Olfactory neuroblastoma – 10-year experience with volumetric modulated arc therapy

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Purpose

Olfactory neuroblastoma is an unusual head and neck tumour arising from neuroectodermal cells. Localized disease is best managed with combined modality treatment with surgical resection and radiotherapy (1). Treatment is challenging due to the proximity of organs at risk.

The majority of previously reported series of patients have been treated with conformal radiotherapy (2,3). We report our experience in using volumetric modulated arc therapy (VMAT) with concurrent chemotherapy in the treatment of olfactory neuroblastoma.

Methods

We retrospectively reviewed the records of patients with olfactory neuroblastoma treated at University College London Hospital from Aug 2006 - June 2016.

Radiotherapy was inverse-planned and delivered using Rapidarc™ VMAT (Varian Medical Systems Inc, CA). A dose of 60 – 65 Gy in 30 fractions was delivered to the planning target volume. The radiotherapy planning constraints for organs at risk were:

- Spinal cord: Max 46 Gy, D0.1cc 44 Gy
- Spinal cord PRV: Max 50 Gy, D0.1cc 48 Gy
- Brainstem: Max 55 Gy, D0.1cc 54 Gy
- Brainstem PRV: Max 59 Gy, D0.1cc 55 Gy
- Parotid: Mean 24 Gy
- Optic nerve PRV: Max 50 Gy
- Optic chiasm PRV: Max 50 Gy
- Lens: Max 6 Gy
- Cochlea: Mean 48 Gy

Results

17 consecutive patients treated with VMAT radiotherapy were included. Median follow-up of patients was 43 months. Median age was 57 years (range 22 – 75 years). 53% were male. The Kadish (4) staging of patients is shown below:

<table>
<thead>
<tr>
<th>Kadish Stage</th>
<th>No. of patients</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>4</td>
<td>23.5</td>
</tr>
<tr>
<td>B</td>
<td>3</td>
<td>17.6</td>
</tr>
<tr>
<td>C</td>
<td>7</td>
<td>41.2</td>
</tr>
<tr>
<td>D</td>
<td>3</td>
<td>17.6</td>
</tr>
<tr>
<td>Total</td>
<td>17</td>
<td>100.0</td>
</tr>
</tbody>
</table>

13 patients had endoscopic surgery and 3 patients had open craniofacial resection. One patient had unsectable disease. Even with inverse-planned treatment, there were minor deviations from radiotherapy constraints for the optic apparatus in some patients, due to the proximity to the target volume (Fig. 1).

There was no acute grade 3/4 toxicity, and no long-term visual or neurological toxicity during the period of follow-up. 5-year overall survival of patients in this series was 83% (Fig. 2 below).

Conclusion

VMAT radiotherapy with concurrent chemotherapy for olfactory neuroblastoma is well-tolerated. Overall survival for patients with olfactory neuroblastoma is very good after multi-modality treatment.

References


Fig. 1. Dose distribution achieved with VMAT after resection of olfactory neuroblastoma with positive margins near left orbit.

Induction chemotherapy was used for bulky disease. Concurrent platinum-based chemotherapy was administered during radiotherapy using cisplatin 35 mg/m2 weekly. Acute toxicity was assessed using the CTCAE grading system. Kaplan-Meier survival analysis was used for the whole group.