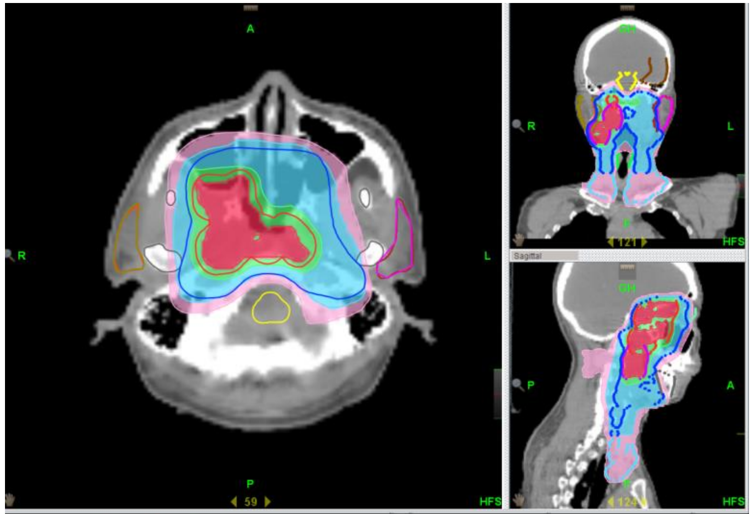
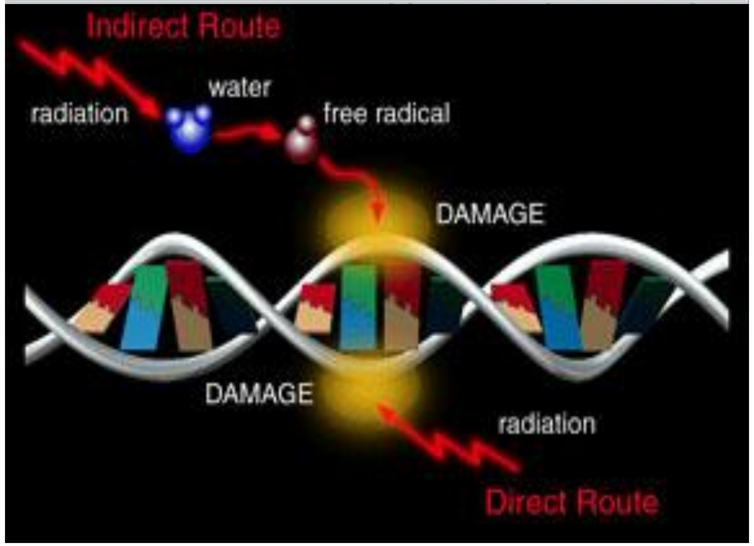
Born	: Jakarta, September 1955
Education	
1. GP	: Faculty of Medicine Univ of Indonesia, 1980
2. Radiologist	: Faculty of Medicine Univ of Indonesia, 1987
3. Radiation Oncologist	: Faculty of Medicine Univ of Indonesia, Muenster Universiteit, 1990
4. PhD	: FKUI, 1998 (EBV LMP1 and Proliferation in NPC)

Current Positions :

Chairperson of Indonesian National Cancer Control Committee (KPKN), Ministry of Health Rep. Indonesia
President of Indonesian Radiation Oncology Society (PORI)
President of Federation of Asian Organizations on Radiation Oncology (FARO)
National Project Coordinator for IAEA
Past President of South East Asia Radiation Oncology Group (SEAROG)
Senior Medical Staff, Radiotherapy Department CiptpMangunkusumo Hospital, Fac of Medicine Universitas of Indonesia

Radiation Oncology
Radiotherapy in Cancer Management





Soehartati Gondhowiardjo, MD, PhD
Arry Setyawan, MD

KEMENTERIAN KESEHATAN REPUBLIK INDONESIA

GERMAS Gerakan Masyarakat Hidup Sehat

VISION 2019

Reducing Cancer Morbidity and Mortality in Indonesia

FINANCIAL

Establishment of sustainable budgeting

ORGANIZATION

Establishment of National Body

REGULATION

Regulation for cancer prevention

Regulation of Complementay and Alternative Medcine

STRATEGIC EFFORT

Establishment of **health seeking behaviour**.

Establishment of effective education for healty lifestyle and **cancer awareness**

Empowering **Primary healthcare** for early detection, palliative, and rehabilitation care.

Monitoring the implementation of cancer treatment based on national guidelines, patient safety, and quality standard.

Effective and efficient **referral sysem for multidiscipline cancer care..**

Empowering **hospice and home care system.**

Effective partnership and advocation with national and international bodies

Establishment of **research unit and HTA for cancer.**

Improvement of **oncology module in medical curriculum**

RESOURCES

Increased quantity and quality of **human resources in Oncology.**

Availability and implementation of **IT system and cancer registry.**

Fulfillment and distribution of **cancer facility as standard.**

Establishment of national cancer **treatment guidelines**

8.Establishment of effective education for healthy lifestyle and cancer awareness

No	Strategic Objective	KPI	Target 2019	2015	2016	2017	Programme	PI	Target	Result
8	Establishment of effective education for healthy lifestyle	• Healthy Life awareness in community	50%		10%	10%	· Public seminar and training of trainers	Number of Public seminars conducted	7	8
								Number of ToT Conducted	3	2
								Number of Master ToT Produced	15	51
							· Promotion for community knowledge and awareness: "SADARI", prevention of smoking, healthy diet, early detection	Number of Education media produced	3	5 public awareness video for media campaign
								Number of dissemination event	5	8
								Number of educational event	5	8

Health Promotion and awareness

World Cancer Day Indonesia

2016

2015

2014

2013

2012

2010

WCD 2010 – 2012

- Department Radiotherapy RSUPN CM

WCD 2013–2014

- National
- Campaign

WCD 2015

- 17 Provinces
- 29 Hospitals
- 2 Public Health Departments
- Public Symposium
- Breast and Cervical cancer Screening

WCD 2016

- 18 Provinces
- 30 Hospitals
- 7 NGO
- 8 Professional Society
- Public and Medical Symposium
- FREE Breast and Cervical Cancer Screening

WCD 2017

- 22 Provinces
- 8 NGO
- 40 Hospitals
- 3000 Dance for Cancer
- Free Breast Cancer Screening
- Free Mammograf
- Free VIA test
- Free PAP Smear

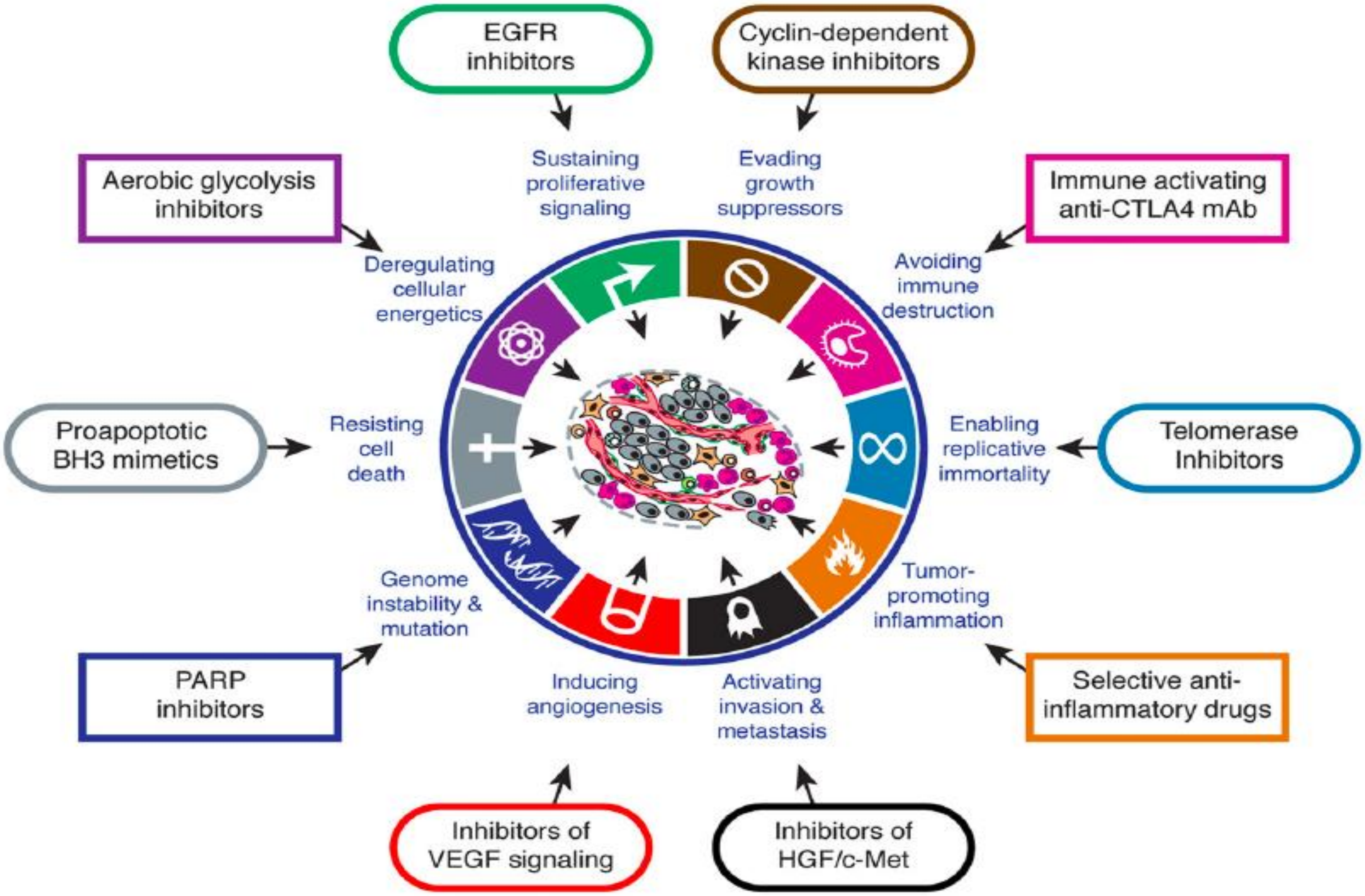
↑ Events

↑ Awareness

↑ Early Detection

Disclosure

I have no conflict of interest to disclose.



Cell 2011 144, 646-674DOI: (10.1016/j.cell.2011.02.013)

Terminology

Radiation oncology is that discipline of human medicine concerned with the generation, conservation, and dissemination of knowledge concerning the causes, prevention, and treatment of cancer and other diseases involving special expertise in the therapeutic applications of ionizing radiation.

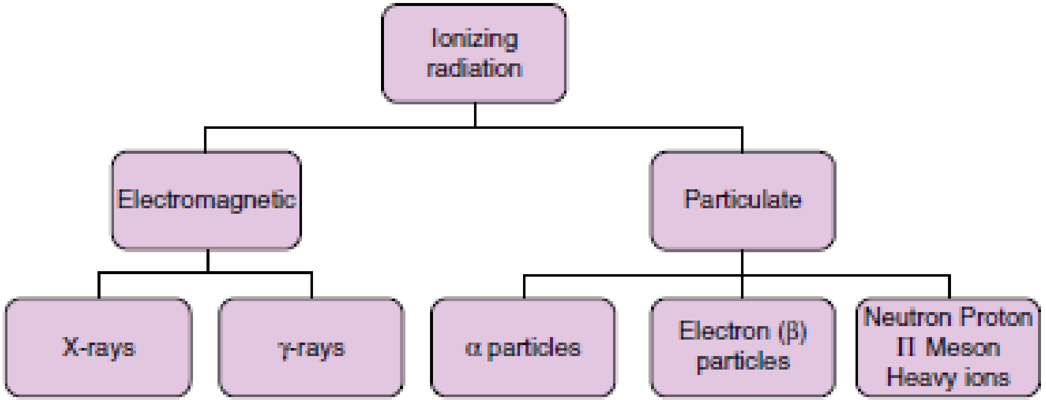
Radiation therapy is a clinical modality dealing with the use of ionizing radiations in the treatment of patients with malignant tumor (and occasionally benign diseases).

Radiation oncologists use radiation therapy to try to cure cancer, to control cancer growth or to relieve symptoms, such as pain.

Knowledge	• **Radiation Oncology**
Modality	• **Radiotherapy**
Person	• **Radiation Oncologist**

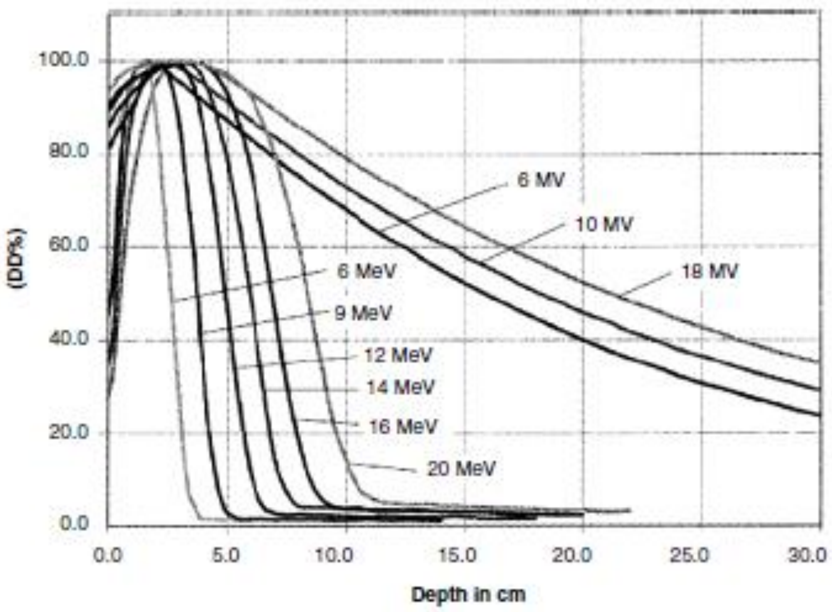
1. Halperin EC et al. Principles and Practices of Radiation Oncology Lipincott Williams & Wilkins, 2008

Types of Radiation Used in Radiotherapy



LINAC **Co-60**

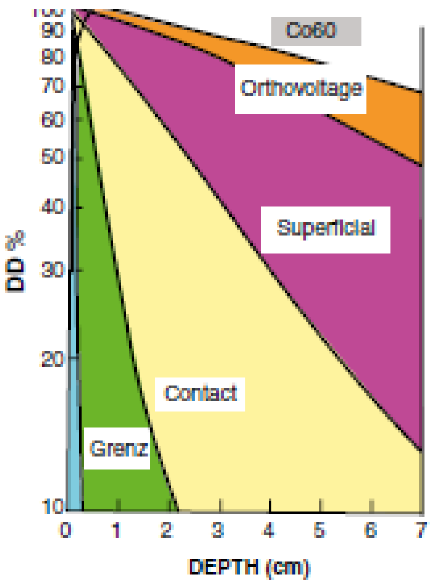
Radiation types scheme

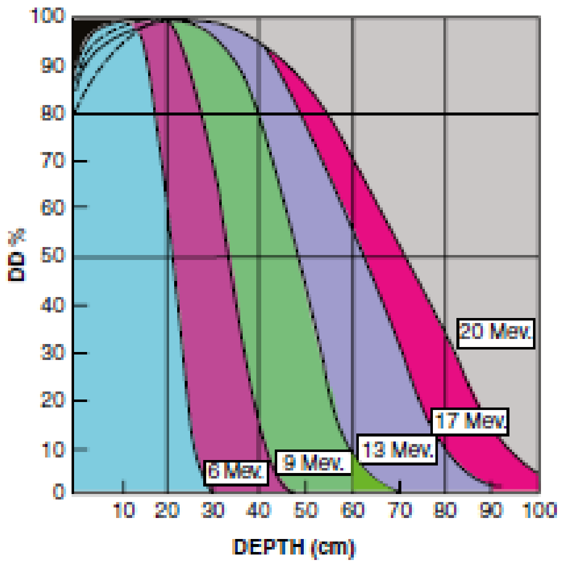


Energy levels

Kilovoltage units

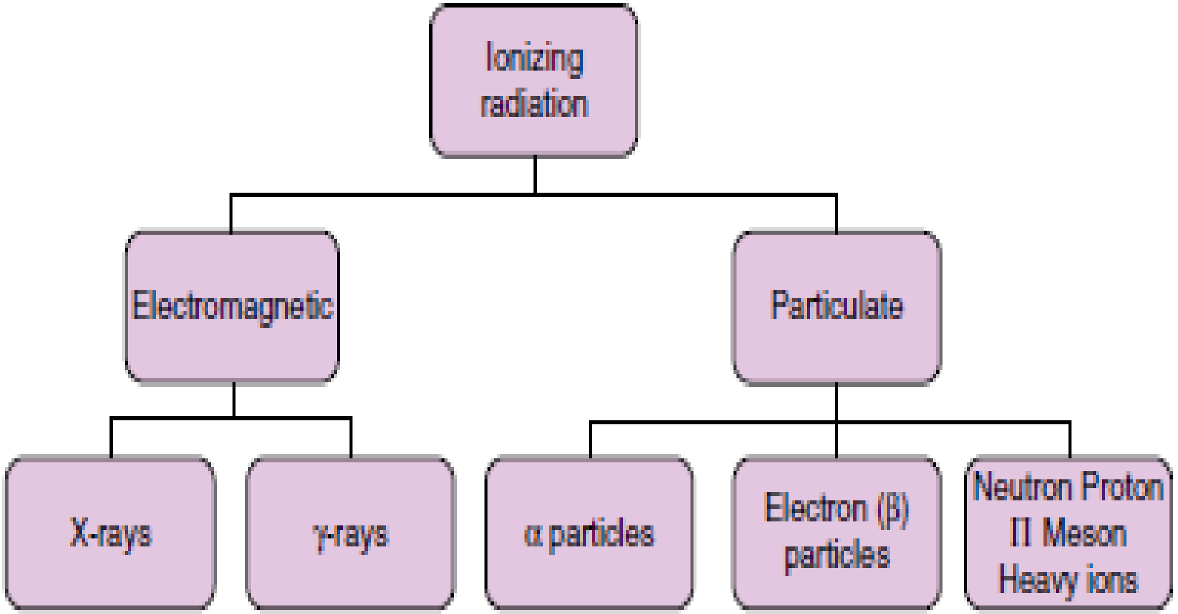
- Grenz rays (<30 kV)
- Contact (40-50 kV)
- Superficial (50-150 kV)
- Orthovoltage (150-500 kV)
- Supervoltage (500-1000 kV)
- Megavoltage (>1 MV)

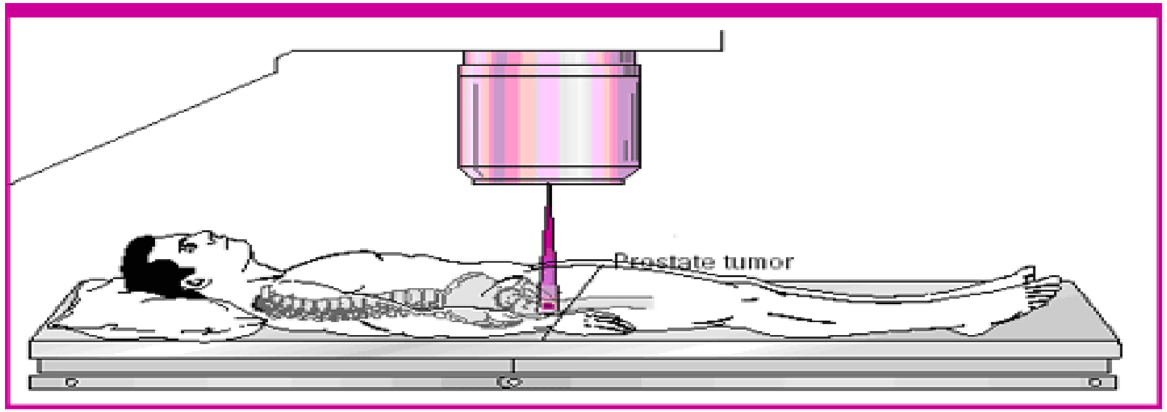


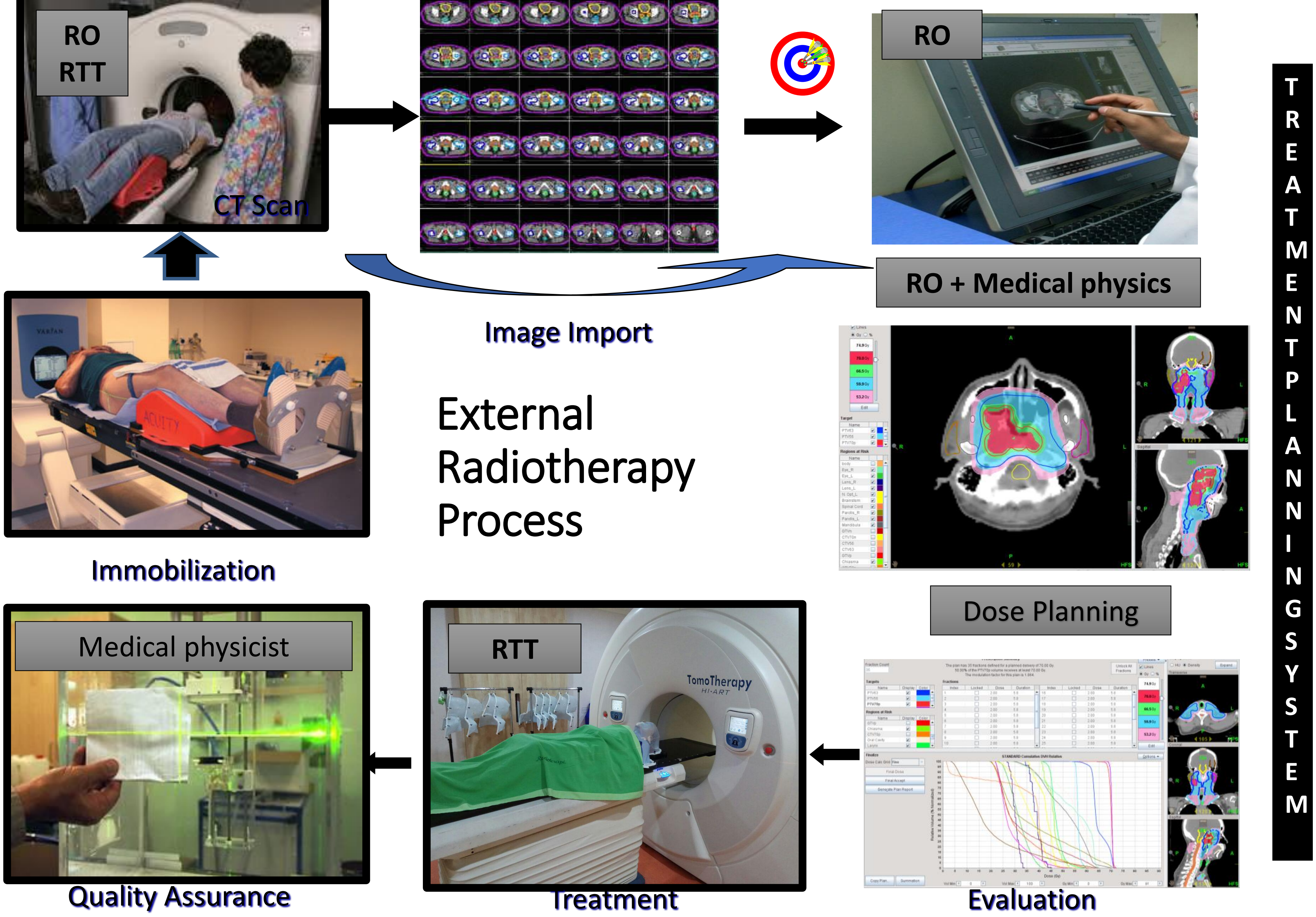


Beyzadeoglu M et al. Basic Radiation Oncology. S

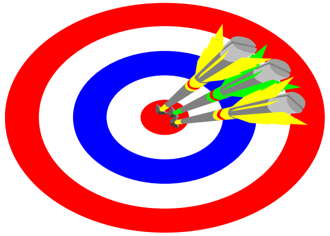
Radiation therapy is a clinical modality ....



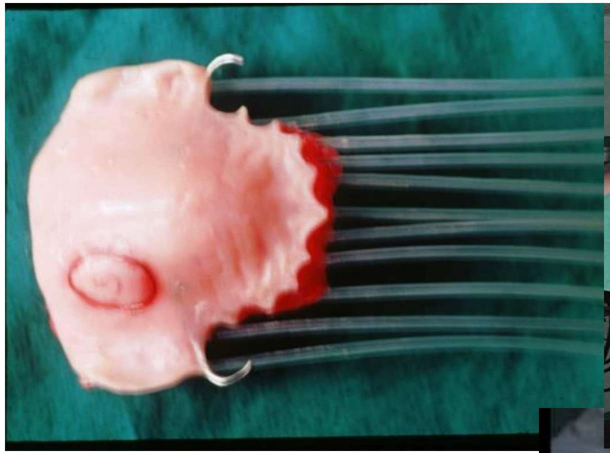


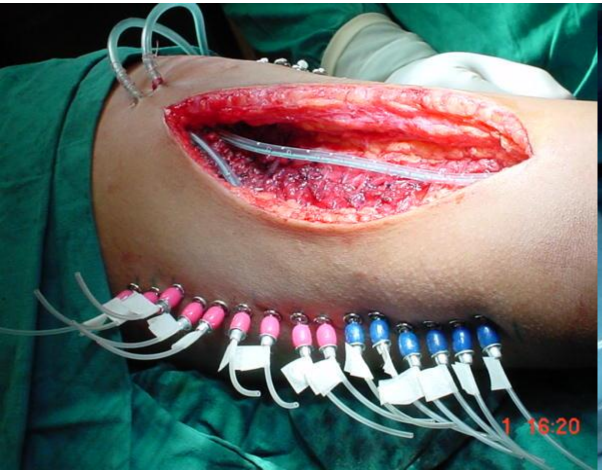

External Radiotherapy Process
RO
RTT
CT Scan
RO
RO + Medical physics
Image Import
Immobilization
Dose Planning
Medical physicist
RTT
TomoTherapy
Quality Assurance
Treatment
Evaluation
TREATMENT PLANNING SYSTEM

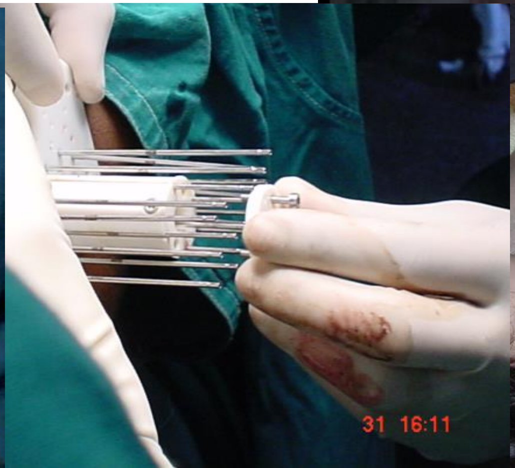
BRACHYTHERAPY



- Methods
  - Contact
    - Intraluminary & intracavitary
    - Surface Mould
  - Interstitial
    - Permanent → iodine / gold seed
    - Temporary (hair pin / flexible catheter = loop / needles)







Cobalt-60 Teletherapy Unit

- Cobalt-60 produces **γ rays**
- Cobalt-60 unit have a cylindrical source 2 cm in diameter.
- The activity of the source is 5.000 – 15.000 Ci.
- After 5 – 7 years of use, activity of the source will be less than 3.000 Ci.
- The half-life of Co-60 is 5,27 years .
- The Co-60 energy is 1,25 MeV.
- Dmax is 0.5 cm below the skin surface.
- Modern isocentric Co-60 unit such as Theratron, have a SAD of 80 cm or 100 cm.

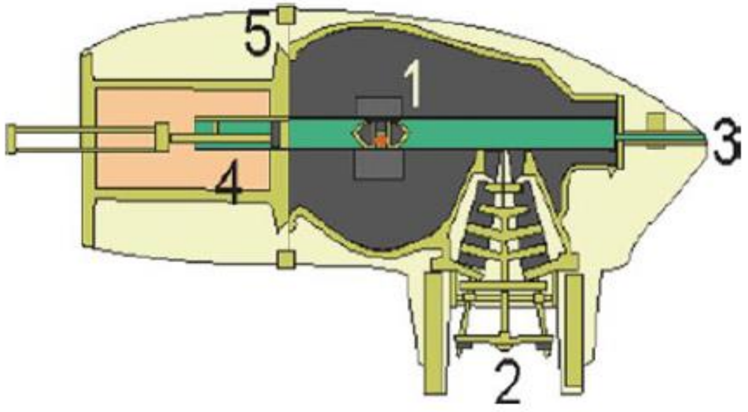
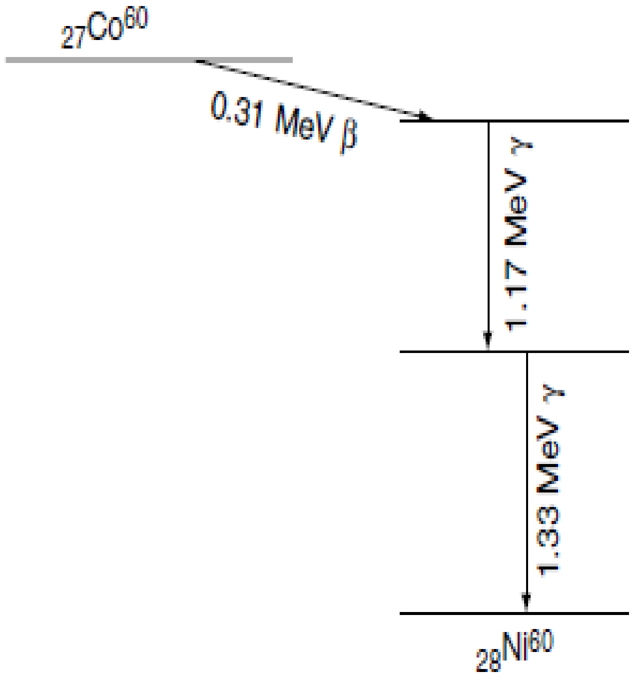


Diagram of Cobalt-60 treatment head



Beyzadeoglu M et al. Basic Radiation Oncology. Springer, 2008

Linear Accelerator (LINAC)

- Medical Linear Accelerator (LINACS) are used for generating high-energy **x-ray beams.**
- The energy range to 4 to 25 MV, and electron beams in the range 4 to 25 MeV.
- Current accelerator are also equipped with online imaging devices

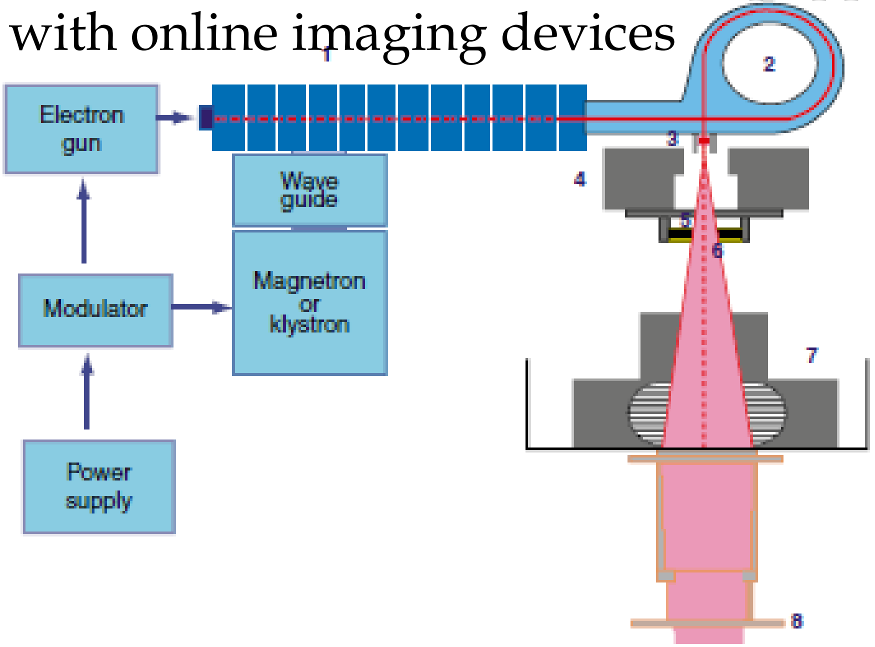
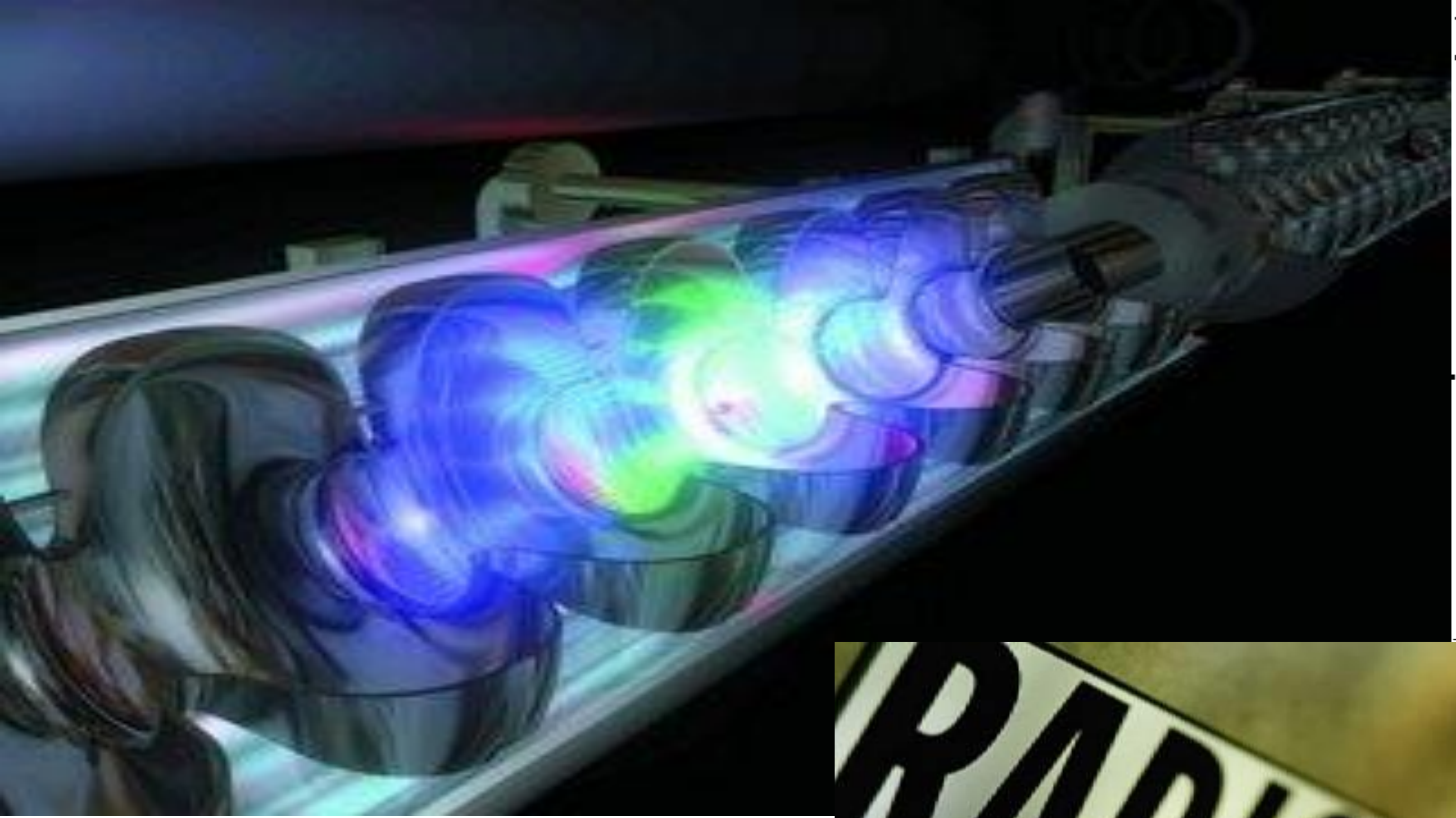
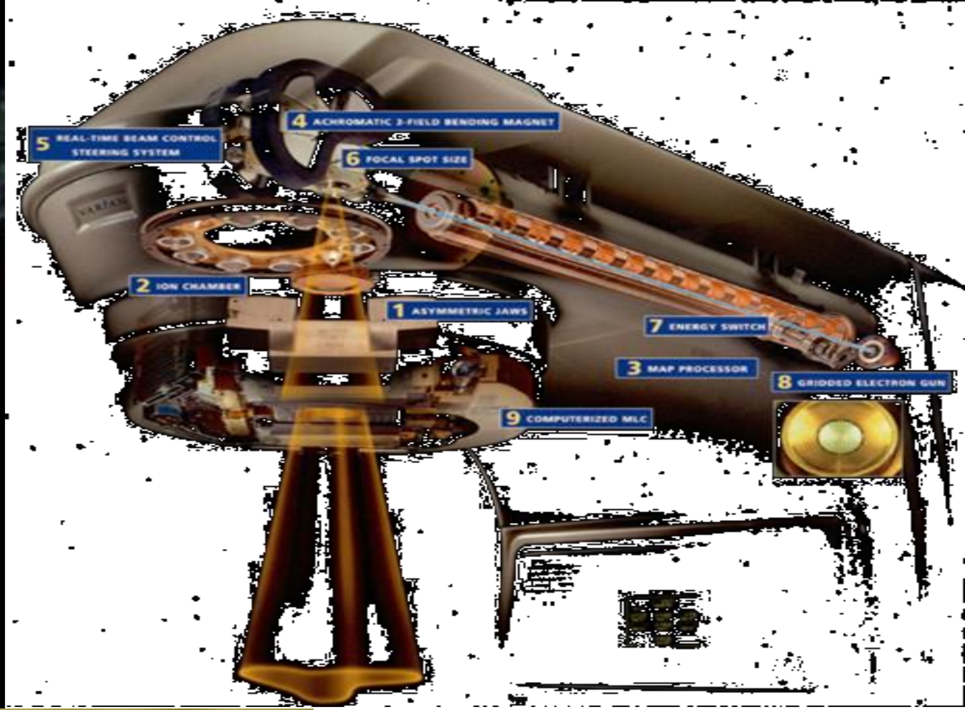


Diagram of Linear Accelerator

Khan F. The Physics of Radiation Therapy. Lipincott Williams & Wilkins, 2008

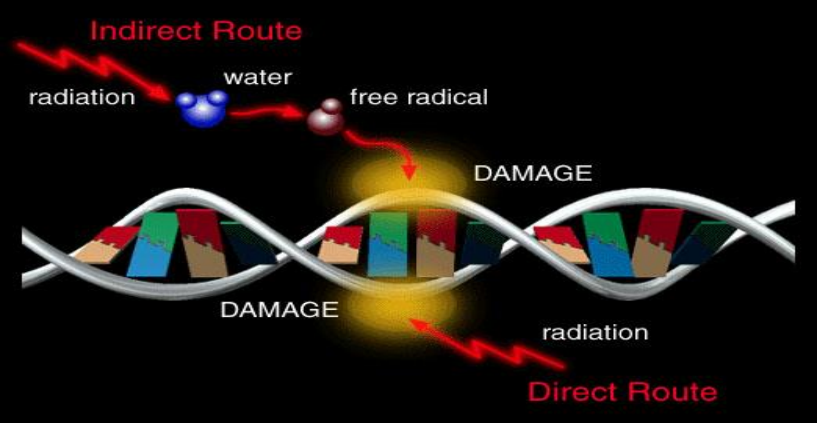




Radiotherapy uses
Megavoltage Radiation
And Radioactive sources
For cancer treatment

SAFETY ISSUES!

Odorless
Tasteless
Colorless



What happens to the tissue after radiation exposure?

2. Radiobiology

Odorless
Tasteless
Colorless

Reaksi Fisika — Reaksi Kimia — Reaksi Biologik — Rata-rata usia manusia

10^{-18} → 10^{-12} → 10^{-6} → 1 → 10^{3} → 10^{6} → 10^{9} (detik)

1 → 10^{3} → 10^{6} (menit)

1 → 10^{3} (hari)

Eksitasi

Radikal Bebas

Ionisasi

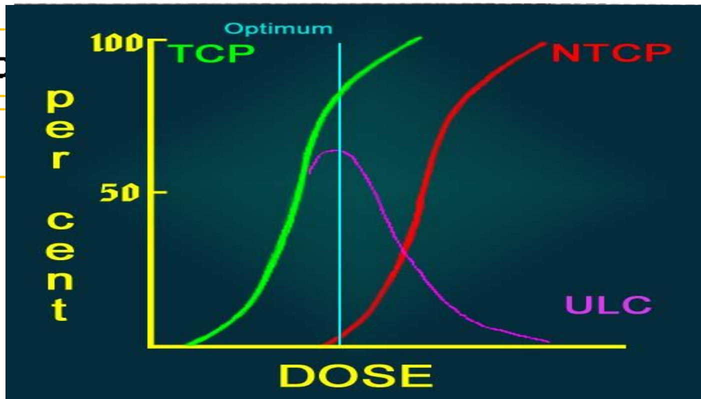
Reaksi Enzimatik

Proses Repair

Early effects

Late effec

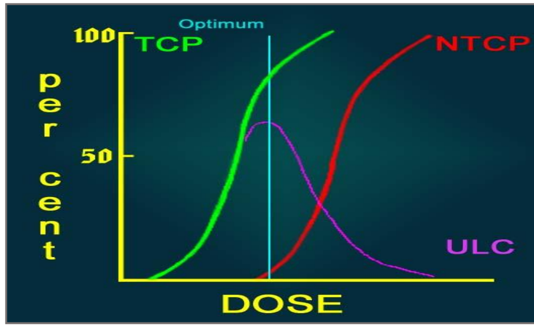
Proliferasi sel

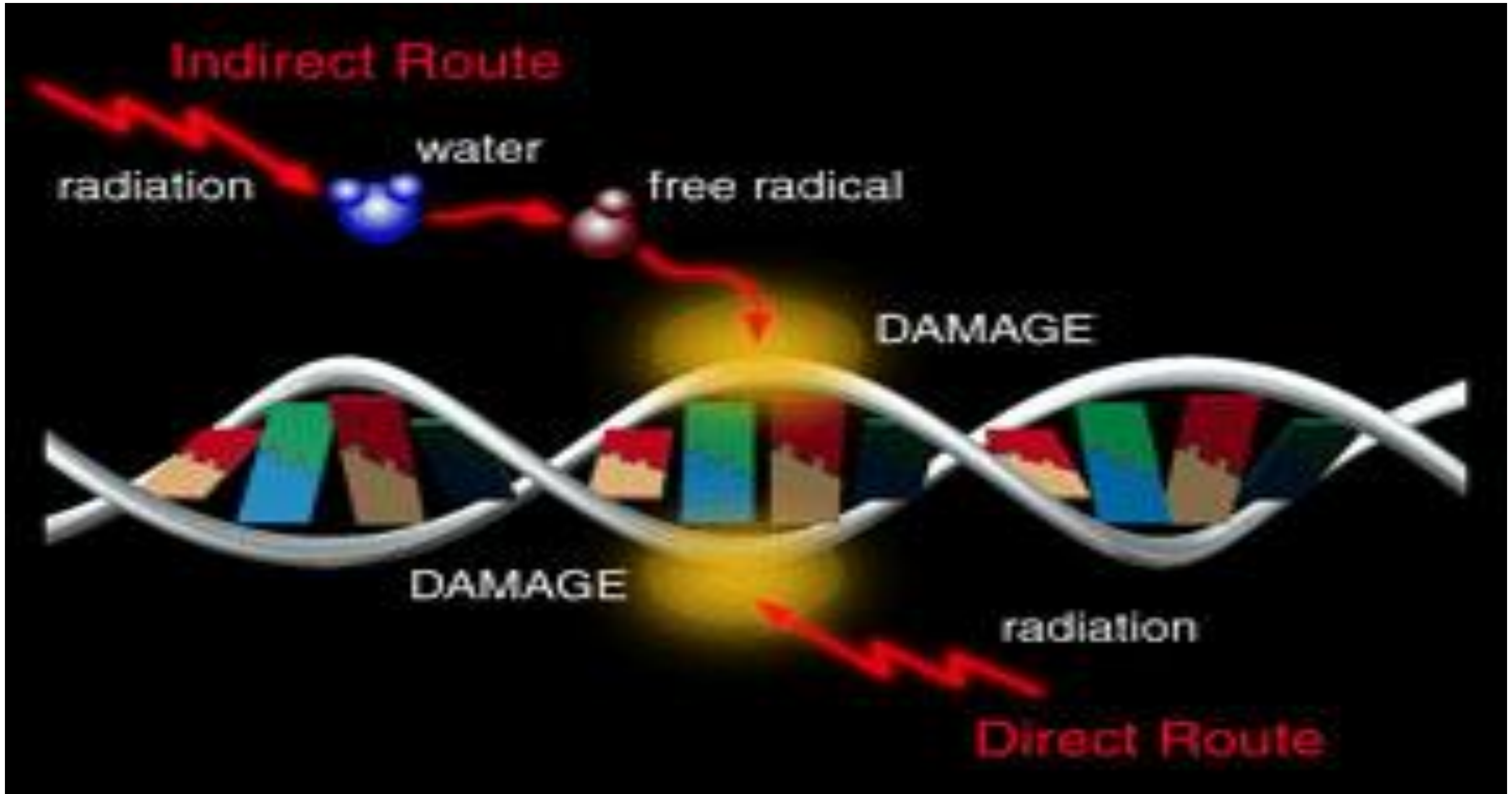


What happens to the tissue after radiation exposure?

Radiation Induced Damaged / cell death

- *DNA* is **primary target**
- **Double Strand breaks** – Primary requisite **(irreversible and irreparable damage**)
- *Reproductive Cell Death ➔ Apoptosis*



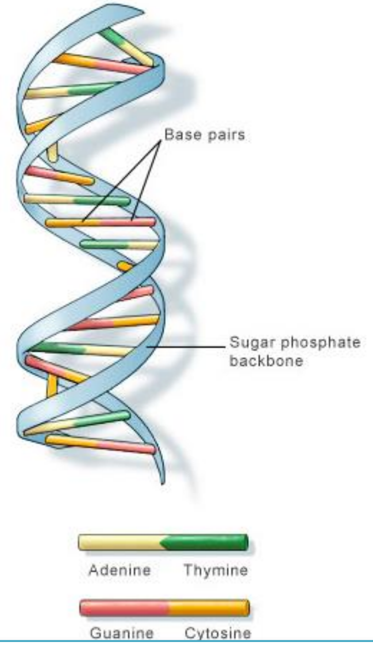


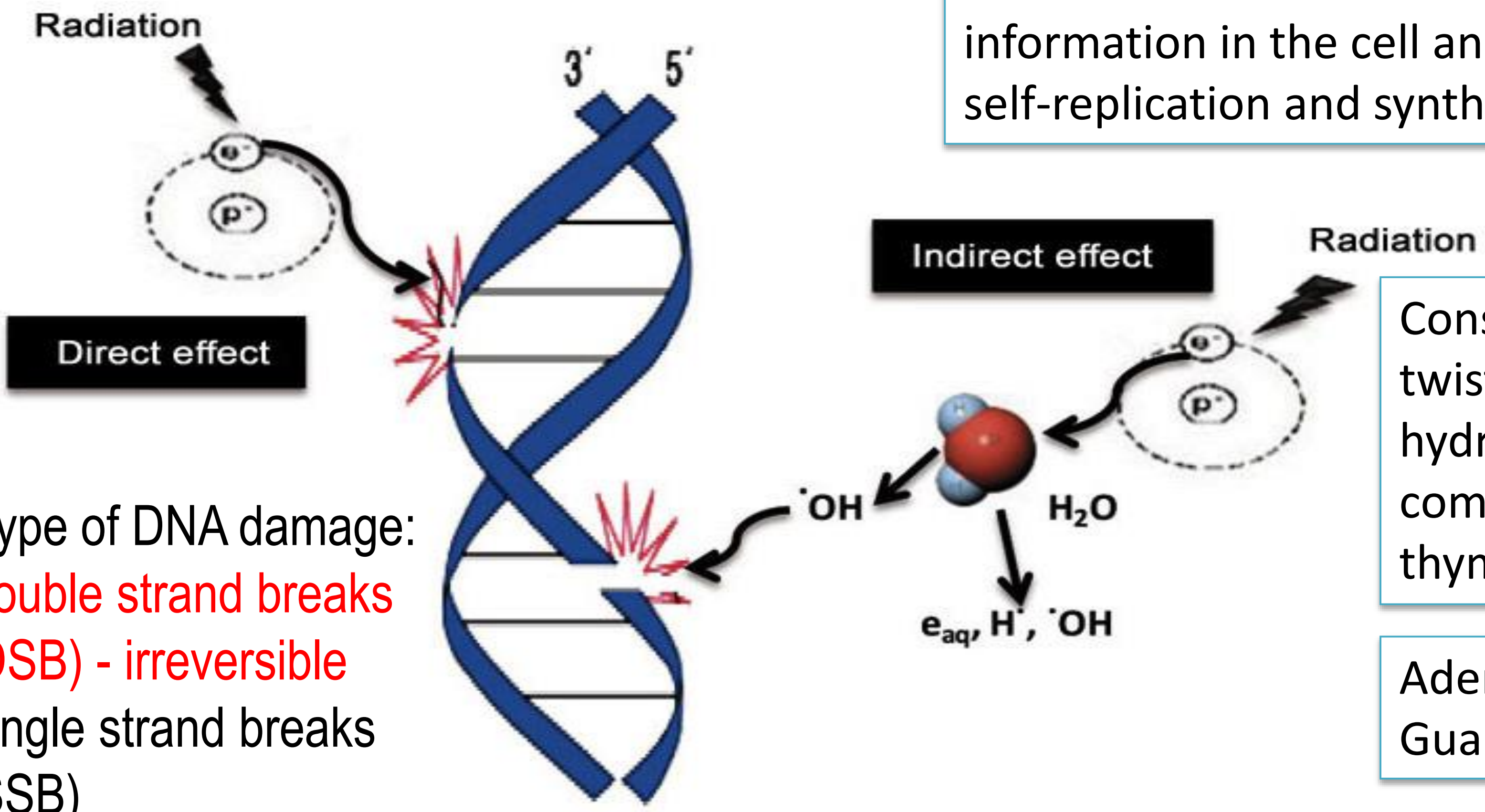
The type od DNA damage:

- Double strand breaks (DSB)
- Single strand breaks (SSB)
- Base damage
- Cross links damage

DNA Damaged by Ionizing Radiation

A nucleic acid that carries the genetic information in the cell and is capable of self-replication and synthesis of RNA





Consists of two long chains of nucleotides twisted into a double helix and joined by hydrogen bonds between the complementary bases adenine and thymine or cytosine and guanine

Adenine -- Thymine
Guanine -- Cytosine

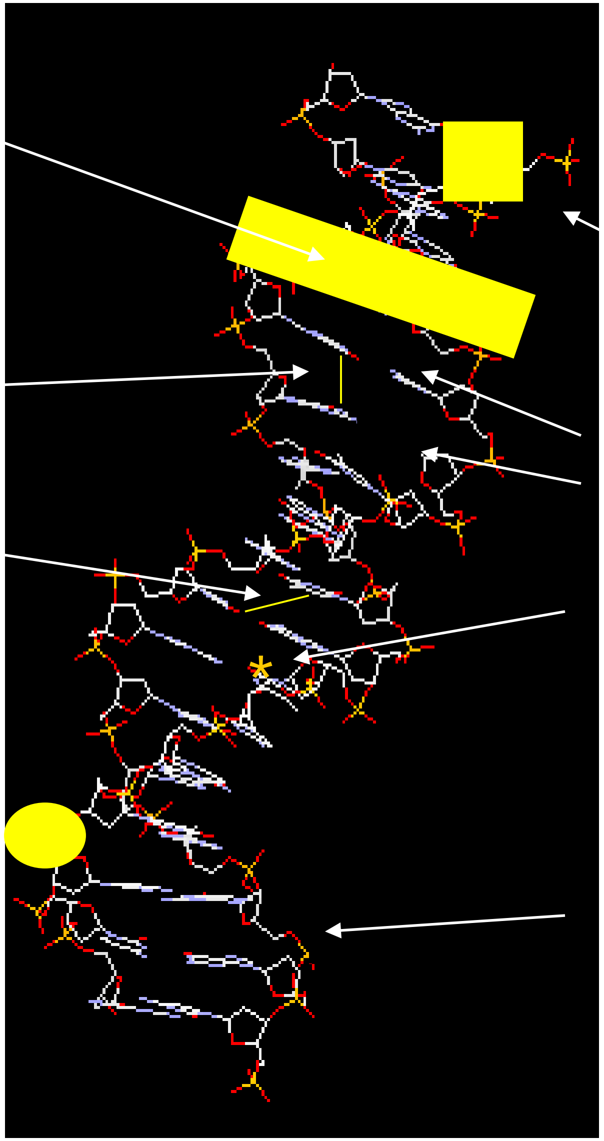
The type of DNA damage:

- Double strand breaks (DSB) - irreversible
- Single strand breaks (SSB)
- Base damage
- Cross links damage

DOUBLE STRAND BREAK
30/ CELL / GRAY

INTRASTRAND CROSSLINK
0.5 / CELL / GRAY
INTERSTRAND CROSSLINK

DNA-PROTEIN CROSSLINK
1 / CELL / GRAY



SINGLE STRAND BREAK
1000 / CELL / GRAY

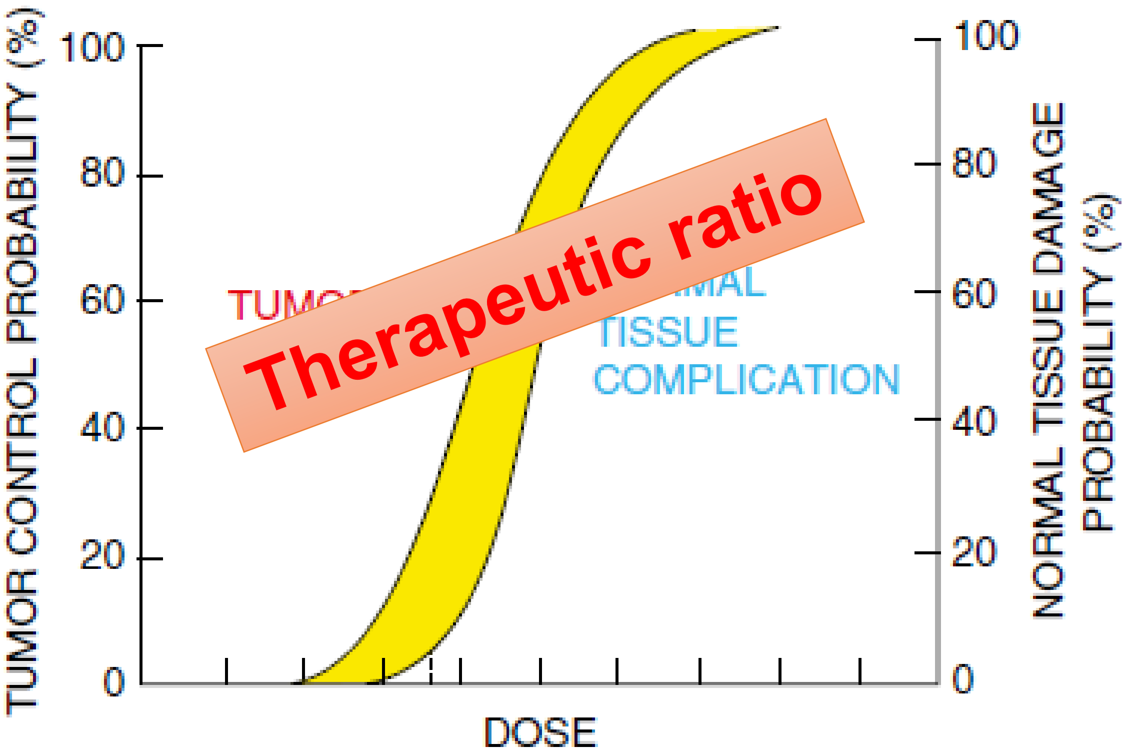
BASE CHANGE (eg C - U)
BASE LOSS
1000 / CELL / GRAY
BASE MODIFICATION
(eg thymine/cytosine glycol)

SUGAR DAMAGE
(abstraction of hydrogen atom)

TCP and NTCP Curves

Prescribed Dose
Prostate = 80 Gy
Cervix = 70 – 85 Gy
Rectal (pre-operative) = 46 Gy

Prescribed Dose
GTV = 70 Gy
CTV = 50 Gy

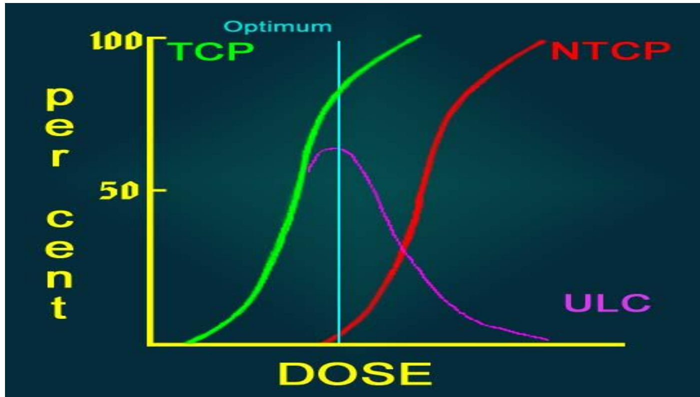


Rectum's dose constraint
V50 < 50%
V60 < 40%
V70 < 20%
BT : rectal dose < 70%

Small bowel dose constraint
45 – 50 Gy
V52 < 0%

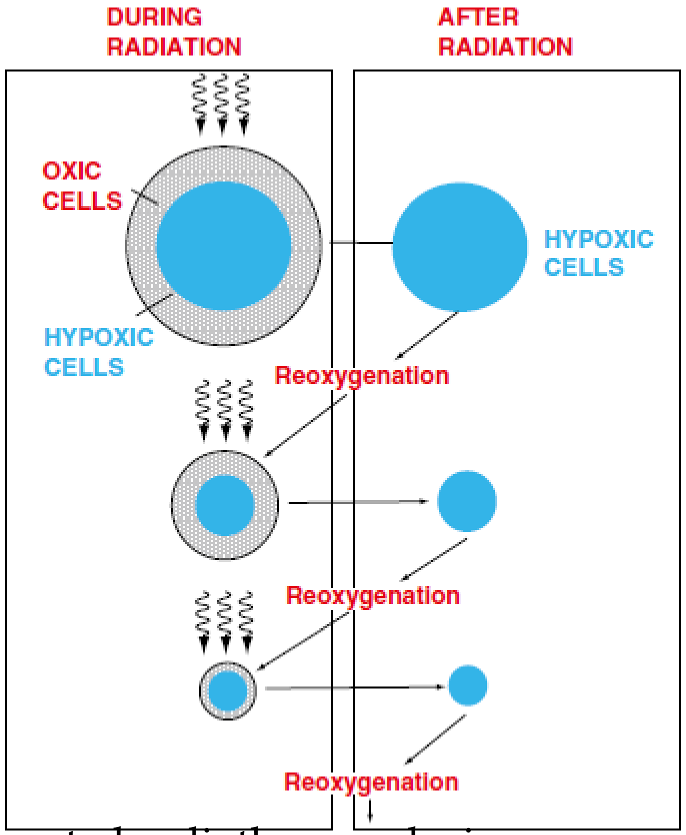
Therapeutic ratio:

- Eradication of the tumor **(Local Control, Disease Free Survival)**
- A high quality of life **(QoL)**
- Prolongation of survival **(Overall survival)**

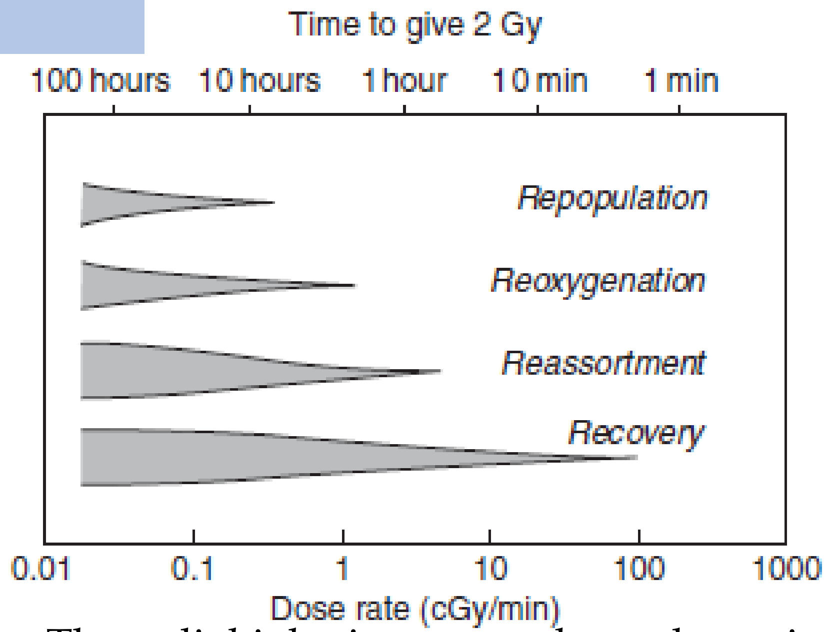


FRACTIONATION ???

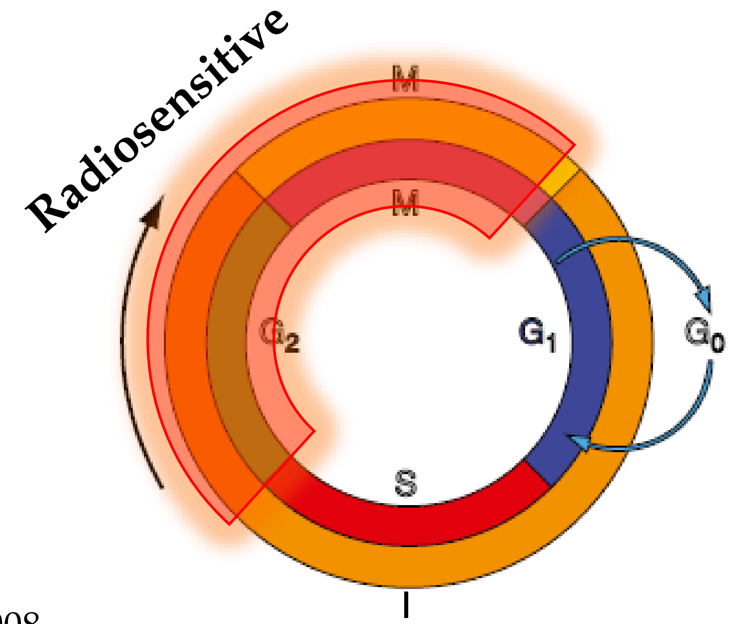
- Repair (recovery)
- Redistribution (reassortment)
- Re-oxygenation
- Repopulation
- Radiosensitivity intrinsic



Fractionated radiotherapy during reoxygenation



The radiobiologic process depends on time

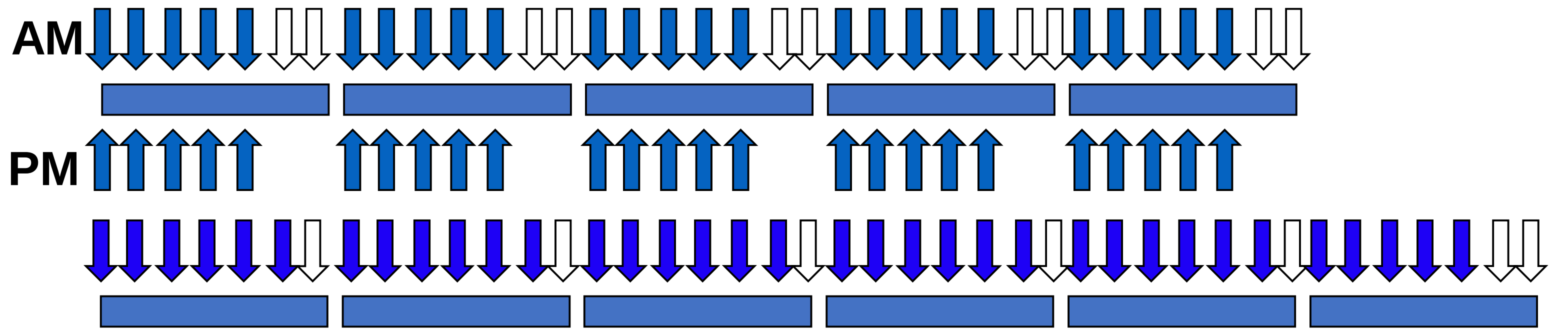


Beyzadeoglu M et al. Basic Radiation Oncology. Springer, 2008

Fractionation Schedules in Radiotherapy

	Example	Dose (Gy)	Tumor control (%)
Sensitive	Seminoma, Lymphoma	≤ 45	≥ 90
Intermediate	SCC, Adeno-Ca	50	≥ 90 (subclinical)
		60	~ 85 (Ø 1 cm)
		70	~ 70 (Ø 3 cm)
			~ 30 (Ø 5 cm)
Resistant	Glioblastoma	≥ 60	none?
	Melanoma	≥ 60	none?

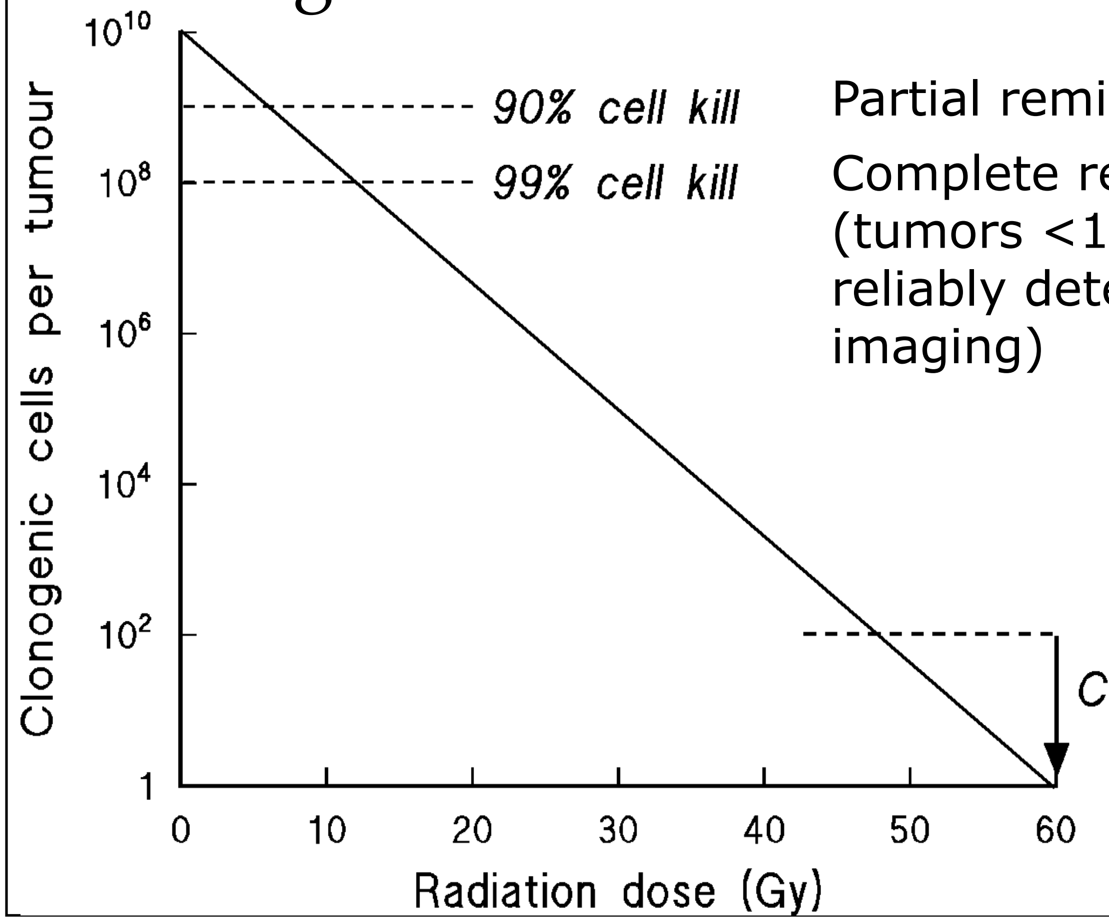
Hyperfractionation: Lower dose of fraction, more fractions, same/higher total dose, same total time



Acceleration: Reducing the total amount of time (Through hyperfractionation or weekends)

Can my patient **STOP** her radiation treatment if her tumor is no longer detectable clinically?

So if you can't see the tumor, it doesn't mean there is no tumor, you MUST give the radiation with curative dosage



Partial remission (>50% reduction)

Complete remission (tumors <10^8 (0.1 cc) can't be reliably detected with current imaging)

The aim of radiotherapy is to eradicate clonogenic tumor cells.

Slide courtesy of Prof Albert van der Kogel, Adapted.

Adapted from Fowler

The Five Fundamental Questions of Radiation Therapy

- What is the indication for radiation therapy?

  Would radiotherapy be efficacious for the patient? The gold standard is phase III

- What is the goal of radiation therapy?

  Curative or palliative

- What is the planned treatment volume?

  GTV, CTV, PTV (ICRU 50 and ICRU 62)

- What is the planned treatment technique?

  Conventional RT, 3D-CRT, 4D-Adaptive RT, IMRT, VMAT, IGRT, Brachytherapy

- What is the planned treatment dose?

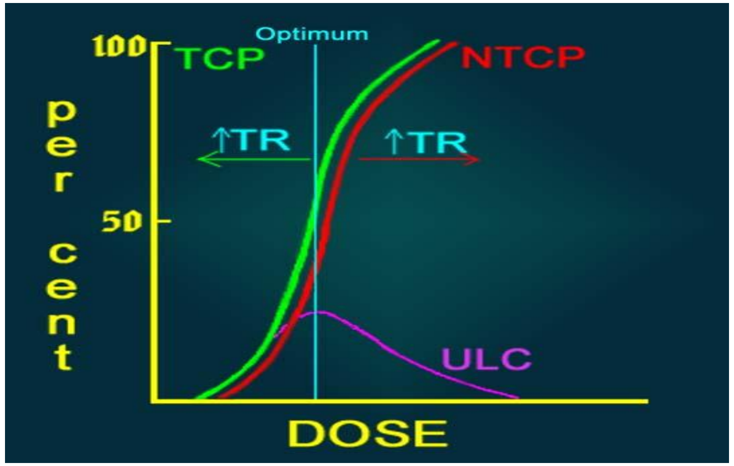
  GTV = 70 Gy
  Elective Lymph Node = 50 Gy
  Palliative = 40 Gy

Halperin EC et al. Principles and Practices of Radiation Oncology Lipincott Williams & Wilkins, 2008

Radiotherapy Goal

Therapeutic ratio

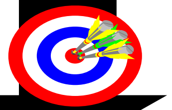
How to increase it?

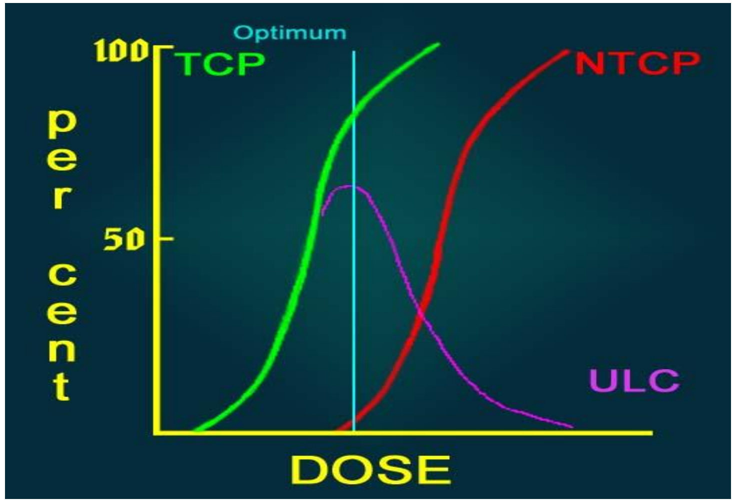


Advances in Technology and Sciences

Physical aspects approach

- Immobilization devices **(Stereotactic, frameless stereotactic)**
- Technological innovation in radiotherapy delivery (**3 D CRT, IMRT, IGRT, Rapid Arc, 4DART)**
- Implementation of biologic imaging (**MRS, PET-Scan)**

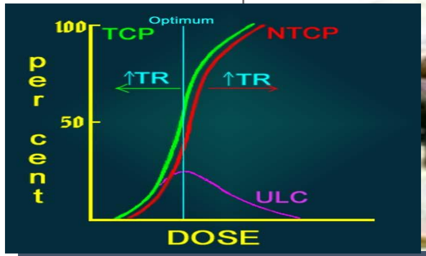


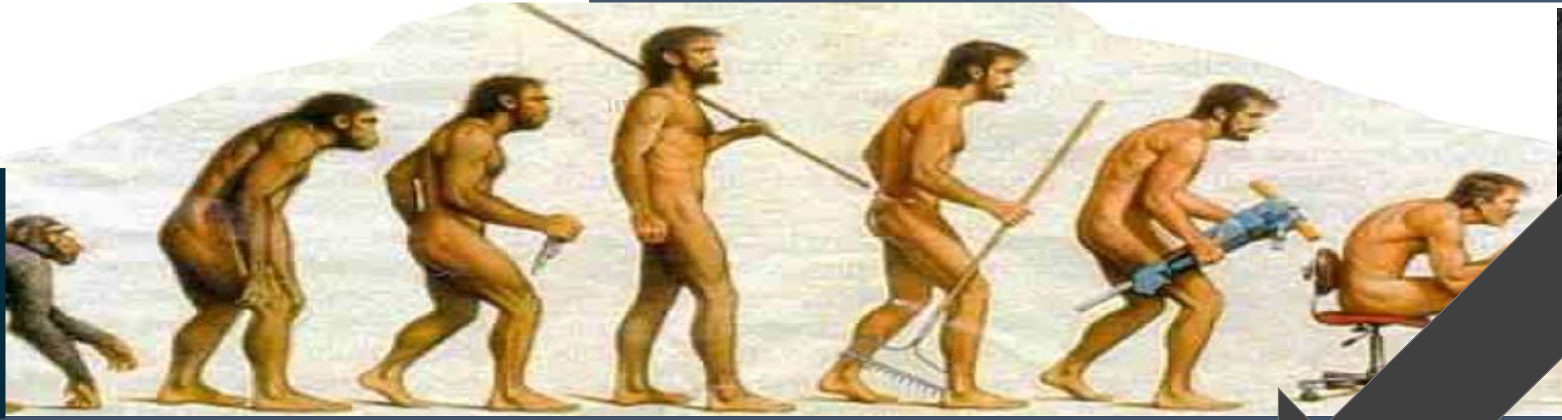


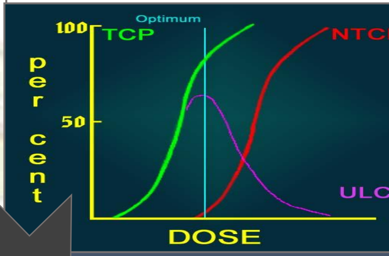
Biologic targeted approach

- Altered fractionation scheduling.
- Combined modality treatments using chemical or biologic agents – Chemotherapy, Hypoxia Modifier.
- Targeting molecular processes and signaling pathways – Targeted Therapy.
- Other ionizing radiation source – proton, neutron heavy ion.

MILESTONES IN RADIOTHERAPY







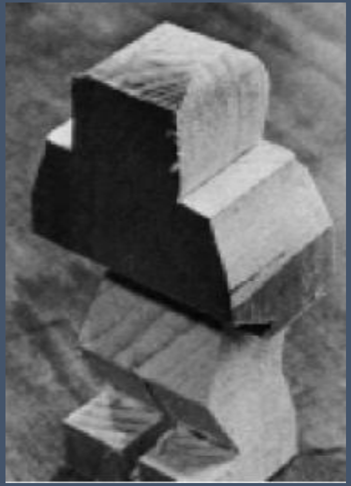
2D-Conventional

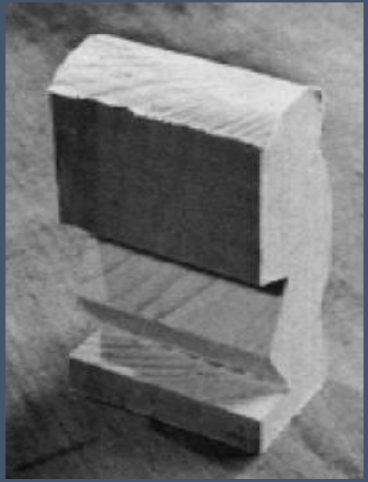
3D-Conformal

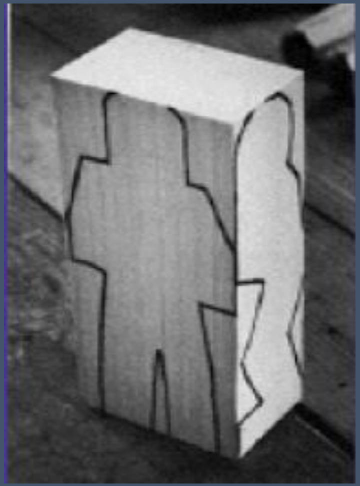
IMRT

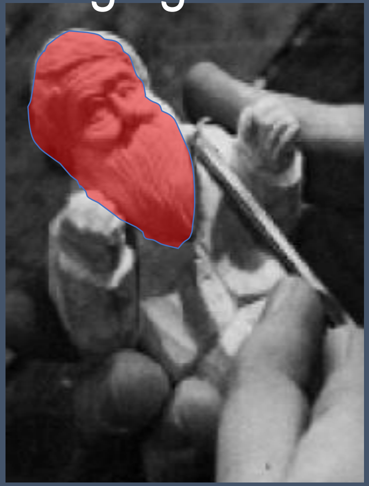
+ Theranostic Imaging

IGRT

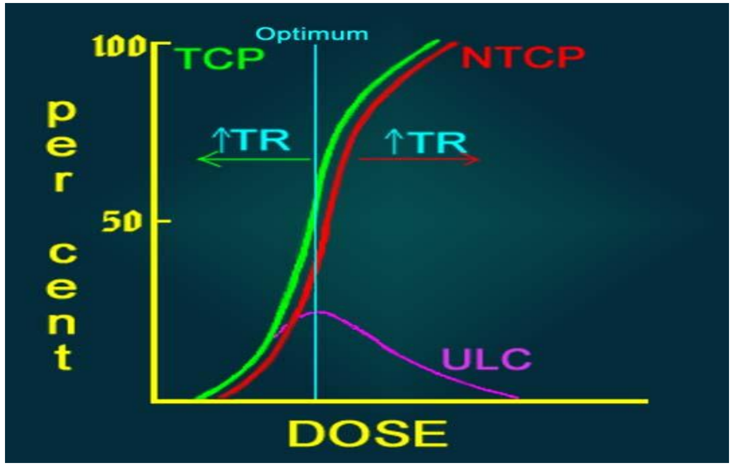


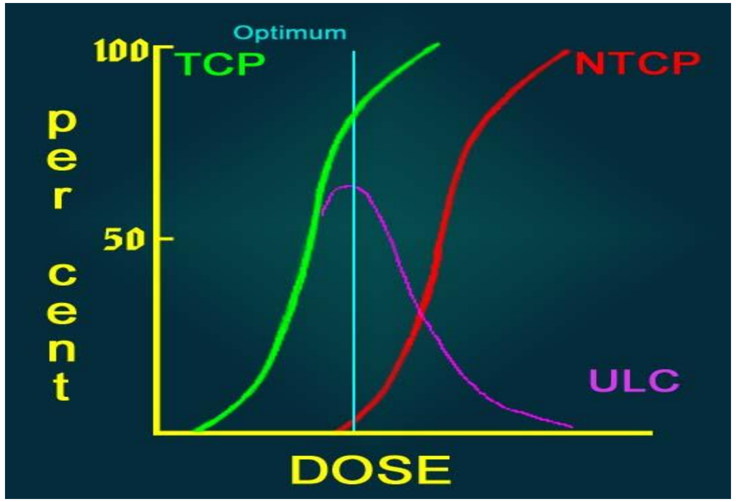






Therapeutic Ratio in Radiotherapy





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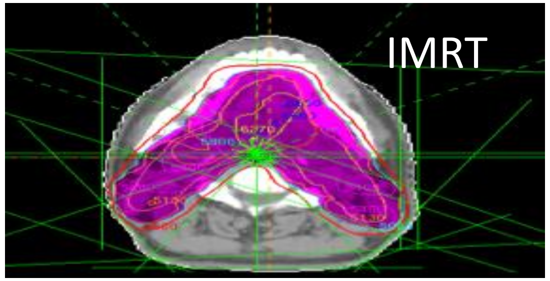
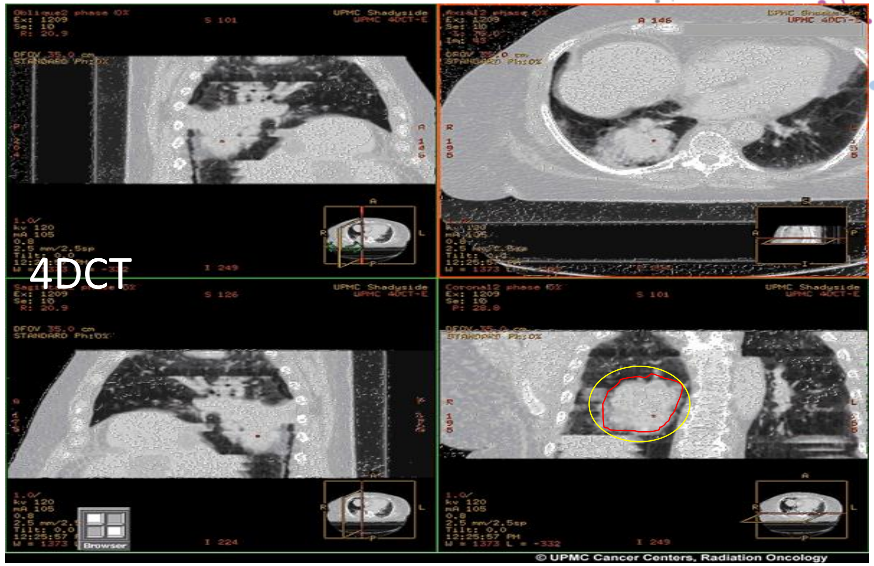
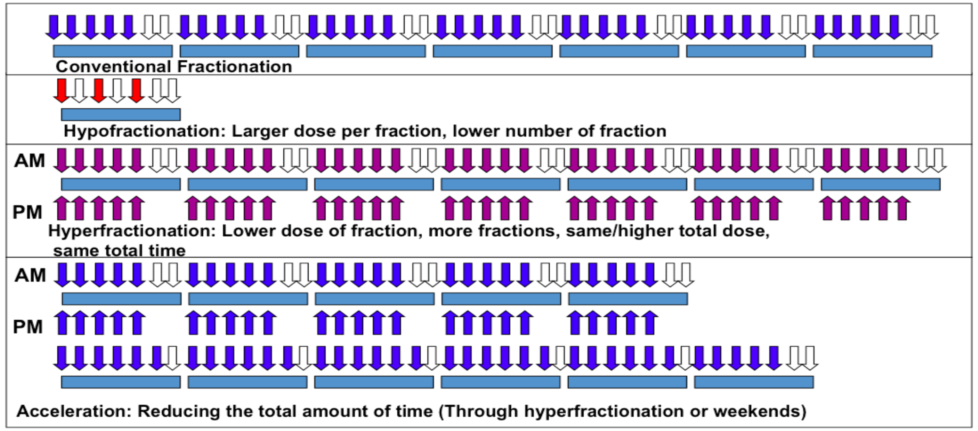
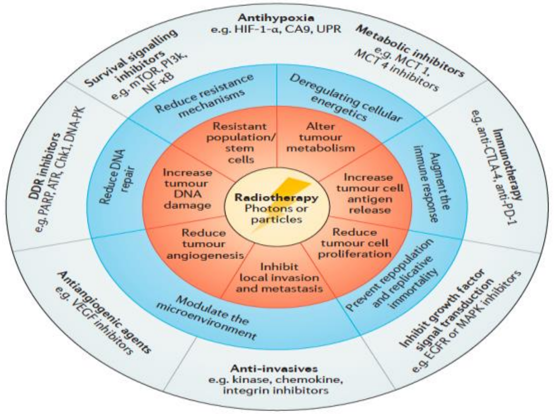
Physical Aspect



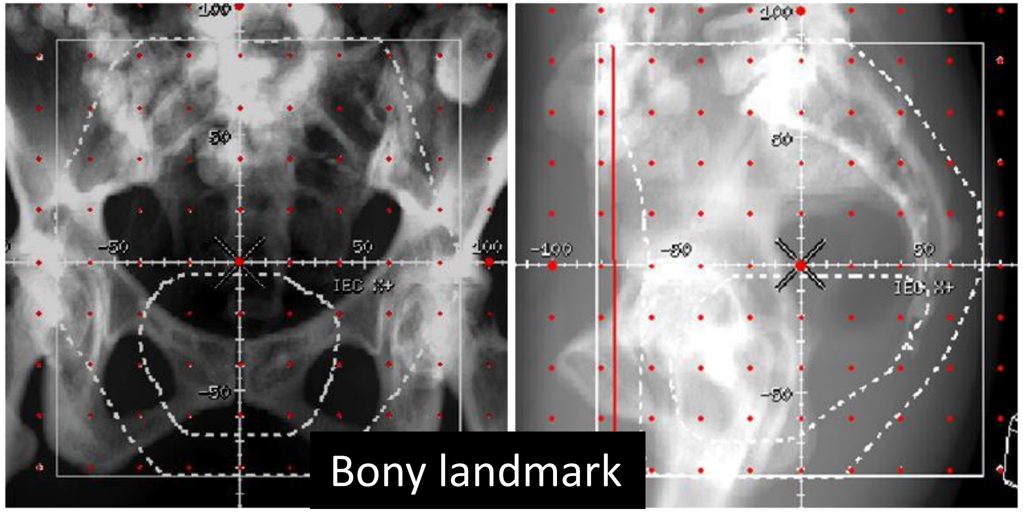


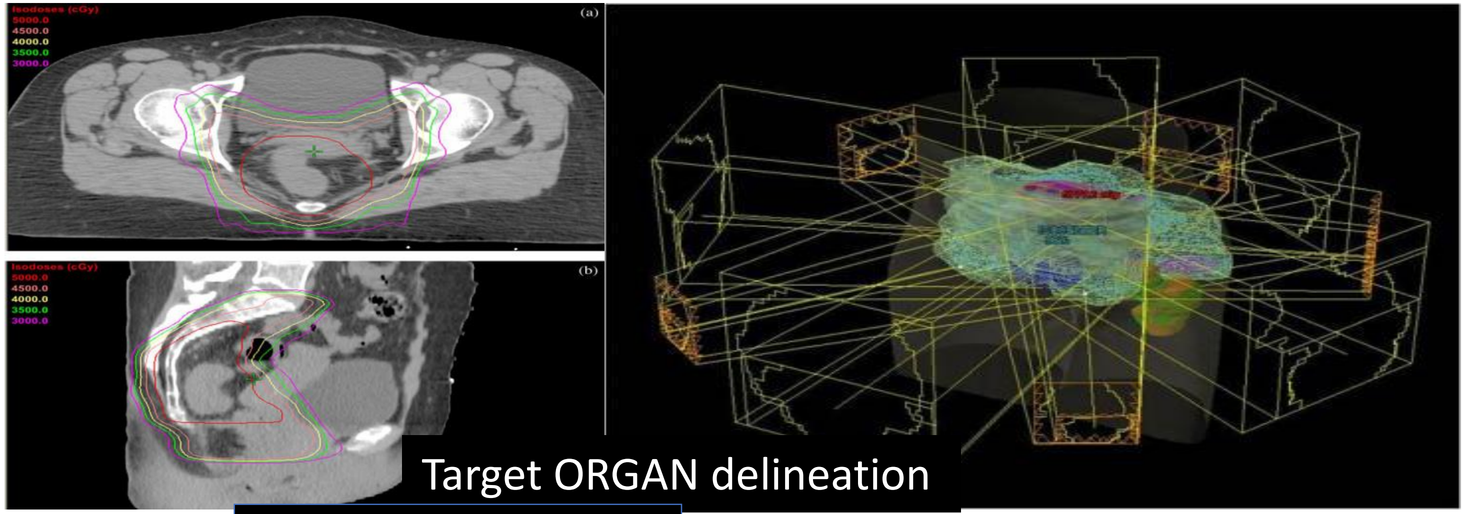
Biological Aspect

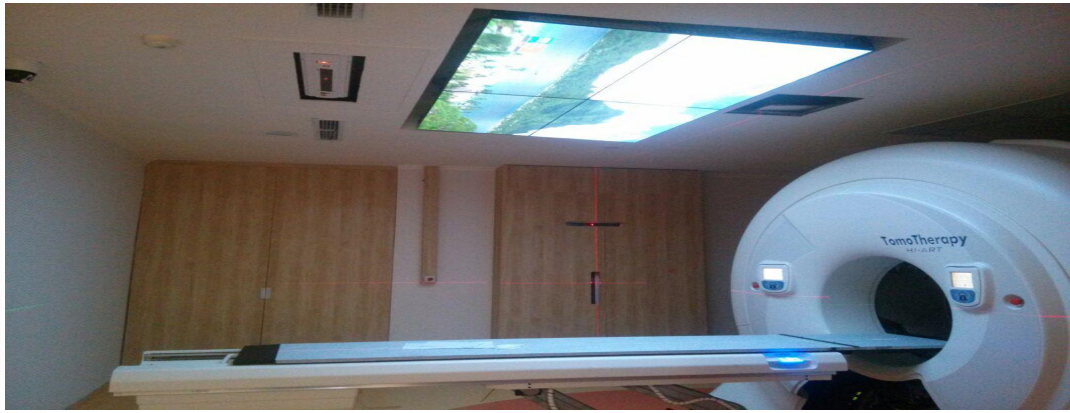




Target Definition:
Bony landmark ➔ Volume / Target / organ definition







1. Courtesy of Karin Goodman, ASTRO refreshment course, 2016.

Isodose Coverage 95%

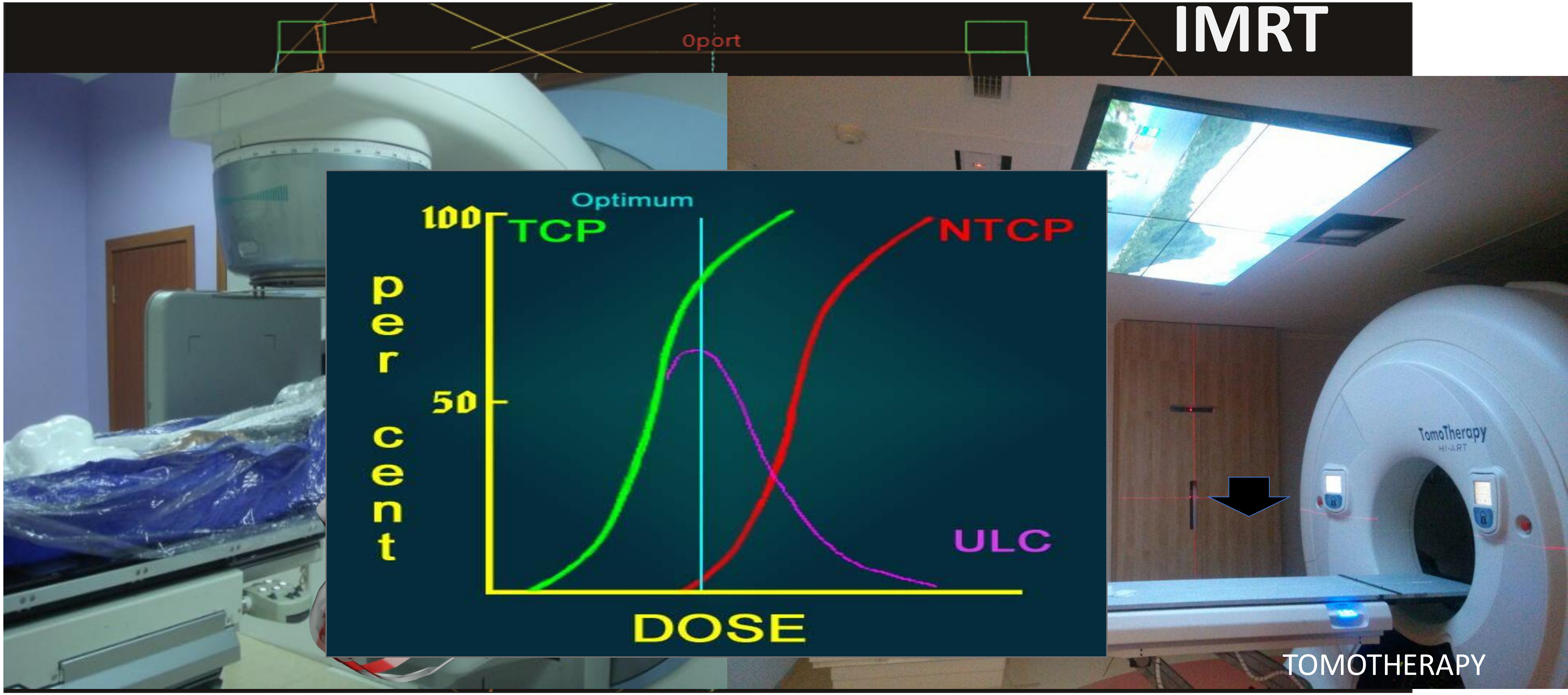
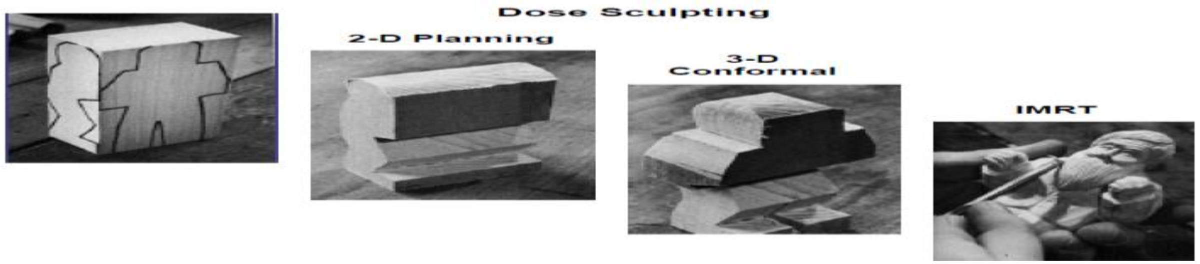
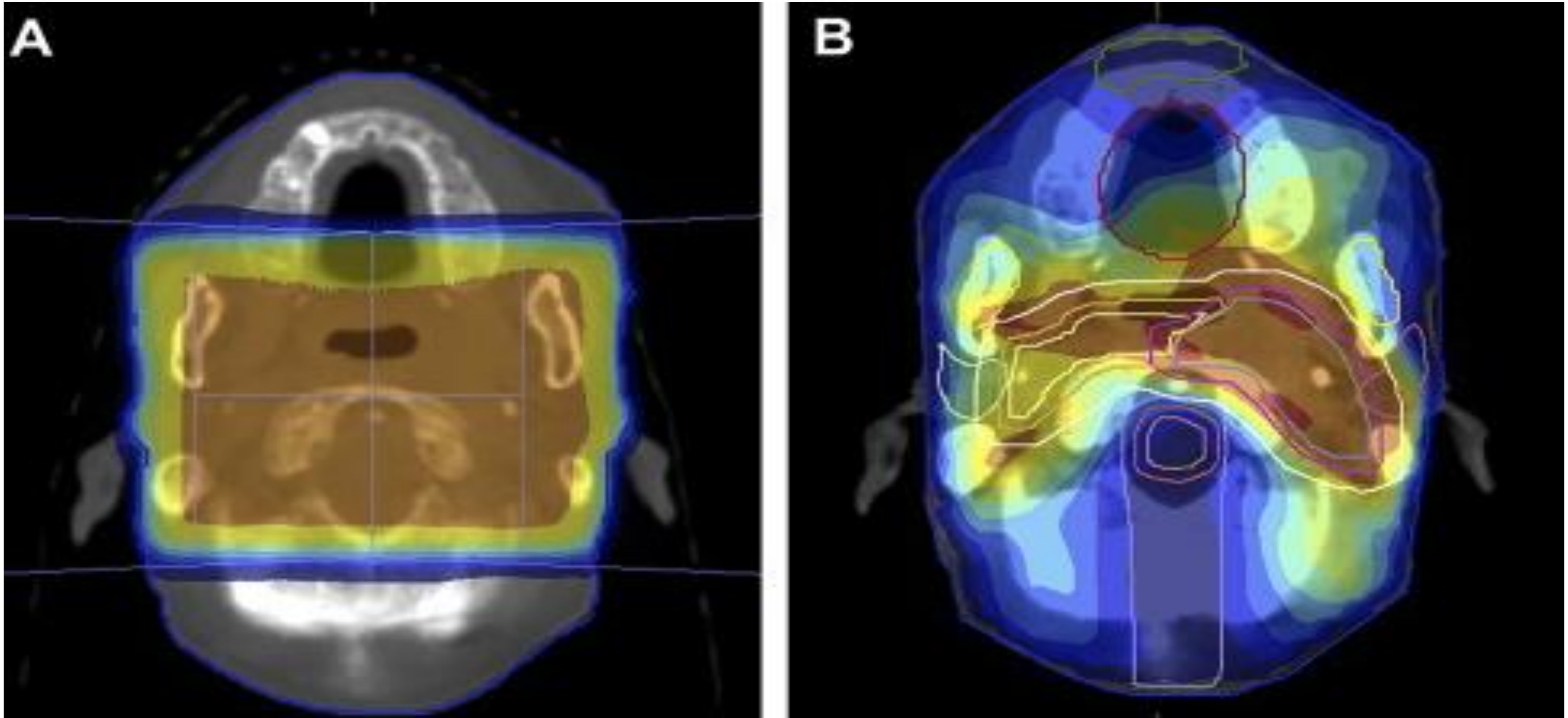


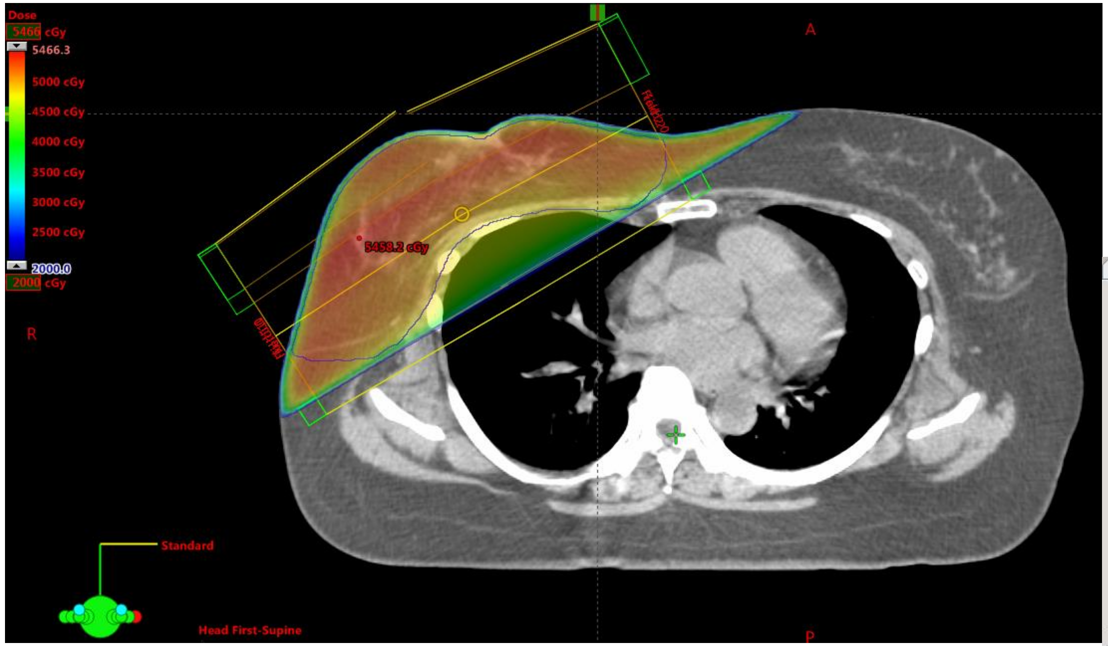
IMAGE GUIDED RADIOTHERAPY … IGRT

Conventional RT Vs Conformal RT

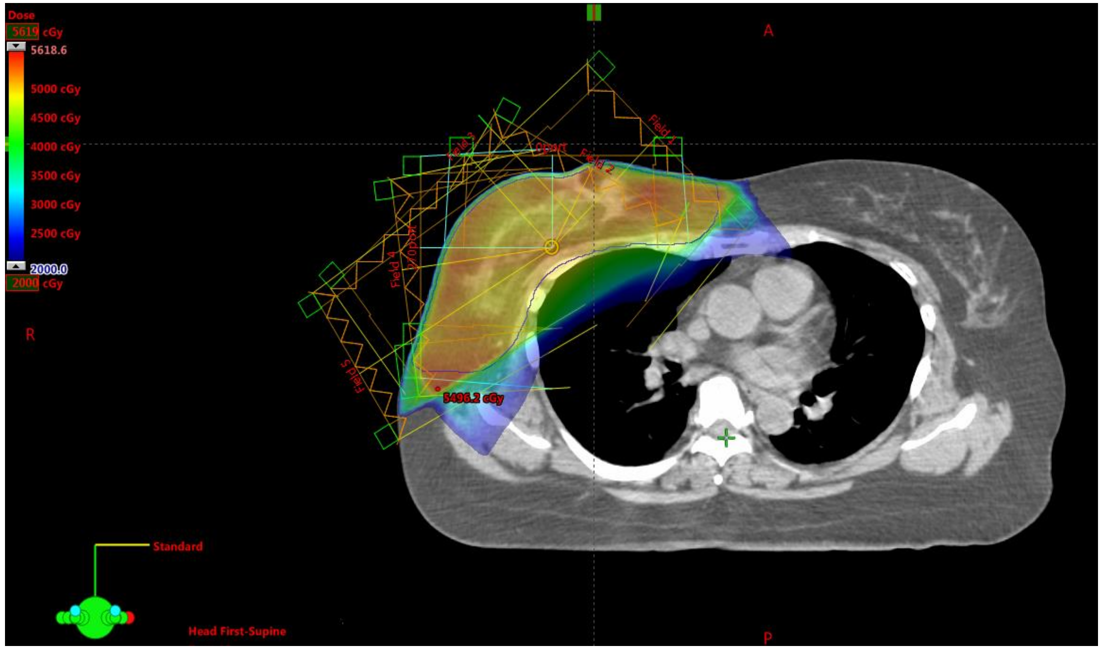




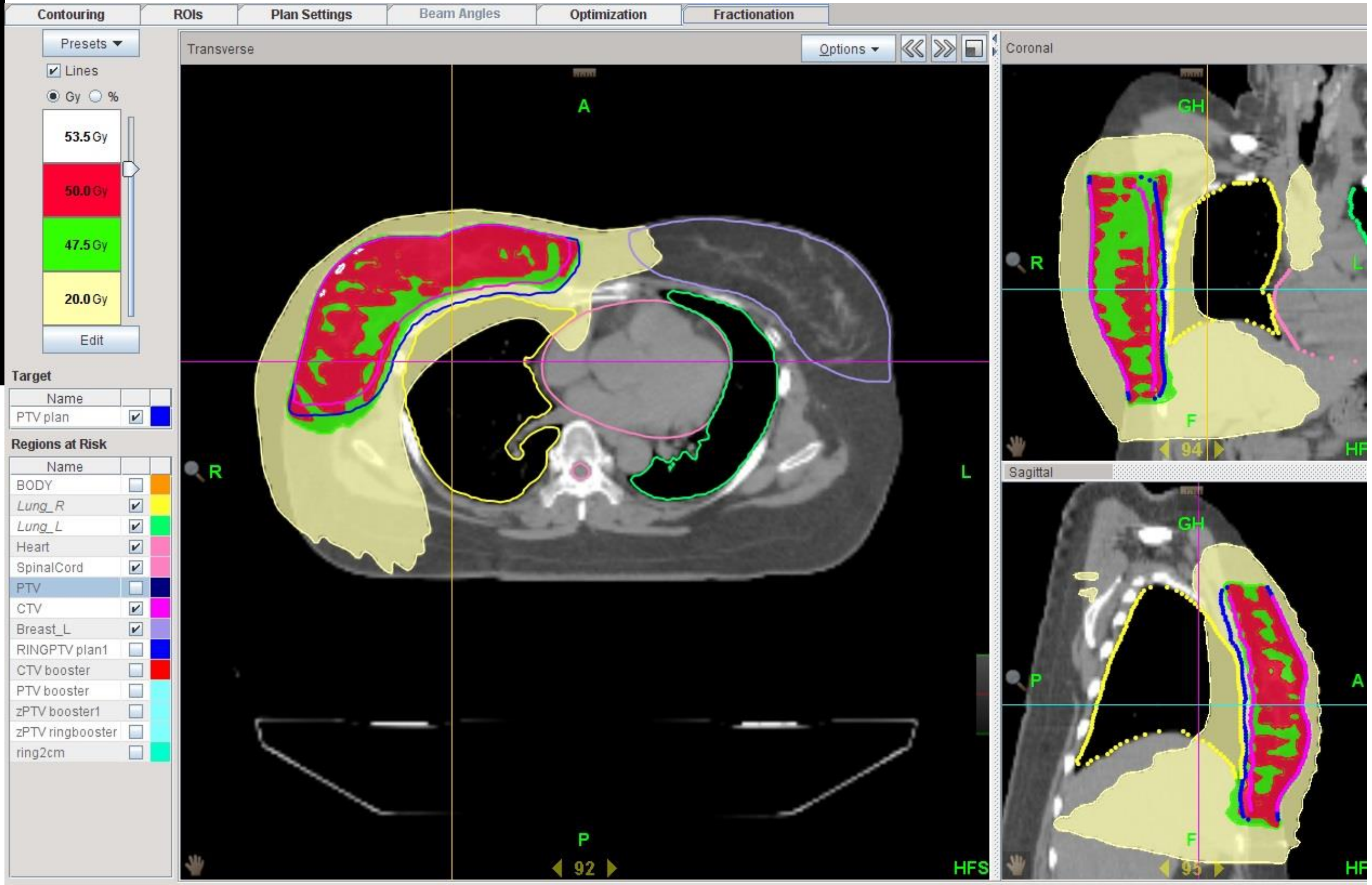
3D Technique



IMRT For Breast Cancer



Tomotherapy For Breast Cancer



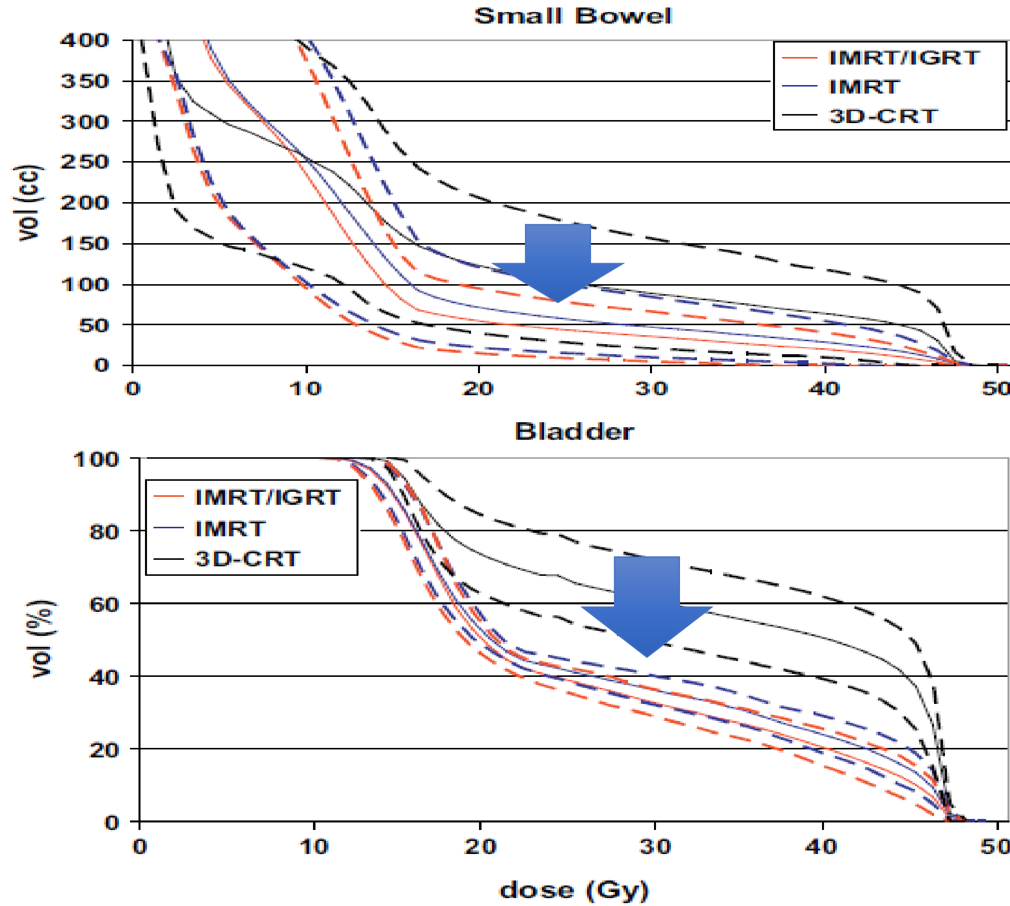
PREOPERATIVE HELICAL TOMOTHERAPY AND MEGAVOLTAGE COMPUTED TOMOGRAPHY FOR RECTAL CANCER: IMPACT ON THE IRRADIATED VOLUME OF SMALL BOWEL

IMRT + IGRT

Benedikt Engels, M.D.,* Mark De Ridder, M.D., Ph.D.,* Koen Tournel, M.S.,* Alexandra Sermeus, M.D.,† Peter De Coninck,* Dirk Verellen, Ph.D.,* and Guy A. Storme, M.D., Ph.D.*

Departments of *Radiation Oncology and †Gastroenterology, Oncologisch Centrum UZ Brussel, Brussels, Belgium

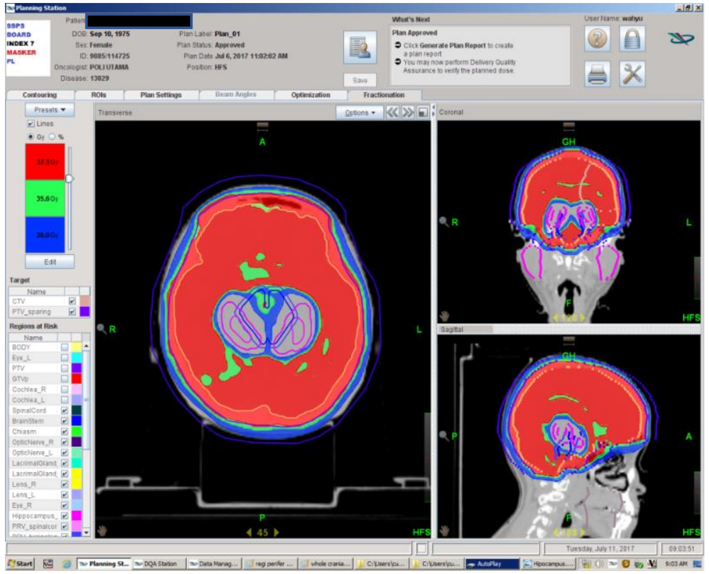
- Techniques such as VMAT and helical tomotherapy can **handle the concave interface between the OARs and the PTV of rectal cancer by creating conformal dose distributions**, resulting in a **significant decrease of the irradiated volume of small bowel and a favorable toxicity profile.**
- We calculated an appropriate CTV to PTV margin by combining the internal organ movement by measuring the d**eformation of the mesorectum** and the intrafraction **movement based on bony anatomy by use of MV-CT imaging.**

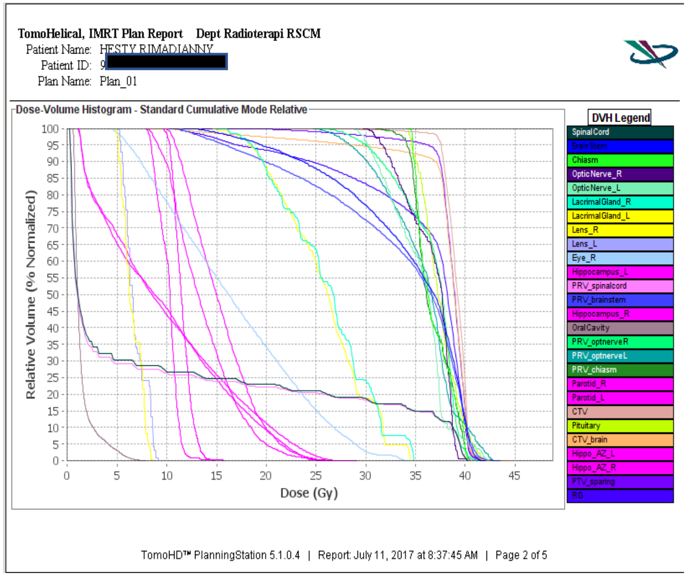


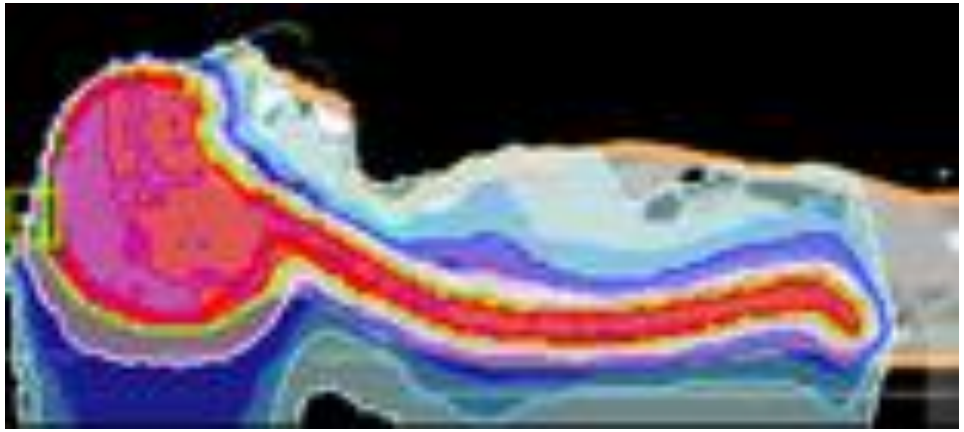
Conclusions : The combination of helical tomotherapy and daily MV-CT imaging significantly decreases the irradiated volume of small bowel and its NTCP

Int. J. Radiation Oncology Biol. Phys., Vol. 74,

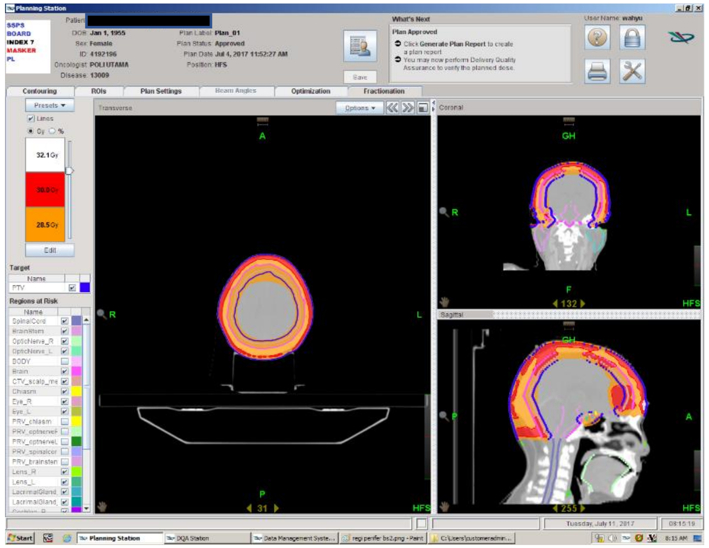
TOMOTHERAPY …..Hippocampal Sparing & Craniospinal

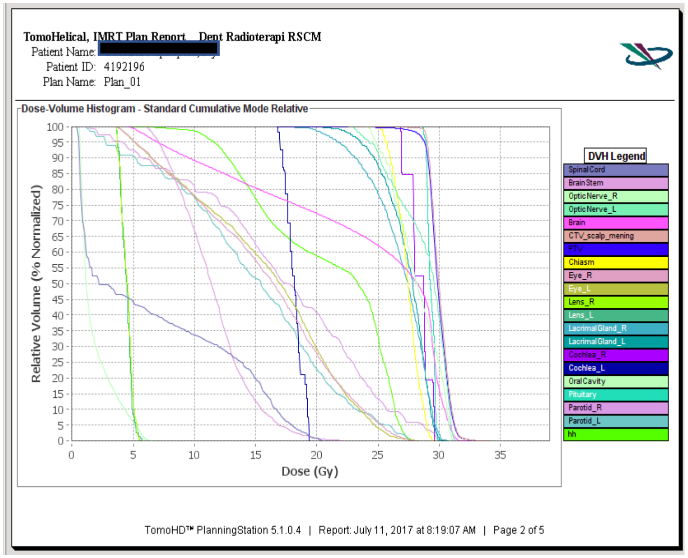


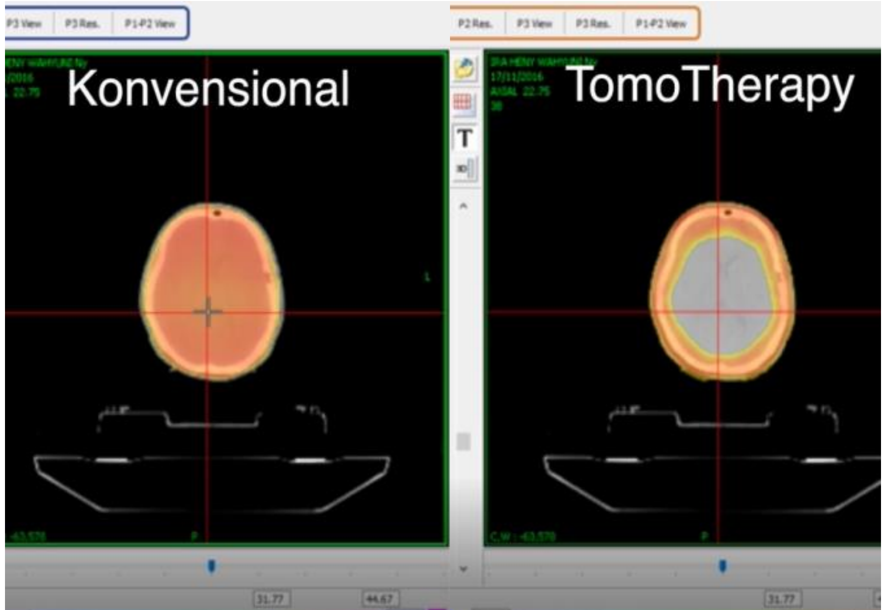




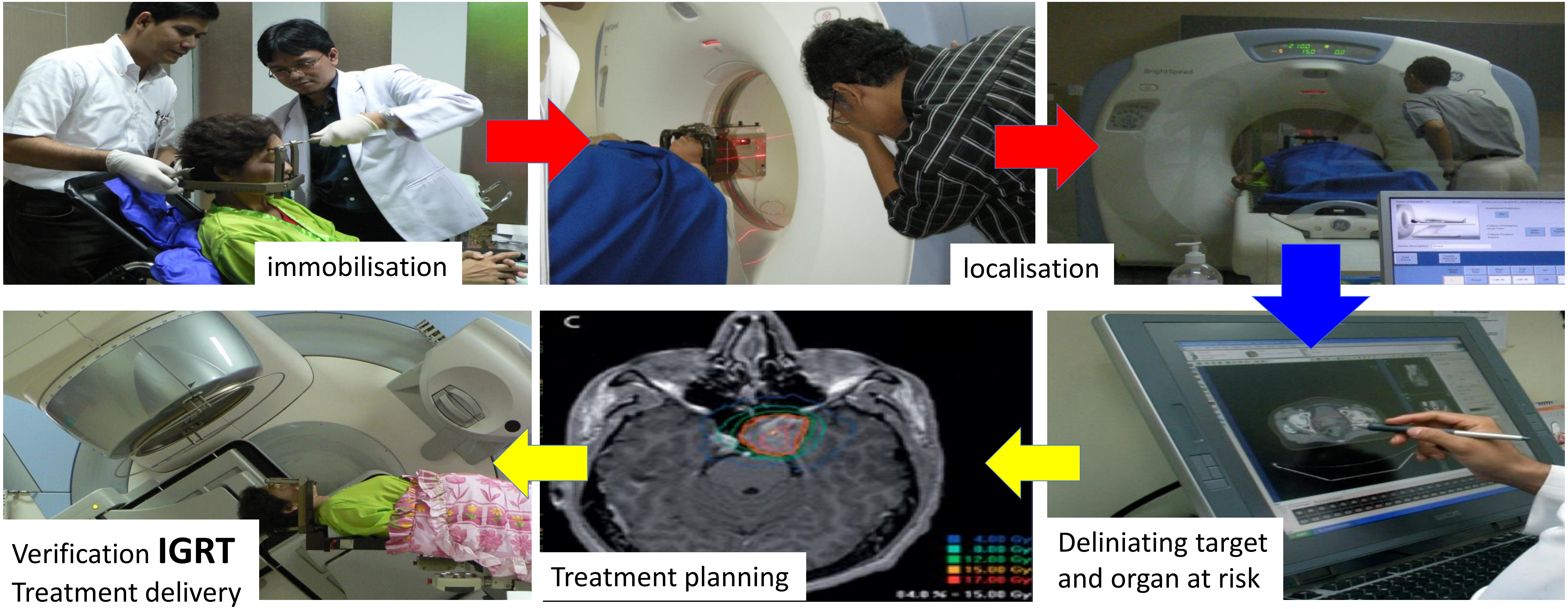
WHOLE CRANIAL





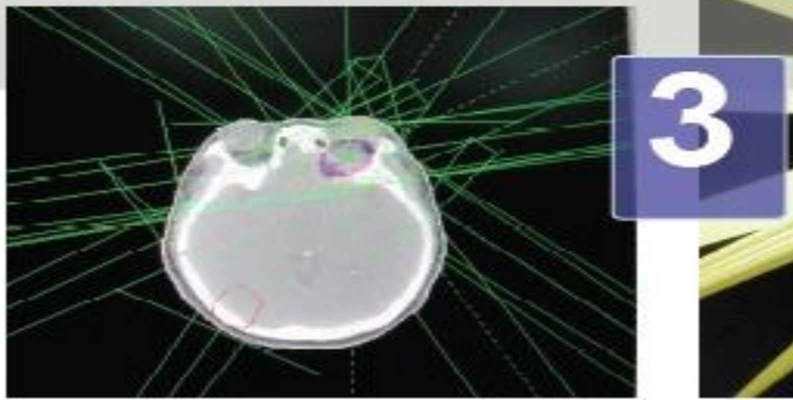


Stereotactic Radiosurgery Process in Ciptomangunkusumo Hospital



Stereotactic Radiotherapy (SRT) with Headfix

- ✓ Fractionated stereotactic radiotherapy
- ✓ Headfix fixation for cranial use
- ✓ Uses stereotactic localization to precisely focus dose of radiation onto a lesion
- ✓ Minimal exposure to healthy tissue



FDG-PET provides the best correlation with the tumor specimen compared to MRI and CT in rectal cancer

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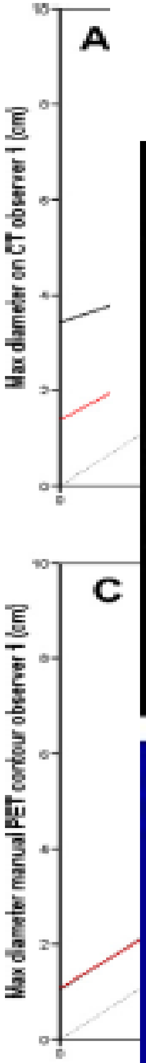

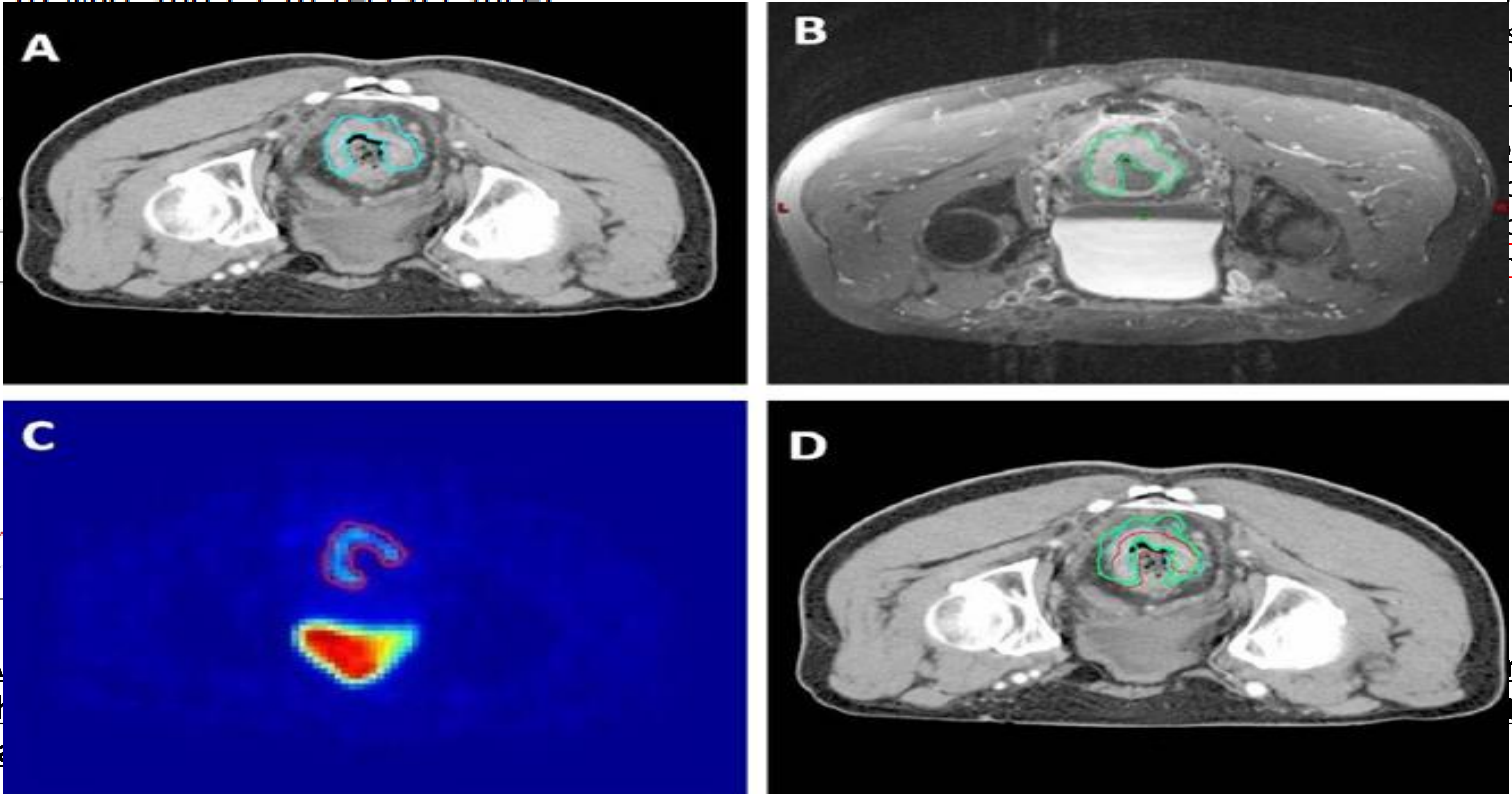

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th **tal**
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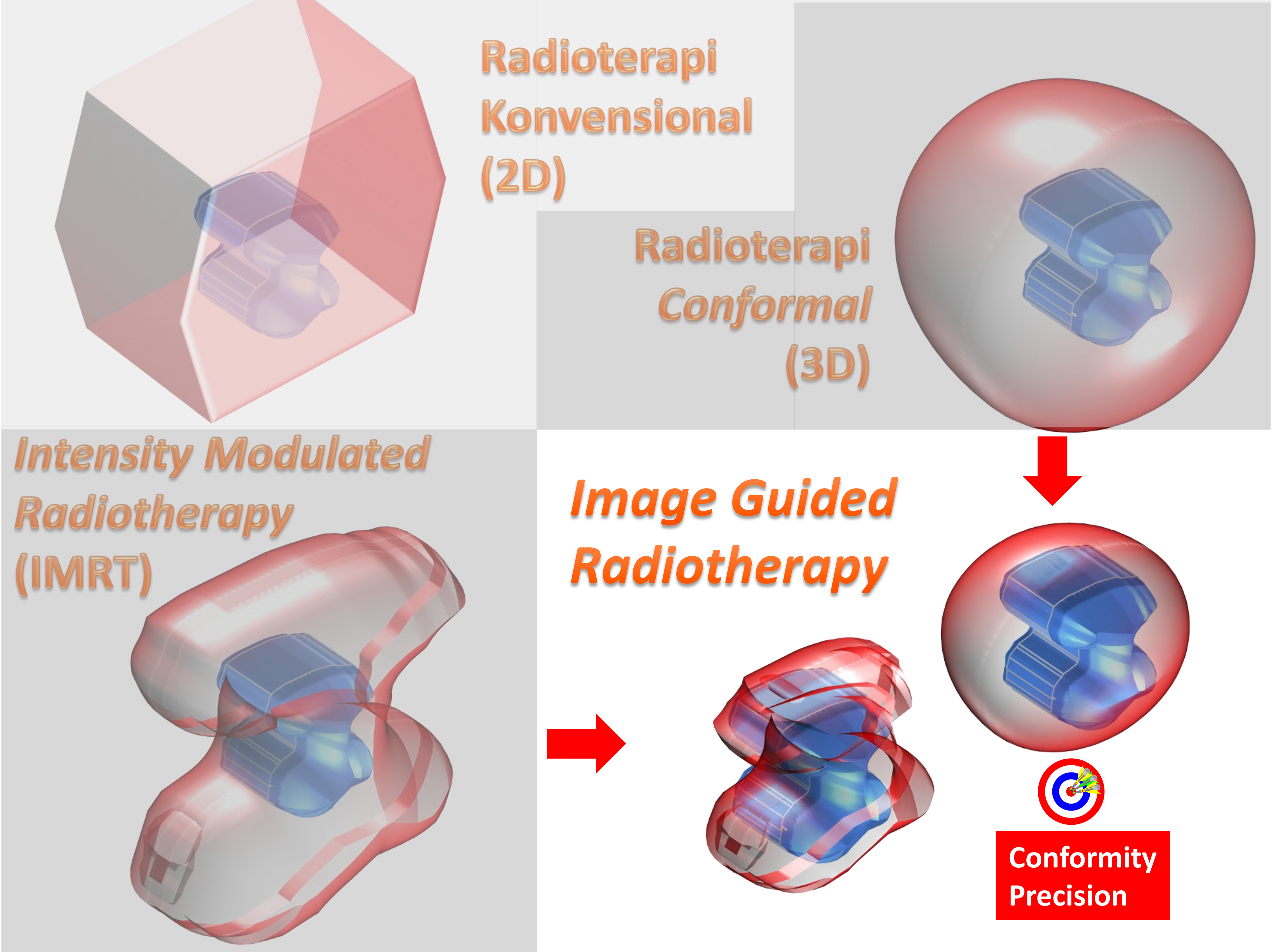
J. Buijsen et al. / Radiotherapy and Oncology 98 (2011) 270–276



Radioterapi Konvensional (2D)
Radioterapi Conformal (3D)
Intensity Modulated Radiotherapy (IMRT)
Image Guided Radiotherapy
Conformity
Precision

Roles of Radiotherapy

As a definitive treatment?

Local Glotic Cancer, Local NPC, Prostate cancer (high risk)

Combination chemo-radiotherapy as a definitive treatment?

Locally advanced NPC, cervical cancer, unresectable lung cancer

In the adjuvant setting?

Breast cancer, colon cancer, lymphoma, endometrial cancer, sarcoma

In palliative care?

Pain, uncontrolled bleeding, VCSS, brain metastases

in benign lesion?

Adenoma pituitary, AVM, vestibular schwabomma by Stereotactic Radiosurgery

Optimal Radiotherapy Utilization Rate by Cancer Type

Tumor type	Proportion of all cancers	Proportion of patients receiving radiotherapy	Patients receiving radiotherapy (% of all cancers)
Breast	0.13	83	10.8
Lung	0.10	76	7.6
Melanoma	0.11	23	2.5
Prostate	0.12	60	7.2
Gynecologic	0.05	35	1.8
Colon	0.09	14	1.3
Rectum	0.05	61	3.1
Head and neck	0.04	78	3.1
Gall bladder	0.01	13	0.1
Liver	0.01	0	0.0
Esophageal	0.01	80	0.8
Stomach	0.02	68	1.4
Pancreas	0.02	57	1.1
Lymphoma	0.04	65	2.6
Leukemia	0.03	4	0.1
Myeloma	0.01	38	0.4
Central nervous system	0.02	92	1.8
Renal	0.03	27	0.8
Bladder	0.03	58	1.7
Testis	0.01	49	0.5
Thyroid	0.01	10	0.1
Unknown primary	0.04	61	2.4
Other	0.02	50	1.0
Total	1.00	-	52.3

ıcer treatment

Table 1: Radiotherapy utilisation rate, mean fractions, and outcome benefits (absolute proportional) for top ten cancers globally by incidence.[2]

	Radiotherapy utilisation rate (%)	Mean radiotherapy fractions per course	5-year local control benefit (%)	5-year overall survival benefit (%)
Breast	87	16	15	2
Cervix	71	21	35	20
Colorectal	19	23	5	2
Haematological	48	8	7	4
Head and neck	74	22	34	20
Liver	0	0	0	0
Lung	77	16	9	6
Oesophagus	71	15	5	2
Prostate	58	28	25*	1
Stomach	27	19	2	1
Total	50	18	10	4

1. Cancer 2005; 104(6): 1129-37.
2. Lancet Oncol 2015; 16: 1153-86.

Head and Neck Cancer

Localized stage

Locally-advanced stage

Metastatic

Recurrence

Definitive Radiotherapy

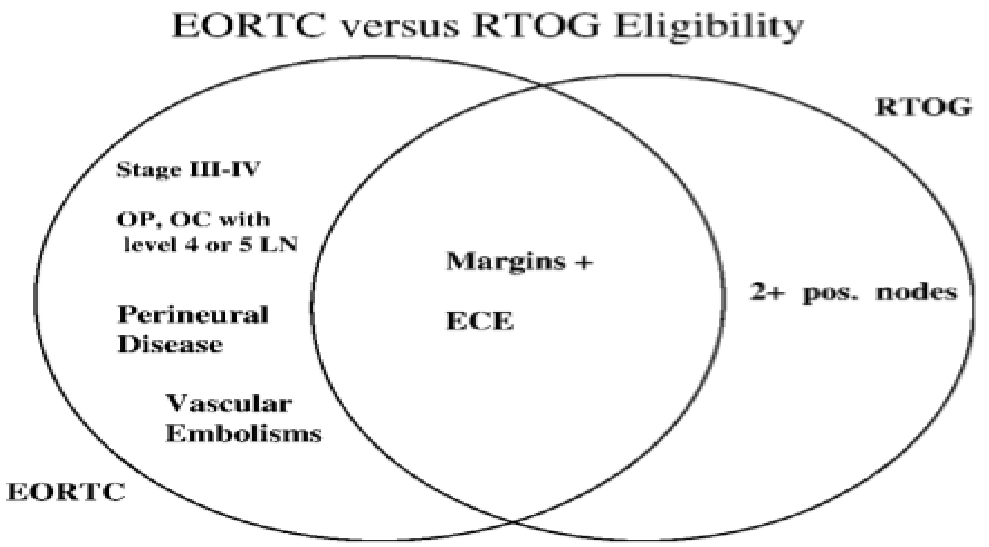
Surgery + Adjuvant Radiotherapy/Chemo-RT

Definitive Chemo-RT

Palliative Radiotherapy

Salvage Radiotherapy

W H E N?



Eligibility criteria in EORTC 22931 and RTOG 9501 trials.

1. Radiat Oncol 2007; 85: 156–170
2. Head & Neck 2005;: 843-850

PRIMARY TREATMENT | **FOLLOW-UP**

Stage IA (T1a-1b, N0, M0), low grade[j]
Stage IB (T2a-2b, N0, M0), low grade[j]

→ Surgery[k,l,m] to obtain adequate oncologic margins

- → Oncologically appropriate margins[m] or intact fascial plane → Follow-up
- → Failure to obtain oncologically appropriate margins[m] (and without an intact fascial plane)[k,l] →
  - Re-resection
  - or
  - Observation (for Stage 1A tumors)
  - or
  - Consider RT[n,o,q] (category 2B for Stage 1A tumors; category 1 for

→ Follow-up

FOLLOW-UP

- Evaluation for rehabilitation (OT, PT)
  - Continue until maximal function is achieved
- H&P every 3–6 mo for 2–3 y, then annually
- Consider chest imaging[b]
- Consider obtaining postoperative baseline and periodic imaging of primary site[b] based on estimated risk of locoregional recurrence[p,r]

→ If recurrence, See Recurrent Disease (EXTSARC-6)

National Comprehensive Cancer Network® NCCN

NCCN Guidelines Version 2.2017
Extremity/Superficial Trunk, Head/Neck

NCCN Guidelines Index
Table of Contents
Discussion

PRIMARY TREATMENT[t] | **FOLLOW-UP**

Stage II, III[s] Resectable with acceptable functional outcomes

Stage IIA (T1a-1b, N0, M0, G2-3) →

- Surgery[k,u] to obtain oncologically appropriate margins → Follow-up
- or
- Surgery[k] to obtain oncologically appropriate margins → RT[n] (category 1)[x,y] → Follow-up
- or
- Preoperative RT[n] (category 1) → Surgery[k,v] to obtain oncologically appropriate margins → Follow-up

Stage IIB, III (T2a-2b, N0, M0, G2)
Stage III (T2a-2b, N0, M0, G3, or Any T, N1, M0, Any G) →

- Surgery[k,l] to obtain oncologically appropriate margins → RT[n] (category 1)[y] or RT[n]+ adjuvant chemotherapy[w,z] (category 2B)
- or
- Preoperative RT[n] (category 1) or Preoperative chemoradiation[n,w] (category 2B) → Surgery[j,v] to obtain oncologically appropriate margins → Consider RT boost[n,aa] ± adjuvant chemotherapy[w,z] (category 2B)
- or
- Preoperative chemotherapy[g,w] (category 2B) → Surgery[j,v] to obtain oncologically appropriate margins → RT[n,y] or RT[n] + adjuvant chemotherapy[w,z] (category 2B)

FOLLOW-UP

- Evaluation for rehabilitation (OT, PT)
  - Continue until maximal function is achieved
- H&P every 3–6 mo for 2–3 y, then every 6 mo for next 2 y, then annually
- Chest imaging[b]
- Consider obtaining postoperative baseline and periodic imaging of primary site[b] based on estimated risk of locoregional recurrence[p,r]

→ If recurrence, See Recurrent Disease (EXTSARC-6)

[t]Treatment options for stage II and III should be made by a multidisciplinary team and

Stage II, III Resectable with adverse functional outcomes or Unresectable primary disease

→ **PRIMARY TREATMENT[t]**

- RT[n]
- or
- Chemoradiation[n,w]
- or
- Chemotherapy[g,w]
- or
- Regional limb therapy[bb]

Resectable with acceptable functional outcomes → Surgery[k,v] to obtain oncologically appropriate margins →
- If not previously irradiated, RT[n] or RT[n] + adjuvant chemotherapy[w,z] (category 2B)
- Consider RT boost[n,aa] ± adjuvant chemotherapy[w,z] (category 2B)

Resectable with adverse functional outcomes or Unresectable primary disease → Options:
- If not previously irradiated, Definitive RT[ee]
- Chemotherapy[w,z]
- Palliative surgery
- Observation, if asymptomatic
- Best supportive care
- Amputation[k]

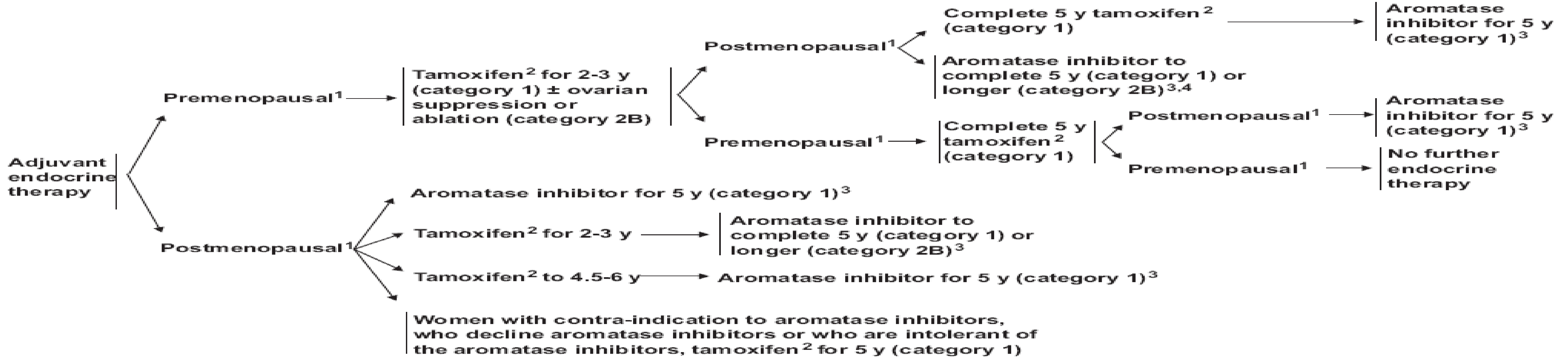
FOLLOW-UP

- Evaluation for rehabilitation (OT, PT)
  - Continue until maximal function is achieved
- H&P every 3–6 mo for 2–3 y, then every 6 mo for next 2 y, then annually
- Chest imaging[b]
- Obtain baseline and periodic imaging of primary site[b,p]

→ If recurrence, See Recurrent Disease (EXTSARC-6)

Breast Cancer

ADJUVANT ENDOCRINE THERAPY



[1] See Definition of Menopause (BINV-K).

[2] Some serotonin reuptake inhibitors decrease the formation of endoxifen, an active metabolite of tamoxifen. However, citalopram and venlafaxine appear to have minimal impact on tamoxifen metabolism. The clinical impact of these observations is not known. At this time, based on current data the Panel discourages CYP 2D6 testing.

[3] The panel believes the three selective aromatase inhibitors (anastrozole, letrozole, exemestane) have similar antitumor efficacy and similar toxicity profiles. The optimal duration of aromatase inhibitors in adjuvant therapy is uncertain.

[4] This specific patient subset was not included in the trials of aromatase inhibitors given sequentially with adjuvant tamoxifen. Some women who appear to become postmenopausal on tamoxifen therapy have resumption of ovarian function after discontinuation of tamoxifen and initiation of an aromatase inhibitor. Therefore, serial monitoring of plasma estradiol and FSH levels is encouraged in this clinical setting. Should ovarian function resume, the aromatase inhibitor should be discontinued and tamoxifen resumed. See Definition of Menopause (BINV-K).

Note: All recommendations are category 2A unless otherwise indicated.
Clinical Trials: NCCN believes that the best management of any cancer patient is in a clinical trial. Participation in clinical trials is especially encouraged.

Unknown Zone

Position Paper

EURECCA colorectal: Multidisciplinary management: European consensus conference colon & rectum ☆

Cornelis J.H. van de Velde [a,*], Petra G. Boelens [b], Josep M. Borras [c], Jan-Willem Coebergh [d], Andres Cervantes [e], Lennart Blomqvist [f], Regina G.H. Beets-Tan [g], Colette B.M. van den Broek [b], Gina Brown [h], Eric Van Cutsem [i], Eloy Espin [j], Karin Haustermans [k], Bengt Glimelius [l], Lene H. Iversen [m], J. Han van Krieken [n], Corrie A.M. Marijnen [o], Geoffrey Henning [p], Jola Gore-Booth [p], Elisa Meldolesi [q], Pawel Mroczkowski [r], Iris Nagtegaal [n], Peter Naredi [s], Hector Ortiz [t], Lars Påhlman [u], Philip Quirke [v], Claus Rödel [w], Arnaud Roth [x], Harm Rutten [y], Hans J. Schmoll [z], Jason J. Smith [aa], Pieter J. Tanis [ab], Claire Taylor [ac], Arne Wibe [ad], Theo Wiggers [ae], Maria A. Gambacorta [q], Cynthia Aristei [af], Vincenzo Valentini [ag]

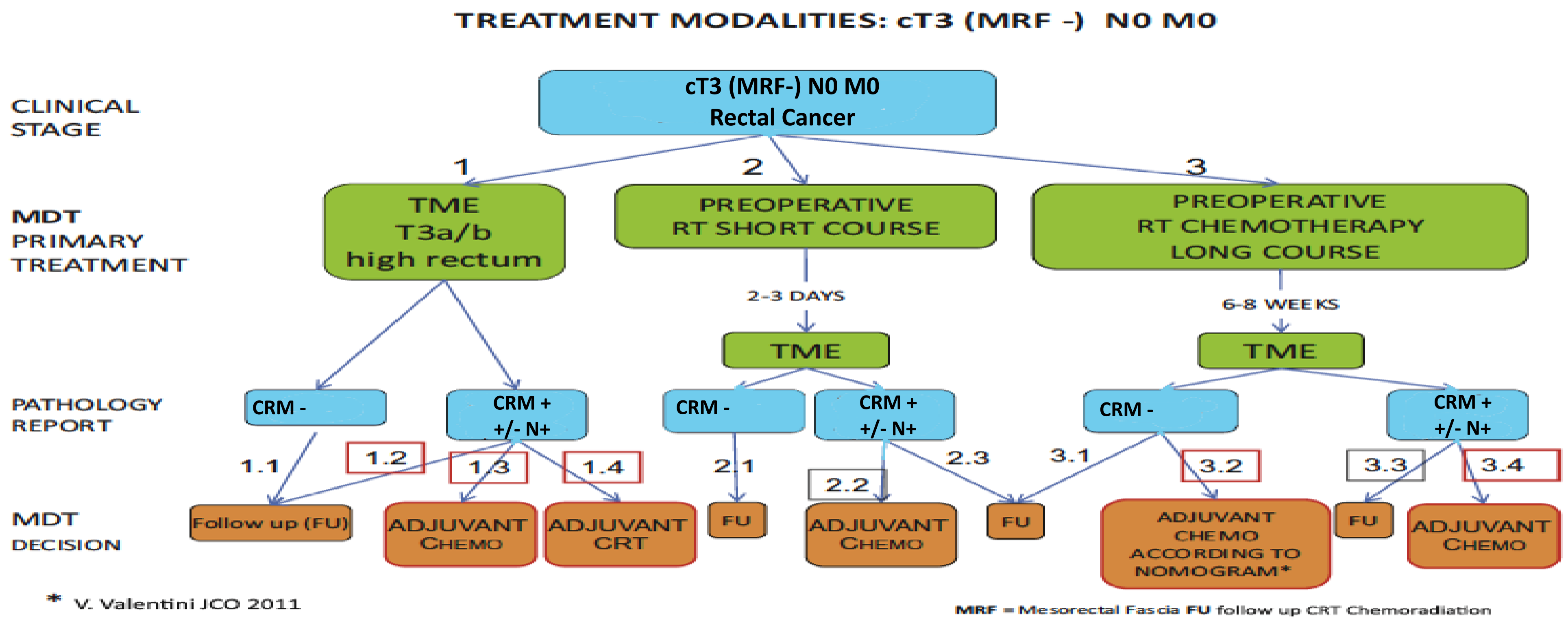
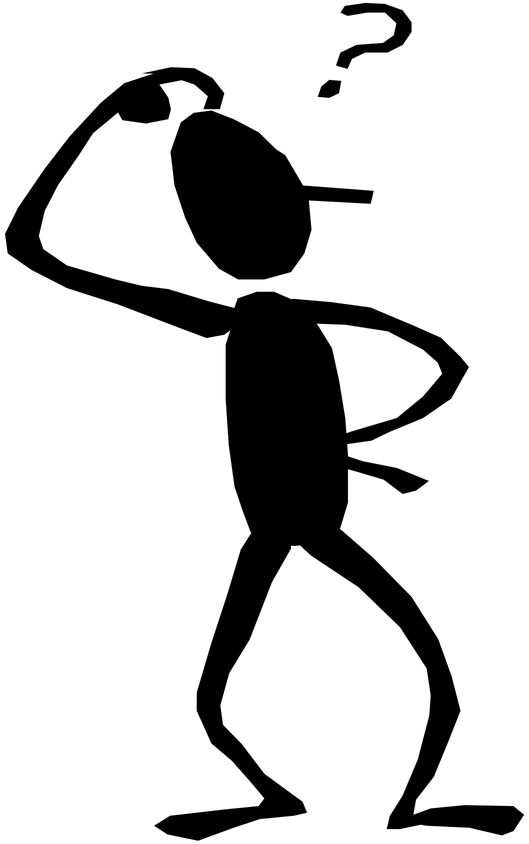


Fig. 7. Treatment strategy: cT3 N0, M0 rectal cancer. Nine decisions in the algorithm did not achieve large consensus. Indicated with red lining is the 'no consensus' for decision 1.3 and 3.2; and 'minimum consensus' for 1.2, 1.4 and 3.4. With moderate consensus it was agreed to decide on step 2, and 3, 2.2 and 3.3.

1. Eur J Cancer 2014; 50: 1.e1– 1.e34

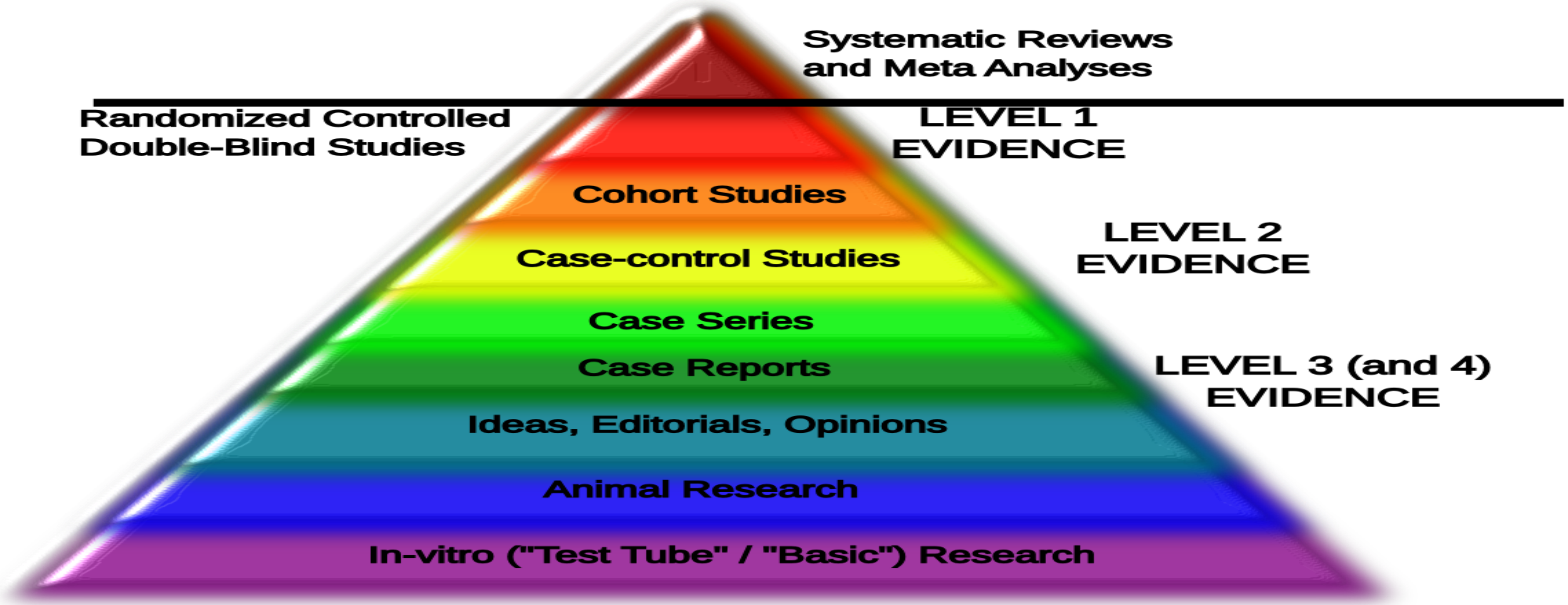
What is “evidence-based medicine?”



“the conscientious, explicit and judicious use of current **best evidence** in making decisions about the care of individual patients.”

Sackett DL, et al. Evidence-Based Medicine: What it is and what it isn’t. BMJ 1996; 312:71-2.

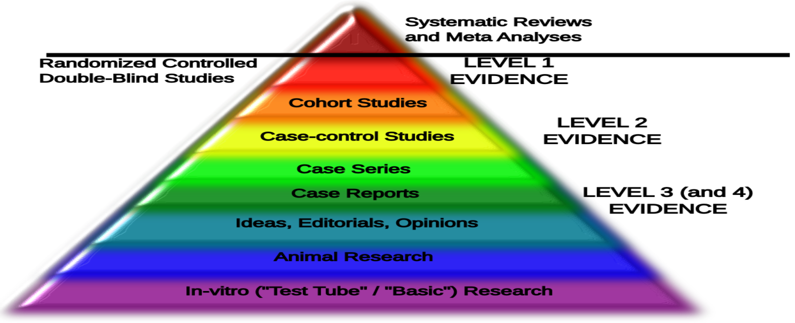
Evidence Pyramid



Adapted from: Sackett D.L., Rosenberg M.C., Gray J.A., Haynes R.B., Richardson W.S. (1996).
Evidence based medicine: what it is and what it isn't. *BMJ*, 312, 71-72.

Level of evidence and grade of recommendation

Level	Type of evidence
	...lysis of randomised trials
	...ne randomised trial
	...designed controlled study without randomisation
	...ne other type of well-designed quasi-experimental study
	...gned non-experimental studies, such as comparative studies, ...ts
4	Evidence obtained from expert committee reports or ... authorities



Grade	Nature of recommendations
A	Based on clinical studies of good quality and consis... and including at least one randomised trial
B	Based on well-conducted clinical studies, but withou...
C	Made despite the absence of directly applicable clini...

Modified from Sackett, et al.

Summary of empirical evidence on the effectiveness of cancer **Multi Disciplinary Teams meetings**

Outcomes assessed	Study	*E**	Total cases	Cancer type	Difference in MDT meeting arm and control arm with respect to the outcome
Time to intervention	[15]	4	269	Breast	Time to treatment (29.6 versus 42.2 days)§
	[16]	4	112	Lung	NSD
	[8]	3b	67	Glioma	NSD
Staging accuracy	[18]	3b	118	Upper GI	MDT improved staging accuracy§
Costs per patients	[19]	4	208	Melanoma	MDT saved $1600 per patient
Decision quality as prediction of accuracy	[20]	4	50	Lung	NSD, Team discussion did not improve the quality of decision making overall.
Psychological morbidity of team members	[21]	5	72	Breast	lower prevalence of psychiatric morbidity (15.7% versus 26.6% $P < 0.005$)

International Journal of Breast Cancer

Cancer treatment

Multi Disciplinary

Source picture: National Cancer Institute

RADIOTHERAPY

RADIATION

- Indonesia 52 – 60% penderita kanker memerlukan Radiotheraphy*
- IDEAL : 1 Mesin : 1 juta penduduk → need more than 200
- Actual Condition for INDONESIA : 1 Mesin untuk 3.5 Juta Penduduk
- Apakah Kondisi ini Optimal???

The role of radiotherapy in cancer treatment: estimating optimal utilization from a review of evidence-based clinical guidelines.
Delaney G[1], Jacob S, Featherstone C, Barton M

Radiotherapy need in cancer treatment

Optimal Radiotherapy Utilization Rate by Cancer Type

Tumor type	Proportion of all cancers	Proportion of patients receiving radiotherapy	Patients receiving radiotherapy (% of all cancers)
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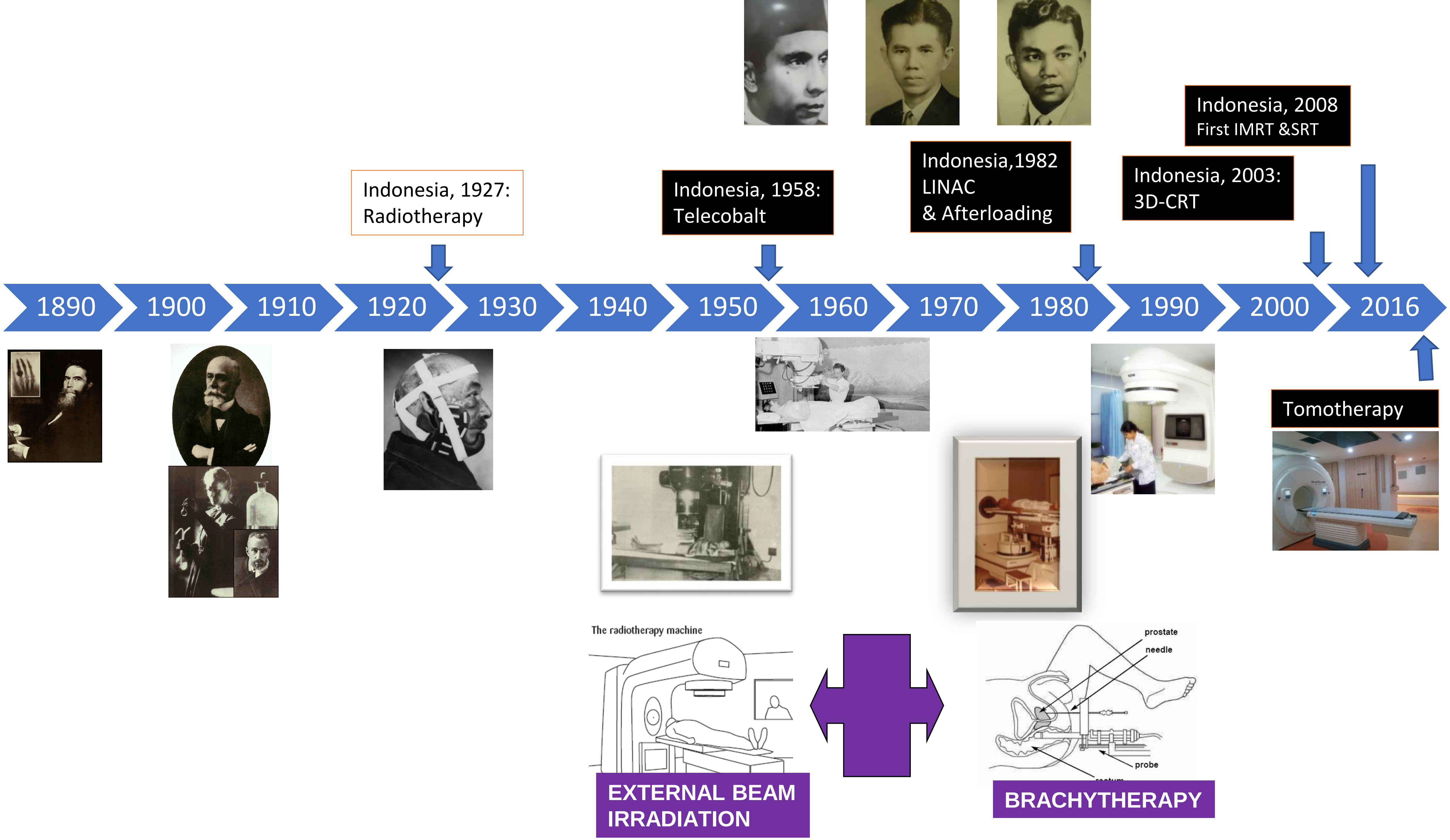
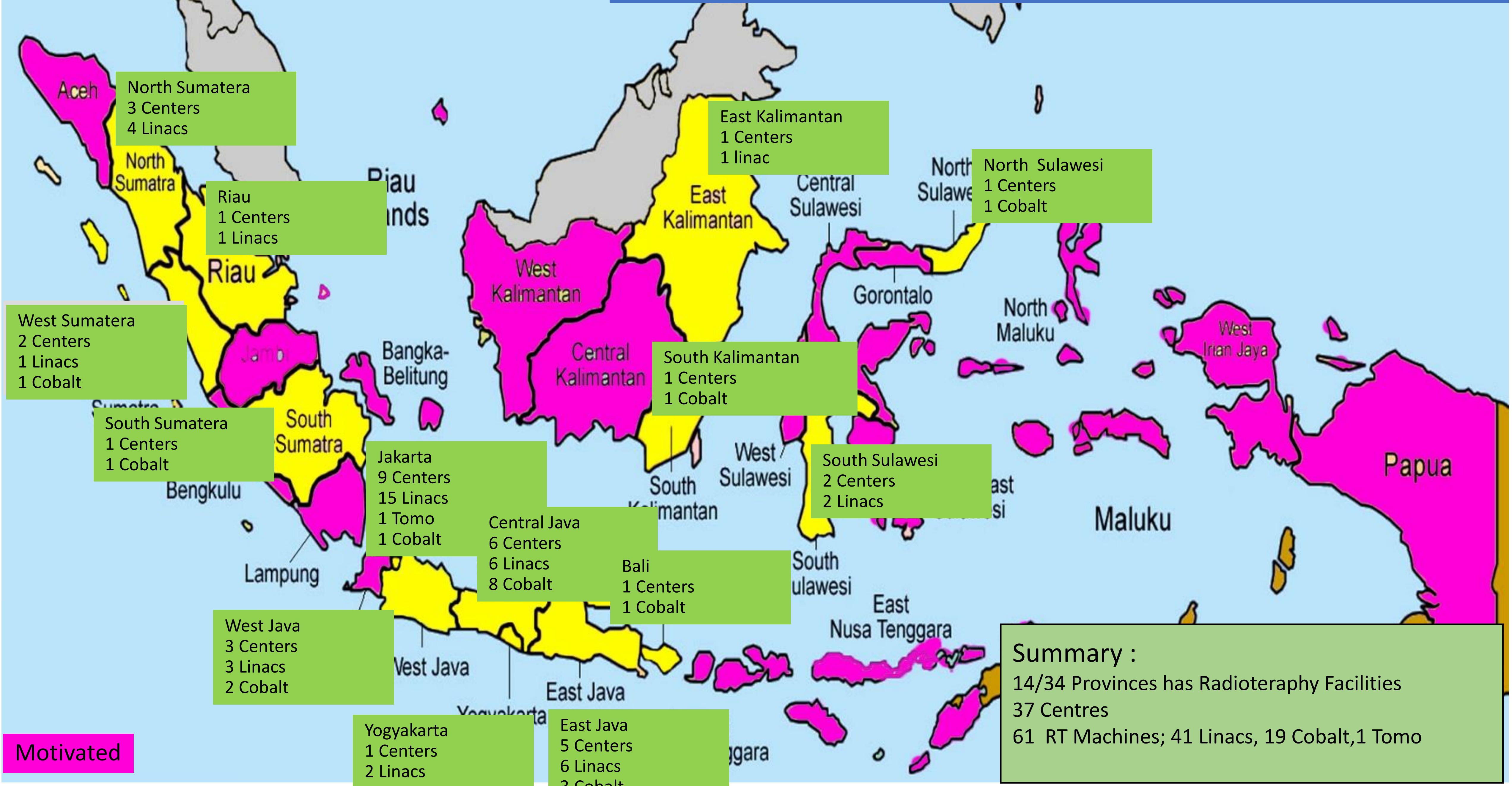
1. Cancer 2005; 104(6): 1129-37.
2. Lancet Oncol 2015; 16: 1153-86.



Indonesia, 1927:
Radiotherapy
Indonesia, 1958:
Telecobalt
Indonesia,1982
LINAC
& Afterloading
Indonesia, 2003:
3D-CRT
Indonesia, 2008
First IMRT &SRT
1890
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
2016
Tomotherapy
The radiotherapy machine
EXTERNAL BEAM
IRRADIATION
prostate
needle
probe
BRACHYTHERAPY

MEGAVOLTAGE PER MILLION POPULATION, 2018(Now)



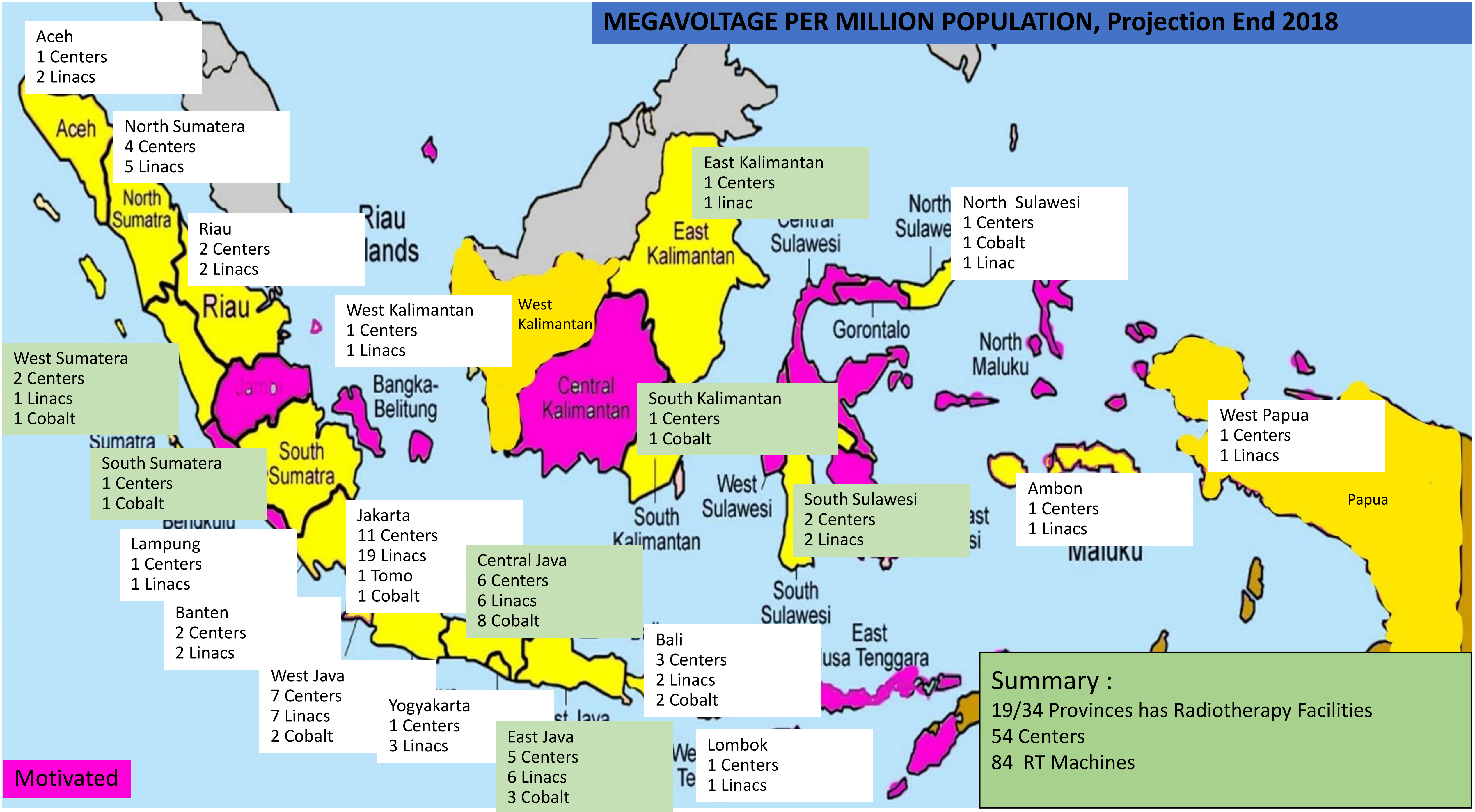
Summary :

14/34 Provinces has Radioteraphy Facilities

37 Centres

61 RT Machines; 41 Linacs, 19 Cobalt,1 Tomo

MEGAVOLTAGE PER MILLION POPULATION, Projection End 2018



UICC global cancer control
A MEMBERSHIP ORGANISATION FIGHTING CANCER TOGETHER

GTFRCC | UICC PRESIDENT'S PORTFOLIO GLOBAL TASK FORCE ON RADIOTHERAPY FOR CANCER CONTROL

The Lancet Oncology Commission

$96·8 billion. Scale-up of radiotherapy capacity in 2015–35 from current levels could lead to saving of 26·9 million life-years in low-income and middle-income countries over the lifetime of the patients who received treatment. The economic benefits of investment in radiotherapy are very substantial. Using the nominal cost model could produce a net benefit of $278·1 billion in 2015–35 ($265·2 million in low-income countries, $38·5 billion in lower-middle-income countries, and $239·3 billion in upper-middle-income countries). Investment in the efficiency model would produce in the same period an even greater total benefit of $365·4 billion ($12·8 billion in low-income countries, $67·7 billion in lower-middle-income countries, and $284·7 billion in upper-middle-income countries). The returns,

radiotherapy. The cost of scaling up radiotherapy in the nominal model in 2015–35 is US$26·6 billion in low-income countries, $62·6 billion in lower-middle-income countries, and $94·8 billion in upper-middle-income countries, which amounts to $184·0 billion across all low-income and middle-income countries. In the efficiency model the costs were lower: $14·1 billion in low-income, $33·3 billion in lower-middle-income, and $49·4 billion in upper-middle-income countries—a total of $96·8 billion. Scale-up of radiotherapy capacity in 2015–35 from current levels could lead to saving of 26·9 million life-years in low-income and middle-income countries over the lifetime of the patients who received treatment. The economic benefits of investment in radiotherapy are very substantial. Using the nominal cost model could produce a net benefit of $278·1 billion in 2015–35 ($265·2 million in low-income countries, $38·5 billion in lower-middle-income countries, and $239·3 billion in upper-middle-income countries). Investment in the efficiency model would produce in the same period an even greater total benefit of $365·4 billion ($12·8 billion in low-income countries, $67·7 billion in lower-middle-income countries, and $284·7 billion in upper-middle-income countries). The returns, by the human-capital approach, are projected to be less with the nominal cost model, amounting to $16·9 billion in 2015–35 (–$14·9 billion in low-income countries; –$18·7 billion in lower-middle-income countries, and $50·5 billion in upper-middle-income countries). The returns with the efficiency model were projected to be greater, however, amounting to $104·2 billion (–$2·4 billion in low-income countries, $10·7 billion in lower-middle-income countries, and $95·9 billion in upper-middle-income countries). Our results provide compelling evidence that investment in radiotherapy not

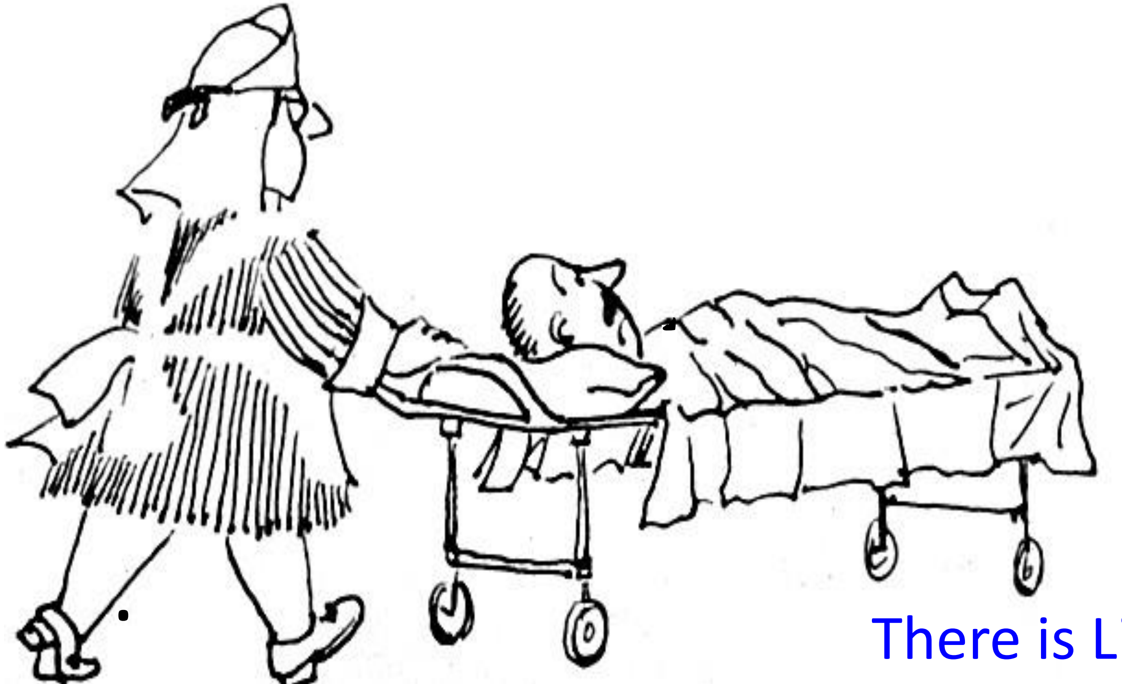
Cancer Centre, Toronto, ON, Canada (Prof D A Jaffray PhD, Prof M Milosevic MD, Prof B O'Sullivan MD, Prof M Gospodarowicz MD); TECHNA Institute, University Health Network, Toronto, ON, Canada (Prof D A Jaffray, T Y M Lui MSc); Department of Radiation Oncology, University of Toronto, Toronto, ON, Canada (Prof D A Jaffray, Prof B O'Sullivan, D L Rodin MD, Prof M Gospodarowicz); Ingham Institute for Applied Medical Research, University of New South Wales, Liverpool, NSW, Australia (Prof M B Barton MBBS, T P Hanna MD, M L Yap MD); International Agency for Research on Cancer, Lyon,

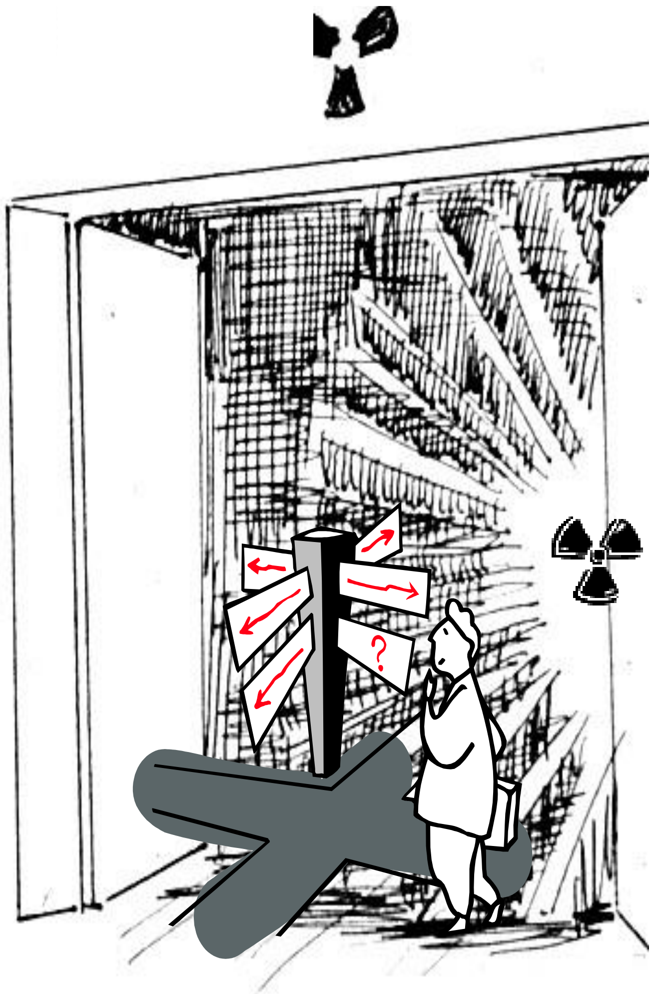
Radiotherapy not only save lives, but also brings positive economic benefits.

Take Home Messages

- Radiobiology to radiation oncology is equivalent to pharmacology to internal medicine.
- “Chain of radiotherapy” involves multiple process and professionals
- The cancer treatment is a multidisciplinary approach
- Radiotherapy plays an integral part in the multidisciplinary treatment of cancer.

Thank you!

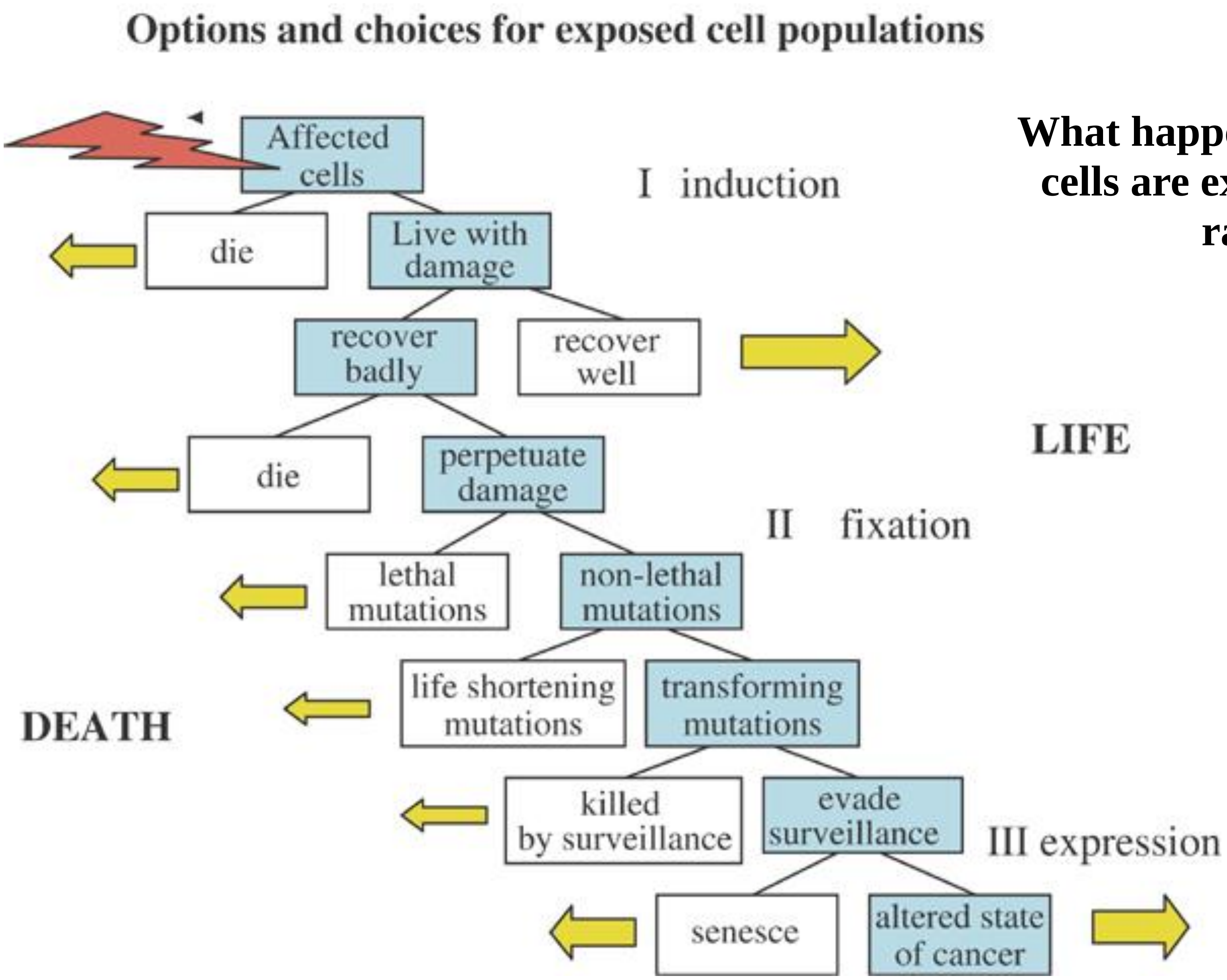




There is Light at the end of the Tunnel

In Summary...

hand in hand...
to provide best and safe treatment for the patients...

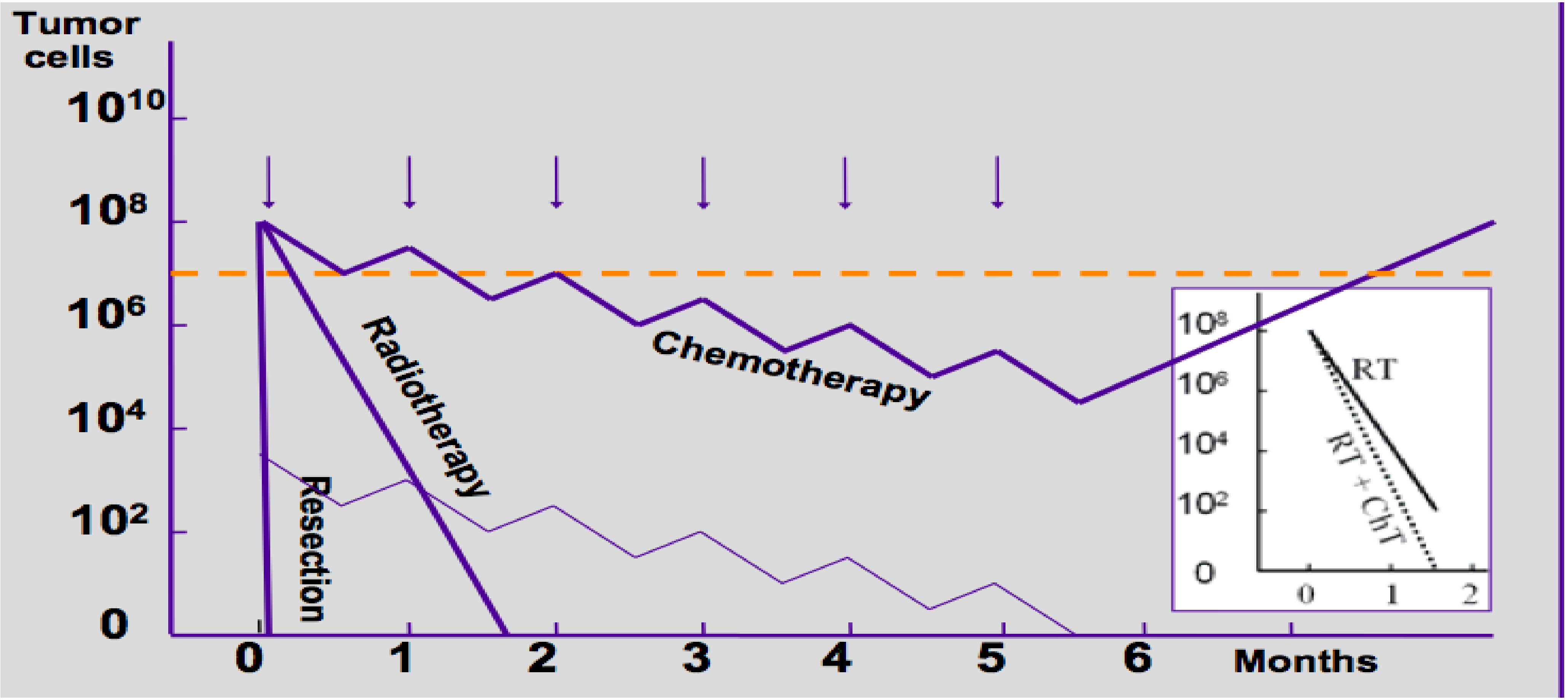


What happens when cells are exposed to radiation?

Take home messages

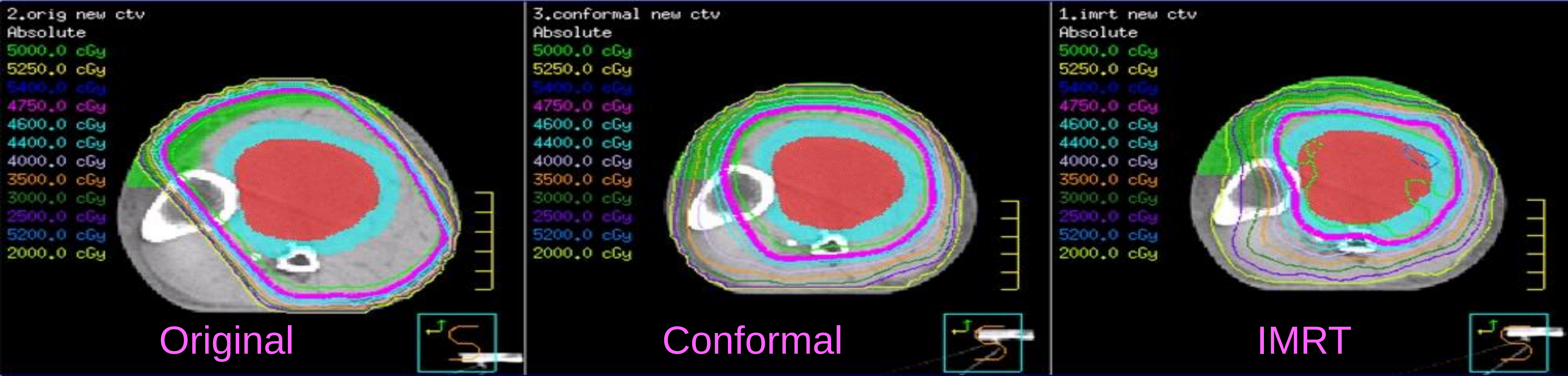
- There are several keypoints need to addressed for treatment strategy determination such as **: tumor location, MRF involvement in MRI, TME quality, CRM and nodal status in pathology report.**
- **More selective use of radiotherapy in patients with low-risk rectal cancer** avoids treatment-induced morbidity and can improve patients' **quality of life.**
- **There was no statistically** significant local recurrence or overall survival difference observed between **SRT and long course chemoRT**. Patients receiving SRT had **lower grade 3 or 4 acute treatment related toxicity** whereas no difference in late toxicity was observed.
- **Short-course radiotherapy (SRT) with delay** to surgery is a useful alternative to conventional short-course radiotherapy with immediate surgery.
- **Local excision was not shown to be superior to TME** in **terms of morbidity and long-term function** in rectal cancer after good response with long course preoperative chemoRT.

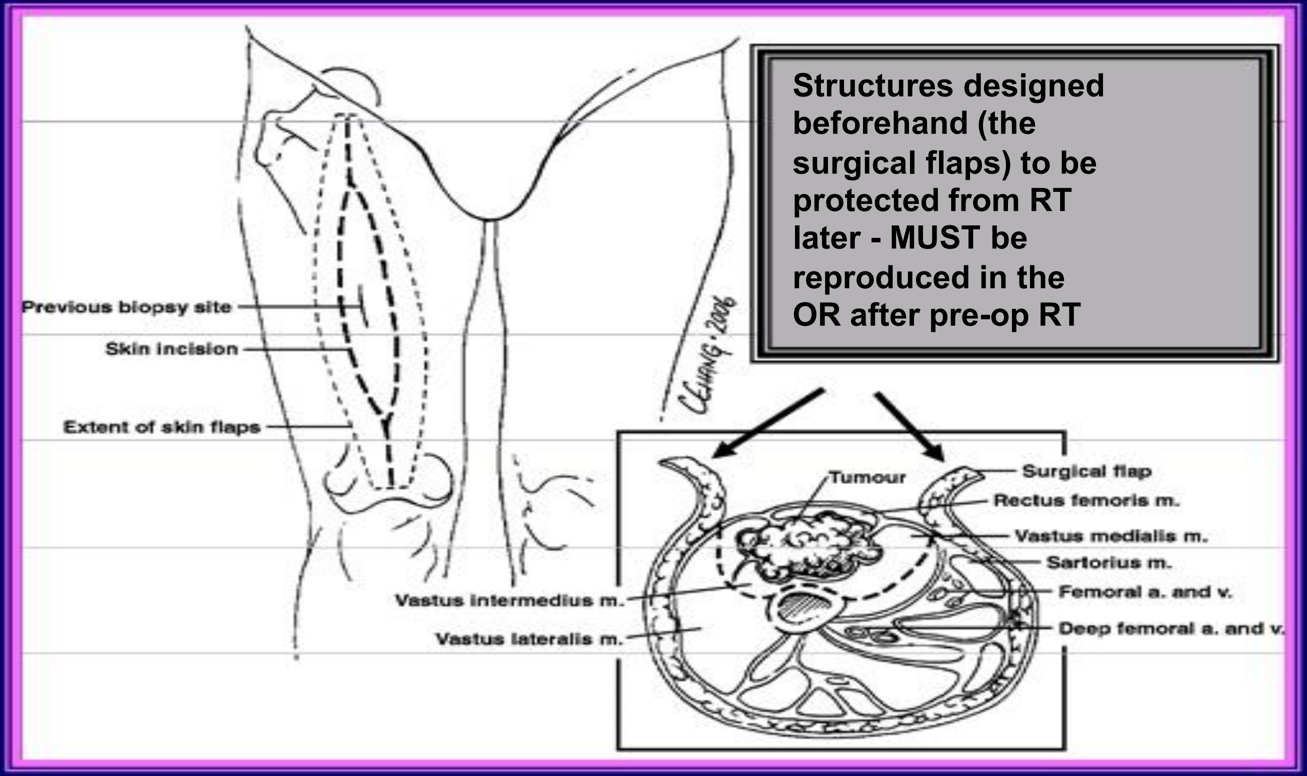
Influence of different therapeutic modalities on number of tumor cells during a course of treatment, based on the models by Tannock



Take home messages

- RT plays a important role in organ preservation treatment in cancer.
- There are several indication in post operative RT.
- Concurrent chemo RT is the treatment of choice in locally advanced inoperable H&N cancer and NPC.
- Induction chemo in NPC shows a promising result.
- Induction chemo in HNSCC does not show benefit in progression free survival and OS, but shows benefit in distant metastases free survival and complete response rate.
- RT plays an important role in palliative setting, but the emerging concept of oligometastatic make RT be more important.
- Local recurrence is not palliative case, try to cure the patient.





Dose modeling: planning feasibility study

"A radiation planning comparison for superficial tissue avoidance in the radiotherapy of soft tissue sarcoma of the lower extremity"

Griffin A, Euler C, Sharpe M, Wunder J, Ferguson P, Catton C, Chung P, Bell R, O'Sullivan B.
Int J Rad Onc Biol Phys, March 2007.

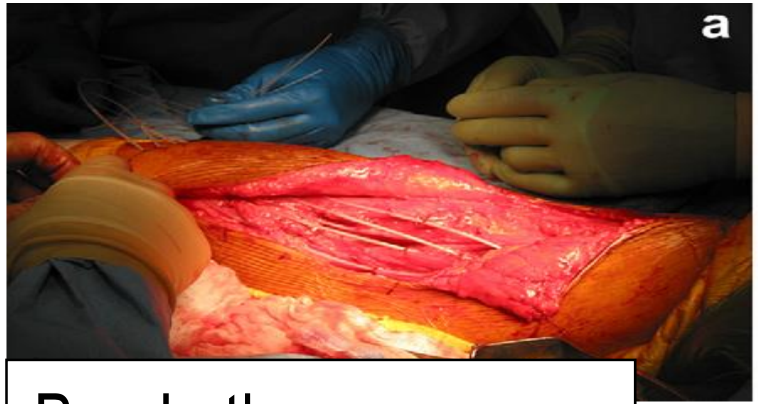
Key points to take home

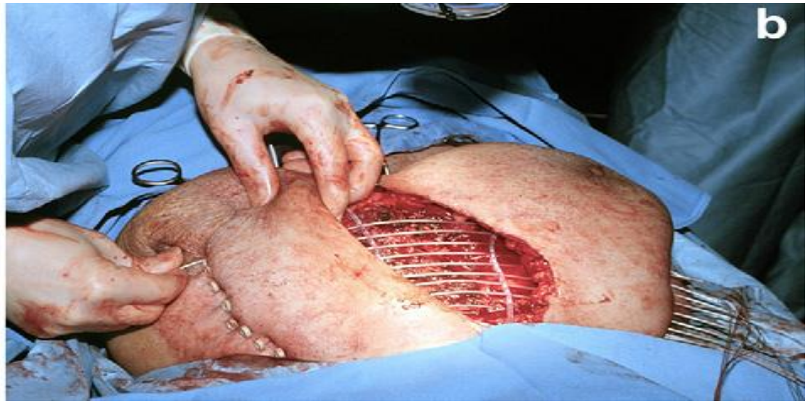
- The cornerstone of the management of ESTS patients is **surgery.**
- Limb preservation treatment in extremity STS requires **multidisciplinary collaboration.**
- The goal of functional limb preservation **with local control and good quality of life.**
- The advancement of radiotherapy in relation to achieve minimal toxicity
  - “**Advanced” RT** is enhanced by modern imaging both for treatment planning and delivery (IMRT & IGRT).
  - **Preoperative radiation** in extremity lesions reduces volume and dose of radiation with equal local control and less long term toxicity/better functional outcome.
  - **Small volume** (in research setting).

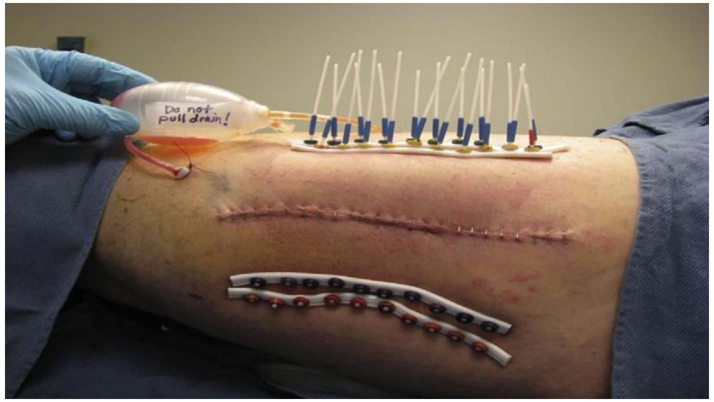
Key points to take home

- The indications for radiation therapy are those features that **put the patient at risk for local recurrence after surgical resection.**
- Indication for RT
  - **Low grade sarcoma (G1)**
    - Narrow or positive surgical margins,
    - Invading the superficial fascia
    - Tumor size of > 5 cm
    - Local recurrence after prior surgery,
  - **High grade sarcoma (G2-3)**
    - **ALL** extremity lesions unless on protocol for treatment with surgery alone

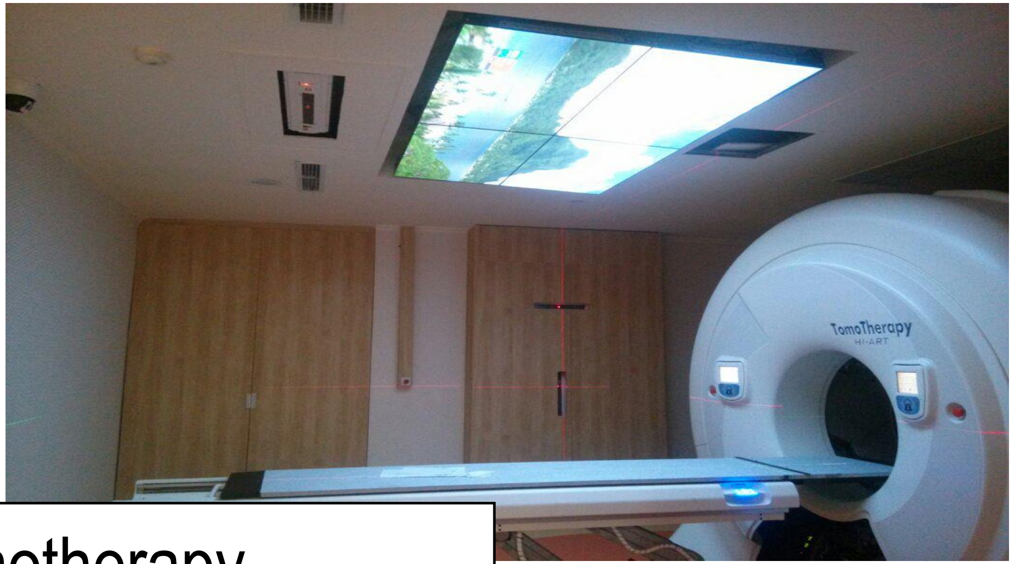
Key points to take home



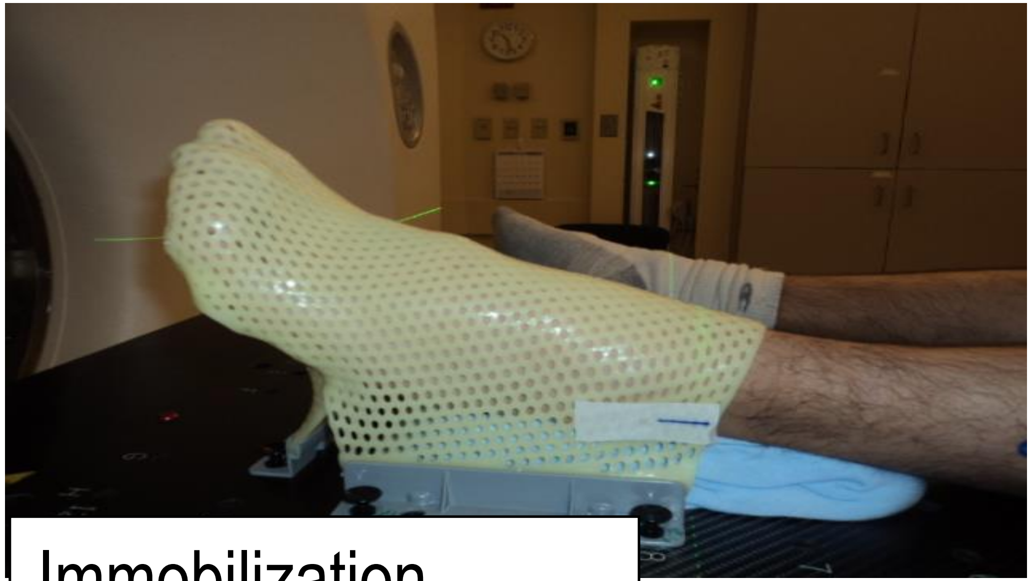




Brachytherapy



Tomotherapy



Immobilization

1. Courtesy of EH Baldini
2. Brachytherapy 2013; 12: 179-190.