

RECURRENT MULTIPLE MYELOMA AT CLIVUS & C1

UCSF Medical Center

UCSF CyberKnife® Team:

Radiation Oncologist: David Larson, Ph.D., M.D.

Neurosurgeon: Philip Weinstein, M.D.

Medical Physicist: Vernon Smith, Ph.D.

Radiation Therapist: Stuart Suen, R.T.(T.)

CyberKnife Center: University of California,
San Francisco
San Francisco, CA

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DEMOGRAPHICS

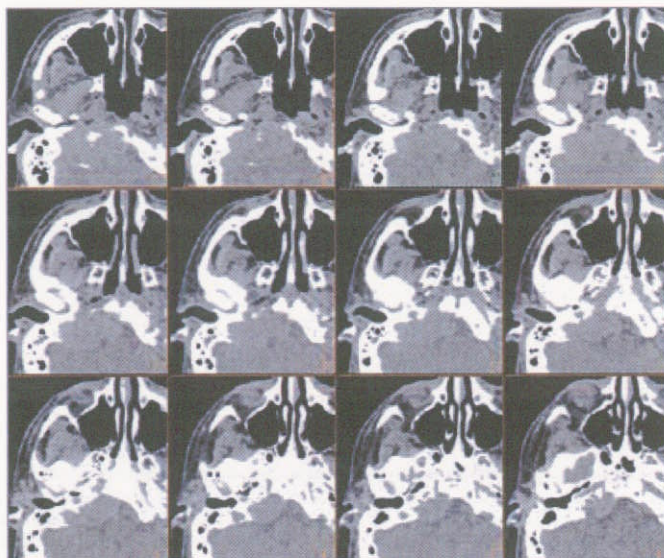
Sex: Male
Age: 43 years
Histology: Multiple Myeloma

CLINICAL HISTORY

Referred by: Medical Oncology
Previous Treatment: External beam radiation for initial disease. Chemotherapy, bone marrow transplant and repeat external beam radiation upon first recurrence. Thalidomide therapy and surgery two years later and bone marrow transplant the following year.

Case History

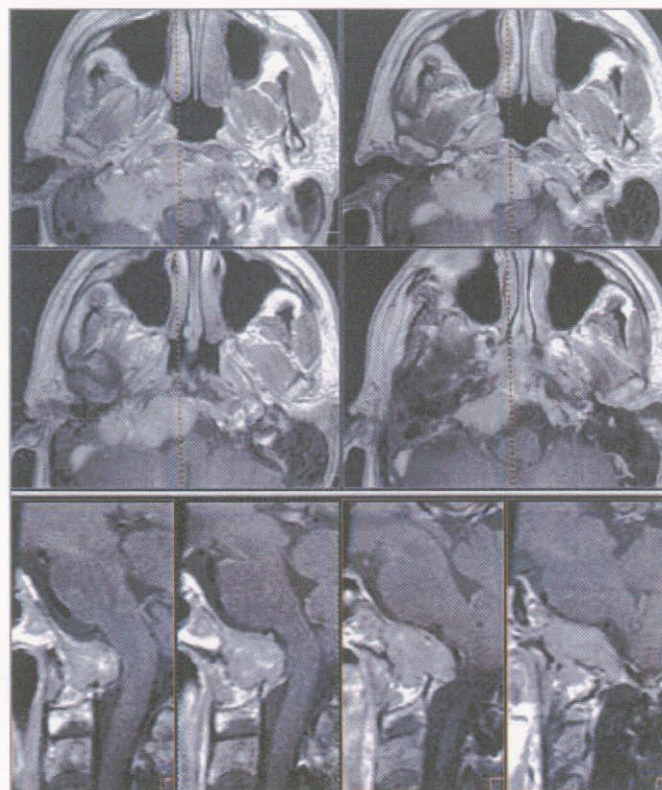
This 43-year-old male had an extended history of multiple myeloma. He was initially diagnosed when he presented with a severely destructive lesion at C1, which was treated with external beam radiation to the neck to 45 Gy. Two years later, he had recurrent disease, which was first treated with VAD (vincristine, adriamycin and dexamethasone). This was followed by a stem cell transplant preceded by high-dose cyclophosphamide plus etoposide and high-dose melphalan. He then was retreated with external beam radiation to 36 Gy with the spinal cord blocked. His disease progressed, and two years later, he underwent a 3-phase surgical resection with occipito-cervical fusion with internal fixation. The next year, he underwent a bone marrow transplant. The patient had been stable for several months, when MRI showed increasing soft tissue mass involving the clivus and skull base, right greater than left.



Planning CT images (1.25 mm) showing the extent of disease in the axial plane covering 3 cm of cranial-caudal anatomy.

CyberKnife Treatment Rationale

This patient had been treated twice with radiation, chemotherapy, stem cell transplant and surgery. Additional external beam radiation would have exceeded normal tissue tolerances. CyberKnife, with submillimeter² accuracy and highly conformal dosimetry, was the only reasonable option to control the patient's tumor without causing undue radiation-induced toxicity.^{1,3}



Axial and sagittal T1 MR with gadolinium contrast at the level of the clivus and C1 compressing the brainstem and upper cervical spine on the right side. This imaging study reveals a 4.8 x 2.9 x 2.8 cm mass extending to the right occipital condyle, the anterior arch of C1 and the superior body of C2, including the dens on the right side.

TREATMENT DETAILS

Tumor Volume: 29.14 cc
Imaging Technique(s): CT, MRI
Rx Dose & Isodose: 30 Gy to 52%
Conformality Index: 1.30
Tumor Coverage: 75.9%
Number of Beams: 229

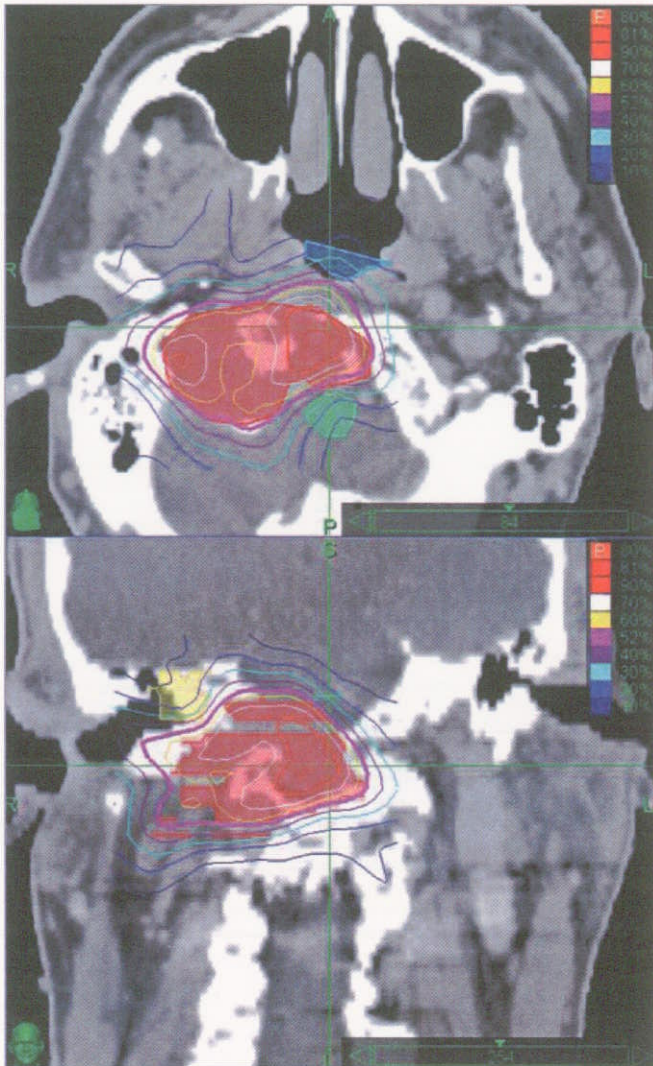
Fractions / Treatment Time: 5 @ 56 min per fraction
Path Template: 3 path 900_1000 mm
Tracking Method: Fiducial
Collimator(s): 15 mm

Planning Process and Goals

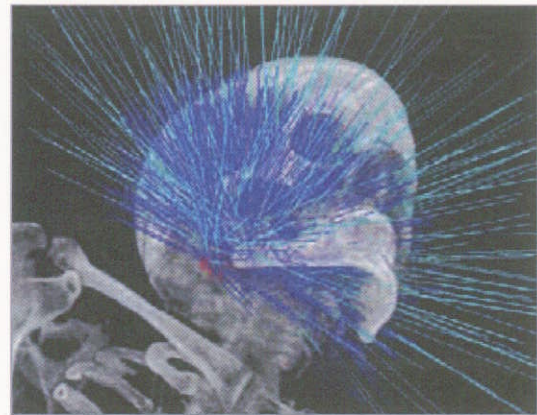
Fiducials were placed in the C2 spinous process, C3 spinous process, C5 lateral mass bilaterally, and the occiput. The patient was supported supine by a soft "timo-B" head rest and immobilized with a head-only Aquaplast mask. A contrast-enhanced CT scan was performed.

Treatment Delivery

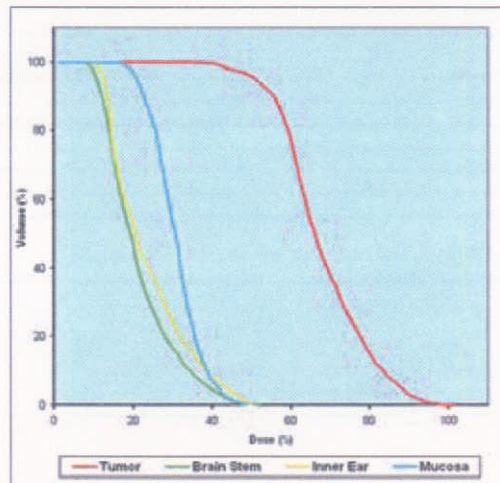
To accurately track and correct for patient movement during treatment, images were taken every other beam. Critical structure doses were designated as follows: a) maximum dose to brain stem/spinal cord was 26.54 Gy; 1 cc of brainstem/spinal cord received ≥ 15.0 Gy; 0.1 cc of brain stem/spinal cord received ≥ 21.75 Gy; b) maximum dose to the right inner ear was 23.20 Gy; 1 cc of inner ear received ≥ 7.9 Gy; 0.1 cc of inner ear received ≥ 16.1 Gy; c) maximum dose to the mucosa was 22.41 Gy; 1 cc of mucosa received ≥ 13.73 Gy; 0.1 cc of mucosa received ≥ 18.5 Gy.



Axial and coronal planning images showing the delineated tumor volume (red) as well as the critical structures of brainstem (green), inner ear (yellow) and mucosa (blue).



Right inferior oblique 3D rendering of bony anatomy and CyberKnife beam positions.



Dose Volume Histogram (DVH) for all key structures.