CASE REPORT

Unresectable squamous cell carcinoma of upper trachea with long-term survival after concurrent chemoradiotherapy

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► Additional material is published online only. To view, please visit the journal online (<http://dx.doi.org/10.1136/bcr-2017-221284>).

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Accepted 2 August 2017

SUMMARY

Upper tracheal malignancies are rare, and long-term survival is even rarer, especially among the unresectable malignancies. A 66-year-old chronic smoker was diagnosed as a locally advanced, non-metastatic squamous cell carcinoma of the upper trachea. Being unresectable, he was treated with six cycles of concurrent weekly cisplatin and three-dimensional conformal radiotherapy to a dose of 60 Gy in 30 fractions over 6 weeks. Follow-up imaging at 6 and 12 months revealed no disease. Our patient is presently 36 months post-treatment and is disease free without tracheal necrosis, fistula or radiation pneumonitis but developed hypothyroidism and is presently euthyroid. Concurrent chemoradiotherapy appears safe up to 3 years at least without any necrosis and is effective in controlling local disease. Meticulous planning obviates the need for higher technology like motion management techniques or intensity-modulated radiotherapy.

BACKGROUND

Tracheal neoplasms are rare malignancies with an incidence rate of 2.6 cases per 1 000 000 population as reported by study over a 30-year time period.¹ In national tumour registry analyses from USA and European nations, the majority of tracheal tumours in adults are malignant, with most of them being either squamous cell carcinomas (SCCs) or adenoid cystic carcinomas.^{1,2}

Tracheal neoplasms have an insidious onset, often leading to a delay in diagnosis, making these potentially curable lesions difficult to treat. Surgery, followed by adjuvant radiotherapy, is usually the treatment of choice; primary radiotherapy with

concurrent chemotherapy, in inoperable cases, can represent a curative management option.³

This case is being reported to highlight the long-term survival of a rare case of SCC in the upper trachea treated with concurrent chemoradiotherapy (CT-RT) with minimal acute and late side effects. Even in the absence of exotic motion management solutions and highly conformal image-guided radiotherapy, two ubiquitous tools used in this case are highlighted here, namely, the use of fluoroscopy to identify maximum tumour excursion (hence generate the internal target volume) and the use of concurrent cisplatin along with three-dimensional conformal radiotherapy (3D-CRT) ad portal imaging for set-up verification.⁴ The supplementary file contains in-depth details of the target volume delineation and planning parameters to enhance the learning from the case.

CASE PRESENTATION

A 66-year-old male with no comorbidities and a smoking history since 30 years presented with complaints of productive cough and breathlessness since 4 years. These symptoms were insidious in onset, progressive in nature and with sudden increase since 4 days. He also had haemoptysis for 4 months about 1–2 episodes per day producing about half teaspoon of blood per episode mixed with sputum and occasional frank haemoptysis. Patient also gave history of loss of weight, which was not quantifiable, and loss of appetite since 4 months.

On examination, his performance status by ECOG was 1, vitals were stable and general examination was unremarkable. The respiratory system examination revealed normal vesicular breath sounds on auscultation with no added sounds in all lung fields. Systemic examination was within normal limits. Video-directed scopy (VDS) showed bilateral mobile vocal cords and no growth or ulcer.

INVESTIGATIONS

Complete blood count, renal and liver function and pulmonary function tests were normal. Contrast-enhanced CT scan of the neck, thorax and abdomen showed a polypoidal lesion involving right lateral wall of trachea distal to cricoid for a length of 3.6 cm, maximum thickness of 1 cm and encompassing more than half the circumference of the trachea, enlarged lower paratracheal and subaortic

Figure 1 Tumour in trachea seen in axial sections of the high-resolution computed tomography.

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To cite: Yathiraj PH, Ail S, Singh A, et al. *BMJ Case Rep* Published Online First: [please include Day Month Year]. doi:10.1136/bcr-2017-221284

Figure 2 Primary tumour delineation in axial section (image taken from Oncentra for better representation): GTV in red, CTV in dark blue, PTV in red, chest wall in navy blue, oesophagus in green, heart in light green and lungs in dark green. CTV, clinical target volume; GTV, gross tumour volume; PTV, planning target volume.

lymph nodes (largest was 12×8 mm) and bronchiectatic changes in left lower lobe (figure 1). There were no distant metastasis. Bronchoscopy revealed a growth on right lateral wall of upper trachea, and biopsy revealed a moderately differentiated SCC (MDSCC).

Figure 3 Primary tumour delineation in coronal section (image taken from Oncentra for better representation): GTV in red, CTV in dark blue, PTV in red, chest wall in navy blue, oesophagus in green, heart in light green and lungs in dark green. CTV, clinical target volume; GTV, gross tumour volume; PTV, planning target volume.

Figure 4 Primary tumour delineation in sagittal section (image taken from Oncentra for better representation): GTV in red, CTV in dark blue, PTV in red, chest wall in navy blue, oesophagus in green, heart in light green and lungs in dark green. CTV, clinical target volume; GTV, gross tumour volume; PTV, planning target volume.

DIFFERENTIAL DIAGNOSIS

The final diagnosis made was of MDSCC upper trachea with chronic obstructive pulmonary disease. As no formal American Joint Cancer Committee staging exists, he was staged as cT2N0M0 (Bhattacharyya staging, 2004).⁵

TREATMENT

Cardiothoracic surgery consultation was sought for surgical feasibility who deemed it unresectable in view of size of primary tumour.⁶ Patient was planned for concurrent CT-RT to a dose of 60 Gy in 30 fractions over 6 weeks given 5 days a week with concurrent weekly cisplatin chemotherapy at 40 mg/m². Patient was immobilised in the supine position with arms by the side, and a thermoplastic mould was made in treatment position. The gross tumour volume (GTV) included the primary growth (GTV-P) and the suspicious nodes at stations IV and V of the mediastinum (GTV-N).⁷ The clinical target volume (CTV) included the GTV-P and GTV-N with a 1 cm isotropic margin, which was edited from normal structures like vertebral body, skin, thyroid gland and vessels. Simulation fluoroscopy was performed to identify maximum tumour excursion in antero-posterior and lateral directions and identified as 7 mm as internal margin. The planning target volume (PTV) included the CTV with a 7 mm internal margin and 5 mm setup margin expanded uniformly. Normal structures delineated were right and left lungs, oesophagus, spinal cord, chest wall, heart and proximal bronchial tree (figures 2–4).

Patient received planned dose of 60 Gy over 30 fractions using 3D-CRT and 6 MV photons over 41 days using antero-posterior with postero-anterior fields until 30 Gy followed by right and left anterior-oblique fields for the PTV primary and 3-field (AP, right and left posterior-oblique fields) to the PTV nodes (figure 5). The mean lung dose to right and left lungs were 8.3 and 5.0 Gy, respectively, V50 for oesophagus was 40% (detailed atlas of contouring, beam arrangement and dosimetry

Figure 5 Beam arrangements of the phase II to PTV primary showing right anterior oblique portal. PTV, planning target volume.

available in online supplementary material) (figure 6). The plan was made on Elekta Precise plan (Elekta, Stockholm, Sweden) and received the treatment on Elekta Precise linear accelerator (Elekta) with weekly portal image verification. Patient received six cycles of weekly cisplatin chemotherapy. Patient completed CT-RT with grade 1 dermatitis and grade 2 dysphagia (RTOG toxicity criteria). A weight loss of 9.5% of baseline weight was recorded during treatment, but nasogastric tube was not inserted at patient's request.

Figure 6 Dose volume histogram of the GTV, CTV, PTV and important normal structures (rest shown in the supplementary data). CTV, clinical target volume; GTV, gross tumour volume; PTV, planning target volume.

Figure 7 Follow-up contrast enhanced computed tomography (at same slice as figure 1) at 6 months representing no growth and minimal radiation pneumonitis.

OUTCOME AND FOLLOW-UP

Patient was kept on regular follow-up monthly for the first 3 months and then 3-monthly since. A CT scan done 6 and 12 months post-treatment showed no evidence of polypoidal growth, no signs of radiation-induced pneumonitis or tracheal stenosis on follow-up (figures 7 and 8). However, he developed hypothyroidism about 9 months post-RT and is on thyroid supplements. Patient is presently 36 months postradiotherapy and is euthyroid and presently without locoregional or distant recurrence.

DISCUSSION

This case is reported to highlight the optimum use of conformal radiotherapy in this rare diagnosis. With the use of 3D-CRT to a relatively low dose of 60 Gy over 30 fractions with six cycles concurrent cisplatin chemotherapy, we could achieve long-term control with negligible long-term side effects. Higher doses were not administered fearing reports of tracheal necrosis from older series.⁸ It is well known from head and neck cancers that the addition of

Figure 8 Follow-up CECT (at same slice as figure 1) at 12 months representing no growth in trachea.

chemotherapy adds a putative 8–10 Gy biological equivalent dose value equivalent in radiotherapy.⁹

Tracheal malignancies are ideally treated with a surgical excision of the tumour and involved nodes followed by adjuvant radiotherapy if found to be an R1 or R2 resection or node positive disease.³ Surgical excision appears to be the cornerstone of therapy as even a positive margin did not translate to worse survival.¹⁰ While no randomised trials exist, best survival is seen from the retrospective series involving both modalities.¹¹ The results from a study showed 58% had 5-year survival with a median survival of 91 months in spite of majority having R1 resection. However, surgical skills appear exclusive as high volume centres operate nearly double the number of low volume centres and nearly two-thirds are margin negative surgeries.¹² The results of margin negative surgeries from a contemporary series suggest 5-year survival between 40% and 50%.^{10 12–14}

Radiotherapy alone when used with definitive intent in SCC have fair results—4-year survival of 41%.¹¹ However, there are only few case reports of outcomes following concurrent CT-RT for unresectable SCC: one with induction chemotherapy followed by radiotherapy, the other with CT-RT with distant failure in the third year of follow-up and the third report of two cases, both of which developed distal failures and died within 18 months.^{3 15–17}

Learning points

- Concurrent chemoradiotherapy with cisplatin and a modest dose of 60 Gy over 30 fractions radiotherapy may be sufficient in unresectable squamous cell carcinoma of the upper trachea.
- There exists a narrow therapeutic ratio for upper tracheal malignancies to avoid devastating tracheal necrosis or fistula yet control the cancer.
- Meticulous radiotherapy planning and conformal radiotherapy appears to obviate the need for more exotic motion management solutions and highly conformal intensity-modulated radiotherapy.
- Hypothyroidism is a potential side effect while irradiating upper tracheal malignancies and must be evaluated at each visit.

Contributors Patient and treatment details collection: SA. Manuscript preparation: SA and PHY. Discussion and references: PHY and AS. Manuscript review: AS and VM.

Competing interests None declared.

Patient consent Obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

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