HEAD AND NECK CASE

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Conflict of interest

• None to declare.
Case 1: Oropharynx

- A 47-year-old female presented with a left neck node increasing in size. Associated lesion in left tonsil.
- Past medical history: HIV negative. Previous motor vehicle accident with multiple fractures.
- Smoker, previous drug user. Does not consume alcohol.
- **On examination**: PS 1
- 3cm lesion left tonsil. Panedoscopy – no synchronous primaries
- Bilateral neck nodes. Left level II is largest (5cm) and fixed.
- **Investigations**: Biopsy well-differentiated squamous cell carcinoma. P16 positive.
- CT scan: Lesion left tonsil, into base of tongue and left parapharyngeal space. Onto medial pterygoid muscle. Bilateral neck nodes. Left II-V, Right level II.
- No distant metastasis.
- **Stage**: T2N2 MO. *(AJCC Cancer Staging Manual, Eighth Edition)*
CT Images
CT Images
CT Images
Treatment options

• Tonsillar cancers can be treated with either primary surgery or RT, with similar outcomes.

• Treatment for patients with HPV associated oropharyngeal cancer is the same as for those with HPV negative oropharyngeal cancers. Although testing for HPV positivity provides prognostic information, there are insufficient data to alter therapy based on HPV status.

• Even with the adoption of the eighth edition AJCC staging system, the standard of care for many stage I (former seventh edition AJCC stage III and IVa) and all stage II and III patients treated nonsurgically will involve conventional seven-week courses of chemoradiation until deintensification trials indicate it is safe to do so.
Treatment plan

• Patient was assessed at the multidisciplinary meeting.
• Offered definitive chemoradiation with 3 weekly cisplatin (100mg/m²).
• VMAT and daily CBCT
Dental assessment prior to RT

• Indications for tooth extraction prior to RT are compromised teeth in an area that is expected to receive a dose of at least 50 Gy or a tooth that is out of the radiation treatment volume, but has a hopeless prognosis or is symptomatic.

• Extraction of healthy teeth does not appear to prevent the development of osteoradionecrosis.

• All indicated dental work should be completed prior to RT. A delay of approximately two weeks is ideal between extractions and the beginning of RT to permit proper healing. If the extracted teeth are outside of the treatment volumes, treatment may be initiated sooner.
Data acquisition

- CT scan
- IV contrast
- Supine, in a head rest.
- Knee rest
- Scanned in 2-3mm slices from vertex to carina
Reference books

Practical Radiotherapy Planning

Fourth Edition

Ann Barrett
Jane Dobbs
Stephen Morris
Tom Roques
Reference books
Reference books
Lymph node spread
### Lymph node levels

<table>
<thead>
<tr>
<th>Level</th>
<th>Anatomical boundaries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ia</td>
<td>Genuohyoid m., plane tangent to basilar edge of mandible</td>
</tr>
<tr>
<td>Ib</td>
<td>Mylohyoid m., cranial edge of submandibular gland</td>
</tr>
<tr>
<td>IIA</td>
<td>Caudal edge of lateral process of C1</td>
</tr>
<tr>
<td>IIB</td>
<td>Caudal edge of lateral process of C1</td>
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</table>
### Anatomical boundaries

<table>
<thead>
<tr>
<th>Region</th>
<th>Cranial</th>
<th>Caudal</th>
<th>Medial</th>
<th>Lateral</th>
<th>Anterior</th>
<th>Posterior</th>
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<tbody>
<tr>
<td>III</td>
<td>Caudal edge of the body of hyoid bone</td>
<td>Caudal edge of cricoid cartilage</td>
<td>Int. edge of carotid artery, paraspinal (scalene) m.</td>
<td>Medial edge of sternocleidomastoid m.</td>
<td>Posterolateral edge of the sternohyoid m.; ant. edge of sternocleidomastoid m.</td>
<td>Post. edge of the sternocleidomastoid m.</td>
</tr>
<tr>
<td>IV</td>
<td>Caudal edge of cricoid cartilage</td>
<td>2 cm cranial to sternoclavicular joint</td>
<td>Medial edge of int. carotid artery, paraspinal (scalen) m.</td>
<td>Medial edge of sternocleidomastoid m.</td>
<td>Anteromedial edge of sternocleidomastoid m.</td>
<td>Post. edge of the sternocleidomastoid m.</td>
</tr>
<tr>
<td>V</td>
<td>Cranial edge of body of hyoid bone</td>
<td>CT slice encompassing the transverse cervical vessels¹</td>
<td>Paraspinal (levator scapulae, splenius capitis) m.</td>
<td>Platysma m., skin</td>
<td>Post. edge of the sternocleidomastoid m.</td>
<td>Anterolateral border of the trapezius m.</td>
</tr>
<tr>
<td>VI</td>
<td>Caudal edge of body of thyroid cartilage²</td>
<td>Sternal manubrium</td>
<td>n.a.</td>
<td>Medial edges of thyroid gland, skin and anteromedial edge of sternocleidomastoid m.</td>
<td>Skin; platysma m.</td>
<td>Separation between trachea and esophagus*</td>
</tr>
<tr>
<td>RP</td>
<td>Base of skull</td>
<td>Cranial edge of the body of hyoid bone</td>
<td>Midline</td>
<td>Medial edge of int. carotid artery</td>
<td>Fascia under the pharyngeal mucosa</td>
<td>Prevertebral m. (longus coli, longus capitis)</td>
</tr>
</tbody>
</table>

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¹ Midline structure lying between the medial borders of the anterior bellies of the digastric muscles
² The insertion of the hyoid muscle is often interposed between level Ia and the body of the hyoid bone
³ For NPC, the reader is referred to the original description of the UICC/AJCC 1997 edition of the Ho's triangle. In essence, the fatty planes below and around the clavicle down to the trapezius muscle
⁴ For paratracheal and recurrent nodes, the cranial border is the caudal edge of the cricoid cartilage
⁵ For pretracheal nodes, trachea and anterior edge of cricoid cartilage

Source: Modified from Greig IY, Levendag P, Ang KK, et al. (2003) [78]
FIGS 6.1, 6.2

- RETROPHARYNGEAL NODES

1. LONGUS CAPITIS MUSCLE
2. INTERNAL CAROTID ARTERY
FIGS. 6.11, 6.12

- LEVEL II
- RETROPHARYNGEAL NODES

2 - INTERNAL CAROTID ARTERY
3 - STERNOCLEIDOMASTOID MUSCLE
4 - INTERNAL JUGULAR VEIN
5 - LONGUS COLLI MUSCLE
7 - GENIOGLOSSUS AND GENIOHYOID MUSCLES
8 - MYLOHYOID MUSCLE
9 - PARASPINAL (LEVATOR SCAPULAE) MUSCLE
FIGS. 6.13, 6.14

- LEVEL IB
- LEVEL II
- RETROPHARYNGEAL NODES

2 - INTERNAL CAROTID ARTERY
3 - STERNOCLEIDOMASTOID MUSCLE
4 - INTERNAL JUGULAR VEN
5 - LONGUS COLLI MUSCLE
6 - GENIOGLOSSUS AND GENIOHYOID MUSCLES
7 - MYLOHYOID MUSCLE
8 - PARASPINAL (ELEVATOR SCAPULAR) MUSCLE
9 - SUBMANDIBULAR GLAND
10 - ANTERIOR BELLY OF DIGASTRIC MUSCLE
FIGS. 6.19, 6.20

- LEVEL IA
- LEVEL IB
- LEVEL II
- LEVEL V
- RETROPHARYNGEAL NODES

1. INTERNAL CAROTID ARTERY
2. STERNOCLEIDOMASTOID MUSCLE
3. INTERNAL JUGULAR VEIN
4. LONGUS COLLIS MUSCLE
5. GENIOHYOID MUSCLE
6. SUBMANDIBULAR GLAND
7. ANTERIOR BELLY OF DIGASTRIC MUSCLE
8. EXTERNAL CAROTID ARTERY
9. POSTERIOR BELLY OF DIGASTRIC MUSCLE
10. LEVATOR SCAPULAE MUSCLE
11. SPLENIUS CAPITIS MUSCLE
12. TRAPEZIUS MUSCLE
FIGS. 6.19, 6.20

- LEVEL IA
- LEVEL IB
- LEVEL II
- LEVEL V
- RETROPHARYNGEAL NODES

2 - INTERNAL CAROTID ARTERY
3 - STERNOCLEIDOMASTOID MUSCLE
4 - INTERNAL JUGULAR VEIN
6 - LONGUS COLLI MUSCLE
7 - GENIOHYOID MUSCLE
10 - SUBMANDIBULAR GLAND
11 - ANTERIOR BELLY OF DIGASTRIC MUSCLE
12 - EXTERNAL CAROTID ARTERY
13 - POSTERIOR BELLY OF DIGASTRIC MUSCLE
14 - LEVATOR SCAPULAE MUSCLE
15 - Splenius Capitis Muscle
16 - TRAPEZIUS MUSCLE
FIGS. 6.21, 6.22

- **LEVEL I**
- **LEVEL II**
- **LEVEL V**

2  - INTERNAL CAROTID ARTERY
3  - STERNOCLEIDOMASTOID MUSCLE
4  - INTERNAL JUGULAR VEIN
7  - GENIOHYOID MUSCLE
10 - SUBMANDIBULAR GLAND
12 - EXTERNAL CAROTID ARTERY
14 - LEVATOR SCAPULAE MUSCLE
15 - SPLENIUS CAPITIS MUSCLE
16 - TRAPEZIUS MUSCLE
17 - HYOID BONE
FIGS. 6.29, 6.30

- LEVEL III
- LEVEL V

3 – STERNOCLEIDOMASTOID MUSCLE
4 – INTERNAL JUGULAR VEIN
14 – LEVATOR SCAPULAE MUSCLE
16 – TRAPEZIUS MUSCLE
19 – COMMON CAROTID ARTERY
FIGS. 6.31, 6.32

- LEVEL III
- LEVEL V
- LEVEL VI

3 - STERNOCLEIDOMASTOID MUSCLE
4 - INTERNAL JUGULAR VEIN
14 - LEVATOR SCAPULAE MUSCLE
16 - TRAPEZIUS MUSCLE
19 - COMMON CAROTID ARTERY
20 - CRICOID CARTILAGE
21 - THYROID CARTILAGE
Target volumes

- **GTV 70**
  - Primary: all gross disease as defined by clinical examination and imaging
  - Neck nodes: all suspicious (>1 cm, necrotic, enhancing, or FDG avid) lymph nodes.
- **CTV 70 = GTV 70 + 5 mm**
- **PTV 70 = CTV 70 + 3–5 mm**
High risk CTV i.e. subclinical disease

• **CTV**
  • Primary: GTV + minimum 1 cm margin while respecting anatomical barriers to spread,
  • Neck nodes – should include the at-risk lymphatic areas in the *node-positive neck*:
    • Levels II–IV
    • Lateral retropharyngeal lymph nodes up to skull base/jugular foramen
    • High level II/retrostyloid space
    • Ipsilateral IB if there is extension of the primary GTV into the oral cavity
Low risk CTV i.e. subclinical disease

- **CTV Neck nodes** – should include the at-risk lymphatic areas in the *node-negative* neck:
  - Levels II–IV
  - Lateral retropharyngeal lymph nodes up to C1
  - High level II/retrostyloid space is excluded
High risk areas

- **Tonsil**
- Primary CTV - Ipsilateral soft palate, ipsilateral base of the tongue, ipsilateral glossotonsillar sulcus. Superiorly, ipsilateral pharynx superiorly to pterygoid plate. Inferiorly, at least 1 cm below GTV, down to level of the hyoid for advanced tumors. Consider coverage of ipsilateral retromolar trigone if anterolateral spread along pharyngeal constrictor to the pterygomandibular raphe is suspected.
OAR: lens Dmax 5-7Gy
OAR: Globe Dmean < 35 Gy
OAR: Optic Nerves Dmax<54GY
OAR: Optic Chiasm Dmax<54Gy
OAR: Optic Chiasm Dmax < 54 Gy
OAR: Brainstem Dmax<54Gy
OAR: Brainstem Dmax < 54 Gy
OAR: Brainstem Dmax < 54 Gy
OAR: Spinal cord $D_{\text{max}} < 45-50$ Gy
OAR: Parotid gland Dmean <26 Gy
OAR: Parotid gland Dmean <26Gy
OAR: Pharyngeal constrictors. Dmean< 45Gy
Doses

**Conventional fractionation**
- Gross disease 70Gy
- High risk 60 Gy
- Subclinical 50Gy
- In 2Gy/#

**Or as SIB**
- Gross disease 69.96Gy
- High risk 59.4 Gy
- Subclinical 54 Gy
- In 33 #
Planning evaluation
## Planning evaluation

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<tr>
<th>Field ID</th>
<th>Technique</th>
<th>Machine/Energy</th>
<th>Field Weight</th>
<th>Gantry Rtn (degree)</th>
<th>Coll Rtn (degree)</th>
<th>MU</th>
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## Planning evaluation

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<th>Field ID</th>
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Planning evaluation
Planning evaluation
Planning evaluation
### Planning evaluation

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<tr>
<th>Structure</th>
<th>Approval Status</th>
<th>Plan</th>
<th>Course</th>
<th>Volume [c...</th>
<th>Dose Cover...</th>
<th>Sampling...</th>
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Issues

• **Large nodal disease on the left:**
  
  • - into the parotid therefore unable to keep in tolerance.
  • - with CTV and PTV margins the volume was into the spinal cord therefore the coverage was compromised to keep the OAR in tolerance.
THANK YOU