Feasibility of post-operative VMAT radiotherapy for circumferential neck keloids: Case Study

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Introduction

Keloid excisions have conventionally utilized electron beam radiotherapy delivered within 24 hours of surgery to reduce recurrence.
Large keloids of the neck often result in matching problems with moving junctions and excessive hotspots with electron beam radiotherapy.
This study presents a volumetric modulated arc therapy (VMAT) keloid plan for a large circumferential keloid excision.

Methods & Materials

Postop neck keloid excision (*21.9 cm ✕ 14.6 cm)* was treated with VMAT. The prescription dose was 1800cGy delivered in 3 fractions over 3 consecutive days. The 1ST fraction was delivered within 24 hours of surgery. CT simulation was performed using a thermoplastic mask and wire placement on incision shown in (Fig.1).

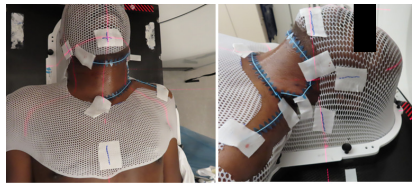

Fig 1. Keloid excision wired (blue solid line, 21.9cm x14.6cm)

CTV = incision + postoperative bed
CTV +3 mm expansion = PTV (Fig. 2)

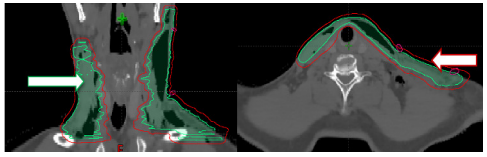

Fig 2. CTV shown in green, indicated by green arrow and PTV shown in red, indicated by red arrow.

Methods and Materials (continued)

A VMAT plan was generated using 3 arcs, 6MV photons and 0.8 cm bolus daily.(Fig 3.)

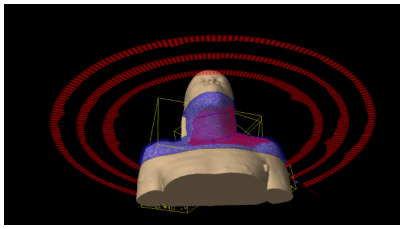

Fig 3. Arcs shown with 0.8 cm daily bolus, as seen in blue, covering the red PTV volume.

The planning goal was 95% PTV with hotspots within 110% of the prescription dose (Rx). 5 cm Normal Tissue Ring (NTR) was created 7 mm from PTV to reduce the NTR dose. Upper gEUD objectives were set to 1.1 to the esophagus and larynx to reduce the mean dose (Dmean) of these two organs. Dmax of brainstem and spinal cord were optimized to less than 50% of Rx. The VMAT plan was evaluated by comparing electron beam plans with matching fields and moving junctions.

Results

PTV coverage to D95% =1800cGy, D90%= 1814cGy, D2% =1893cGy, and Global Dmax=1954cGy and inside PTV. (Fig.4)

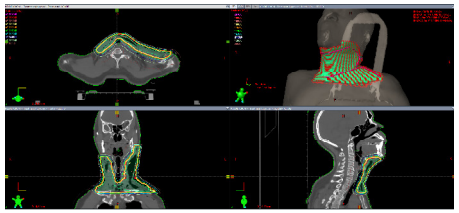

Fig 4. VMAT plan isodose distribution in coronal, axial, and sagittal planes. Yellow representing 1800cGy or 100% of Rx.

Results (continued)

Electron beam plans failed to cover 95% of the PTV with hotspots exceeding 120%. VMAT plan better spared OARs compared to electron beam plan, except for spinal cord, due to electron plans' failure to adequately cover PTV. (Fig.6)

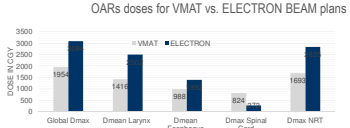

Fig.6. VMAT plan compared to matching Electron beam plans for evaluation of OARs sparing and Dmax values.

The clinical result for pre-surgical excision and six months post-irradiation is shown in (Fig.7).

Fig 7. Pre-surgical keloid and six months post-radiation

Conclusion

A VMAT postoperative keloid plan for complex circumferential neck incisions provide superior target coverage and better OAR sparing compared to electron beam plans.

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