ACCURAY

CASE STUDY

C5 MALIGNANT PERIPHERAL NERVE SHEATH TUMOR

CYBERKNIFE
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DEMOGRAPHICS	
Sex:	F
Age:	56
Histology:	Malignant peripheral nerve sheath tumor (MPNST)

CLINICAL HISTORY	
Referred by:	Sheba Medical Center, Israel
Past Medical History:	Surgery, Radiotherapy, Chemotherapy

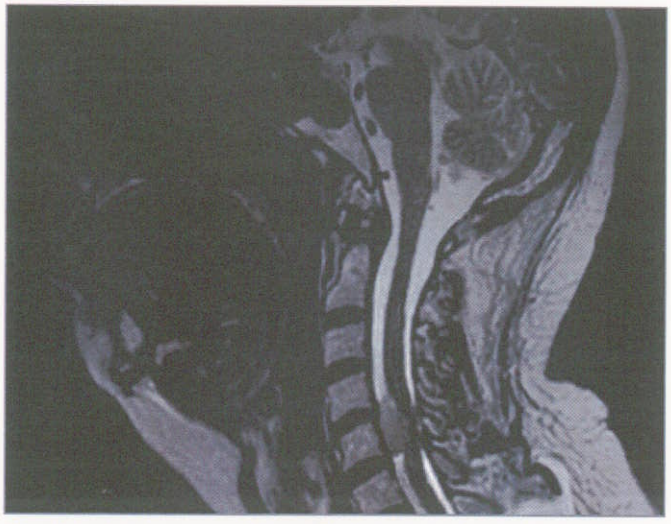
Case History

Malignant peripheral nerve sheath tumors (MPNST) are rare spindle-cell sarcomas derived from Schwann cells or pluripotent cells of the neural crest. The estimated incidence of MPNST in patients with Neurofibromatosis Type 1 (NF1) is 2-5% compared with 0.001% in the general population. MPNST originate from peripheral nerve root trunks, extremities, and the head and neck region. The tumor can be located intraspinally, foraminally, and extend extraforaminally. These tumors pose specific therapeutic challenges as they recur locally after surgery. Adjuvant conventional radiation therapy improves survival rate or local control in some series but not in others.[1,2,3]

We present here a rare case of a recurrent spinal non-NF1 MPNST treated by spinal radiosurgery. This 56-year-old female patient was transferred for progressive gait disturbances accompanied by severe neck pain. She was on morphine medication for 8 weeks. Incomplete surgery for a cervical non-NF1 MPNST at the level of C5 was performed 6 months prior to admission. After surgery the patient underwent a course of conventional fractionated radiotherapy (40 Gy) covering the whole spinal canal. Magnetic resonance imaging (MRI) of the cervical spine on admission revealed a large contrast enhancing extradural mass compressing the ventral spinal cord at C5.

CyberKnife® Treatment Rationale

There were no further treatment possibilities as surgery, conventional radiation therapy and chemotherapy were already attempted without preventing tumor growth. It was hoped that additional robotic radiosurgery targeting only the tumor mass could help to prevent further tumor progression and to reduce cervical pain.



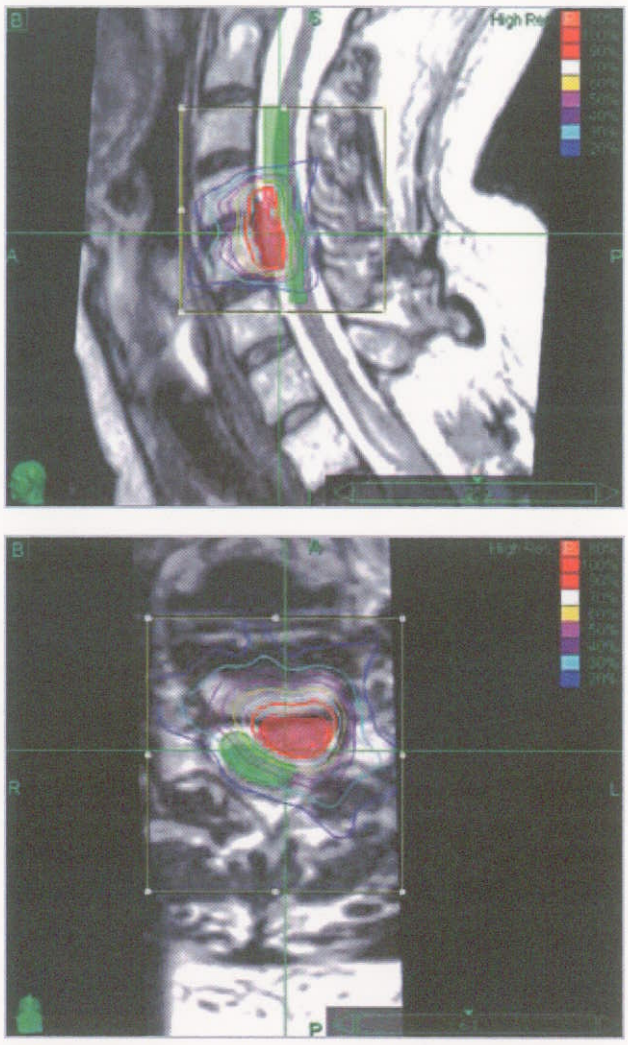
T2-weighted pre-treatment MRI scan. The lesion is clearly visualized at C5 significantly compressing the ventral aspect of the cervical spinal cord resulting in severe neck pain.

TREATMENT DETAILS

Tumor Volume:	1.8 cm^3	**Fractions / Treatment Time:**	1 @ 105 minutes
Imaging Technique(s):	CT, MRI	**Path Template:**	3 paths 900_1000 mm
Rx Dose & Isodose:	13.5 Gy to 80%	**Tracking Method:**	Xsight™ spine tracking
Conformality Index:	1.46	**Collimator(s):**	5 mm
Tumor Coverage:	91.4%	**Homogeneity Index:**	1.25
Number of Beams:	311		

Treatment Planning Process

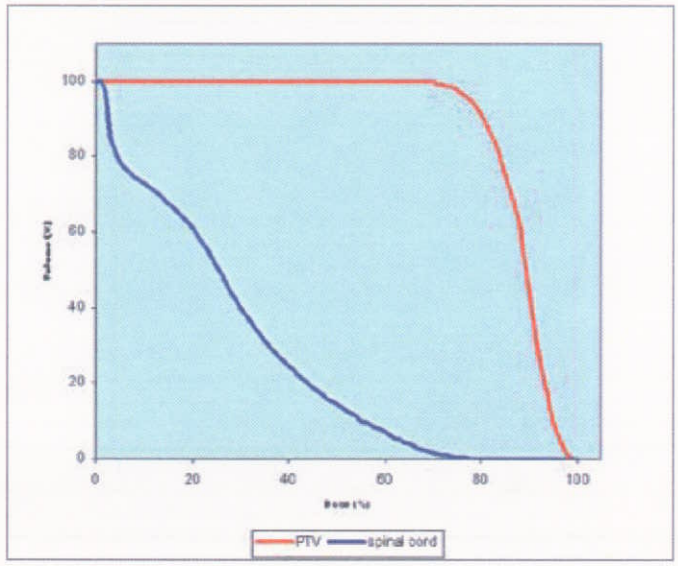
Treatment planning utilized CT, T1- and T2-weighted MRI scans +/- Gd with the patient positioned supine. These data sets were transferred to the MultiPlan® Treatment Planning System and registered using an algorithm based on normalized mutual information. The target volume, spinal cord, and other structures were defined mainly using the T2 MRI data. A treatment plan was generated using an iterative inverse planning algorithm. A dose of 13.5 Gy was prescribed to the 80% isodose, and delivered in a single fraction.



Mid-sagittal (top) and axial (bottom) isodose distributions: The red structure is the target volume and the green structure the spinal cord. A very steep dose gradient was obtained posteriorly in order to spare the spinal cord.

Treatment Delivery

The patient was positioned supine and fitted with a thermoplastic mask only. Treatment was delivered using the Xsight™ fiducial-less spine tracking system. With this system the position of the spinal vertebrae are calculated automatically from orthogonal X-ray images acquired during treatment. These are compared with digitally reconstructed radiographs (DRRs) calculated from the pre-treatment CT. The offset required to maintain the alignment of each individual beam to the target volume is calculated by a deformable registration algorithm which also compensates for any non-rigid change in patient position between pre-treatment imaging and treatment delivery. By repeating this process throughout treatment, intra-fraction patient motion, which can be significant in spinal treatments, is effectively negated.[4]



Dose Volume Histogram (DVH) for all key structures.