed using multiple non-coplanar arcs delivered to the PTV, which was 10 cc as defined by CT and MR images as in case 1. Sixteen Gy were administered to the periphery of the residual tumor, corresponding to the 80% isodose line. The tumor was not visible on follow-up MR images and no complications have been observed 4 years and 2 months after the SRS.

Key words: nasopharyngeal cancer – radiotherapy – stereotactic radiosurgical boost

INTRODUCTION

Nasopharyngeal cancer tends to occur at a younger age compared with other head and neck cancers (1). Stereotactic radiosurgery (SRS) is increasingly being applied to extracranial lesions. One of the most common extracranial lesions is the nasopharynx, but most reports on the use of SRS have been for recurrent nasopharyngeal cancer.

Here we describe the treatment of two young patients with nasopharyngeal cancer. To improve local control, we performed SRS as an additional treatment to conventional radiotherapy.

CASE REPORT

CASE 1

A 14-year-old boy, who was complaining of a persistent headache and discharges from the right ear, visited Tokyo Medical University Kasumigaura Hospital (Ibaraki, Japan). A nasopharyngeal tumor was found and biopsies were performed. The pathological diagnosis was determined as undifferentiated carcinoma of the nasopharynx and the clinical staging was T4N1M0 according to the 1997 American Joint Commission on Cancer staging (AJCC) guidelines. As an initial treatment, conventional radiotherapy was performed with the large fields covering the entire planning target volume (PTV). This was given by opposing lateral fields and the anterior lower neck field with a 4-MV Linear Accelerator (Clinac 2100C, Varian, USA). We administered 1.8 Gy in five daily fractions per week. After 39.6 Gy had been delivered, the field was shrunk to the nasopharyngeal tumor with 1.0 cm margins and an additional 20.0 Gy were delivered with 10-MV X-rays (2 Gy in five daily fractions per week). In total, 59.6 Gy were delivered. When 39.6 Gy were delivered, the neck lymph node had already disappeared, so we thought that a further radiation dose to the neck was unnecessary. Before the conventional radiotherapy, systemic chemotherapy (CDDP, 120 mg/body; 5FU, 1000 mg/body) was administered. Figure 1 shows an MR image of the tumor before the conventional radiotherapy had been given. The tumor had been decreasing in size. However, evaluation of MR images taken about 1 month after the conventional radiotherapy showed that a persistent residual tumor
remained. We therefore planned the use of SRS so that a further irradiation dose could be given with minimal damage to adjacent normal tissues. SRS boost therapy was performed 6 weeks after completion of the conventional radiotherapy. The reason why it took 6 weeks before we started the SRS was that we needed enough time to obtain informed consent from the parents and they needed enough time to decide whether their child should get an SRS boost. This patient was only 14 years old, so he could not decide by himself and we would not be allowed to treat him without his parents’ consent.

We defined residual tumors on T1-weighted MR images with intravenous contrast media as the gross tumor volume (GTV) and three-dimensionally manipulated it to add 1 mm to the GTV as an internal target volume (ITV). Furthermore, considering the set-up margins, we added 1 mm to the ITV as a PTV. We used a BrainLAB treatment planning system with BrainSCAN software 4.03 (BrainLAB AG, Heimstetten, Germany). SRS was performed using multiple non-coplanar arcs of 10-MV X-rays delivered to the PTV. This was 30 cc as defined by CT and MR images. Both CT and MR images with intravenous contrast media were performed using a slice thickness and distance of 3 mm, which were fused by means of BrainSCAN software. Twenty Gy were administered to the periphery of the PTV, corresponding to the 80% isodose line. The dose distribution of the SRS plan is shown in Fig. 2. An MR image 48 months after completion of SRS is shown in Fig. 3. No recurrences or late complications have been seen up to the present time (4 years and 6 months after the SRS).

CASE 2

A 27-year-old man complaining of bloody sputum visited Tokyo Medical University Hospital (Tokyo, Japan). A nasopharyngeal tumor was found and biopsies were performed. The pathological diagnosis was determined as undifferentiated carcinoma of the nasopharynx and the clinical staging as T1N0M0 according to the 1997 AJCC guidelines. Conventional radiotherapy was performed with the large fields covering the entire PTV and using opposed lateral fields. We administered 1.8 Gy in five daily fractions per week using a 4-MV Linear Accelerator (Mevatron MD, Siemens, USA). After 45 Gy had been delivered, the irradiated field was shrunk to the nasopharynx and an additional 10 Gy were delivered with 10-MV X-rays (Mevatron DX, Siemens, USA). In total, 55 Gy were delivered. Before completion of conventional radiotherapy, two treatment options were proposed to the patient. The first was additional conventional radiotherapy up to 65 Gy and the second was an SRS boost after conventional radiotherapy to a total dose of 55 Gy. The SRS option was chosen by the patient and, 1 week after completion of 55 Gy of conventional radiotherapy, SRS was performed using multiple non-coplanar arcs of 10-MV X-rays delivered to the PTV, which was defined as in case 1. This was 10 cc as defined by CT and MR images. Sixteen Gy were administered to the periphery of the PTV, corresponding to the 80% isodose line. The dose distribution of the SRS plan is shown in Fig. 4. Figure 5 shows a CT image
DISCUSSION

There is no doubt that nasopharyngeal cancer is a good candidate for definitive radiotherapy, although local recurrences can often occur. A relationship between radiation dose and local tumor control has been widely recognized. Therefore, modern treatment methods such as 3-dimensional conformal radiotherapy (3D-CRT), intensity modulated radiotherapy (IMRT) and brachytherapy have been developed to deliver a higher radiation dose to PTV while minimizing damage to adjacent normal tissues (2–5). 3D-CRT would have been a treatment option following conventional radiotherapy, but we think it may not be enough to avoid an excess radiation dose to adjacent normal tissues, for example, the brain stem or the optic chiasm. Although IMRT is supposed to be a promising treatment method, we have so far not had an opportunity to use it. Of course, we could send these patients to a hospital where IMRT had already been performed, but it would take a lot of time to do so. We have already had experience in applying stereotactic irradiation (STI) to head and neck cancer and we believe that STI is an effective way to treat head and neck cancer patients. Brachytherapy would have been a treatment option following conventional radiotherapy to case 2, because the PTV was small and located on superficial mucosa. But brachytherapy was not suitable for a large deep-seated tumor, such as in case 1.

The technology of STI has been applied not only to intracranial lesions but also to extracranial ones. Nasopharyngeal tumors are now commonly treated with STI, but most reports involve recurrent nasopharyngeal cancer (6–9). Regarding the use of STI for recurrent nasopharyngeal cancer, we have so far treated five patients with hypofractionated SRT (30–36 Gy/5–6 fractions) alone. Local control was achieved for each of the five patients after a median follow-up of 7 months (range 5–11 months). There have been no complications. We have proposed that hypofractionated stereotactic radiotherapy may be effective for recurrent nasopharyngeal cancer, although the optimal dose and fractionation schedule are yet to be determined (10).

The two patients described in this report were treated with SRS as a boost therapy. To our knowledge, there are only a few studies reporting the use of SRS as an initial treatment for nasopharyngeal cancer. Cmelak et al. (11) reported that 11 patients were treated for nasopharyngeal cancer using radiosurgery as a boost (7–16 Gy, median 12 Gy) to the nasopharynx after conventional radiotherapy (64.8–70 Gy). Local control was achieved in all 11 patients (follow-up 2–34 months, median 18 months), although one patient required secondary radiosurgical treatment for regional relapse outside the initial radiosurgery volume. Four patients have developed distant
metastases. Le et al. (12) reported that 45 patients were treated with radiosurgery (7–15 Gy, median 12 Gy) following radiotherapy (66 Gy) for nasopharyngeal cancer. No local recurrences developed in any of the 45 patients but nodal recurrence was observed in 3 patients and 14 patients developed distant metastasis. No patients developed acute complication related to radiosurgery. The two patients who were treated with SRS following conventional radiotherapy tended to have a lower total dose of conventional radiotherapy and a higher dose of SRS compared with the previous two reports. Fortunately, the two patients that we have treated have not had recurrences or severe complications, such as mucosal ulcer endoscopically, at the last follow-up. Although a longer follow-up time is necessary for full evaluation, radiosurgical boost may be useful to improve local control for patients with nasopharyngeal cancer.

References