CENTRE DE LUTTE CONTRE LE CANCER LEON BERARD

Chercher et soigner jusqu'à la guérison

INTRODUCTION TO CANCER TREATMENT : RADIATION ONCOLOGY

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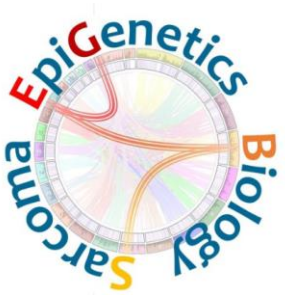

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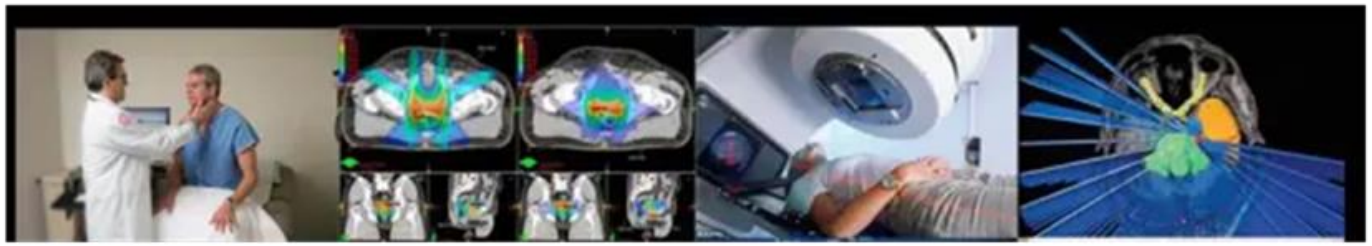
Disclosures

- None

Radiation Oncologist

What my friends think I do ?

What I really do ?



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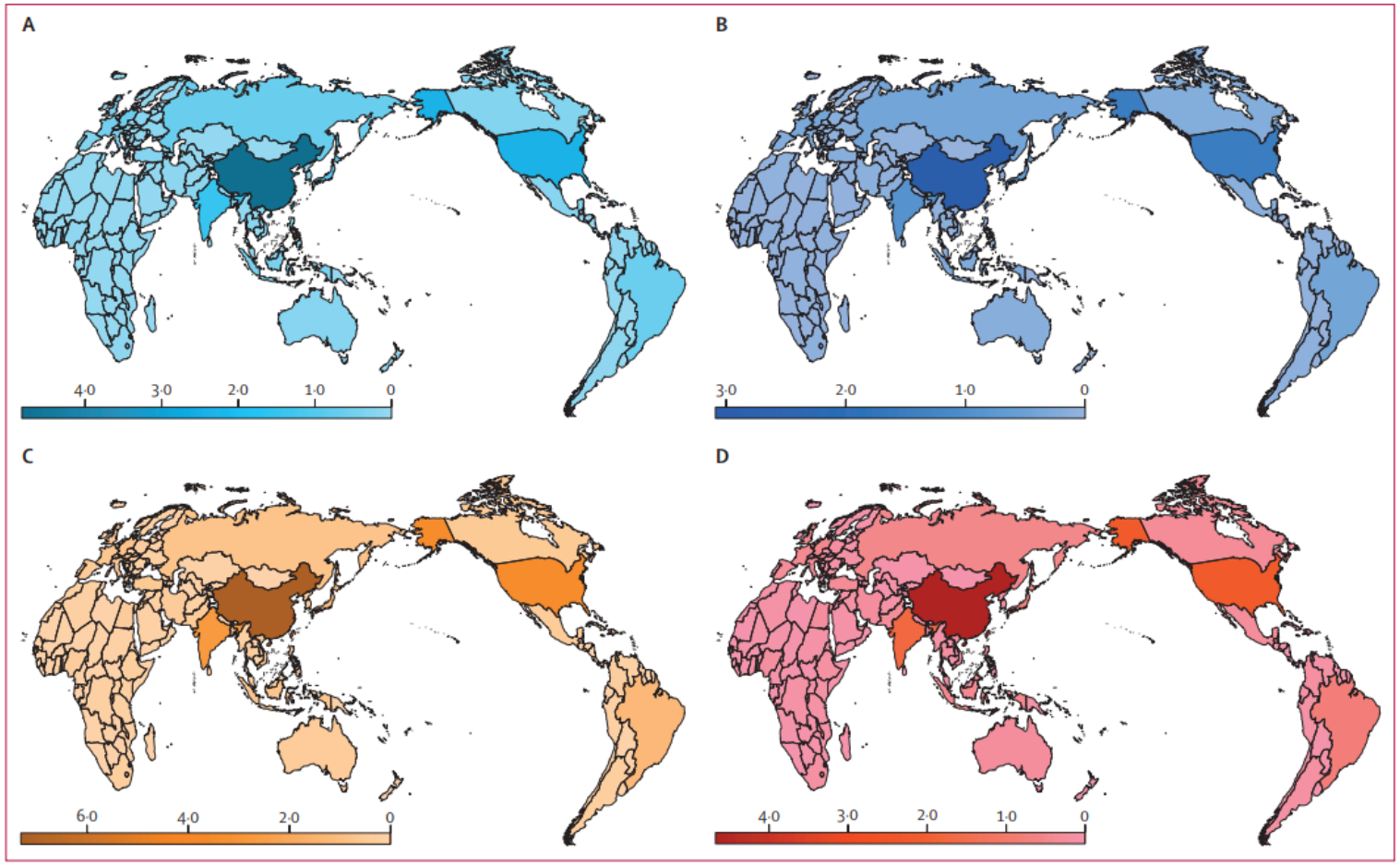
Objectives

- Understand the **role of radiation therapy** in cancer management.
- Recognize **different radiation techniques** and their clinical applications.

Introduction



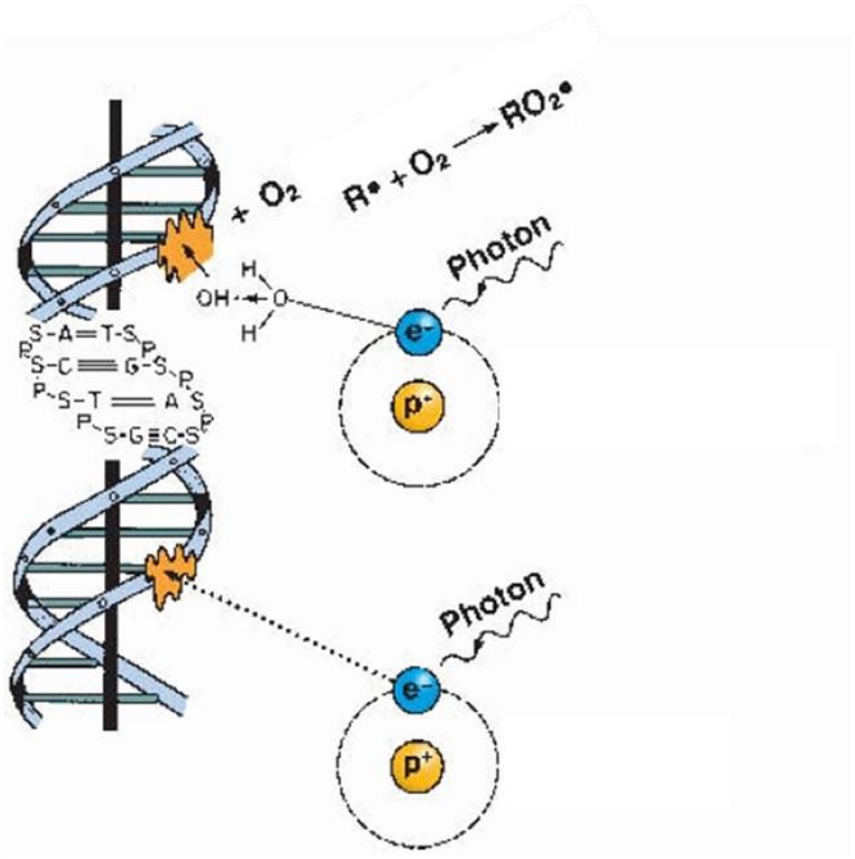
In 2050, GLOBOCAN 2022 data indicated 33·1 million new cancer diagnoses, with 16·5 million new patients needing radiotherapy at an estimated use rate of 50% and 21·2 million at an estimated use rate of 64%.

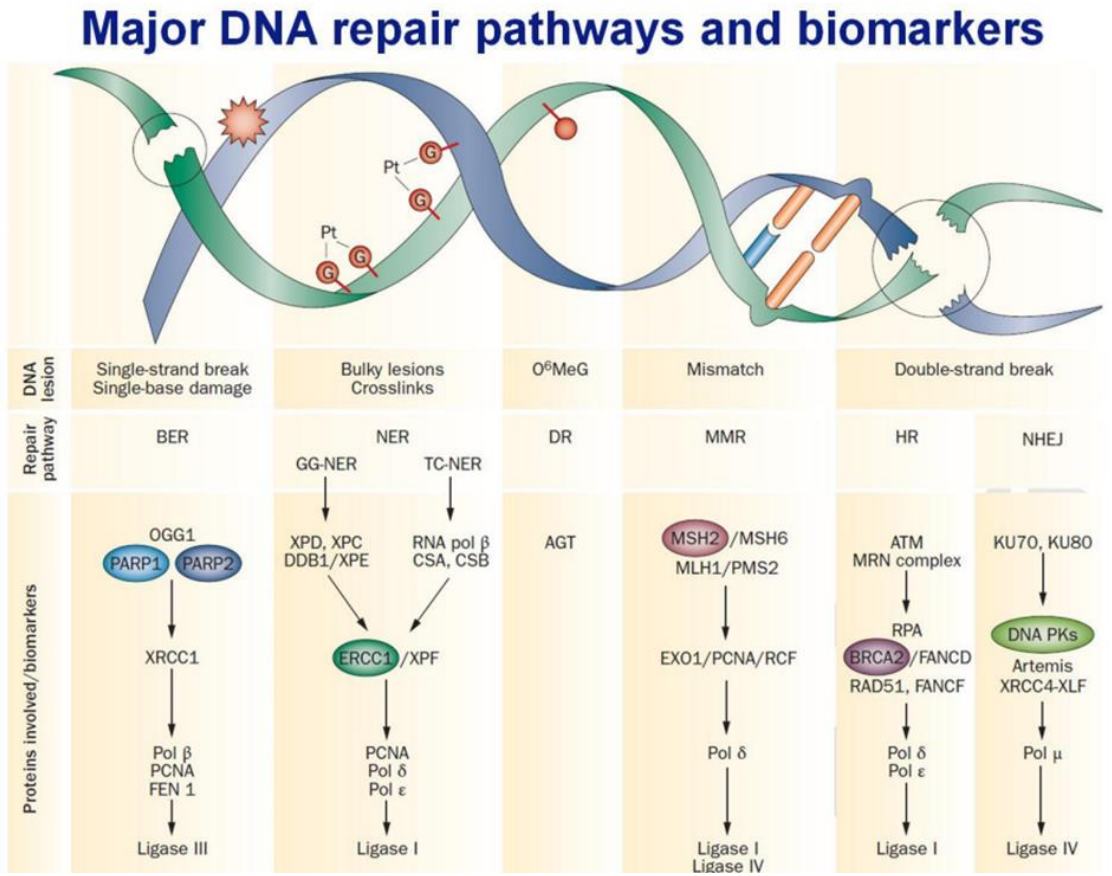
Zhu et al Lancet glob health 2024

Why Radiation therapy matters ?

- Radiation therapy has been a cornerstone of cancer treatment for over a century.
- Initially used for symptom relief, it evolved into a curative modality for many cancers.
- Today, it is integrated with surgery and systemic therapy for optimal outcomes.
- Advances in imaging and computing have transformed Radiotherapy to highly precise techniques.

Radiation and DNA Damage





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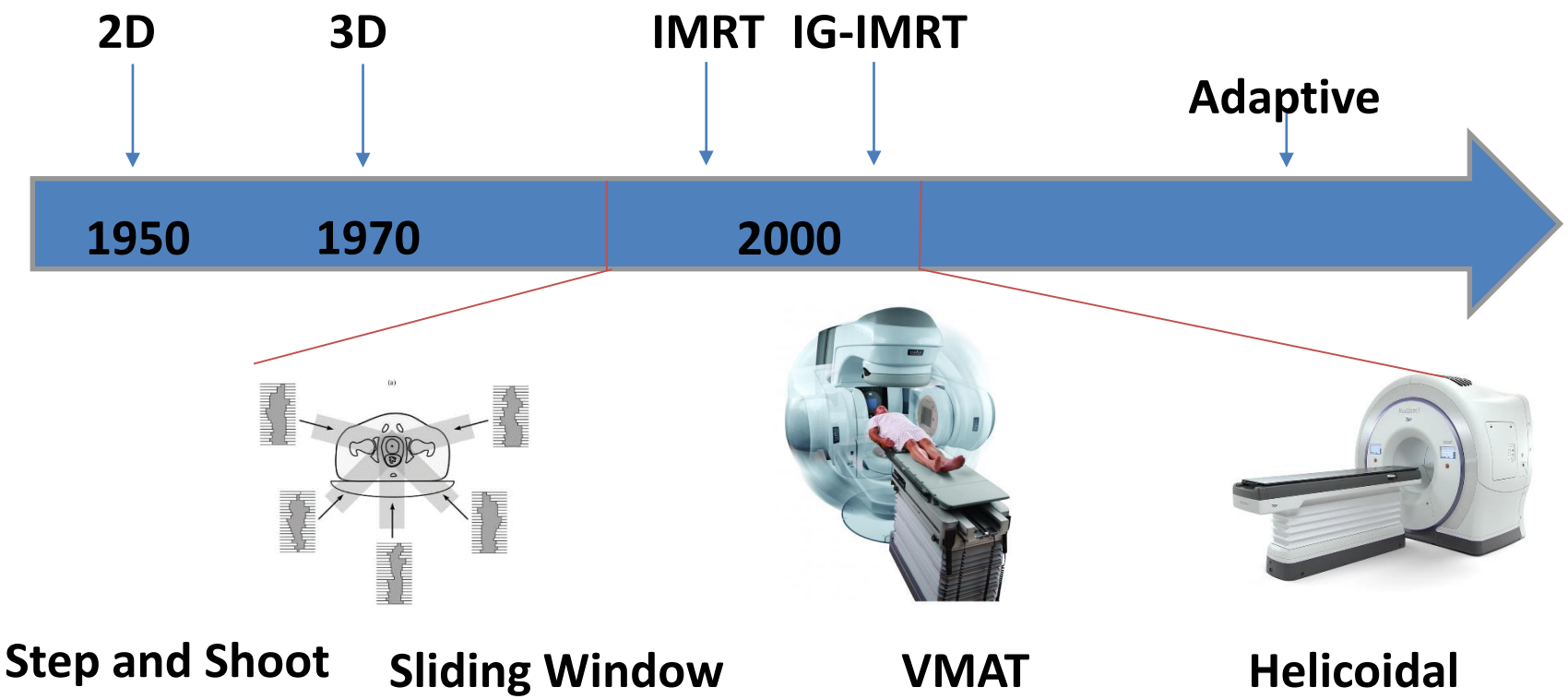
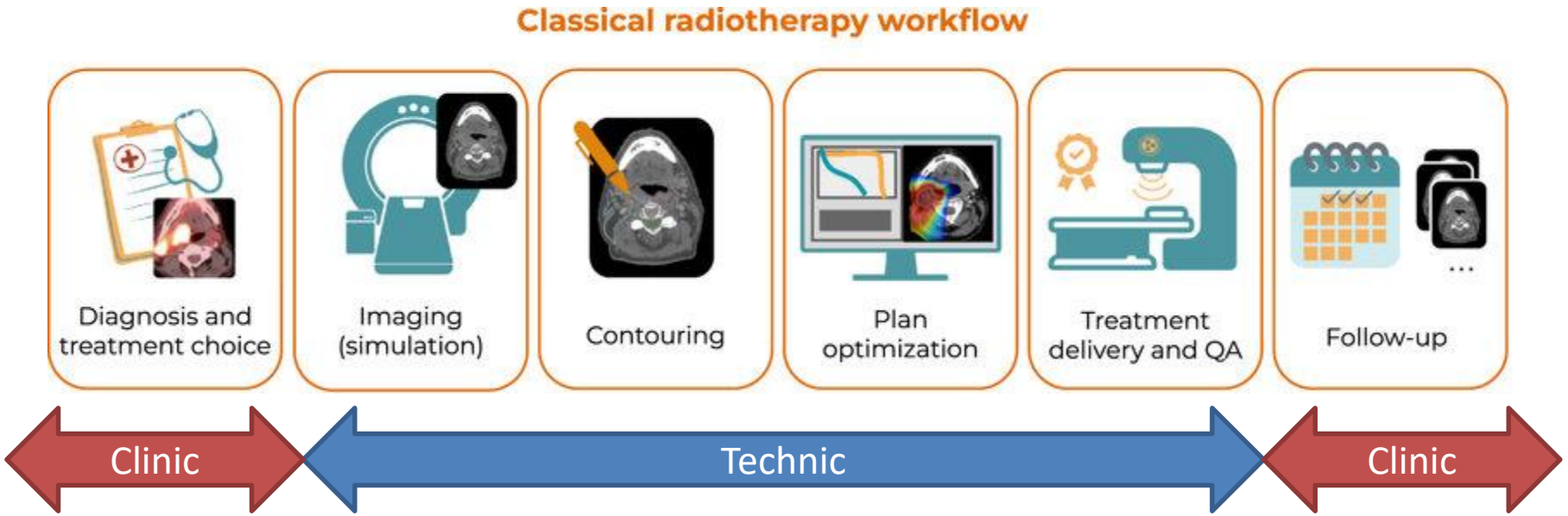
Treatment modalities



How to prescribe radiation in clinical setting ?

- Particle : usually Photons
- Total dose
- Dose per fraction
- Number of fraction per day/week
- Overal treatment time
- Techniques :
  - External : 3DCRT, IMRT
  - Brachytherapy

Workflow



Multidisciplinary meeting
Consultation

➔ What type of radiation treatment
➔ What is teh beneft ?
➔ What are the side effects ?

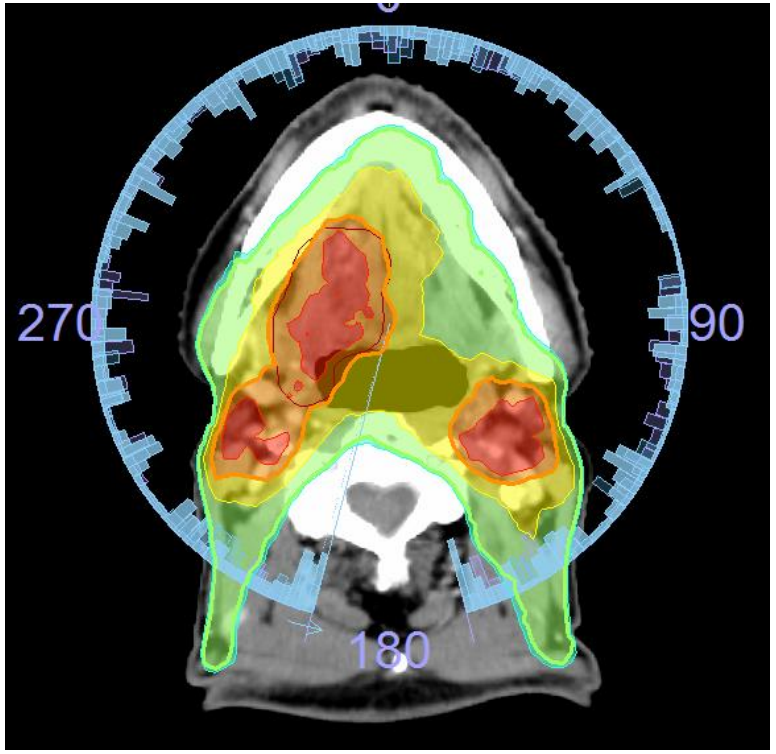
Treatment response evaluation
Side effects

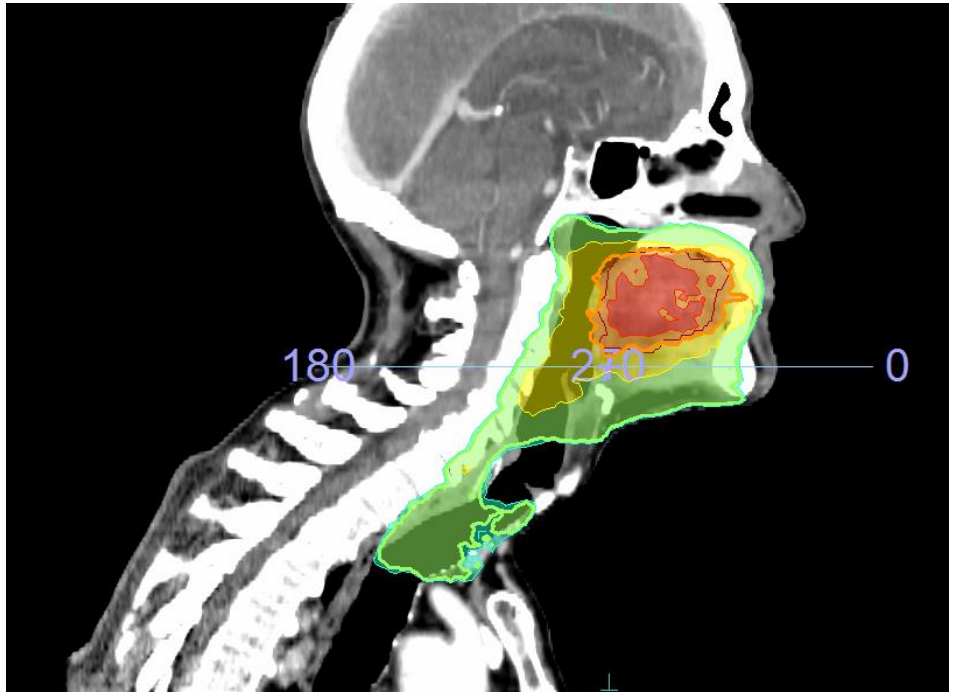
Monterro et al Physics ine med 2022

Radiation Therapy indications

- Radiation therapy is present at all stages of the disease:
  - Exclusive: As the sole treatment modality.
  - Before surgery (Neoadjuvant): To shrink the tumor and facilitate surgery.
  - After surgery (Adjuvant): To eliminate microscopic residual disease and reduce recurrence risk.
  - In case of relapse (Re-irradiation): When cancer returns in a previously treated area.
  - In metastatic setting (Palliative): To relieve symptoms and improve quality of life.
  - In oligometastatic setting : to postpone new systemic treatment

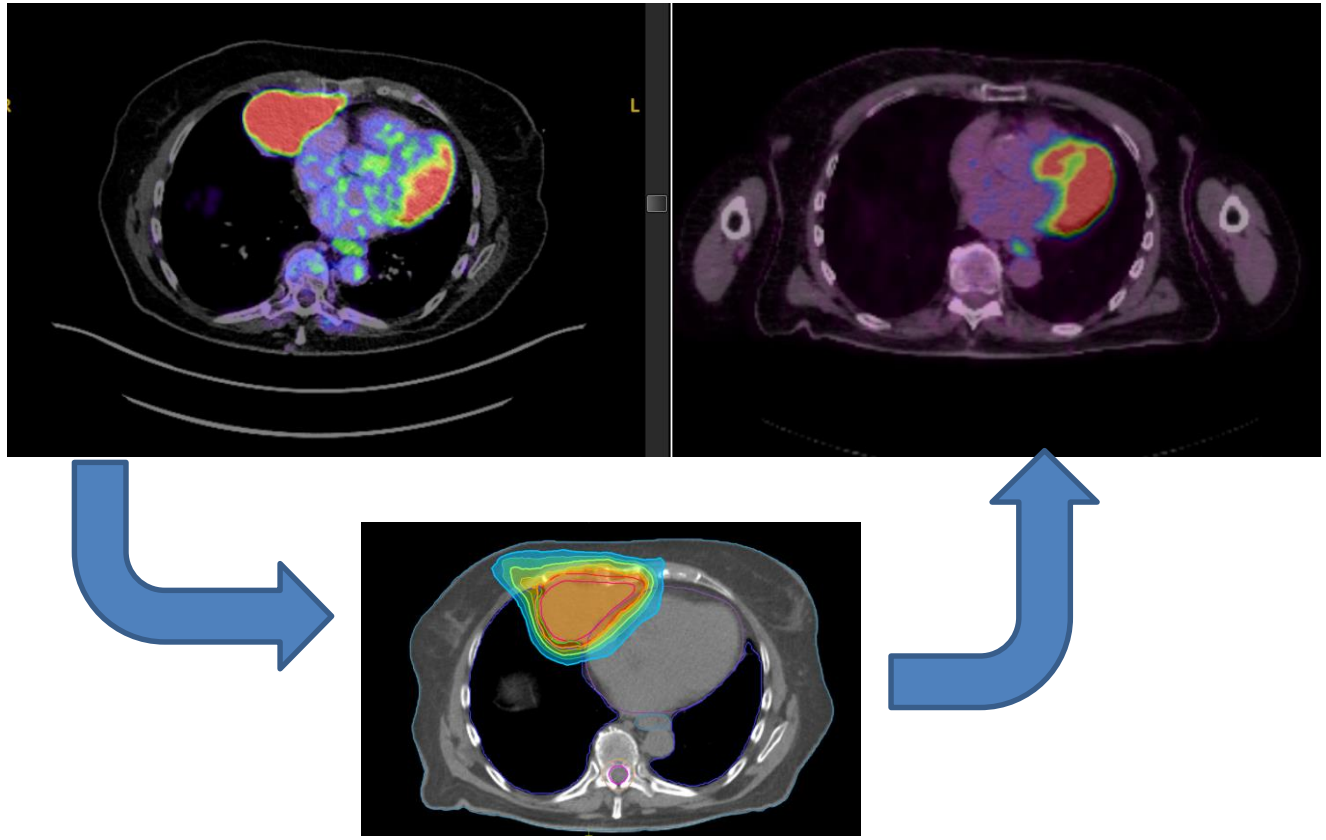
Definitve Curative treatment : HNSCC





70 Gy in 35 fractions in the high risk area

Definitive Curative low dose radiotherapy

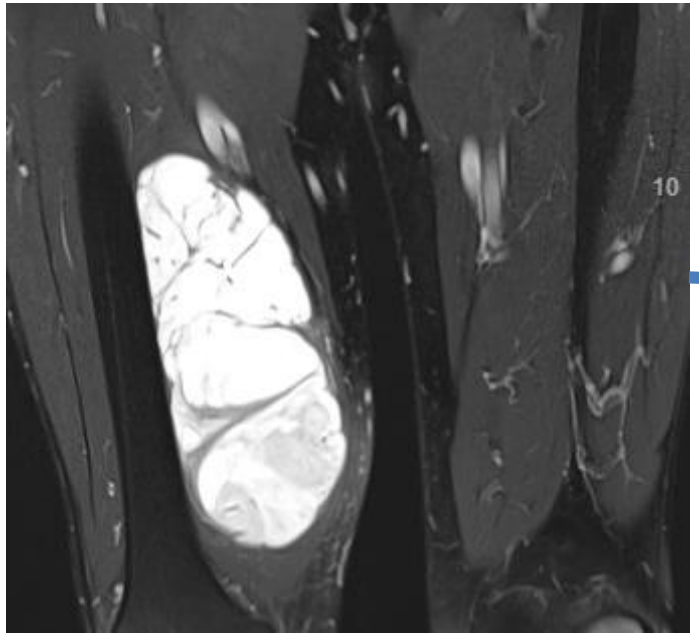


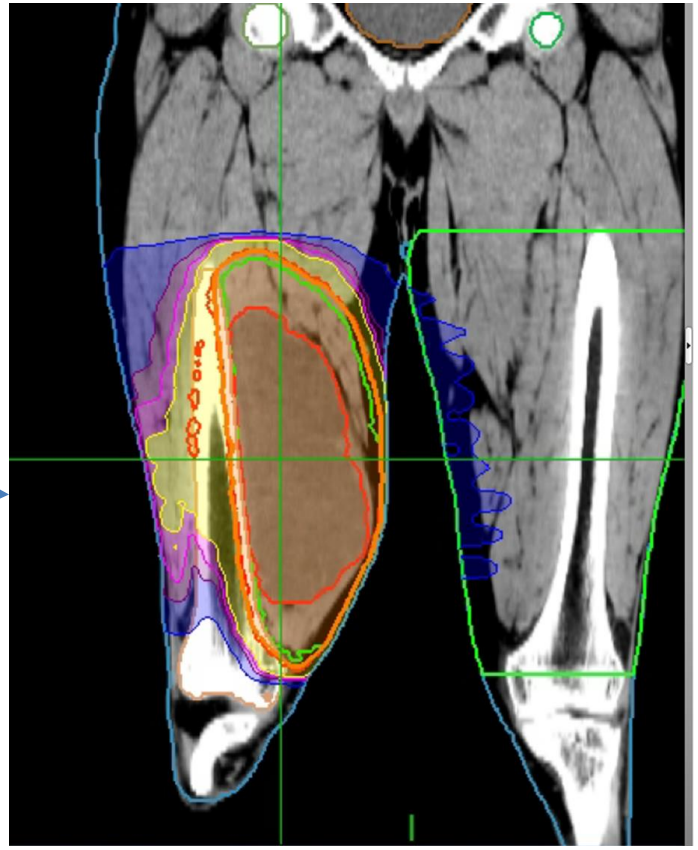
2x2Gy

➔ Complete response

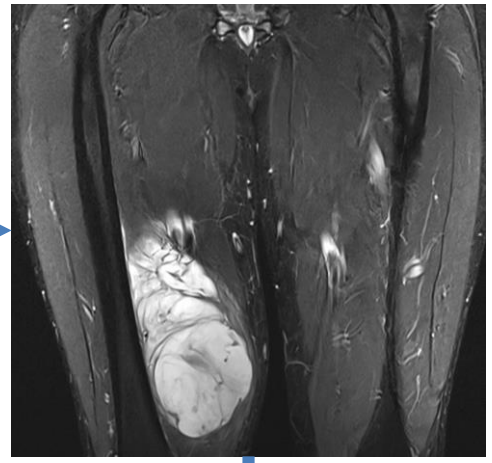
Neo-adjuvante Curative treatment- Soft tissue sarcoma

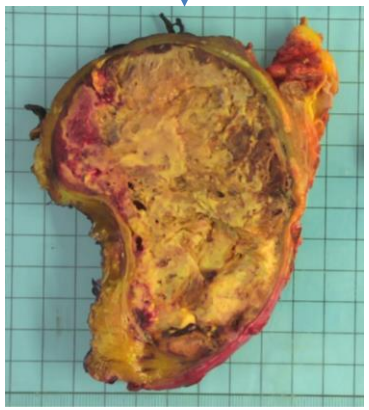
Myxoid liposarcoma – Right lower limb



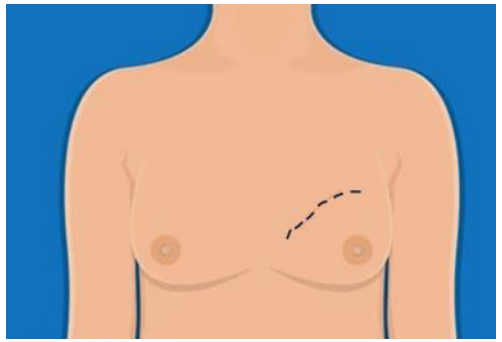


50 Gy in 25 fractions

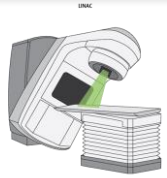


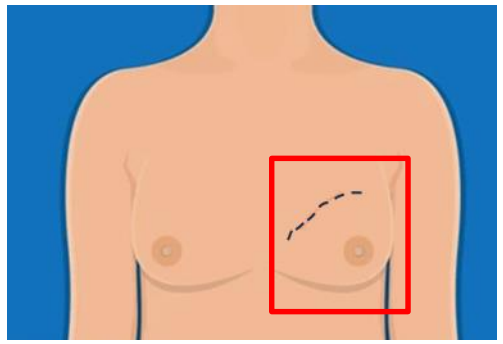


Adjuvant curative treatment-Breast Cancer

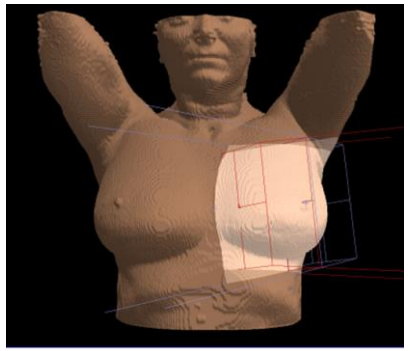


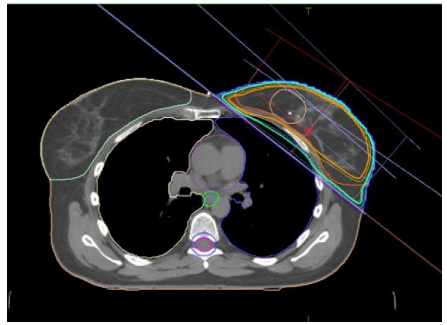
Surgical lumpectomy





Adjuvant radiotherapy

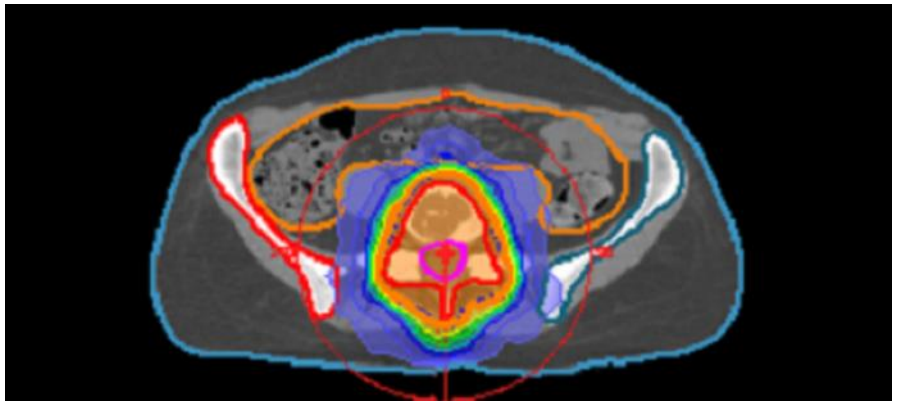




Palliative indication-Bone metastasis

Breast Cancer multiple bone metastasis

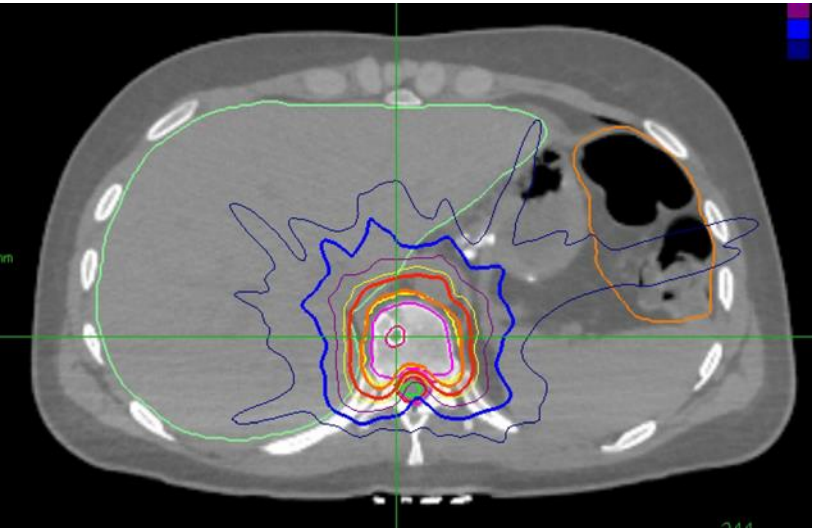
L5 symptomatic bone metastasis : 8 Gy in one fraction

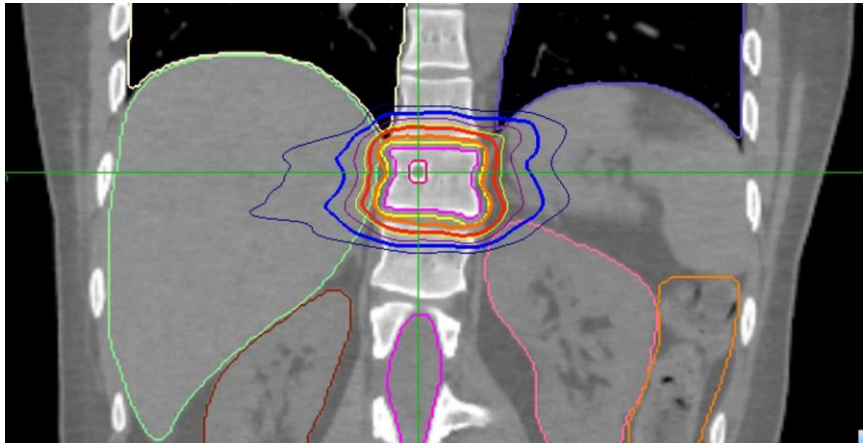


SBRT

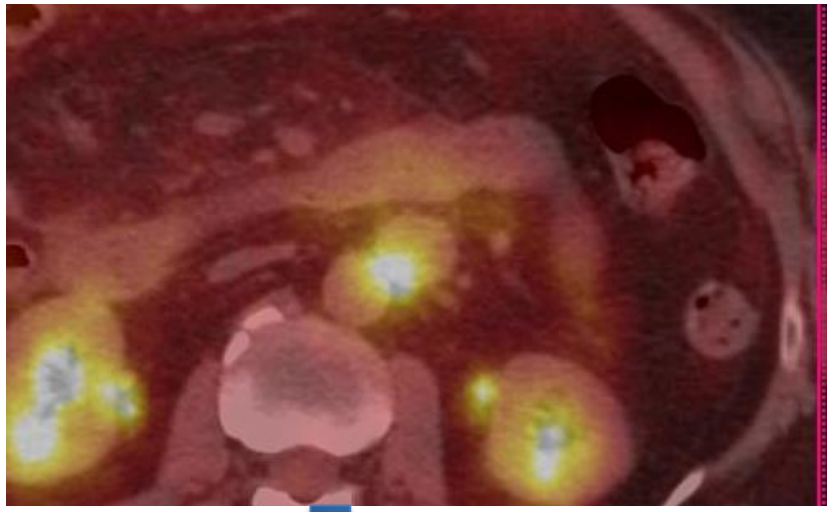
Oligometastic –Bone metastasis

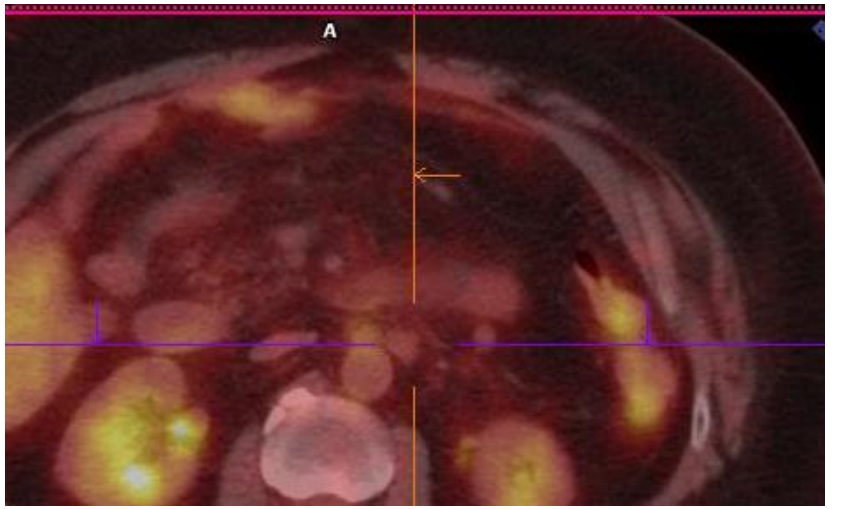
Clear cell sarcoma : 1 bone metastasis : SBRT

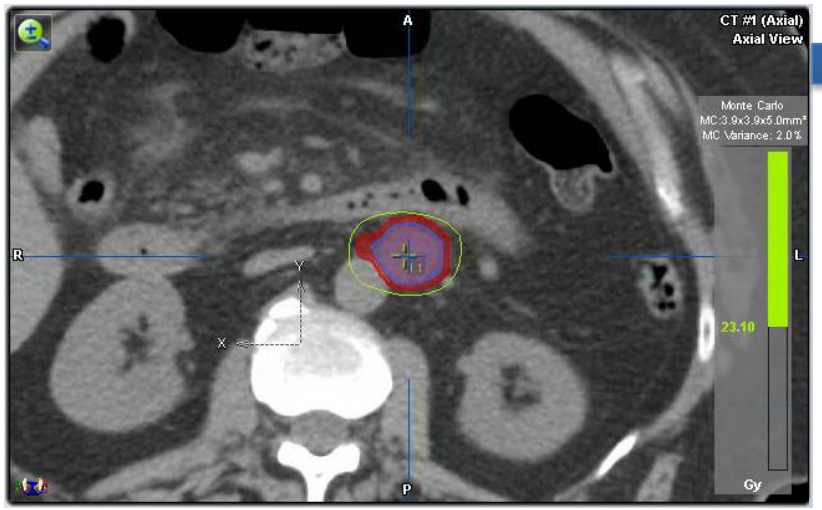




Oligometastatic treatment-SBRT







Case Presentation

- Mrs L..
- 60 yo, post menopausal
- Initial presentation : December 2023, Mammogram screening shows a mass with irregular shape and spiculated margins
- Medical history : None
- Family history : None

Clinical examination

- Right breast: T0
- Lymph nodes: N0

Ultra sound guided biospies

- Right breast mass (core needle),
  - Invasive ductal carcinoma, grade 1, No LVI
  - ER+(100%)PR+(90%)Her2-
  - Ki-67 5%

Surgery and Pathology

- Right simple Lumpectomy and sentinel lymph node dissection. Pathology:
  - Breast : 15mm, Grade 1, LVI-
  - Lymph nodes: 0/3 involved
- Stage pT1c pN0 (Stage IA, AJCC 8th Ed. Anatomic)
- Negative surgical margins

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Should patient undergo Radiotherapy ?

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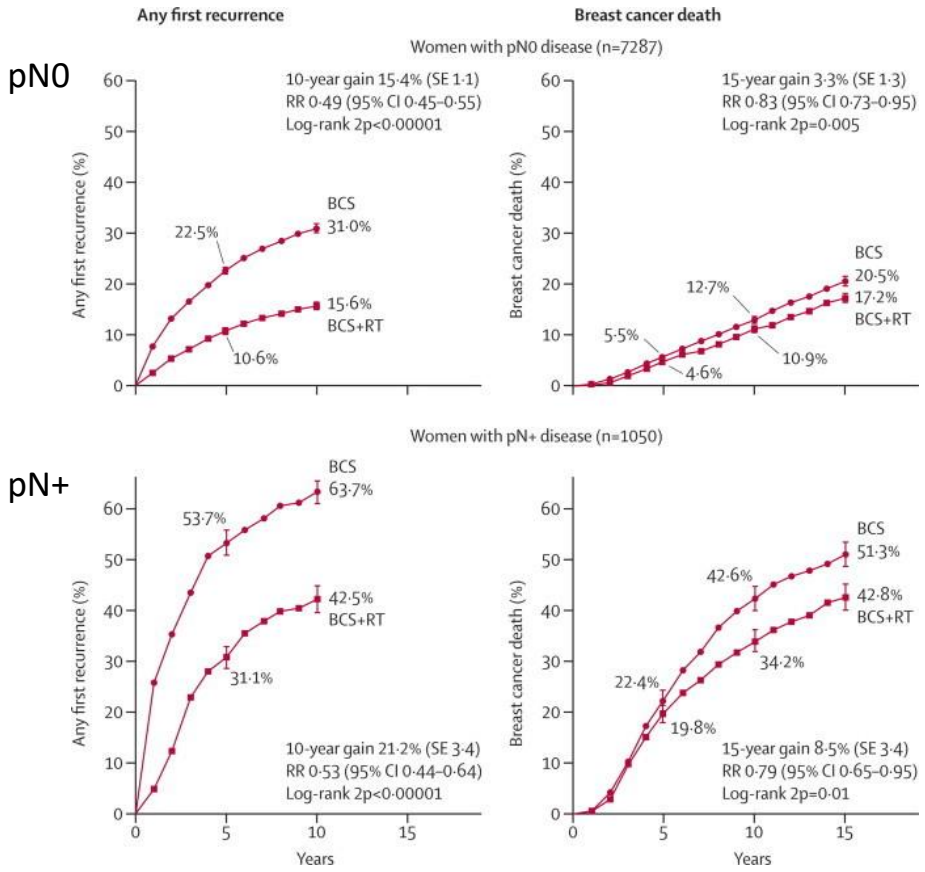
Rationale for post lumpectomy radiotherapy



EBCTCG, Lancet, 2011

First relapse

Specific survival

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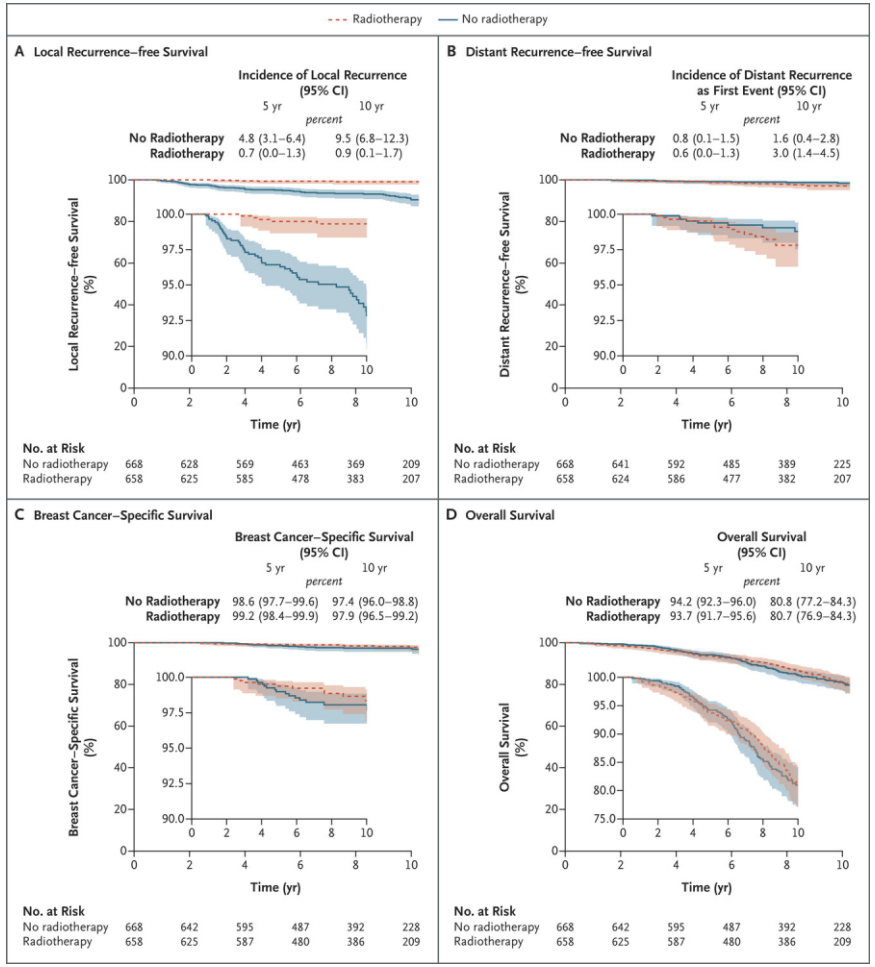
PRIME II Trial

Age >65 years old
T1 or T2<3cm
N0
ER or PR +



Kunkler I et al NEJM 2023

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What treatment schedule is the most appropriate ?

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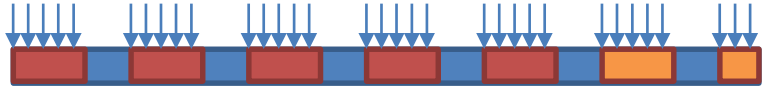
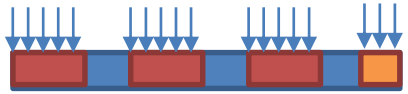
Fractionation

- Conventionnal



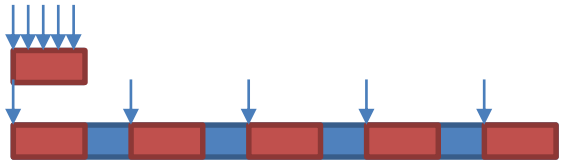
- 2Gy/fraction
- 5-6,5 weeks

- Moderate



- >2Gy/fraction
- 3-5 weeks
- OCOG/START A-B/DBCG

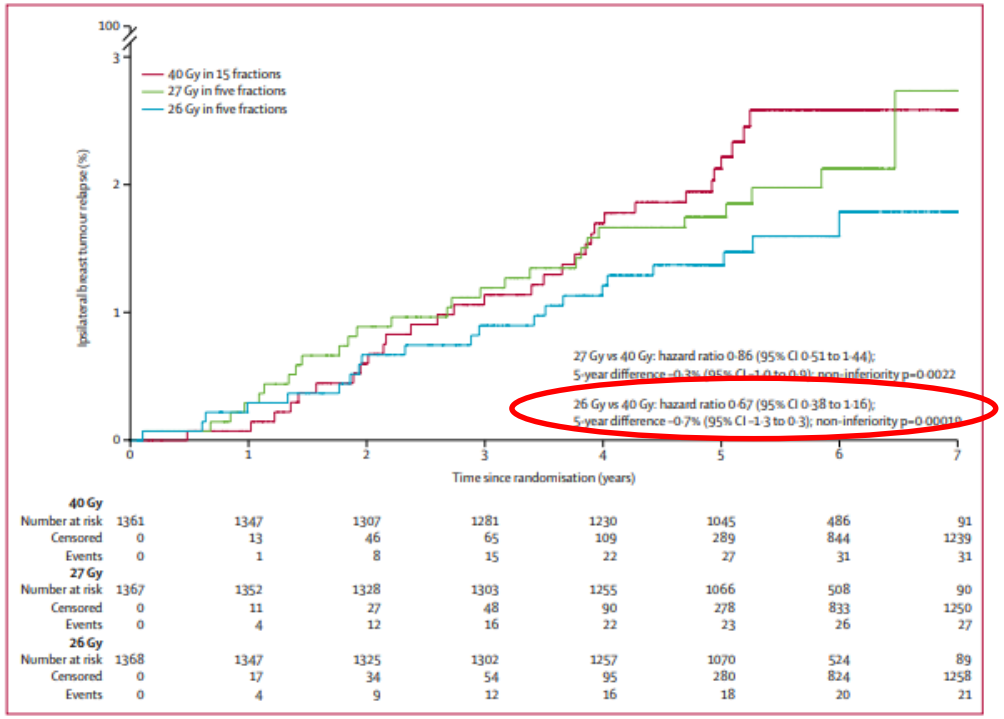
- Ultra



- 5,2-5,7 Gy/fraction
- 1 week ou 5 weeks
- FAST et FAST FORWARD

FAST-FORWARD

Age >50 : 85 %
Grade 1-2 : 72%
Lumpectomy : 93%
pN0 : 82%
IDC : 80%
<pT2 : 98 %
ER+/HER2- : 82%
Boost : 25%



40 Gy								
Number at risk	1361	1347	1307	1281	1230	1045	486	91
Censored	0	13	46	65	109	289	844	1239
Events	0	1	8	15	22	27	31	31
27 Gy								
Number at risk	1367	1352	1328	1303	1255	1066	508	90
Censored	0	11	27	48	90	278	833	1250
Events	0	4	12	16	22	23	26	27
26 Gy								
Number at risk	1368	1347	1325	1302	1257	1070	524	89
Censored	0	17	34	54	95	280	824	1258
Events	0	4	9	12	16	18	20	21

➔ Ultra Hypofractionnation is non inferior to Moderate hypofractionnation

BRUNT AM et al. Lancet Oncol 2020

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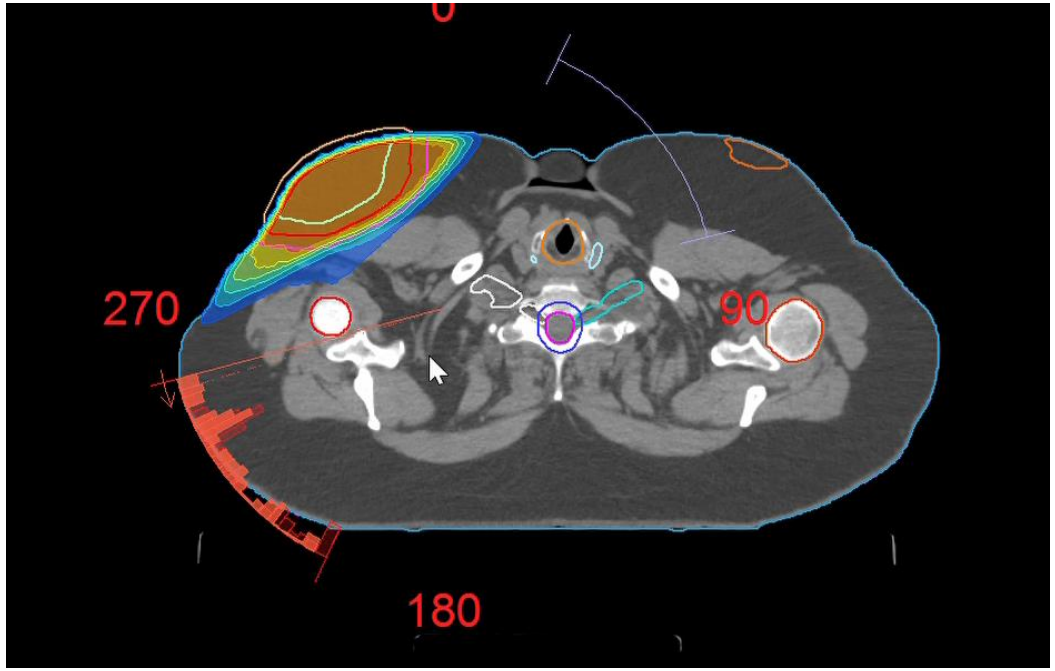
Planning

➔ Dose prescription : 26Gy in 5 fractions

FAST FORWARD phase III RCT

➔ 2 VMAT Arc : Butterfly



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Could partial Breast irradiation be an alternative ?

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Partial irradiation

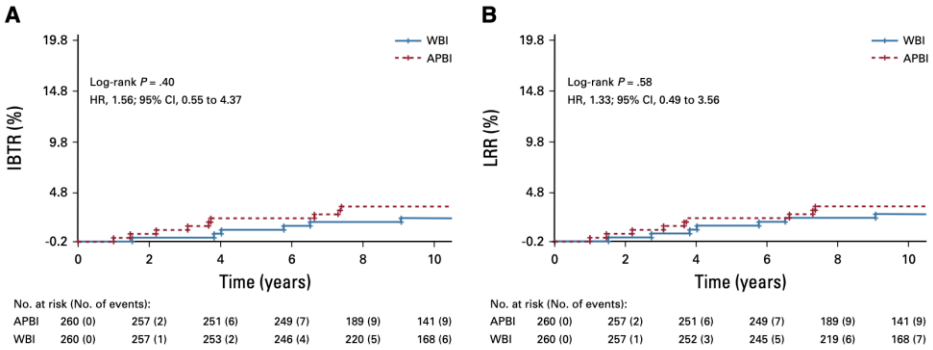
520 patientes

pT1-2 (<2.5 cm)
Age>40 ans

R

50Gy/25 fractions + boost

30Gy/5 fractions



Patient-rated cosmesis[b]			
Excellent	44 (17.9)	13 (5.1)	.0001
Good	200 (81.3)	209 (80.3)	
Fair	2 (0.8)	38 (14.6)	
Poor	—	—	

Meattini et al. JCO 2020

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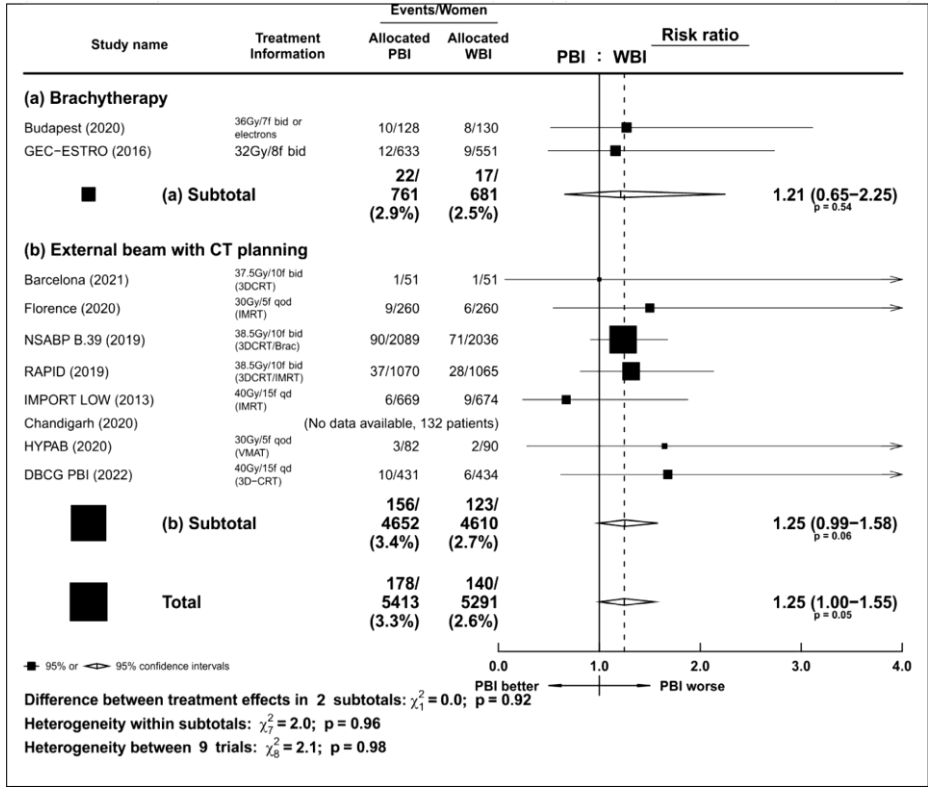
Perspectives : APBI



Goldberg et al. IJROBP 2023

Guidelines

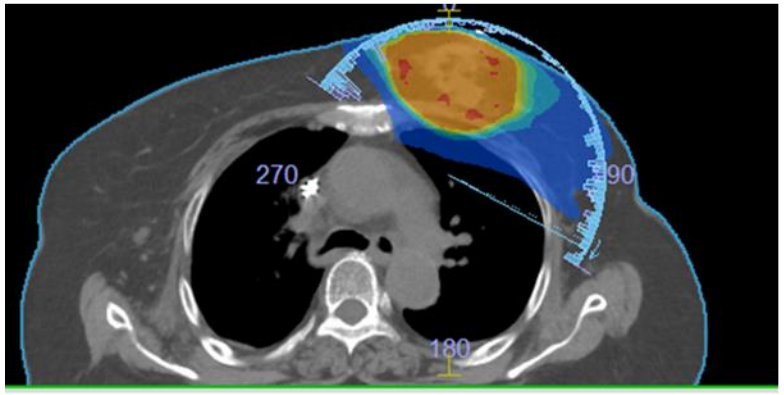
4. Partial breast irradiation–suitable patient selection for external beam radiotherapy		
I. Luminal-like subtypes small tumour (≤3 cm)	91·3%	Strong consensus
II. Clear surgical margins (>2 mm)	95·6%	Strong consensus
III. Nodal status	..	..
IIIa. Node negative	100%	Unanimous consensus
IIIb. Node negative (including isolated tumour cells)	82·6%	Consensus
IV. Absence of lymph vascular space invasion	87·0%	Consensus
V. Non-lobular invasive carcinoma	87·0%	Consensus
VI. Tumour grade 1–2	91·3%	Strong consensus
VII. Low-to-intermediate grade DCIS, sized ≤2·5 cm, clear surgical margins (≥3 mm)	78·2%	Consensus
VIII. Age 50 years or more	87·0%	Consensus
IX. Unicentric or unifocal	100%	Unanimous consensus
X. Primary systemic therapy and neoadjuvant chemotherapy is considered an exclusion criterion for partial breast irradiation	78·2%	Consensus

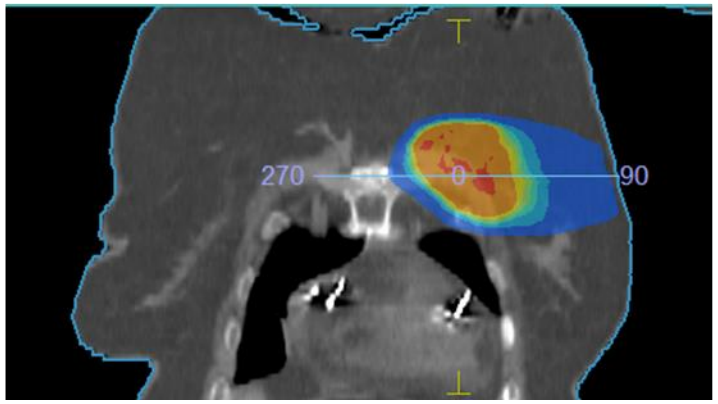
5. Partial breast irradiation–dose and fractionation		
5a. Moderate hypofractionation (40 Gy in 15 fractions) and ultrahypofractionation (26–30 Gy in five fractions) represent acceptable schedules for external beam partial breast irradiation	91·6%	Strong consensus
5b. Twice a day external beam partial breast irradiation dose and fractionations similar to those used in the RAPID trial should not be offered	86·9%	Consensus

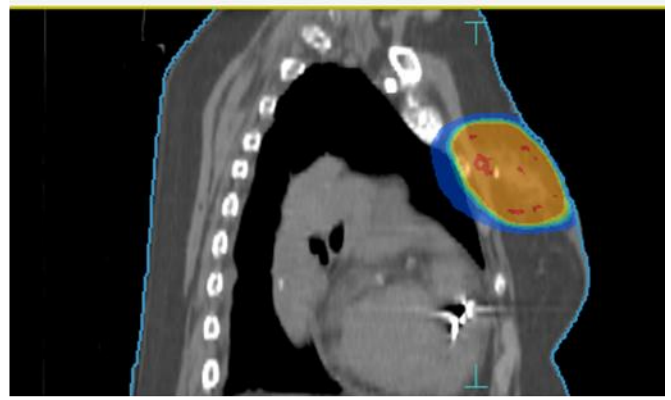
pT1-pT2 (<3 cm)
pN0
R0 (>2mm)
SBR1-2
Age> 50 ans
Unifocal
Low grade DCIS

Meattini I et al. Lancet Oncol 2022

Example







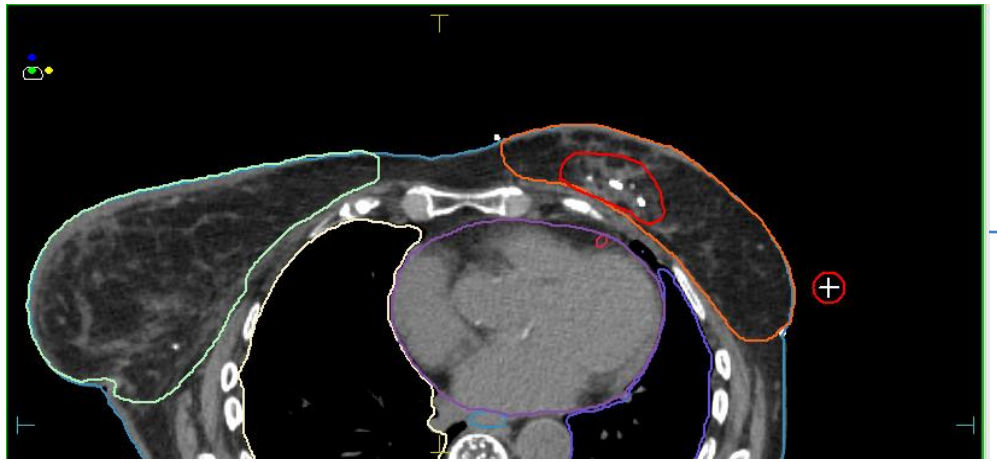
Can brachytherapy be an alternative ?

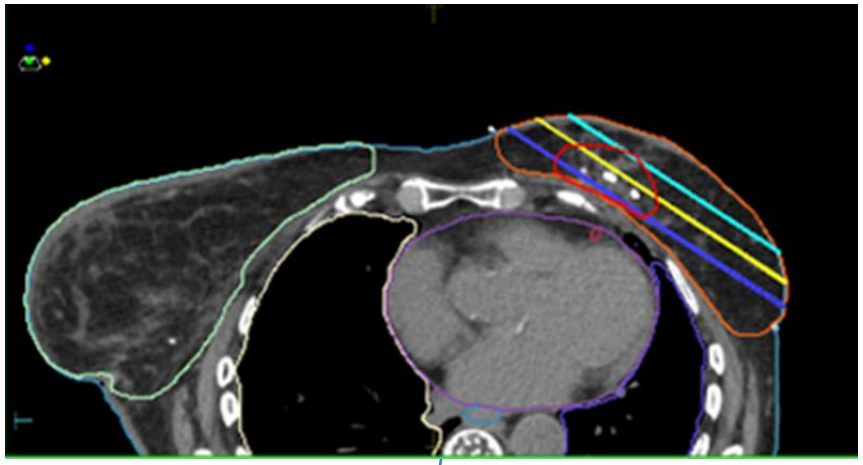
- What is brachytherapy ?

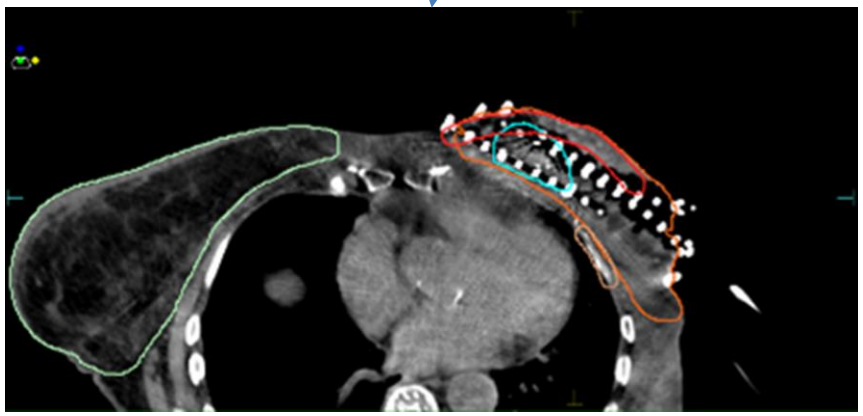
➔ Placement of radioactive material, either temporarily or permanently, directly inside the body in order to treat cancer

➔ unlike external beam radiotherapy, that delivers radiation through healthy tissues, brachytherapy delivers dose directly within or adjacent to tumor

Can brachytherapy be an alternative ?







- Thank you for your attention

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