

Sarcoma radiotherapy

PATIENT'S GUIDE

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Patient photos courtesy of Dr Wong Fuh Yong

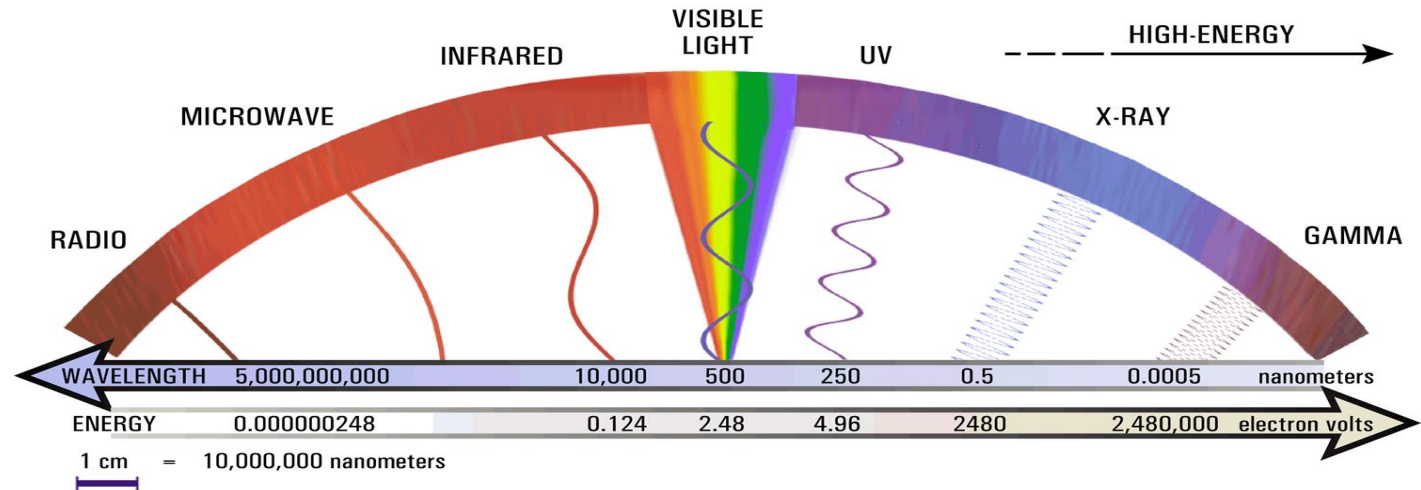


Outline

- What is radiotherapy
- Schedule
- Abdomen
- Extremity
- Side effects
- Resources
- Questions

What is radiotherapy

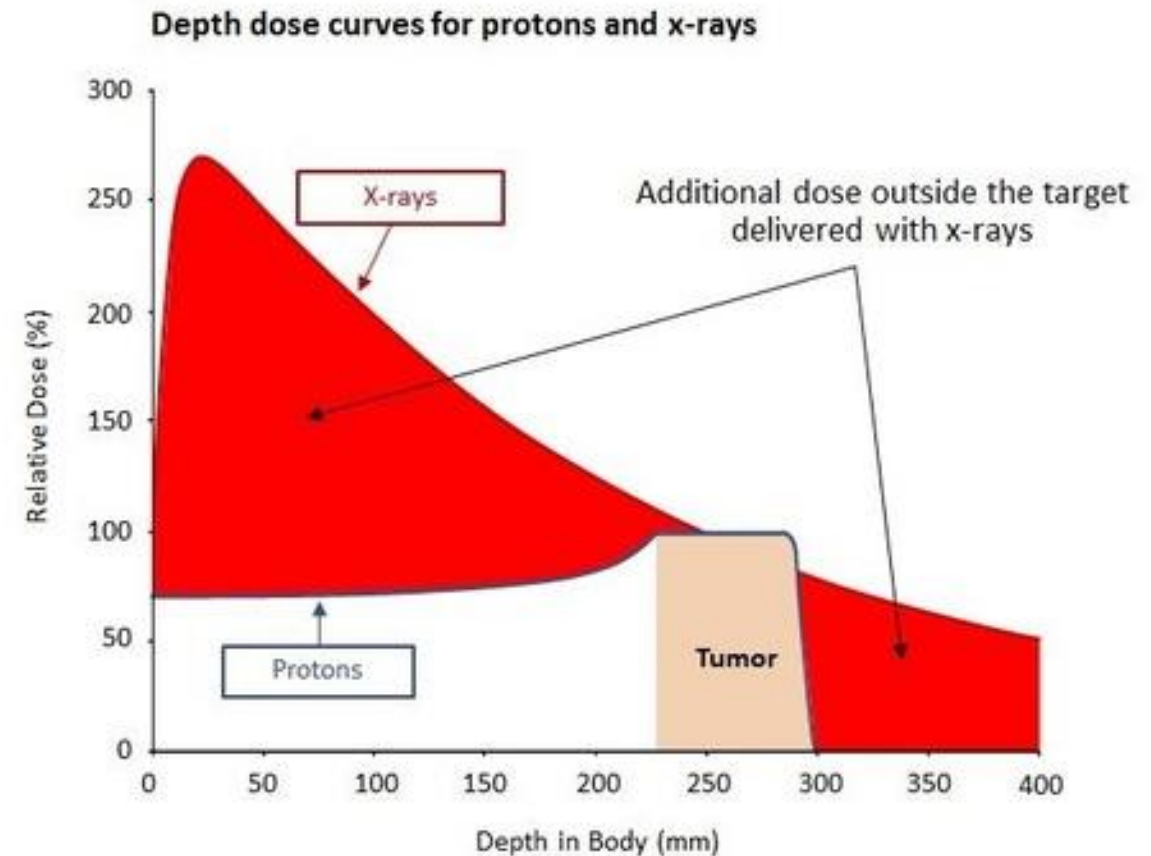
High energy XR



Protons

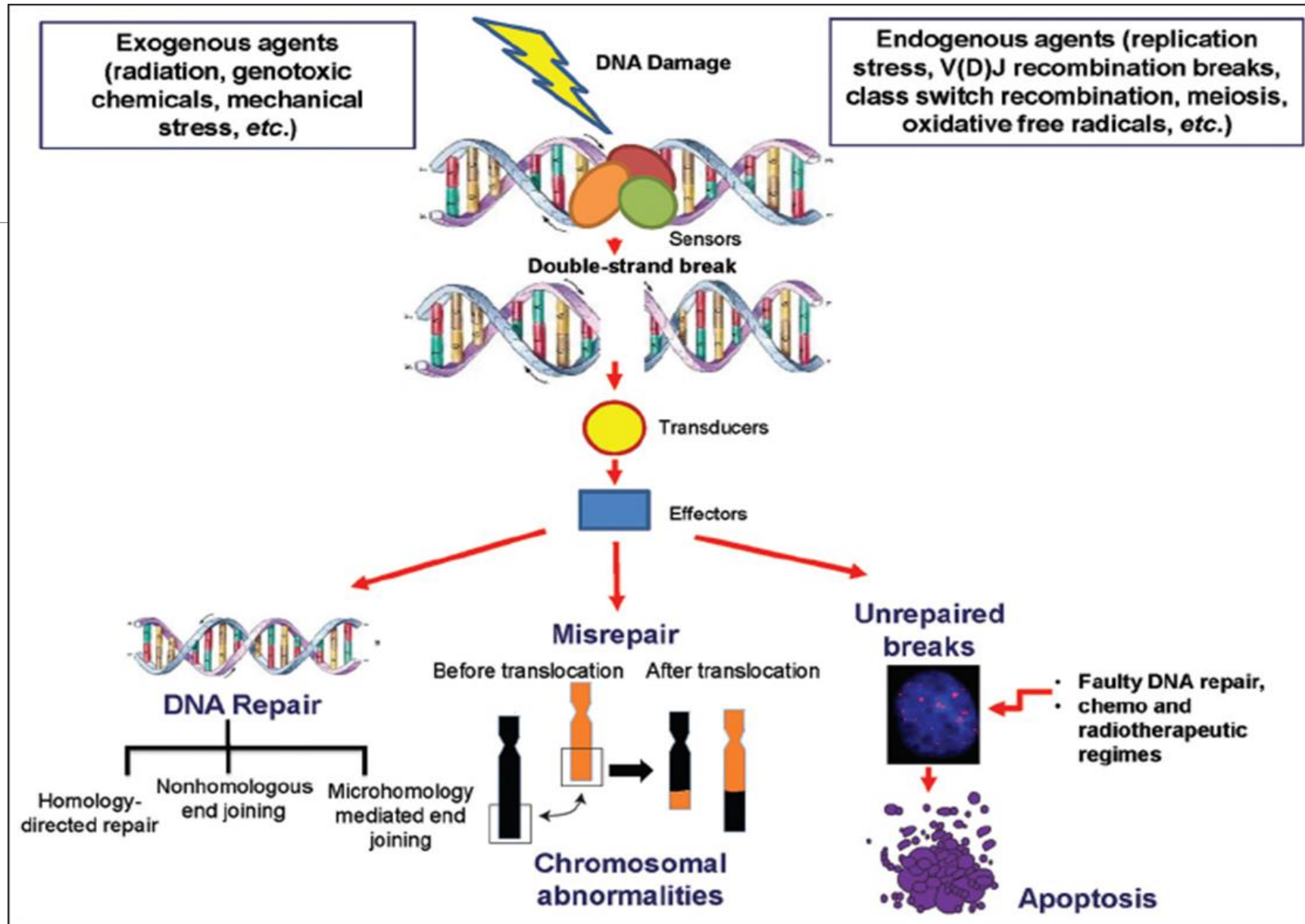
The Physics of Protons

In order to deliver the same dose to the tumor, x-rays must deliver a greater dose outside the target than protons do



MediShield Life Claim and MediSave Withdrawal Limits for Approved Proton Beam Therapy (PBT) Indications

S/N	Indication	PBT Category	MediShield Life Claim Limit	MediSave Withdrawal Limit
Cancer subtypes for patients of all ages				
<u>Musculoskeletal system</u>				
1	Base of Skull Chordoma	3	\$1,800 per treatment	\$2,800 per treatment
2	Base of Skull Chondrosarcoma			
3	Spinal and Paraspinal Bone and Soft Tissue Sarcoma	1	\$300 per treatment	\$80 per treatment
4	Non-metastatic retroperitoneal sarcomas			



Schedule

- Pre-operative

~45-50Gy

5 weeks

Definitive

~70-74Gy

6-7 weeks

Schedule

Consultation

CT simulation

Planning

Treatment starts



5 times a week

Soft tissue sarcoma

- Limbs
 - Chest wall
 - Para-spinal
 - Head and neck
-
- Prognosis
 - Histology
 - Grade
 - Size
 - MSKCC, Sarculator nomogram

Soft tissue sarcoma

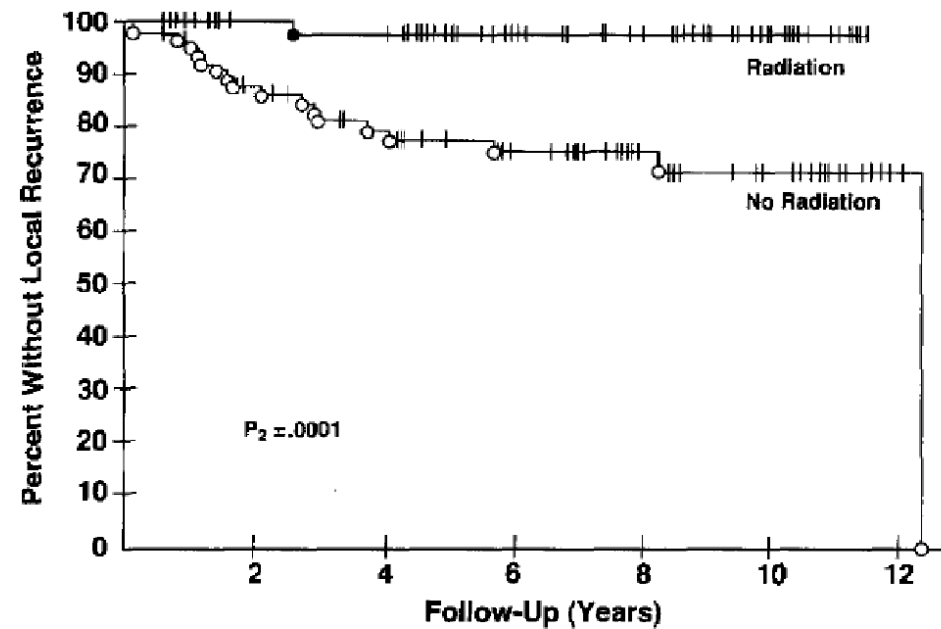


Fig 1. Local recurrence-free survival for all patients with soft tissue tumors of the extremity randomized to receive or not receive adjuvant postoperative external-beam XRT. Patients who develop metastatic disease are censored for LR.

Soft tissue sarcoma

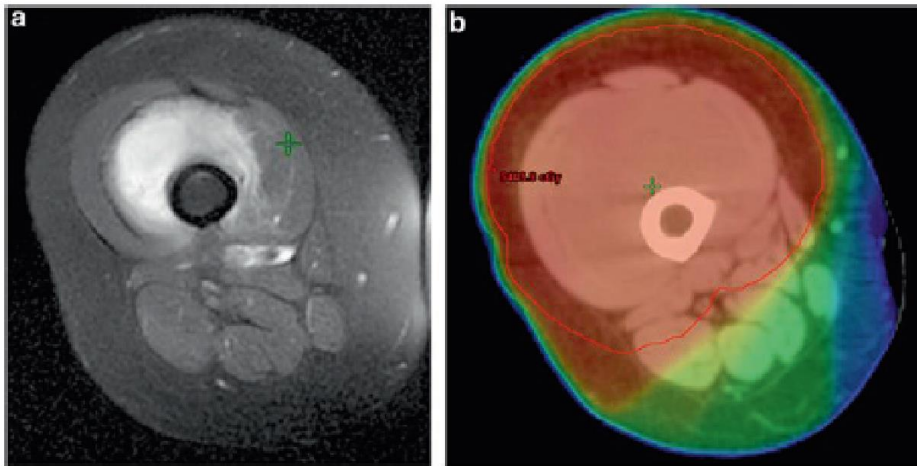


Fig. 3.13 Preoperative IMRT dose distribution: (a) Axial MRI demonstrating anterior thigh STS. (b) Axial view demonstrating the conformal dose distribution of IMRT

Retroperitoneal sarcoma

- Prognosis
 - Size
 - Grade
 - Surgery type
 - MSKCC, Sarculator nomograms

Retroperitoneal sarcoma

STRASS/STREXIT

- local control benefit in well differentiated and low grade dedifferentiated liposarcoma
- safe
- hazard ratio 60%

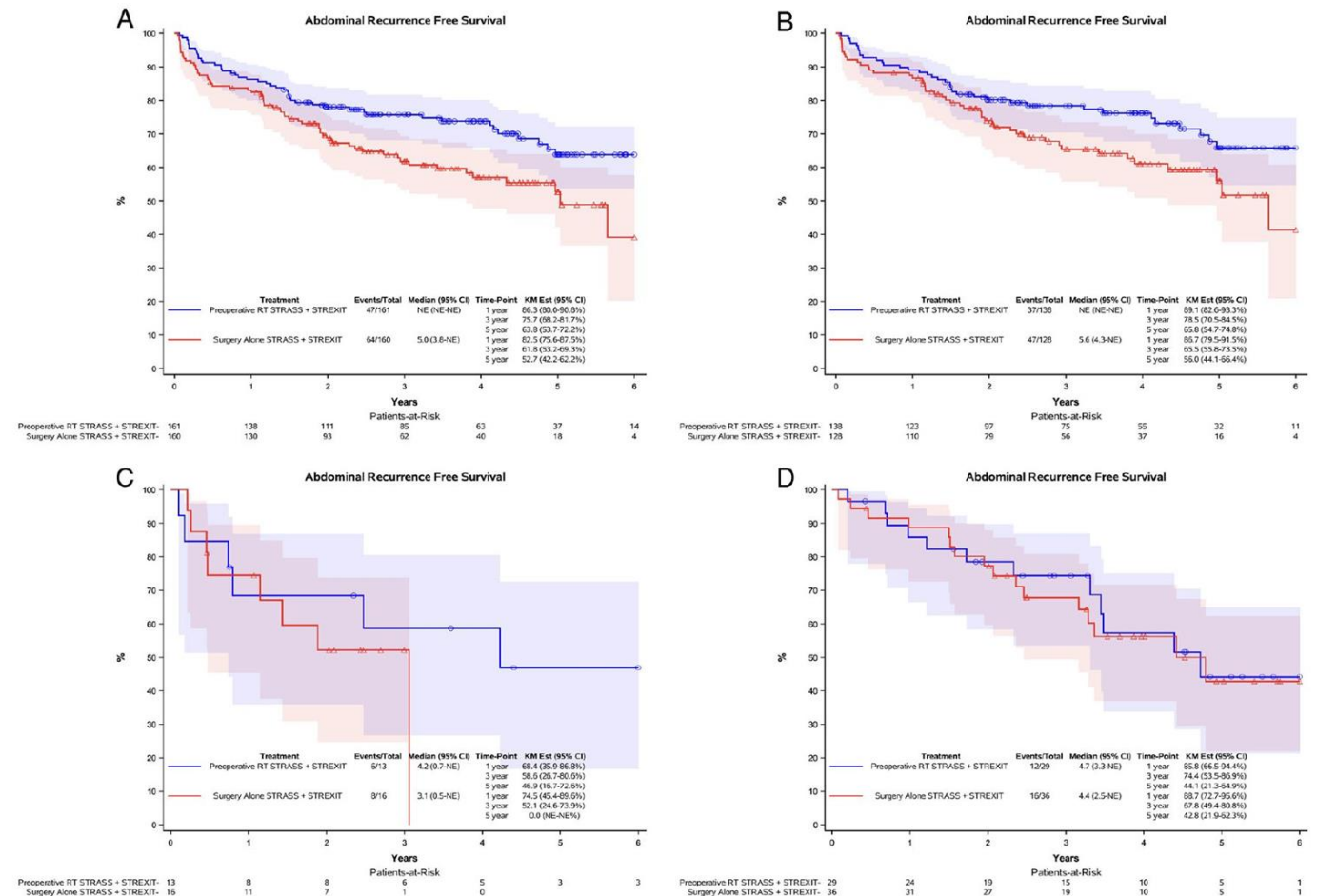


FIGURE 2. Abdominal recurrence-free survival curves in the pooled cohort subgroup analyses according to treatment (blue: preoperative radiotherapy + surgery; red: surgery alone). A, Patients with liposarcoma. B, Patients with G1-2 dedifferentiated liposarcoma and well-differentiated liposarcoma. C, Patients with G3 dedifferentiated liposarcoma. D, Patients with leiomyosarcoma.

Retroperitoneal sarcoma

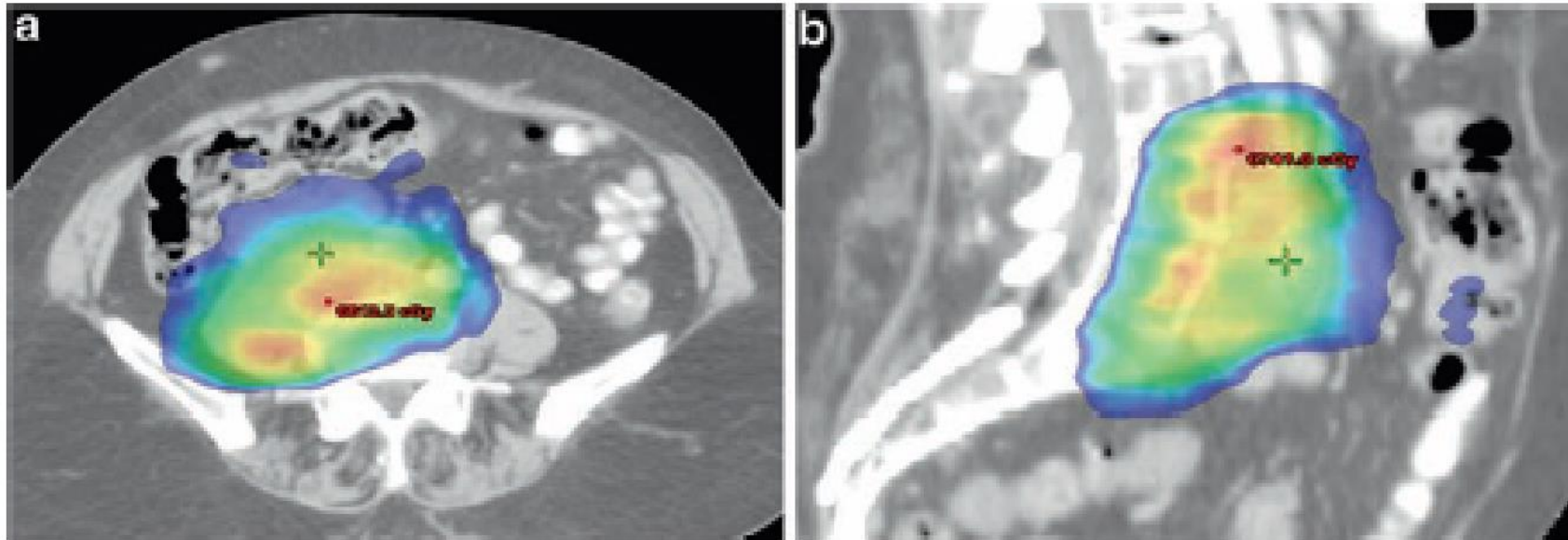


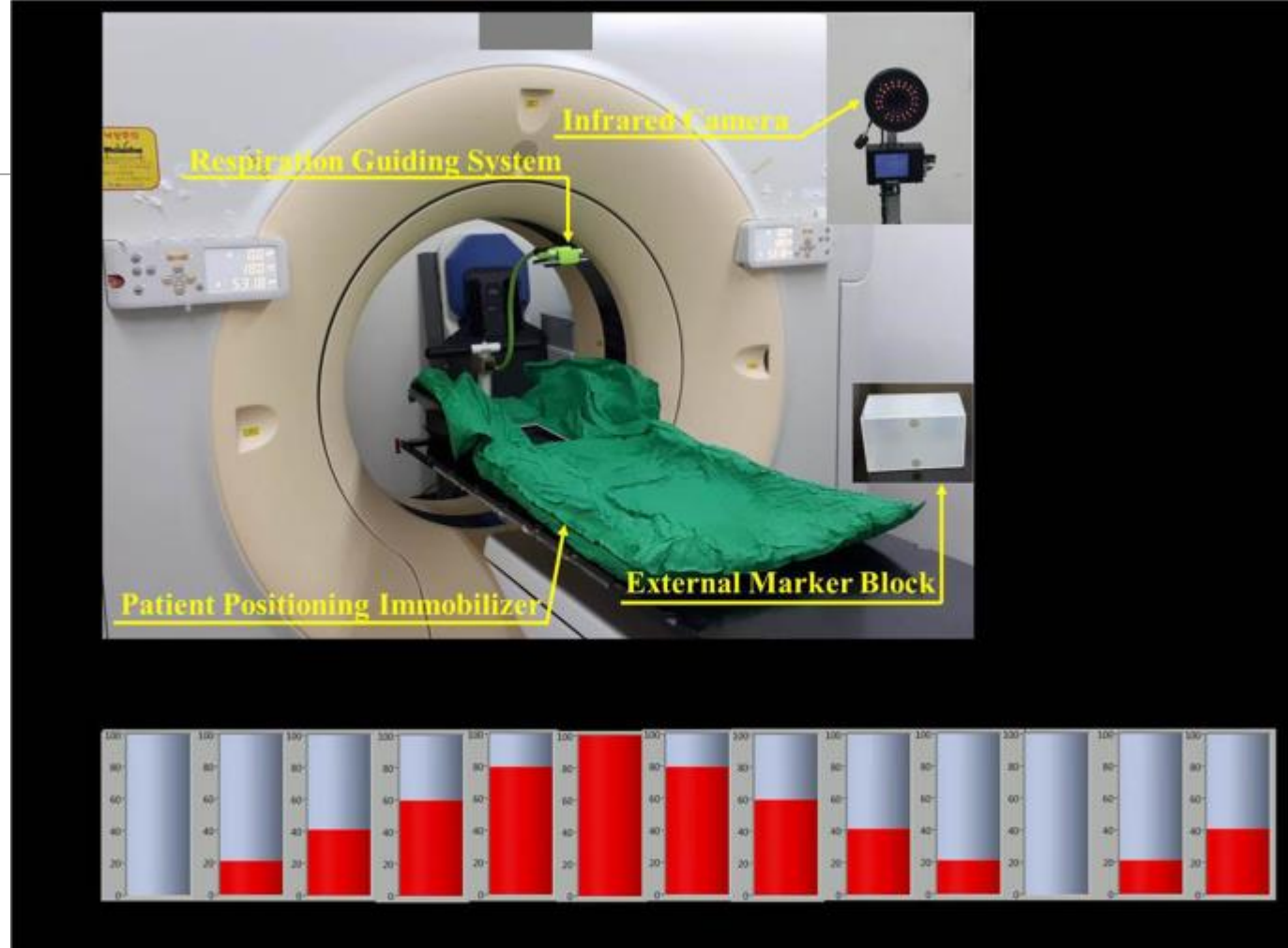
Fig. 3.14 Retroperitoneal STS: Dose-painting preoperative IMRT: (a) axial view demonstrating high dose (*red*) juxtaposed to posterior structures. (b) Sagittal view demonstrating low dose of radiation (*blue*) juxtaposed to bowel

RPS

Fasting

Breathing control

Image guided



Ewing

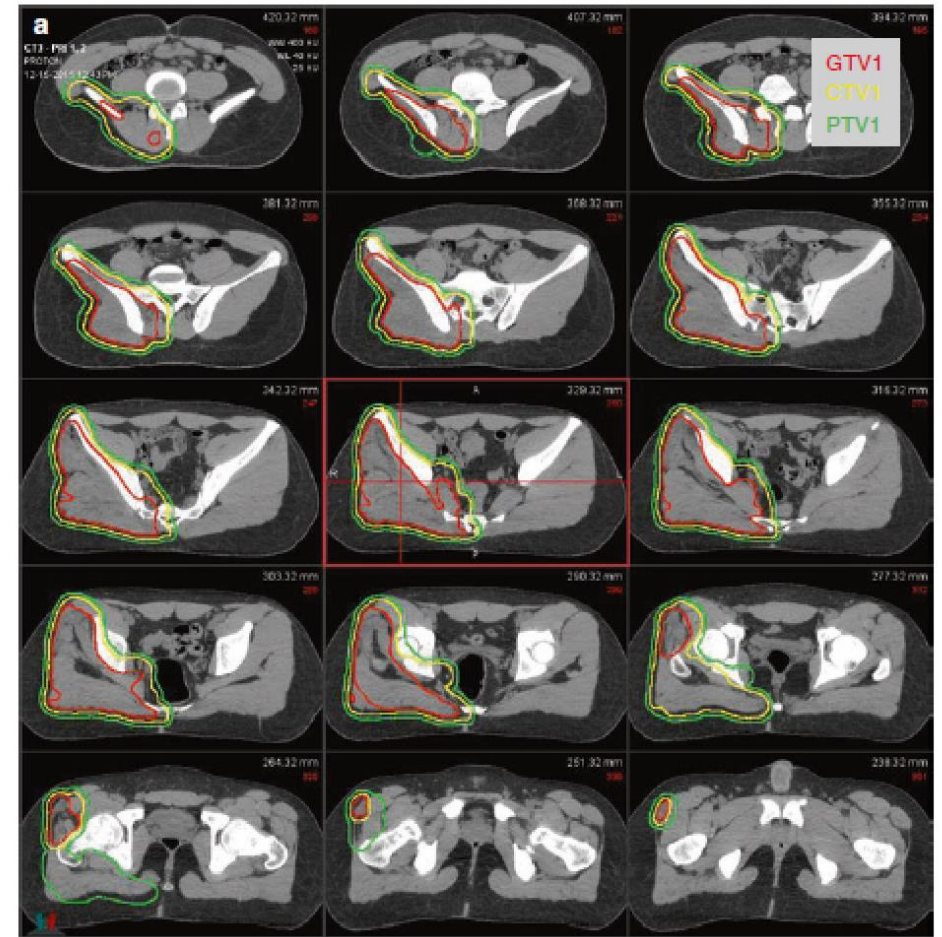
Indications

- Definitive radiotherapy
- Adjuvant if margins +, poor chemo response
- Whole lung
- Metastatic sites

Ewing

45-54 Gy: ~5 weeks

Whole lung: 16.5 Gy ~ 2 weeks



Definitive radiotherapy

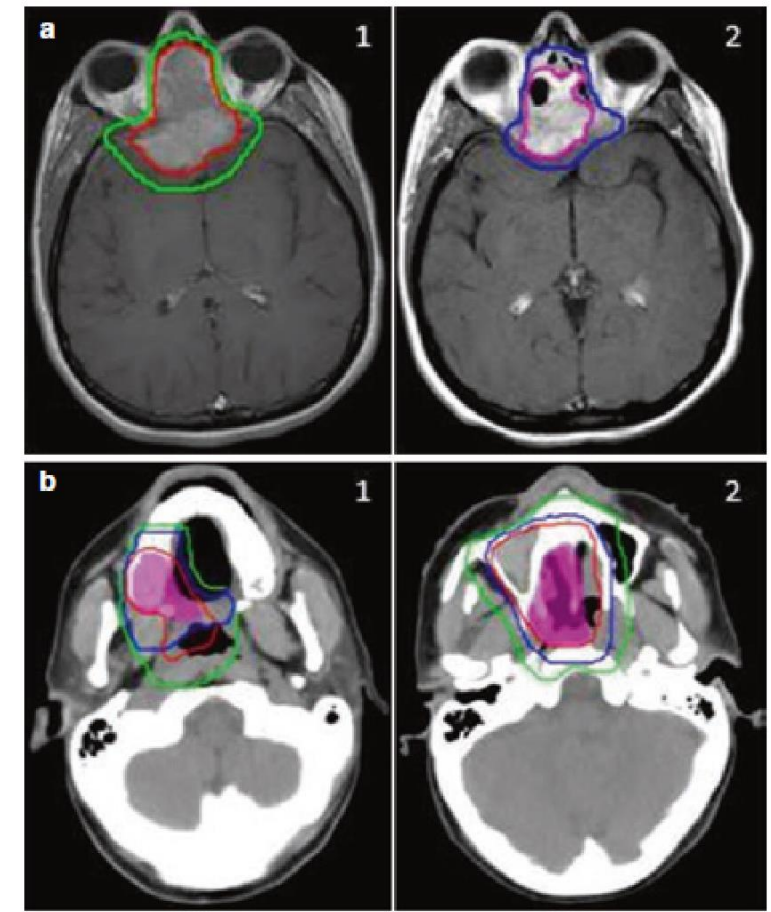
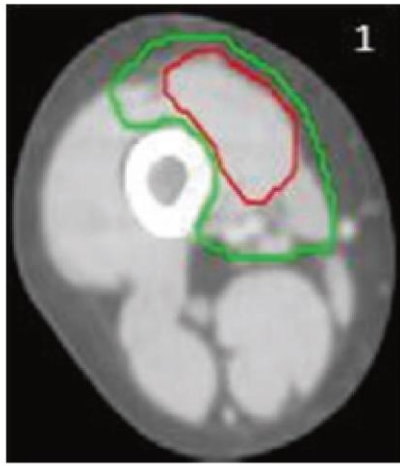
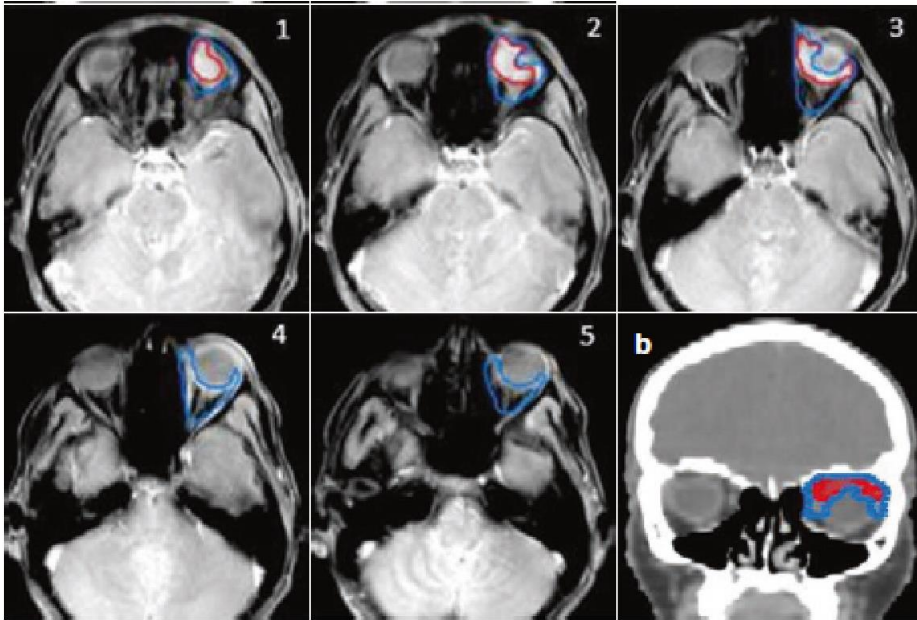
Rhabdomyosarcoma

- Very radiosensitive
- Almost every patient needs RT
 - Except smaller localized favorable histology
 - 36-50.4 Gy~ 5 weeks

Rhabdomyosarcoma

- Definitive
- Post-operative
- Metastatic sites
- Whole lung
- Whole abdomen

Rhabdomyosarcoma



Chordoma

PELVIC SARCOMAS: PBT OR CIRT

91 pts (single institution)

Chordoma: 53 pts, chondrosarcoma: 14 pts,
osteosarcoma: 10 pts, UPS: 5 pts, etc.

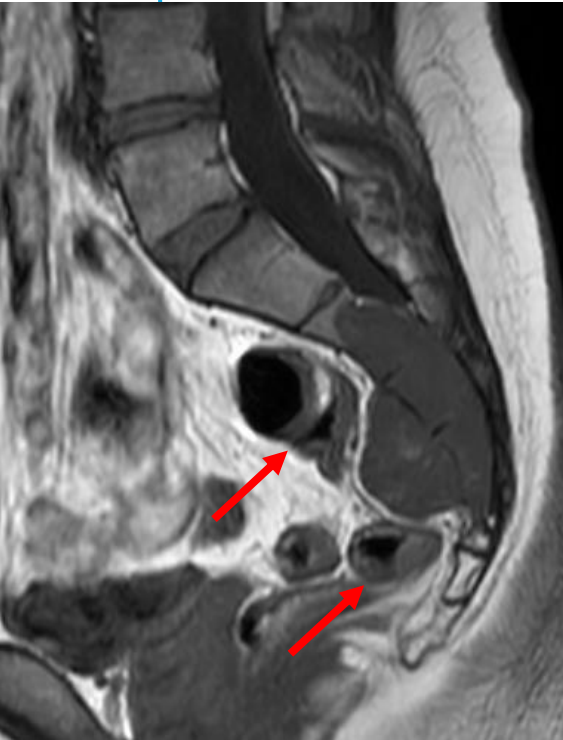
PBT: 52 pts, CIRT: 39 pts

3-yr OS: 83%, PFS: 72%, LC: 92%

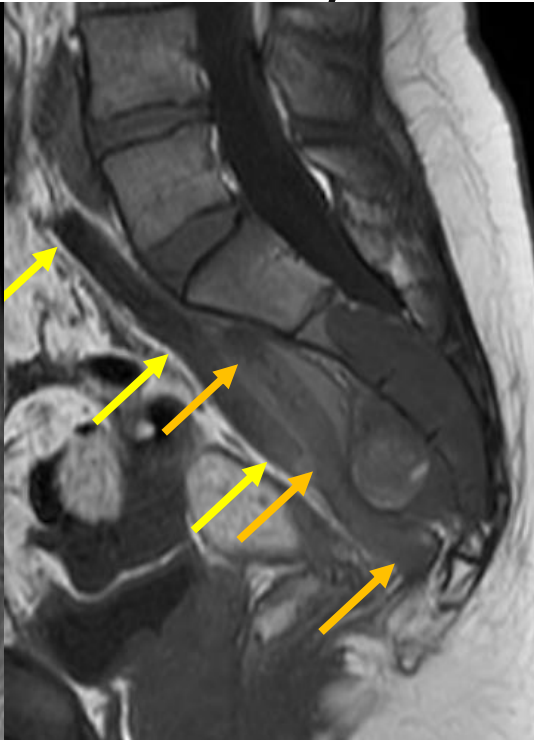
No significant difference between PBT and CIRT

16# worse toxicities than 32#

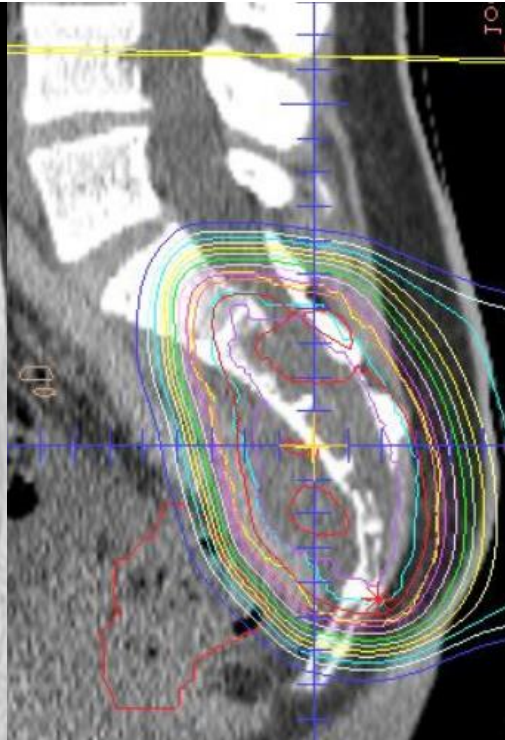
CASE: 20S MALE, SACRAL CHORDOMA



Before
surgical spacer
placement
(SSP)

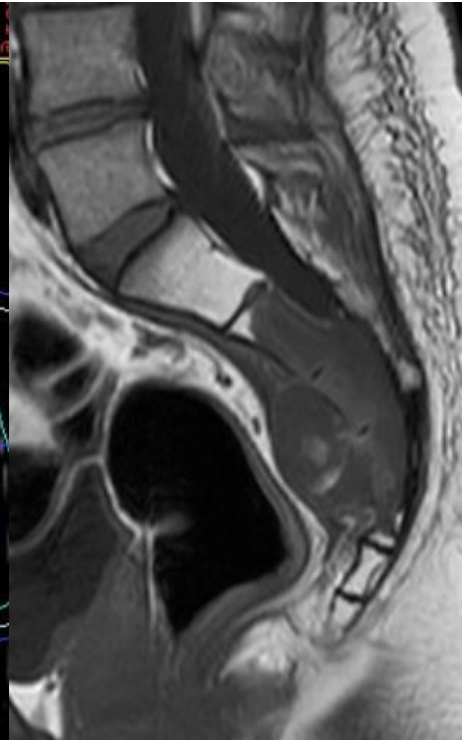


After SSP

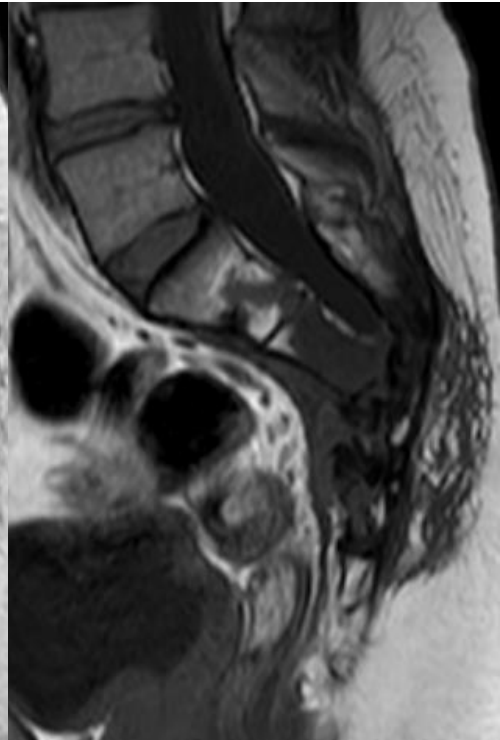


PBT
70.4 Gy (RBE)
/ 16 fr

Credits Dr Demizu



7M later
Tumor shrank
Spacer
disappeared



6Y 8M later
No relapse
No severe
toxicity

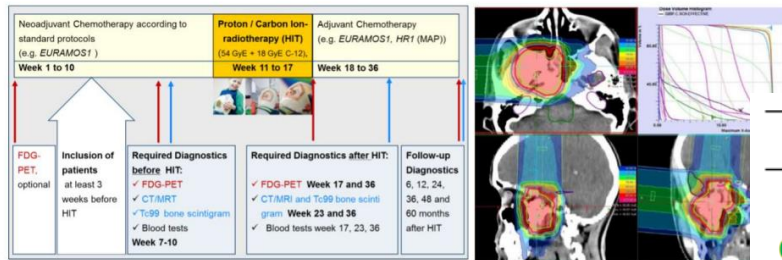
Unresectable sarcomas

- Protons or carbon ion
- Definitive particle therapy
- 74 Gy at least
- SBRT is a consideration for small tumours

OSCAR- trial

OSteosarcoma – CARbon Ion Radiotherapy: Phase I/II therapy trial to determine the safety and efficacy of heavy ion radiotherapy in patients with inoperable high-grade osteosarcoma

Secondary endpoints: local control disease-free and progression-free survival, Overall survival, role of **FDG-PET** in response monitoring



research group	modality	overall Survival	PFS	comment
OSCAR	P + C	68 % (2 years)	45 % (2 years)	
COSS-Kollektiv	Heterogen	41 % (5 years)	26 % (5 years)	
DeLaney 2002	Ph / P	66 % (5 years)	40 % (5 years)	surgery, rarely pelvic
Ciernik 2011	P	67 % (5 years)	65 % (5 years)	surgery, high tox. (>30 % grade III-IV)
Matsunobu, 2012	C	58 % (2 years)	n/a, 2y-LC 73 %	surgery, short FU, 10 % grade III-IV
Kamada, 2002	C	46 % (3 years)	n/a, 3y-LC 73 %	surgery
Mohamad, 2018	C	50 % (3 years)	35 % (3 years)	Incl. pelvic, 15 % grade III-IV

Osteosarcoma of the Trunk

Matsunobu A, Imai R, Kamada T, et al.

Impact of Carbon Ion Radiotherapy for Unresectable Osteosarcoma of the Trunk.

Cancer 2012;118:4555-4563.

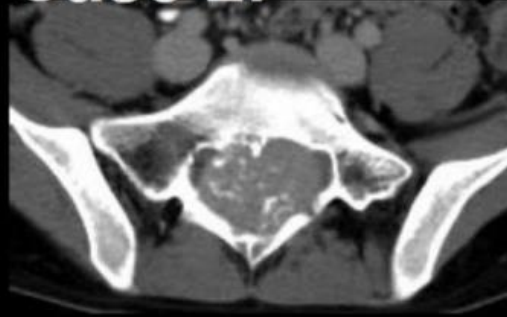
ESTRO
School⁷

Case 1.



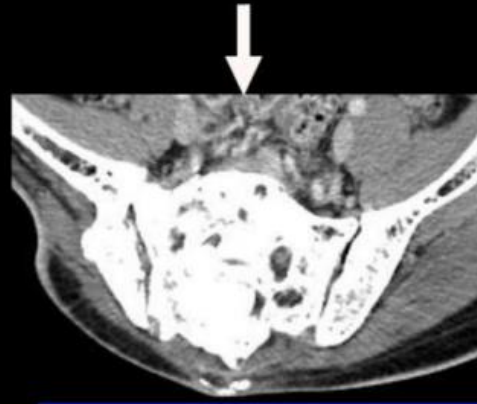
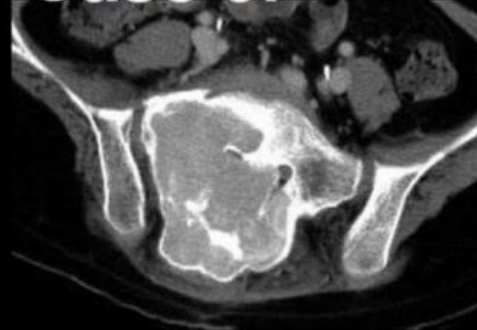
At 13 years

Case 2.



At 9 years

Case 3.



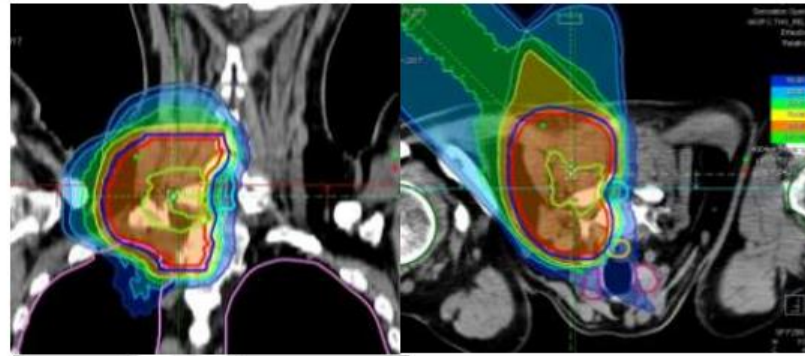
At 7 years

1 patient gave birth to
healthy child years later

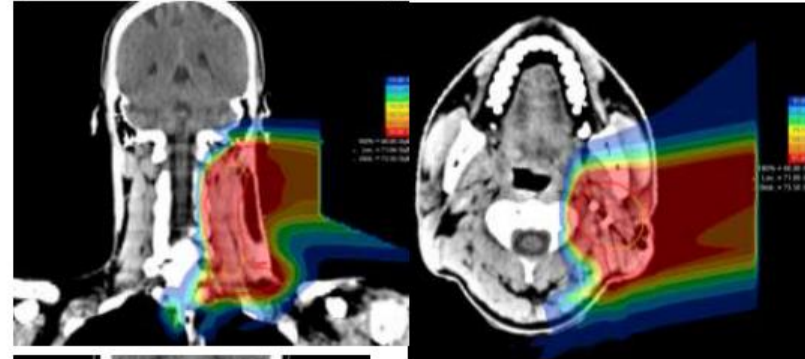
Soft tissue sarcoma

a) definitive

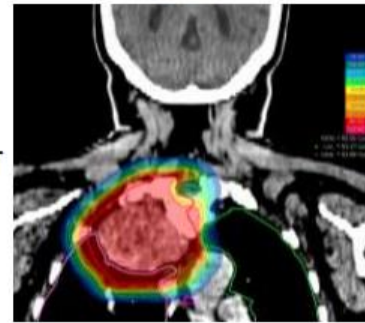
MPNST
Partial resection
Additive ^{12}C ion-RT



Undiff. Sarcoma
Partial resection
Additive ^{12}C ion-RT



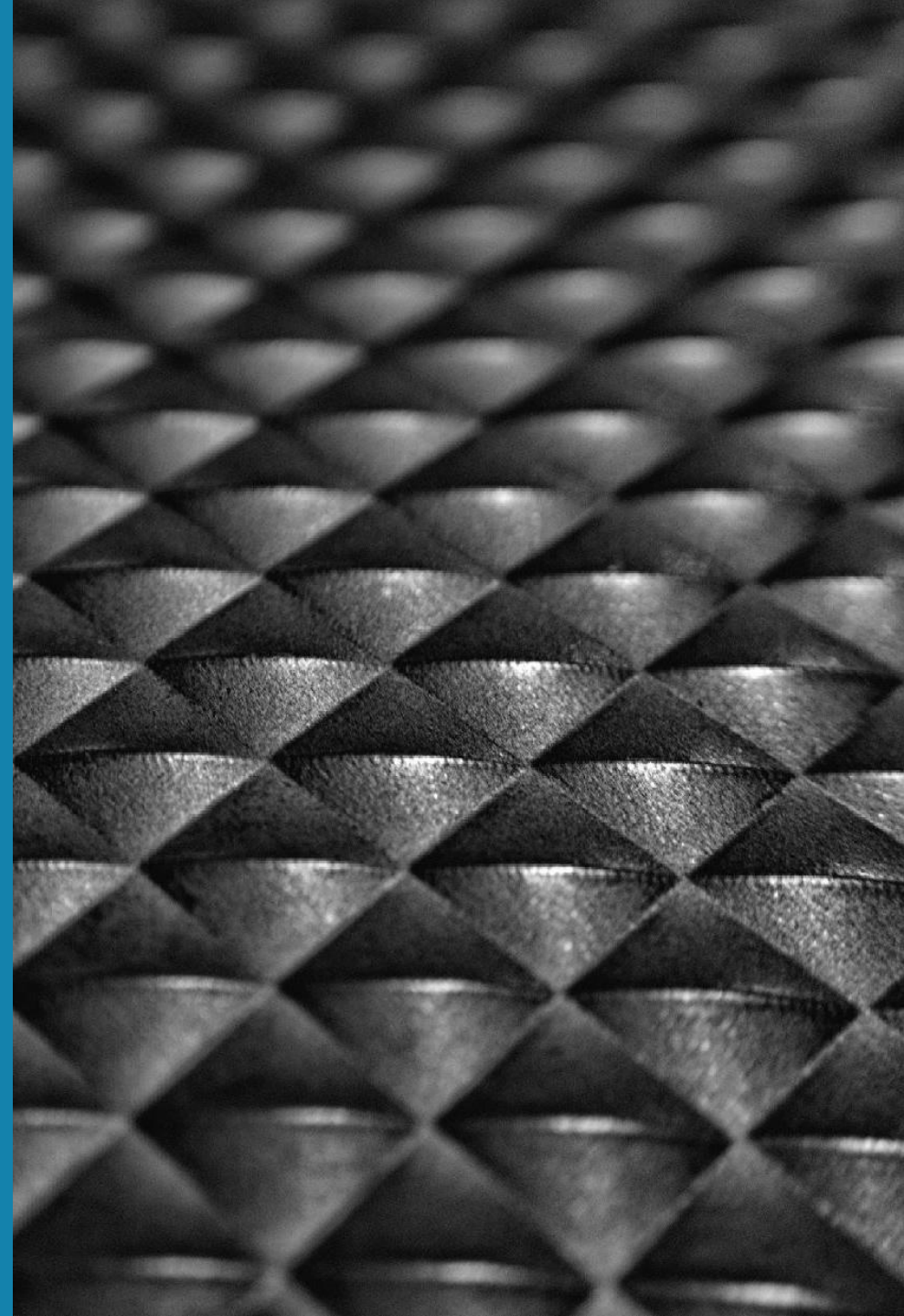
SFT
definitive ^{12}C ion-RT



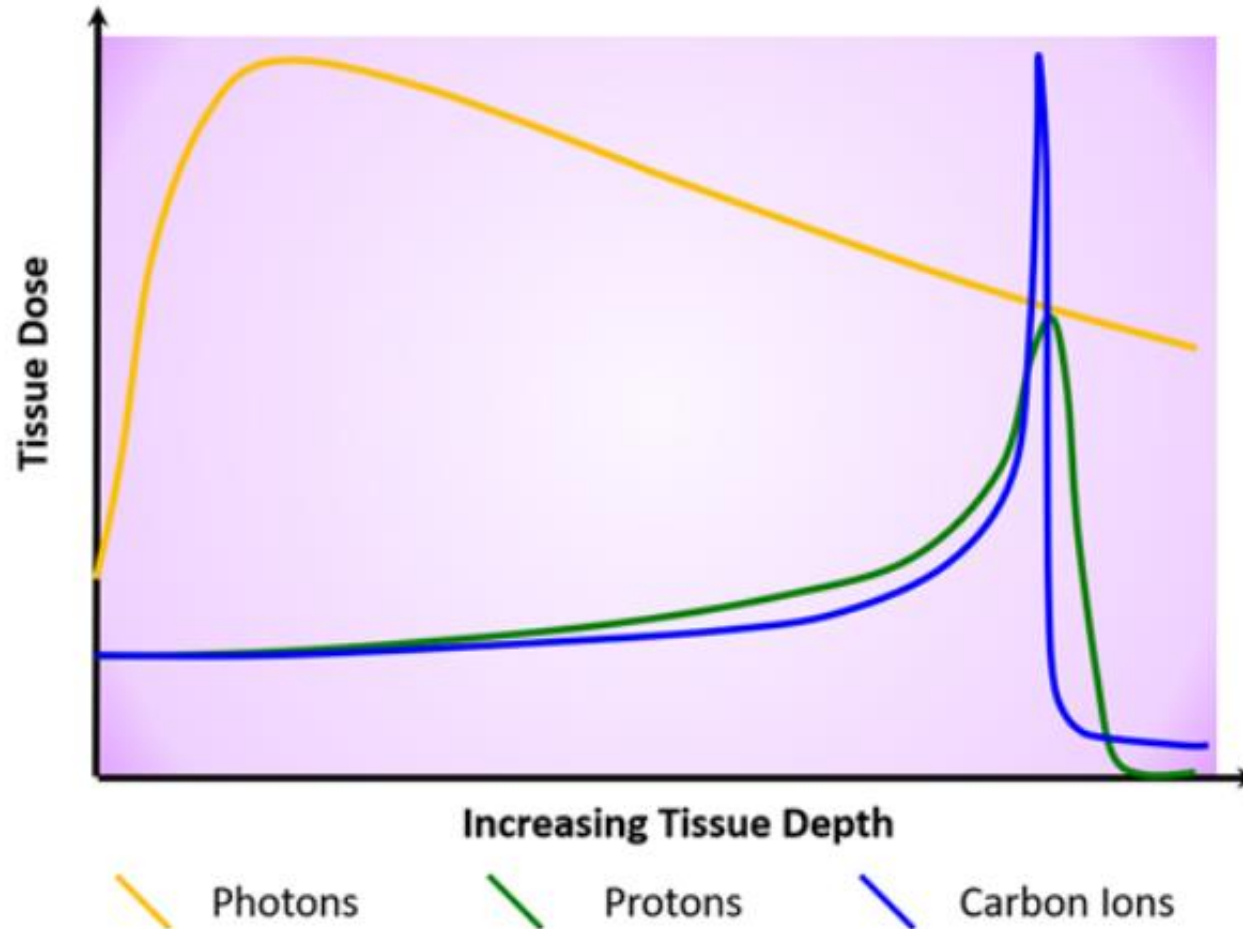
ESTRO
School

CARBON

- heavier particle than protons



CARBON VS PROTONS



Compensate for lack of carbon by dose escalation with protons?

Pennington et al 2021

PEDIATRIC BONE SOFT TISSUE SARCOMA

Indication for particle therapy

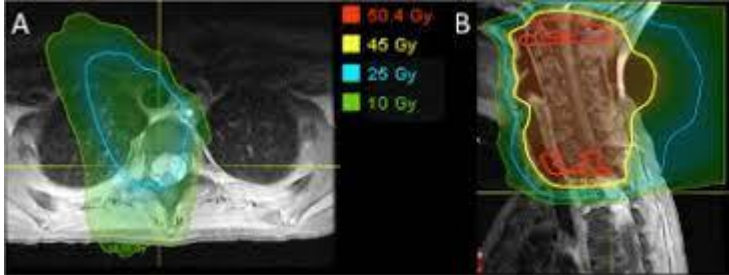
- Ewing sarcoma family of tumors, rhabdomyosarcoma, etc.
- Definitive RT if surgery is too morbid
- One of the best indications for PBT

SPINAL EWING MODERN SERIES

Indelicato et al 2022

32 patients, 14 definitive, 18 after biopsy/STR decompression

5 year LC 92%



PELVIC RHABDOMYOSARCOMA

Outcomes Following Proton Therapy for Group III Pelvic Rhabdomyosarcoma

Indelicato et al, red journal 2020

- n=31 (14 had resection)
- 5 year LC 83%
- no diff btw sx/definitive proton

TAKE HOME

- particle therapy has an important role
- so does surgery
- issues to consider
 - Implants
 - Morbidities
 - Age
 - Histology

Process



CT simulation

Immobilization



Source: www.qfix.com

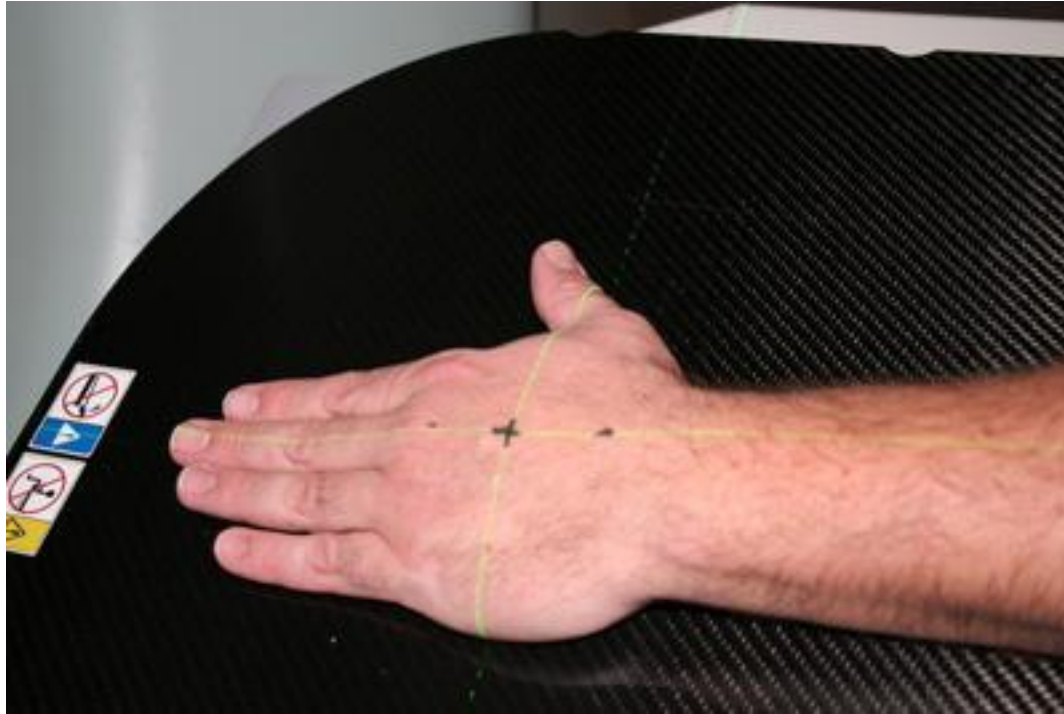


www.civcort.com

Immobilisation and positioning



Tattoo

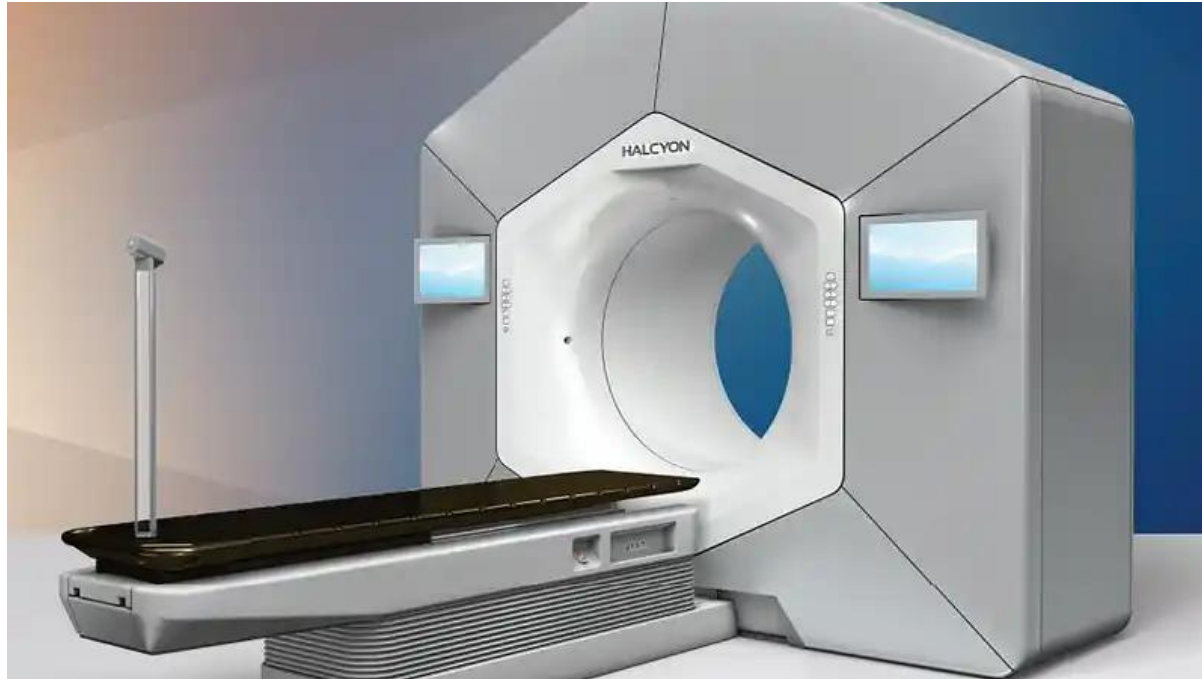


www.oncolink.org



Community.macmillian.org.uk

Treatment room



Patient care

- Light moderate exercise during RT
 - Normal lifestyle after
- Symptomatic medicines during RT
 - Skin ointment
 - Anti-nausea
 - Anti-diarrhea
- Avoid supplements with anti-oxidants

Acute side effects

- Fatigue
 - Nausea/vomiting
 - Alopecia
 - Dermatitis
 - Diarrhea
 - Lung inflammation
-
- Will resolve

Long term

- Gastro-intestinal
 - Perforation (<5%)
 - Stricture (<5%)
 - Bleeding (<5%)

Late effects

- Musculoskeletal
 - Short stature
 - Asymmetry
 - Muscle atrophy
 - Joint stiffness
- Skin
 - Dryness
 - Pigmentation

Secondary malignancy

- Dose dependent
- >5 years later
- Genetic predisposition

Follow up

- Close follow up for first few years
- CT imaging
- Alternate with multidisciplinary team

Questions

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- www.ro-se.org
- www.advancedmedicine.sg

- Updated 2023