



PET/CT planned IMRT and Brachytherapy in cervical cancer with lymph node metastases

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Purpose

PET/CT scanning for patients with cervical cancer was introduced at Rigshospitalet in 2003. It is a more sensitive method to detect lymph node metastasis compared to CT alone. The existence of tumor positive lymph nodes requires intensive treatment to a higher total dose and to a larger volume. We wanted to intensify the treatment without radically changing the treatment of the uterus and cervix. This work is primarily a guideline for the new intensive treatment for cervical cancer.

Normal treatment/no positive lymph nodes recognised

The traditional treatment at Rigshospitalet for cervical cancer is extern radiation therapy followed by intracavitary brachytherapy.
ERT: 4 box technique 2 Gy x 23 F, 5 F/W based on CT scan.
Equipment: 18 MV Clinac 2100/2300 (Varian Medical Systems)
BT: In 2 subsequent weeks 1,75 Gy x 10, 1 pulse/h. Dose defined in point A.
Equipment: Ir-192 PDR microSelectron (Nucletron BV)

Present method: PET positive lymph nodes

ERT: 5-7 fields sliding window IMRT based on PET-CT scan.
2 Gy x 32 F, 5 F/W to PET positive lymph nodes
50 Gy/32 F, 5 F/W to the rest volume (incl. cervix and uterus)
Equipment: 18 MV Clinac 2100/2300 (Varian Medical Systems)
BT: In 2 subsequent weeks 1,75 Gy x 10, 1 pulse/h. Dose defined in point A.
Equipment: Ir-192 PDR microSelectron (Nucletron BV)

Material

Since October 2004, a total of 15 patients had PET positive lymph node metastases. Nine patients had disease confined to the pelvic region, whereas six patients had also been treated in the para aortic region. All patients had concomitant chemotherapy.

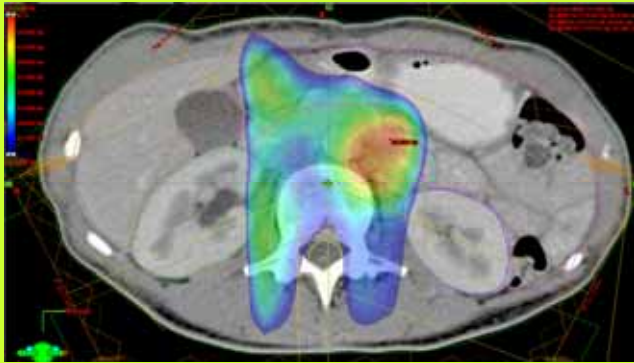


Figure 1: IMRT in the para aortic region

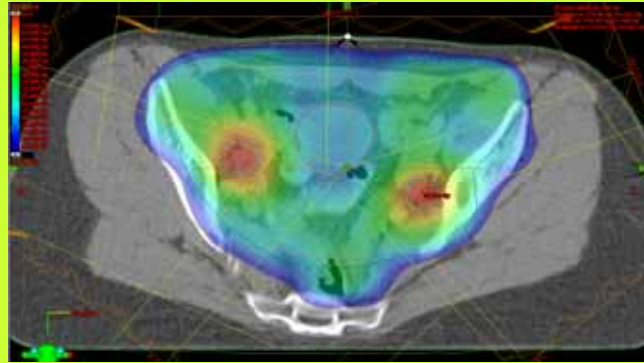


Figure 2: IMRT in the pelvic region

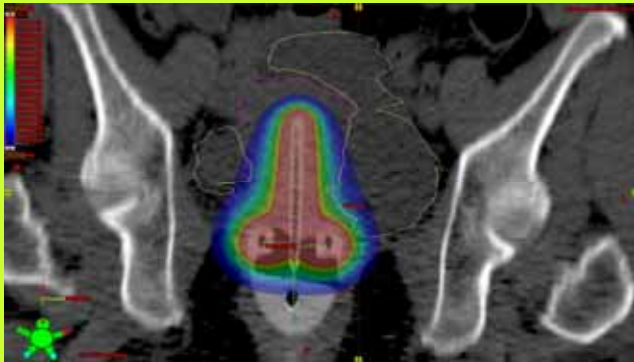


Figure 3: Brachytherapy of the cervix and uterus

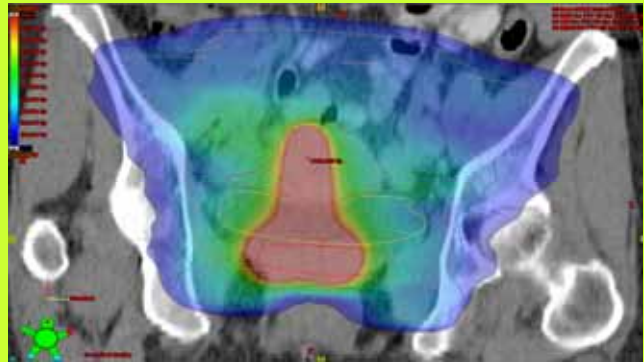


Figure 4: IMRT + brachytherapy

Guidelines for IMRT followed by brachytherapy

Bladder	55 Gy	5 %
Rectum	55 Gy	5 %
Spinal cord	45 Gy	0 %
Intestine	50 Gy	15 %
	35 Gy	40 %
Kidneys	20 Gy	20 %
	15 Gy	40 %
Pelvic bones	50 Gy	30 %
	35 Gy	70 %
Comments	20 Gy	85 %

It is obvious that it is difficult to avoid the bladder and the rectum. In spite of this, we recommend avoiding doses higher than 55 Gy with IMRT as these organs at risk may receive a further 20 Gy or more from brachytherapy.

Doses to the intestine and kidneys are only calculated for patients treated in the para aortic region.

As the patients receive concomitant chemotherapy and a higher total dose than earlier we recommend to minimise doses to the bone marrow. The femoral heads can be spared by IMRT.

Doses to the uterus treated with brachytherapy can be discussed. But this review has made it clear that we have to individualise the brachytherapy in future to get the primary tumour in the cervix (PET positive) to be treated optimal.

Conclusions

Combination of IMRT and brachytherapy allows to administer higher doses to the PET positive lymph nodes and at the same time obtain the usual dose in the cervix and uterus.

This technique allows a combination of IMRT and brachytherapy.

Since 2003 we have treated 35 patients by IMRT followed by intracavitary brachytherapy with satisfactory results.

We recommend IMRT in order to acquire a sufficient dose to positive lymph nodes in the pelvic or para aortic region.

IMRT technique

IMRT confined to the pelvis is normally performed by 5 fields – including the para

aortic region which in some cases requires 7 fields to get a satisfactory treatment plan. CTV is defined by a radiologist in co-operation with an oncologist.

PTV = CTV + 5 mm's margin is optimised to a dose of 50 Gy.

PET positive lymph nodes + 5 mm's margin are optimised to a dose of 64 Gy.

Optimisation is done at TPS Eclipse (Varian Medical Systems).

PET positive volumes in cervix are optimised to 50 Gy and receive 35 Gy as a boost from brachytherapy.

Brachytherapy technique

For brachytherapy we employ a ring and intrauterine tube (Nucletron BV).