

SBRT LIVER

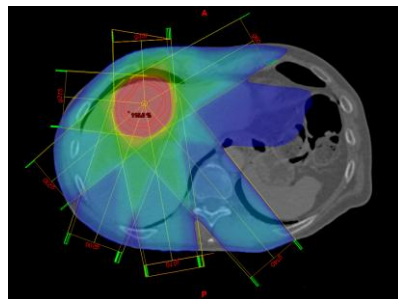
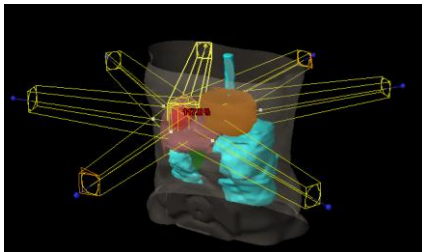
LEUVEN EXPERIENCE WITH ORFIT SBRT SOLUTION

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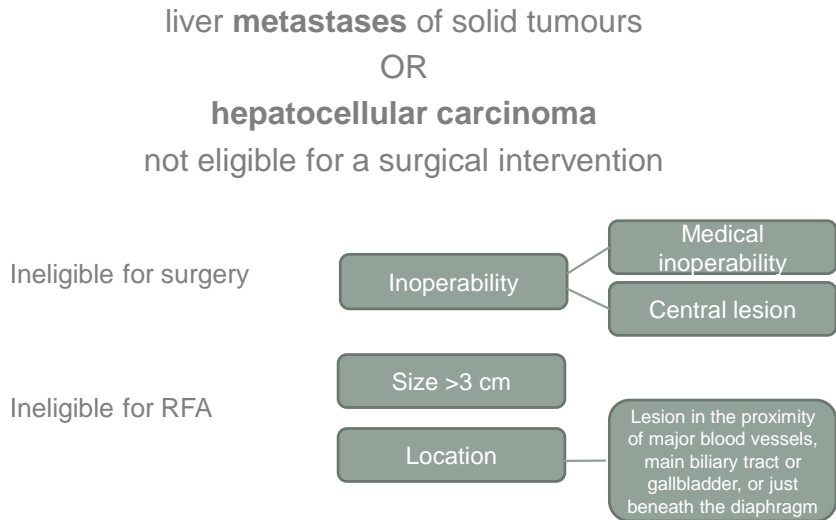
Stereotactic Body Radiation Therapy

“An external beam radiation therapy method used to very precisely deliver a high dose of radiation to an extracranial target within the body, using either a single dose or a small number of fractions”

ASTRO definition (Potters et al, IJROBP 2010)



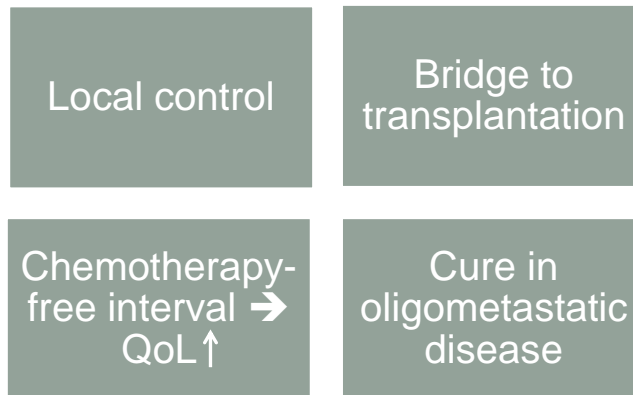
Indications



Indications

- ≤ 3 lesions
- Diameter of largest lesion 60 mm
(or feasible by planning; at least 700 cm³ of uninvolved liver)
- Adequate liver function
- Life expectancy > 3-6 months

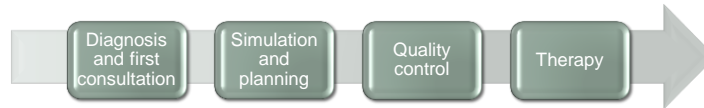
Objectives



Results of SBRT for liver metastases

Study	Pts	Dose	LC	OS	Primary colorectal
Herfarth Front Radiat Ther Oncol 2004	35	14-26 Gy/ 1fr	67% at 18 m	72% at 12 m	53%
Mendez-Romero Acta Oncol 2006	25	37.5 Gy / 3 fr	86% at 24 m	62% at 24 m	88%
Hoyer Acta Oncol 2006	64	45 Gy/ 3 fr	79 % at 24 m	-	100%
Rusthoven JCO 2009	47	36-60 Gy / 3 fr	92% at 24 m	30% at 24m	32%
Lee JCO 2009	68	27.7-60 Gy / 6 fr	71% at 12 m	47% at 18 m	59%
Ambrosino Anticancer Res 2009	27	25-60 Gy/ 3 fr	74%	-	41%
Goodman IJROBP 2010	19	18-30 Gy/ 1 fr	77% at 12 m	49% at 24 m	32%

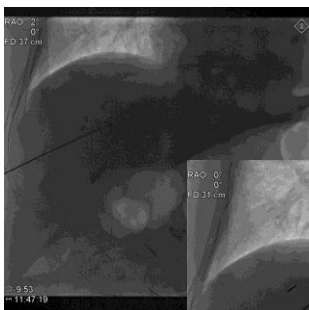
Challenges



- Target volume definition
- Image guidance
- Sufficient resources and expertise
- Rigorous quality assurance

Fiducial markers

Aim: to facilitate image guidance



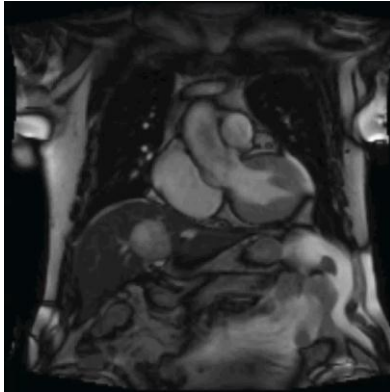
- Ultrasound liver to evaluate visibility of lesion
- Placement of 4-5 seeds in proximity of the tumour
- Percutaneously under general anesthesia
- By interventional radiologist



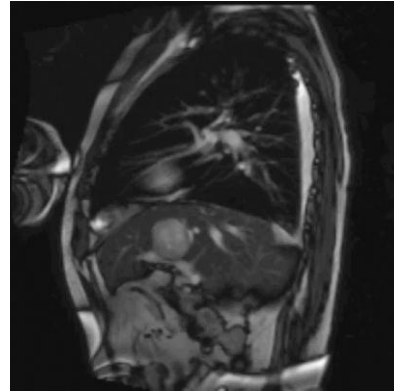
Tumour motion

Cine MR

Coronal view



Sagittal view



Tumour motion

Tumour motion must be accounted for

- to ensure proper delivery of the radiation to the **tumour** and
- to avoid unnecessary dose to the surrounding **healthy tissue**

→ Need for methods to deal with tumour motion

Motion
restrictive

Motion
compensating

Tumour motion

Motion Restrictive Methods

- Abdominal compression
- Breath-hold techniques

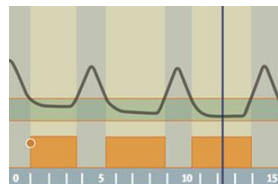


SBRT solution Orfit industries

Tumour motion

Motion Compensating Methods

- Respiratory gating
- Tumour tracking



Treatment preparation

orfit



Patient comfort!

SBRT solution Orfit®

Abdominal compression

- Maximal tolerable compression
- Grade of compression indicated on bar
- Fasting state

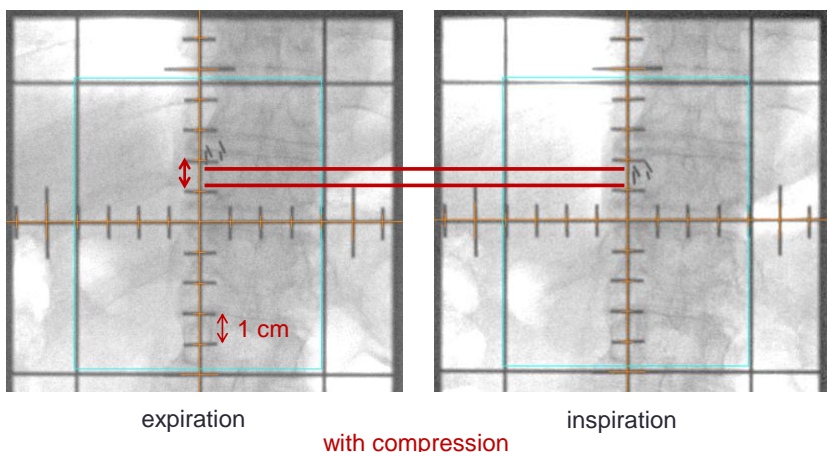


- In Leuven always used unless dose to organs at risk increases (e.g. small or large bowel)

Treatment preparation

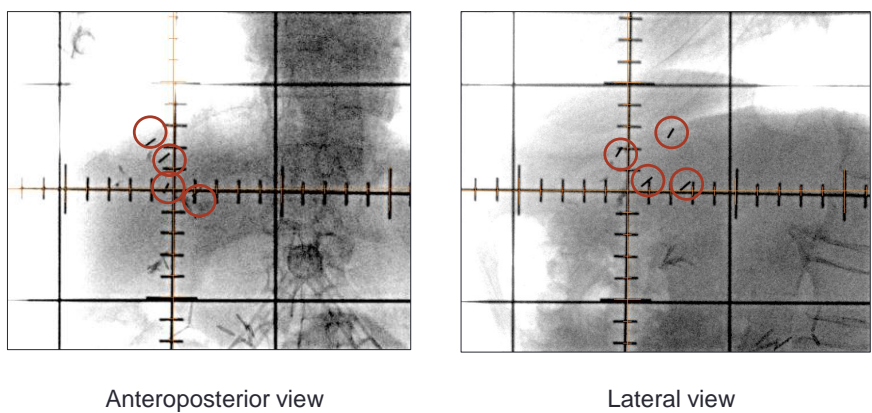
Marker motion during fluoroscopy

Abdominal compression reduces marker motion with about 50%



Treatment preparation

Marker motion during fluoroscopy

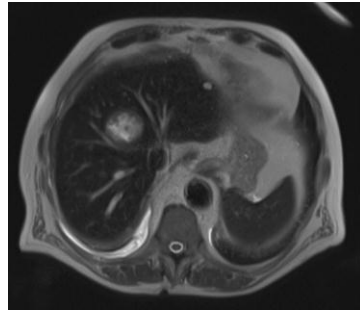


Target definition

Multimodal imaging and registration for target and organs at risk delineation



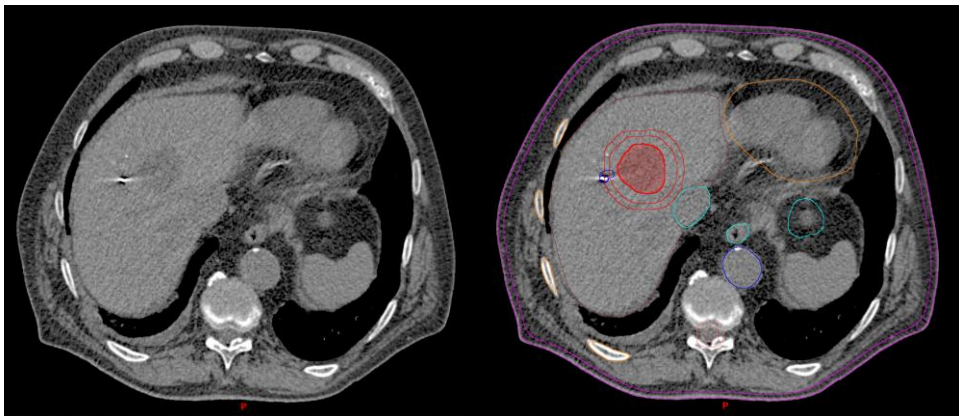
CT with compression



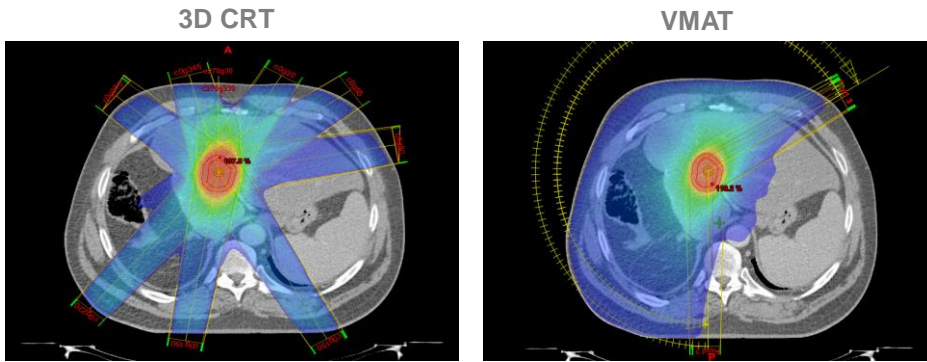
MRI with compression

Target definition

Multimodal imaging and registration for target and organs at risk delineation



Planning: 3D-CRT vs. VMAT



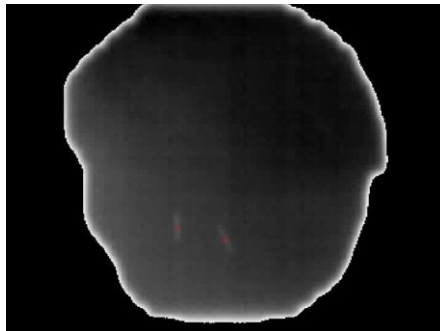
At least 7 beams

Choice of modality is patient dependent

Reproducibility of SBRT system

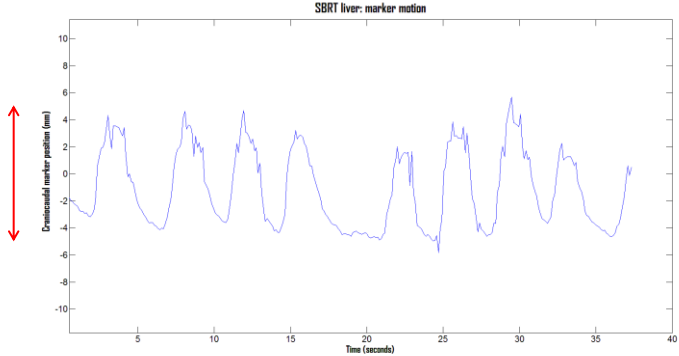
MV-cine images during radiation delivery

Cranio-caudal marker movement



Reproducibility of SBRT system

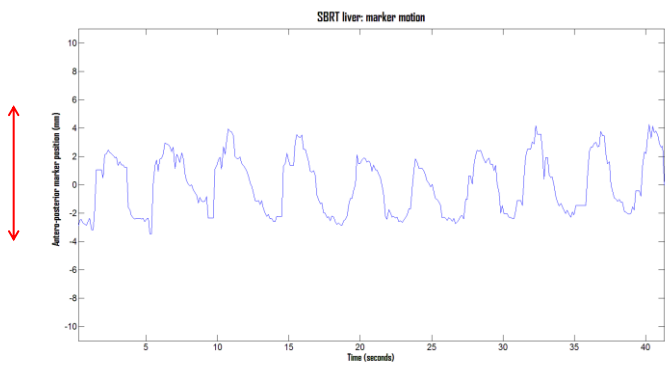
Craniocaudal marker motion



Range 8 mm 1 patient → respiratory cycle

Reproducibility of SBRT system

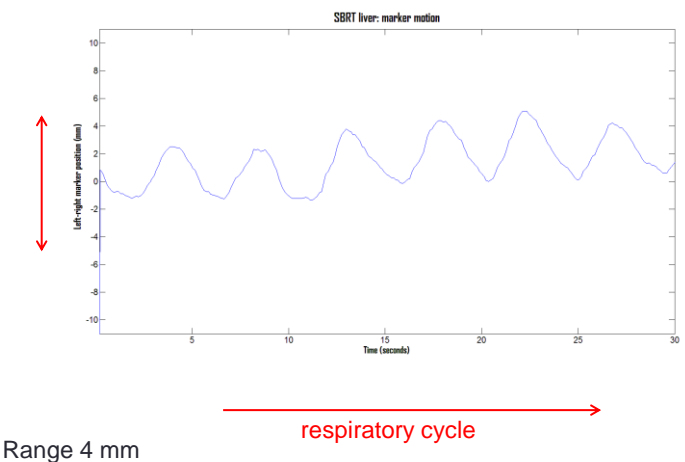
Anteroposterior marker motion



Range 4-6 mm → respiratory cycle

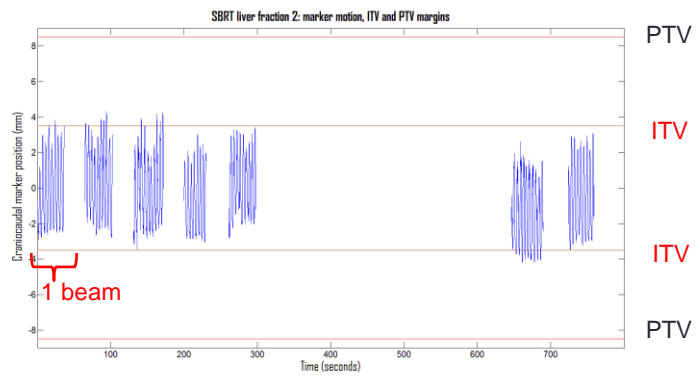
Reproducibility of SBRT system

Lateral marker motion

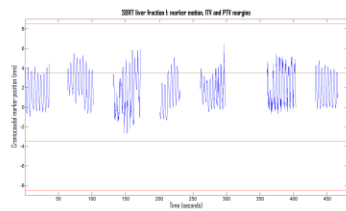


Reproducibility of SBRT system

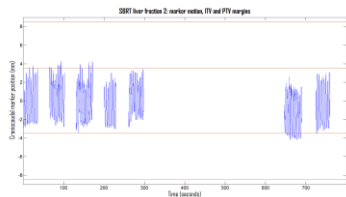
Intrafractional marker motion



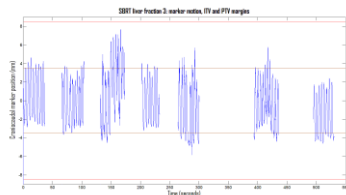
1 fraction



Fraction 1



Fraction 2



Fraction 3

Interfractional marker motion

- Intrafractional amplitude of motion stable, baseline drift within 1.5 mm
- Interfractional amplitude of motion within 2 mm

Conclusions

- Data on SBRT liver are emerging and early results on local control and survival are promising
- Long-term follow-up data are not available yet
- SBRT liver requires interdisciplinary discussion
- Abdominal compression reduces tumour motion and allows for smaller treatment margins
- Abdominal compression allows for a reproducible treatment delivery

Acknowledgements

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