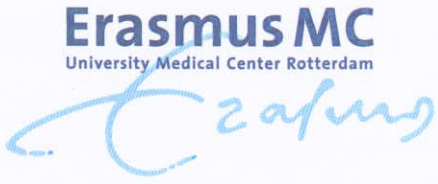
CASE STUDY

RECURRENT RECTAL CARCINOMA



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RECURRENT RECTAL CARCINOMA

DEMOGRAPHICS:

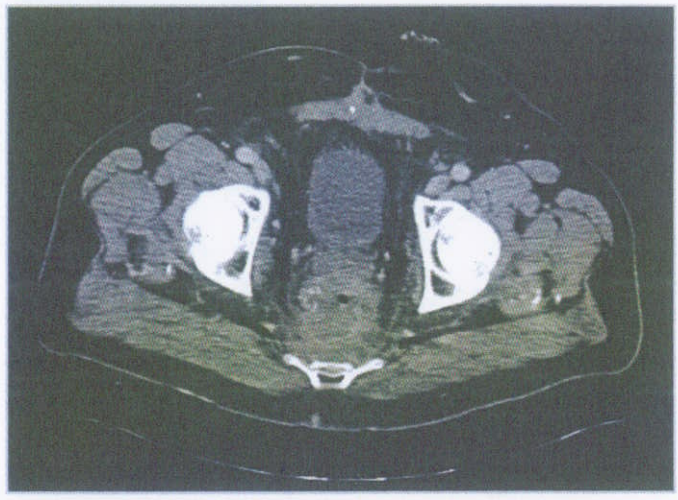
Sex: M
Age: 62
Histology: Recurrent Rectal Carcinoma
Treat Date(s): April 2005

CLINICAL HISTORY:

Referred by: Radiation Oncologist
Previous Treatment: Surgery, Radiation Therapy

Case History:
This patient presented in 2001 with a pT3 pN1 rectal adenocarcinoma. A surgical resection was performed followed by external beam radiation therapy (25 x 2Gy) using a three field technique. In 2002 a local recurrence was detected at the surgical scar site, and this was treated using a single electron field (30 x 2Gy). In 2004 a further recurrence was detected distal to the original treatment site, in the anal stump. This was treated with further radiation therapy (15 x 2Gy) using a three field technique. The lesion was found to be inoperable on open examination. In March 2005 the patient presented again with pain in the sacrum and coccyx, which also radiated into the right leg. He also described pain in the anus. He had anal fluid discharge, and had daily anal bleeding episodes.

CyberKnife Treatment Rationale:
A CT scan of the thorax, abdomen and pelvis showed no evidence of metastatic disease, and so chemotherapy was not considered to be appropriate. The lesion was already known to be surgically inoperable, and further conventional radiation therapy was not possible because of the high doses already delivered to a large volume. CyberKnife radiosurgery was considered to be safe in this case given the high conformality and dose gradient achieved. Treatment was delivered with the intention of palliating the pain symptoms and reducing rectal bleeding.



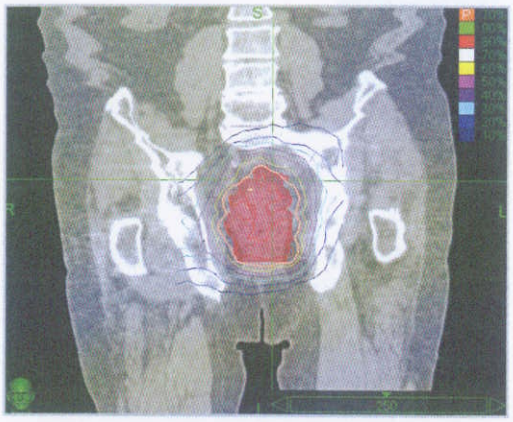
Pre-treatment CT, showing a large rectal lesion adjacent to both the bladder and cauda equina. The hypo-dense region at the center of the lesion is an area of infection, responsible for the fluid discharge.

RECURRENT RECTAL CARCINOMA

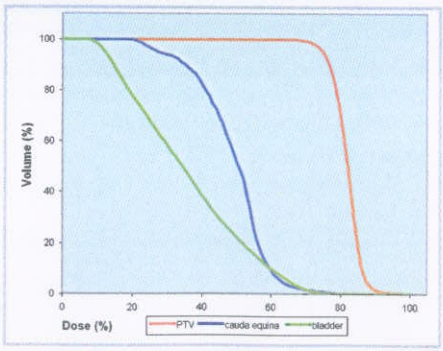
TREATMENT DETAILS:

Tumor Volume:	294 cm^3	**Fractions / Treatment Time:**	2 / 2 hours per fraction
Imaging Technique(s):	CT	**Path Template:**	3 paths 900_1000 mm
Rx Dose & Isodose:	16 Gy to 70%	**Tracking Method:**	Fiducial Tracking
Conformality Index:	1.44	**Collimator(s):**	12.5 mm and 40 mm
Tumor Coverage:	98.1%	**Number of Beams:**	232

Treatment Planning Process:
Four fiducial markers were implanted under local anesthesia without complication. A planning CT was acquired with the patient in the prone position. The Clinical Target Volume was defined as the diffuse hyper-dense area visible on the CT. A Planning Target Volume was constructed using a uniform 3 mm margin to account for residual positioning uncertainty caused by breathing motion. (This patient was not treated using the Synchrony motion tracking system). The bladder and cauda were defined as organs at risk, together with the left and right nerves branching from S1. A conformal treatment plan was developed using inverse optimization. This plan included 232 beams, each of 12.5 mm or 40 mm diameter. A dose of 16 Gy was prescribed to the 70% isodose and delivered in two fractions.

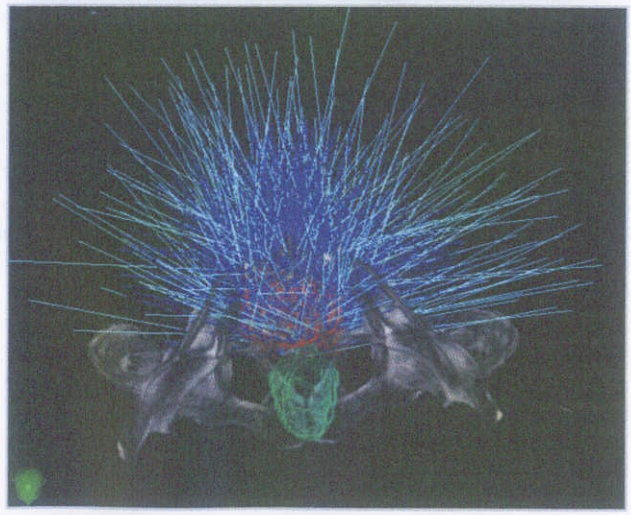


Coronal section showing tight conformality of the prescription isodose to the large target volume.



The dose-volume histogram shows excellent sparing of the bladder and cauda equina, which are both adjacent to the PTV.

Treatment Delivery:
The patient was treated in April 2005 using the CyberKnife system with fiducial tracking. He was positioned prone using a vacuum formed immobilization device. The treatment was delivered in about two hours, including set-up. This was performed as an out-patient procedure.



3D views of the treatment plan, showing the beam arrangement and close proximity of the PTV (red) to the bladder (green).