รศ.นพ. ประเสริฐ เลิศสงวนสินชัย

- **Position:** ผู้อำนวยการฝ่ายดูแลผู้ป่วยโรคมะเร็ง โรงพยาบาลวัฒโนสถ
  อาจารย์พิเศษสาขารังสีรักษาและมะเร็งวิทยา ภาควิชารังสีวิทยา
  คณะแพทย์ศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย และอดีตนายกสมาคมรังสีรักษา
  และมะเร็งวิทยาแห่งประเทศไทย พ.ศ. 2556 -2559)
- **Specialty:** Radiation Oncologist
- **Qualification & Education:**
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  - วุฒิบัตร รังสีรักษาและเวชศาสตร์นิวเคลียร์ คณะแพทยศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย (2529)
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สมาคมพยาบาลโรคมะเร็งแห่งประเทศไทย

การประชุมวิชาการครั้งที่ 3 ประจำปี 2560

Inspiring Innovation and transition cancer nursing from prevention to long term care

30-31 สิงหาคม และ 1 กันยายน 2560
ณ โรงแรมปรินซ์พาเลซ มหานาค กทม

Radiotherapy in Advanced Cancer

การประชุมวิชาการครั้งที่ 3 ประจำปี 2560
สมาคมพยาบาลโรคมะเร็งแห่งประเทศไทย
31 สิงหาคม 2560

รศ นพ ประเสริฐ เลิศสงวนสินชัย
รังสีรักษา โรงพยาบาลวัฒโนสถ

World Cancer Day (4th Feb)

- World Cancer Report in 2012
- Total new cancer approx 14 million
- Death from Cancer 8.8 million
- Most common cancer death is lung cancer 1.6 million (18.2% of all cancer death)

In 2016

2016 New cancer patients about 14-15 million
Yearly Radiation cases 4.5 million
Average patient received RT 30-35%

Current Data:-

New cancer patient need RT 50-60%
Old cancer patients need Re-RT 20-25%

Thailand

- Cancer is the most common cause of death since 2000 (2543)

- In 2013
- Total Thai population death 426,065 cases
- Death from cancer 76,184 cases
- (15.7%)
- Average cancer death 184 cases/d
- (7.7 cases/hr)

RT centers in Thailand 2016

Total RT centers service in Thailand = 34 centers

-Government = 26 centers

-Private = 8 centers

Location:- Bangkok 15 centers (44%)

-Out of Bangkok 19 centers (56%)

RT Machine

- Total RT machines :- 82 machines

Linear accelerator	68 machines
Cobalt-60	14 machines
Brachytherapy (HDR)	26 machines
Conventional simulation	30 machines
CT-simulation	26 machines
MRI-Simulation	1 + 1 machines

- RT Personnel

• Full Time RT Oncologist	123
• Part Time RT Oncologist	10-12
• Medical Physicists	98
• RadiationTechnologist	272
• RT oncology Nurses	173

Thailand 2015

New cancer patients approx 100,000 cases

New patients received RT 34,177 cases(34%)
(about 65-70% that get to the RT service)
Old patients (Re-RT) 4,883 cases(14.2%)

RT cases/Machine/Year 251-773 cases
average 494 cases/machine

IAEA Recommendation

- Developed country 250,000-300,000 /machine
- Developing Country 500,000/machine
- Poor country 750,000/ machine

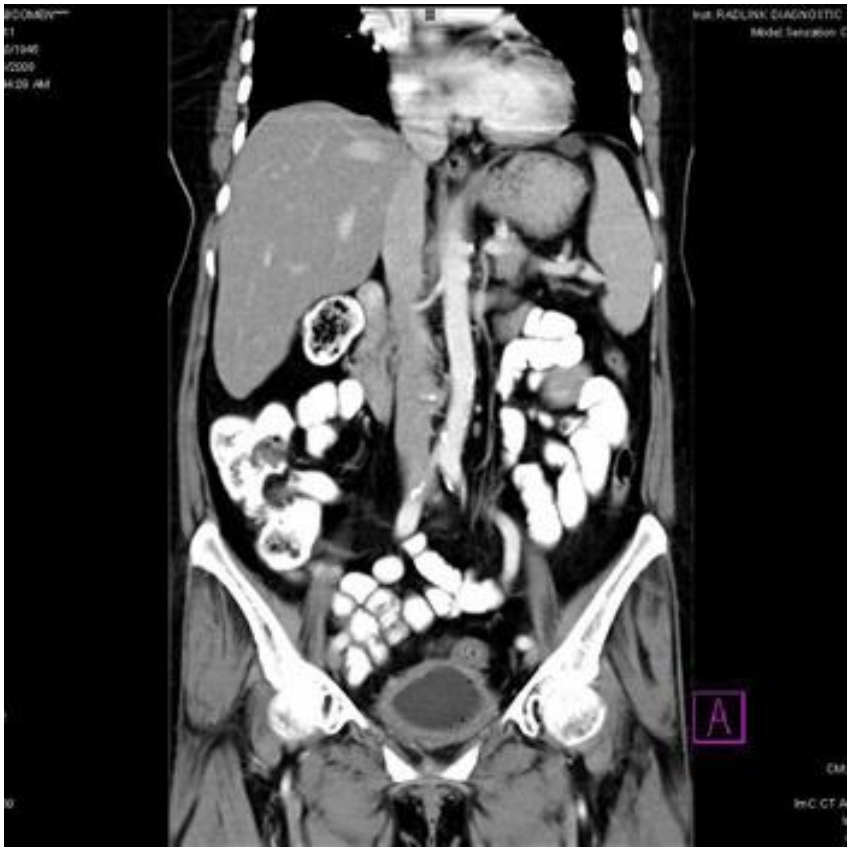
- Thailand population 66-67 million
- need about 110-130 machines
- RT cases/year/machine 400-450 cases

• Radiation Oncology

Needs :-

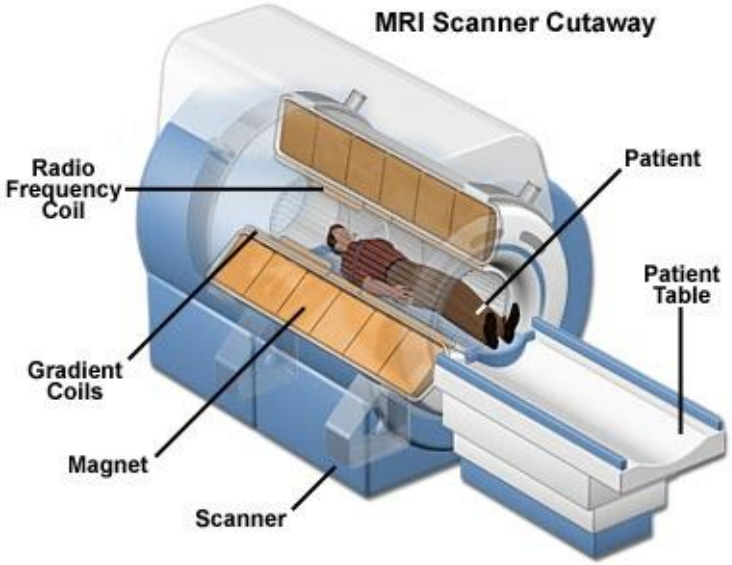
- Good quality and accurate imaging system
- Modern radiation treatment planning.
- Sophisticated radiation treatment machine
- Experience/ expert team.

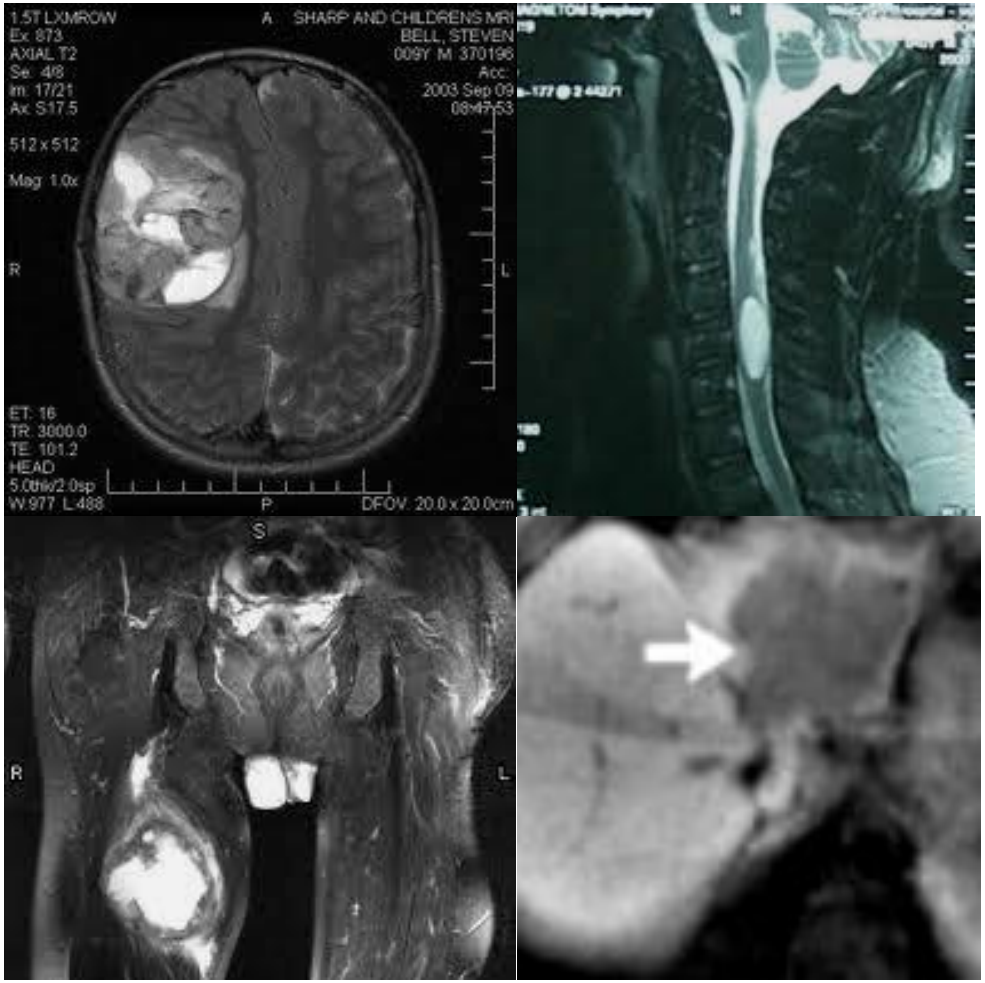
CT scan



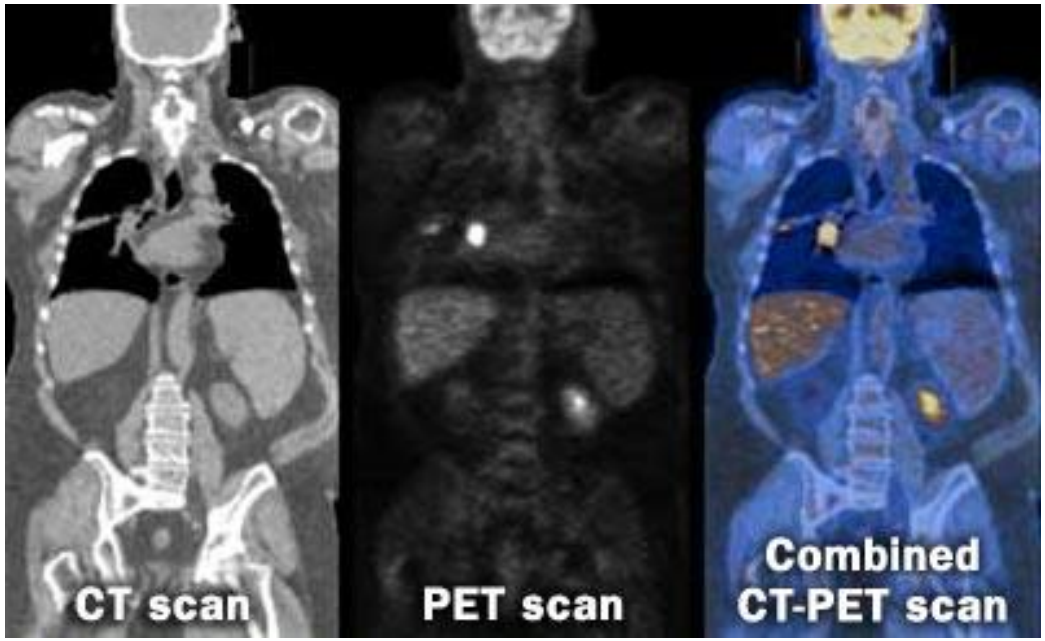
MRI

- MRI Images





- PET/CT scan (Functional Imaging)



Simulation Machine
(เครื่องจำลองแผนการรักษา)

- Conventional simulation
- CT simulation
- PET/CT simulation
- MRI simulation

Simulator

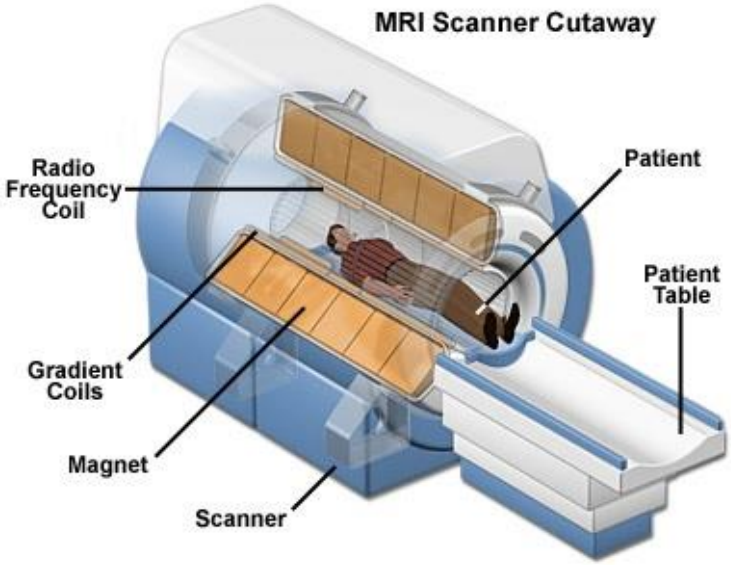
For determination of radiation treatment area

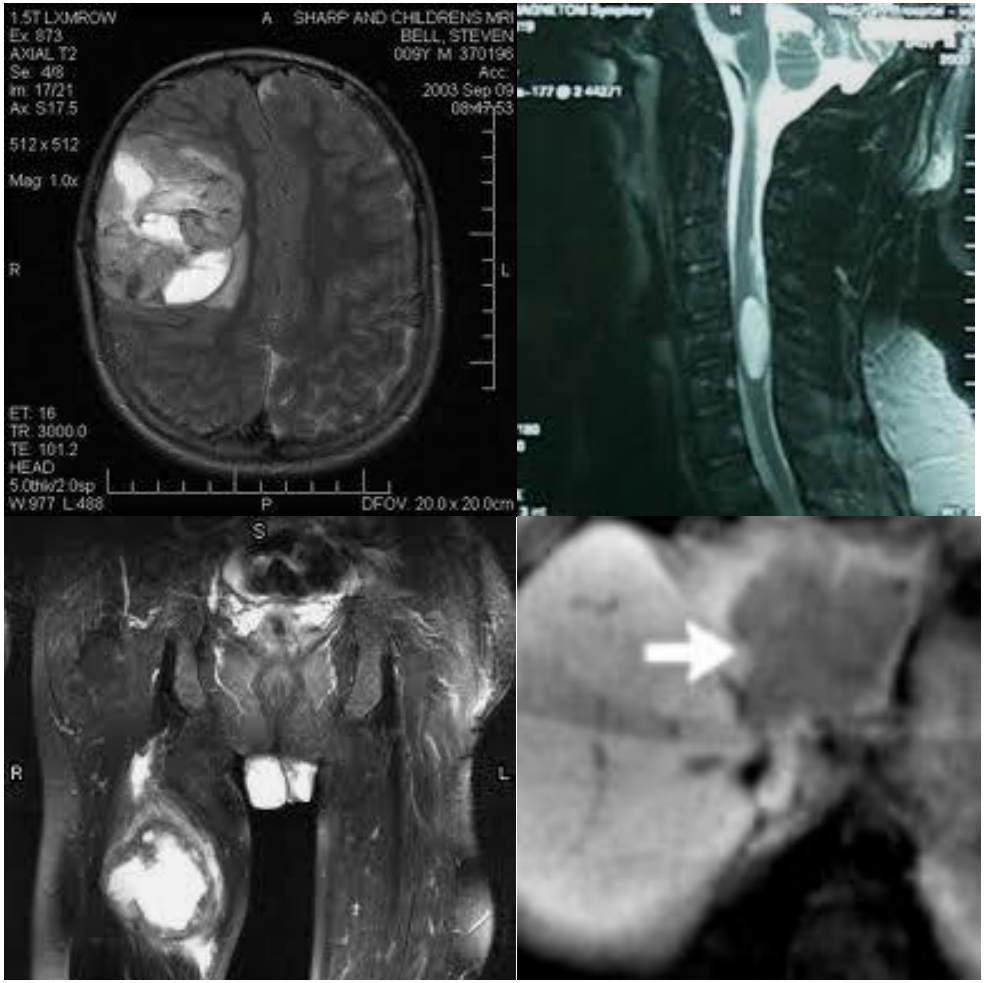
- Conventional sim

- CT SIMULATOR

- MRI

MRI Images





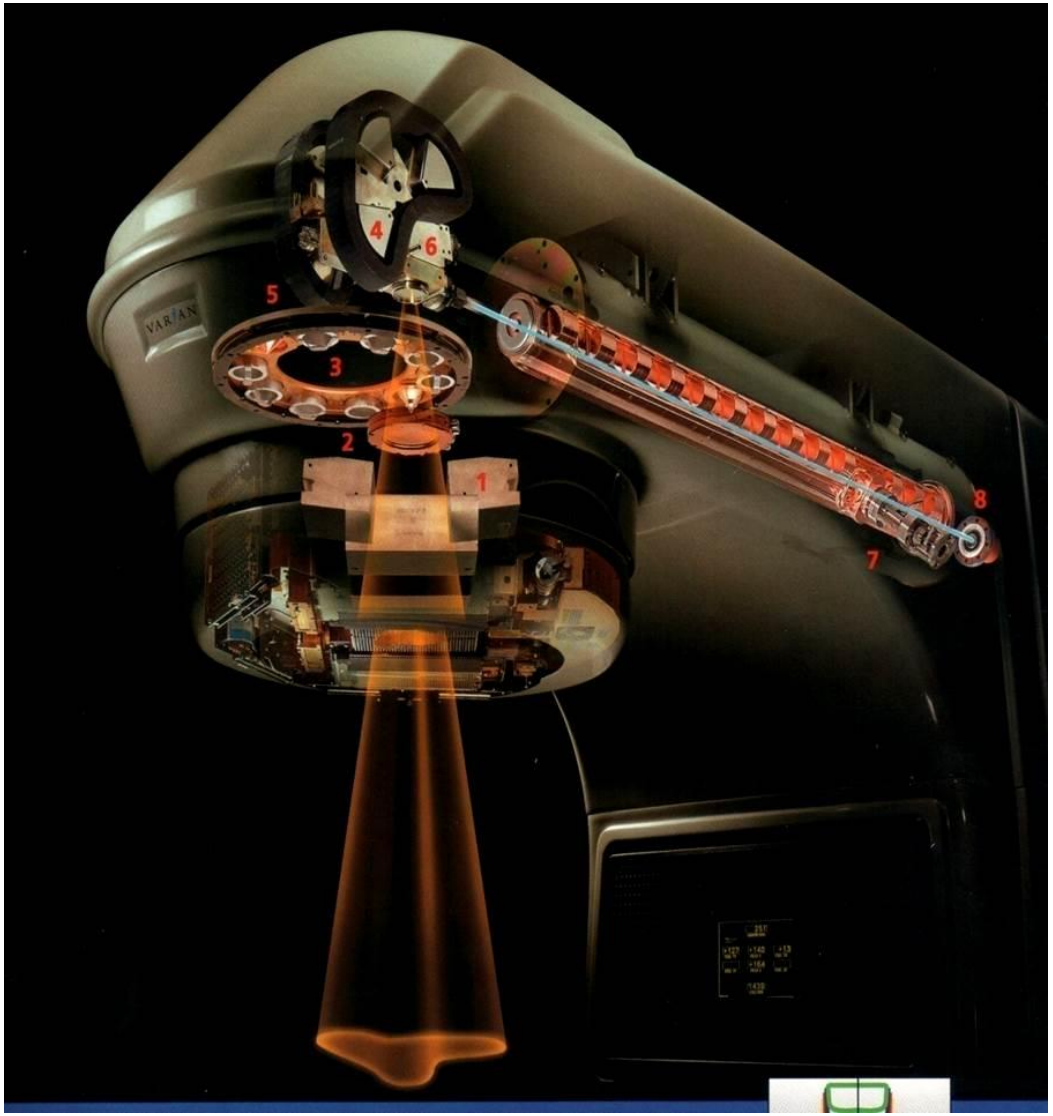
- PET/CT SIMULATOR

Radiation machine

- Deep X-ray
- Cobalt-60
- Linear accelerator
- Gamma Knife
- Cyber knife
- Tomotherapy

Cobalt -60

Linear Accelerator with MLC



Linear Accelerator with Robotic couch

Gamma Knife

Cyber Knife

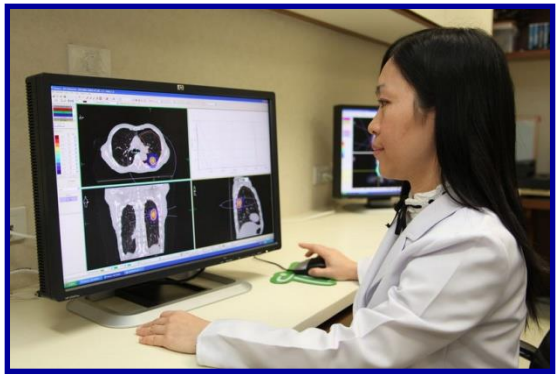

Stereo X-ray cameras
Infrared camera
6 DOF KUKA robot
6 MeV LINAC (radiation source)
5 DOF OR table
Built-in stereo X-ray detectors

Tomotherapy

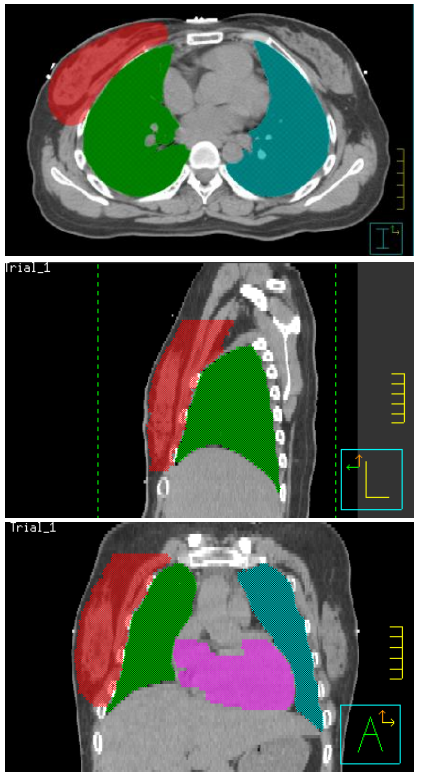
EDGE Radiosurgery

โรงพยาบาลวัฒโนสถ
WATTANOSOTH HOSPITAL
โรงพยาบาลมะเร็งกรุงเทพ

Radiation Treatment Planning

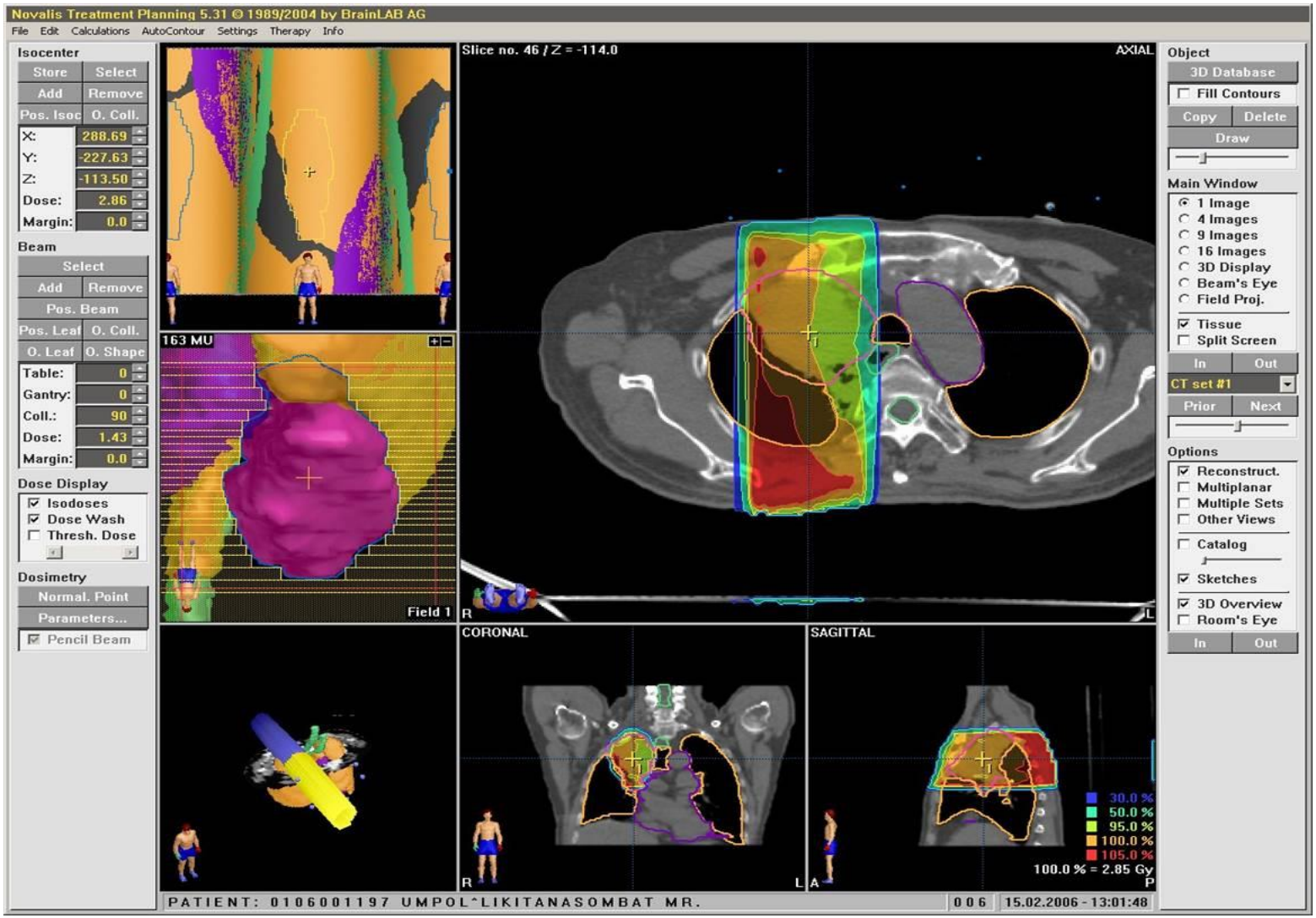


- Advances of computed tomography can now demonstrate three dimensional tissues/organs
- Advances in radiation treatment planning system (soft ware)
- Advance in radiation machine



We can now give high radiation doses to the tumor while sparing the normal surrounding tissue

2D RT


Novalis Treatment Planning 5.31 © 1989/2004 by BrainLAB AG
File Edit Calculations AutoContour Settings Therapy Info
Isocenter
Store Select
Add Remove
Pos. Isoc O. Coll.
X: 288.69
Y: -227.63
Z: -113.50
Dose: 2.86
Margin: 0.0
Beam
Select
Add Remove
Pos. Beam
Pos. Leaf O. Coll.
O. Leaf O. Shape
Table: 0
Gantry: 0
Coll.: 90
Dose: 1.43
Margin: 0.0
Dose Display
Isodoses
Dose Wash
Thresh. Dose
Dosimetry
Normal. Point
Parameters...
Pencil Beam
163 MU
Field 1
Slice no. 46 / Z = -114.0
AXIAL
CORONAL
SAGITTAL
30.0 %
50.0 %
95.0 %
100.0 %
105.0 %
100.0 % = 2.85 Gy
Object
3D Database
Fill Contours
Copy Delete
Draw
Main Window
1 Image
4 Images
9 Images
16 Images
3D Display
Beam's Eye
Field Proj.
Tissue
Split Screen
In Out
CT set #1
Prior Next
Options
Reconstruct.
Multiplanar
Multiple Sets
Other Views
Catalog
Sketches
3D Overview
Room's Eye
In Out
PATIENT: 0106001197 UMPOL^LIKITANASOMBAT MR.
006
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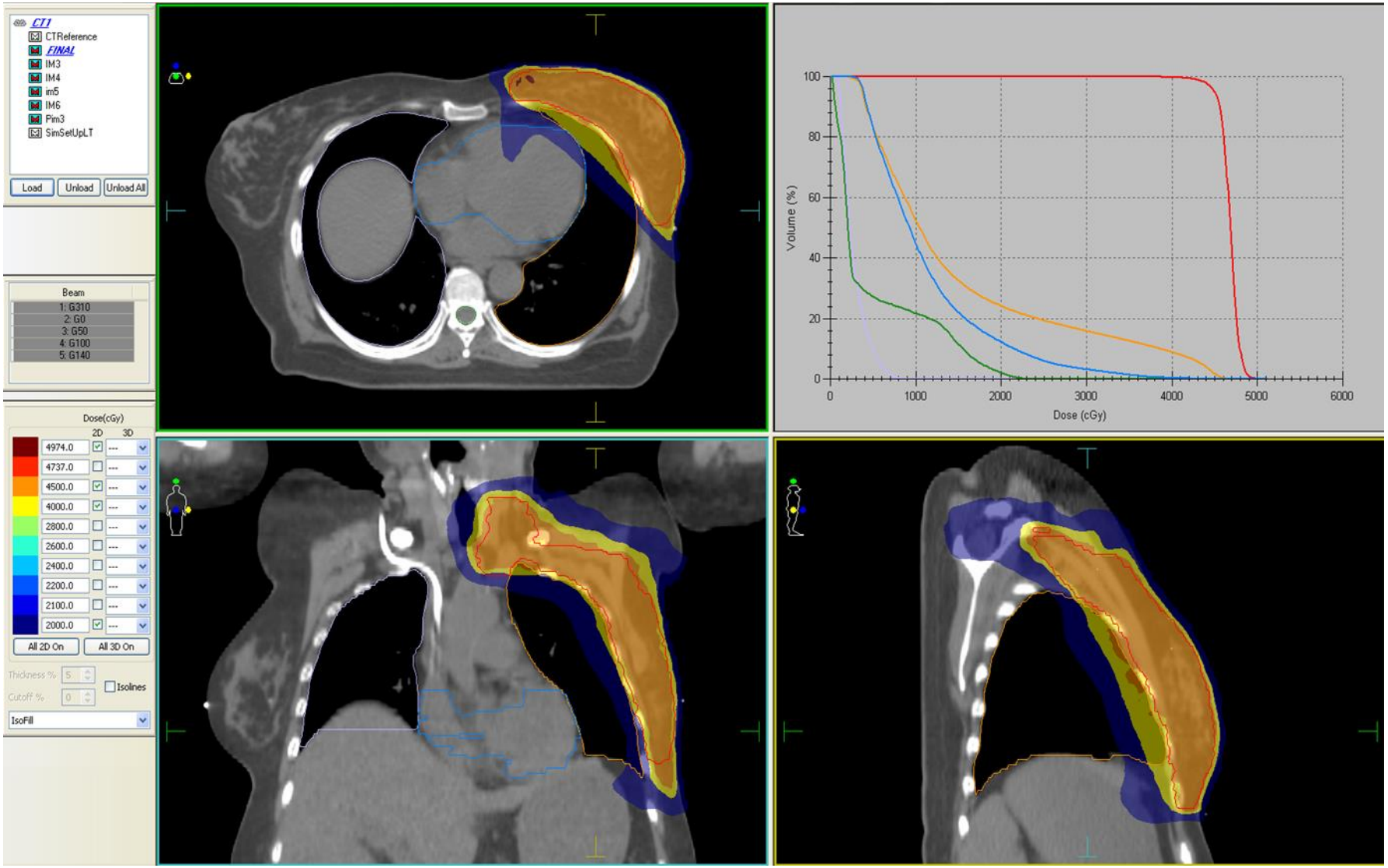
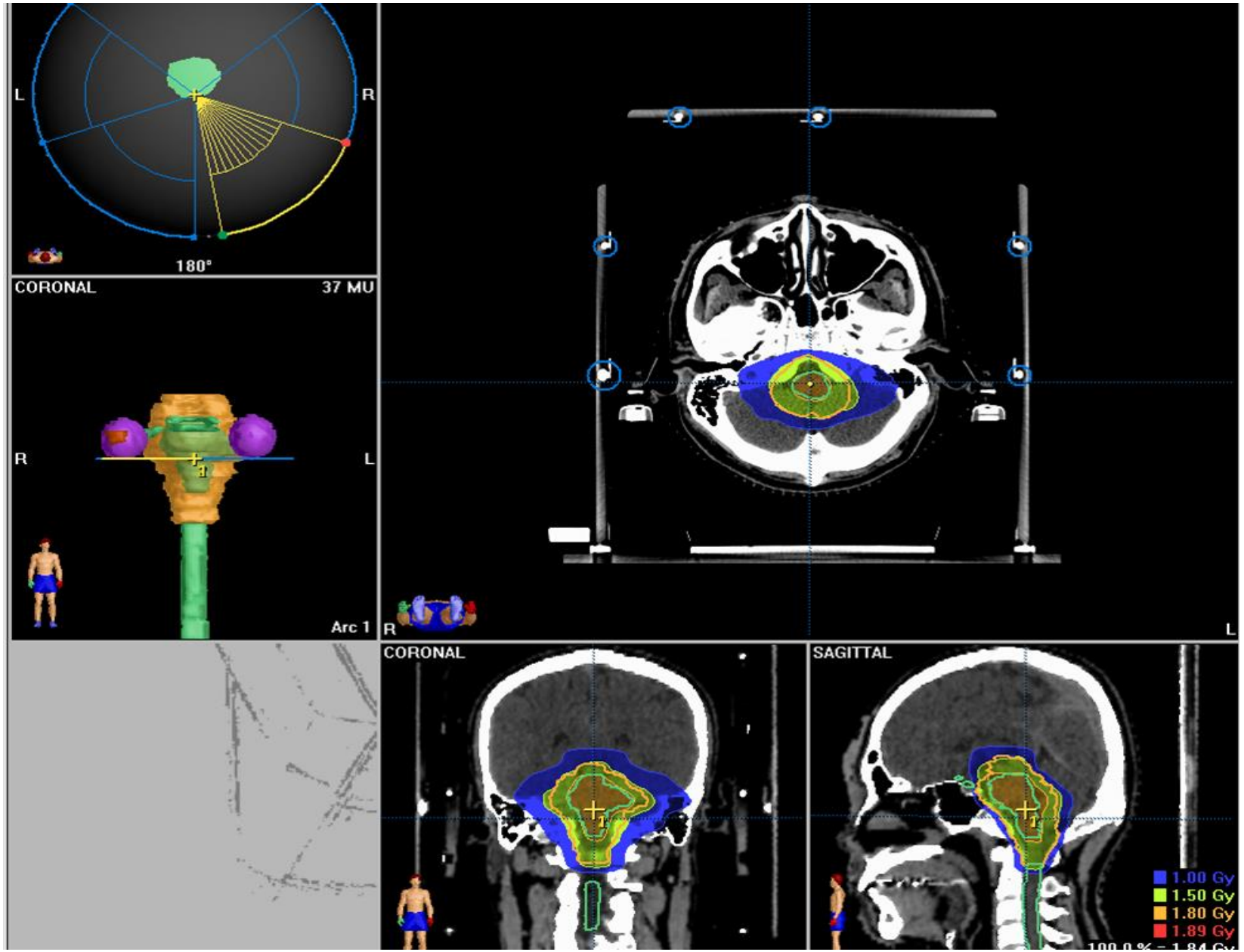
3D-CRT / IMRT



SRS / SRT



Cancer Treatment

- Main types of cancer treatment include :-
- - Surgery
- - Radiation Therapy
- - Chemotherapy
- - Hormonal Therapy
- - Targeted Therapy
- - Immunotherapy
- - Stem cell Transplantation (restoration blood-forming stem cells in cancer patients who had destroyed by very high doses of chemotherapy or radiation therapy)

Radiation Therapy

- Curative RT :- the goal is to deliver a high total RT dose to the tumor while limited long-term toxicity to normal tissue
- -use high number of low-dose fractions, long overall treatment time , 5-7 wks
- Palliative RT :- deliver radiation dose that sufficience to control symptom
- - use shorter overall treatment time , convenience , low cost

Treatment of Advanced Cancer

- Advanced cancer can not be cured , but can be treated

Aim :- Palliation

- To relief suffering symptom
- Minimization of side effect
- Consideration of patients convenience:-short treatment time
- Consideration of cost (low cost)
- Giving patients a better quality of life (QOL)

Treatment of Advanced Cancer

- Treatment of choices :-

1. Surgery :- bowel obstruction
   - bleeding
   - tumor compressing causing pain
   - broken bones

2. Ablative therapy :- using heat , cold or chemical agents for lesion in the liver , bone eg ; Radiofrequency Ablation (RFA), Cryoablation/ cryotherapy

Treatment of Advanced Cancer

- 3.Radiation Therapy :- use high energy X-ray to kill cancer cells and shrink tumors
- 4. Radiopharmaceuticals :- I-131 in Thyroid cancer ,Ra-223 or Strontium-89 for diffuse bone metastasis
- 5. Drugs Therapy :-Chemotherapy
  - Hormonal Therapy
  - Targeted Therapy
  - Immunotherapy

Palliative Radiation

- Indications:-

- Pain relief from bone metastasis
- Prevention of pathological fracture
- Spinal cord compression
- Brain metastasis
- Control of bleeding
- Control of ulceration /fungation
- Impending/actual obstruction (SVCO, bowel)

Bone Metastasis

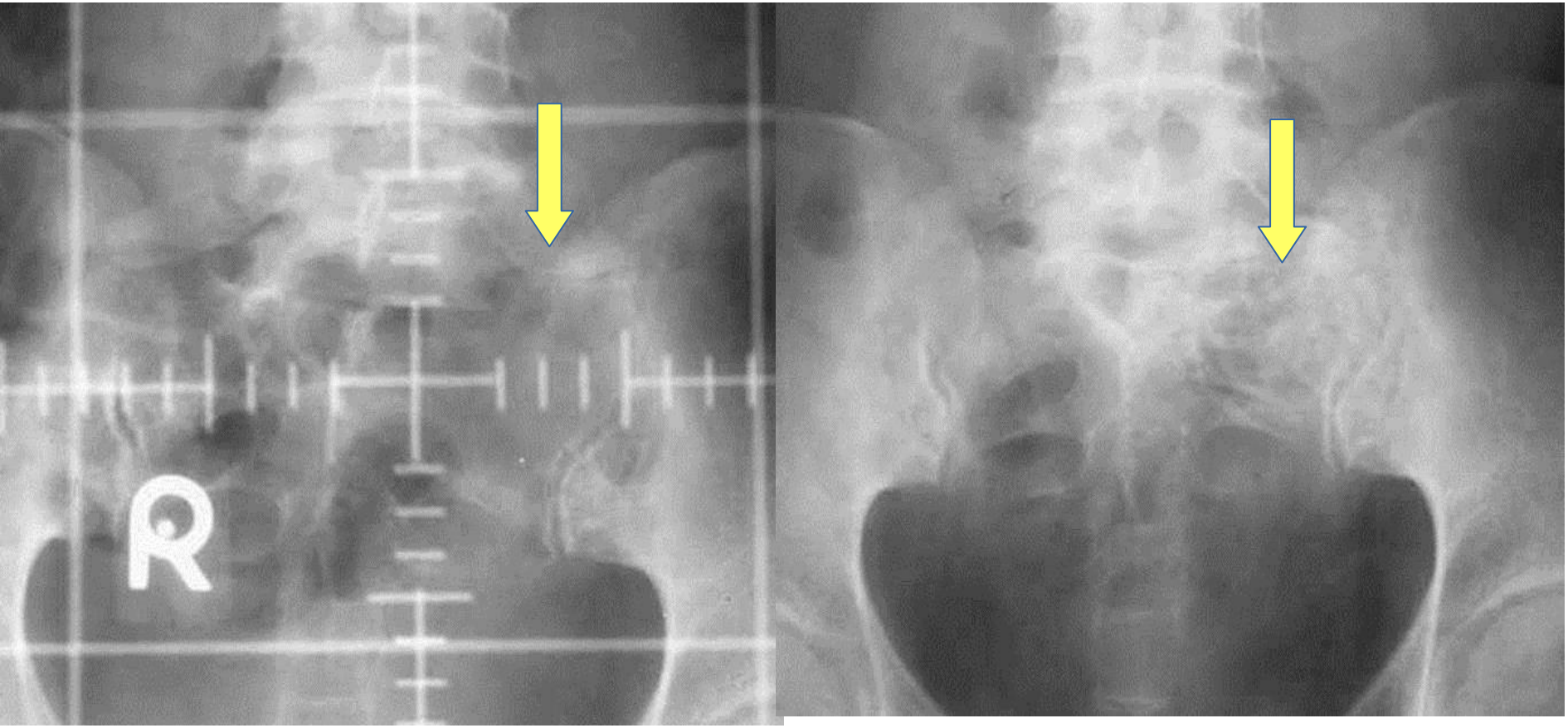
Bone Metastasis

- RT can provide significant palliation of painful bone metastasis in 60-80% of patients
- 1/3 of patients achieving complete pain relief

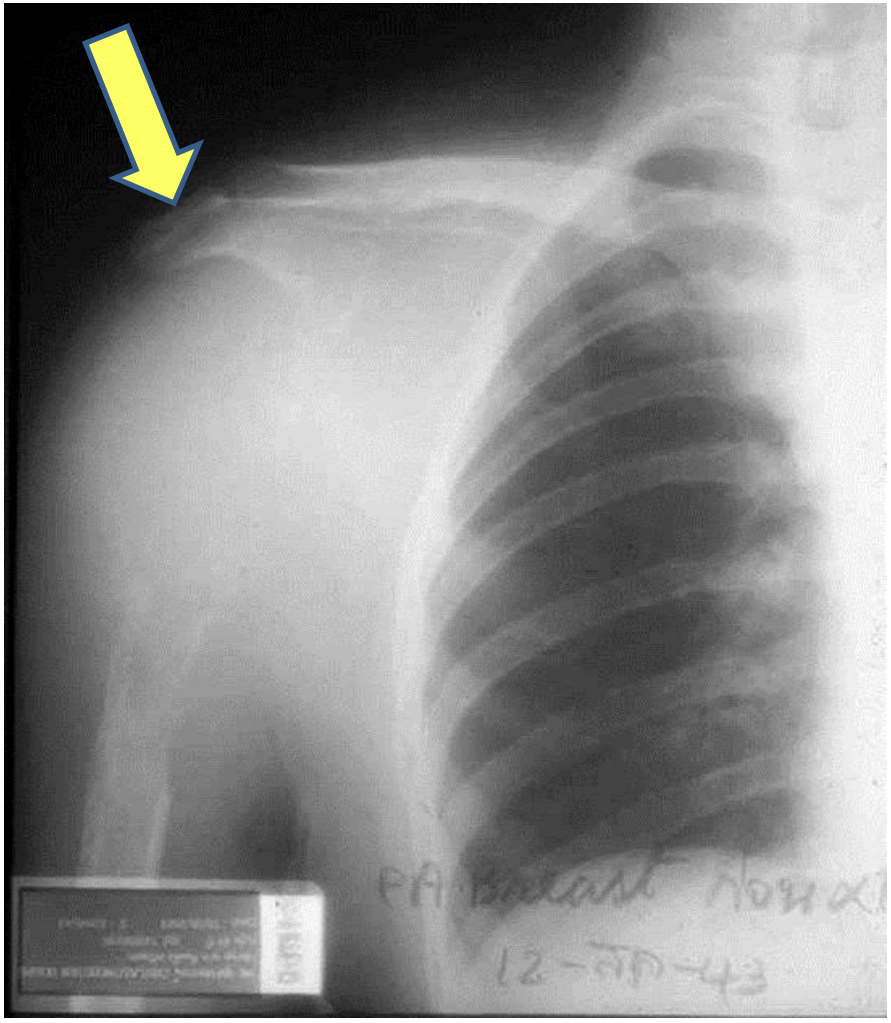
- RT schedule :- Single dose 8-10 Gy
  - 20-24 Gy/5-6 F
  - 30 Gy/10F
- Single fraction :- 20% need Re-RT
- Multiple fractions :- 8 % need Re-RT

Before RT

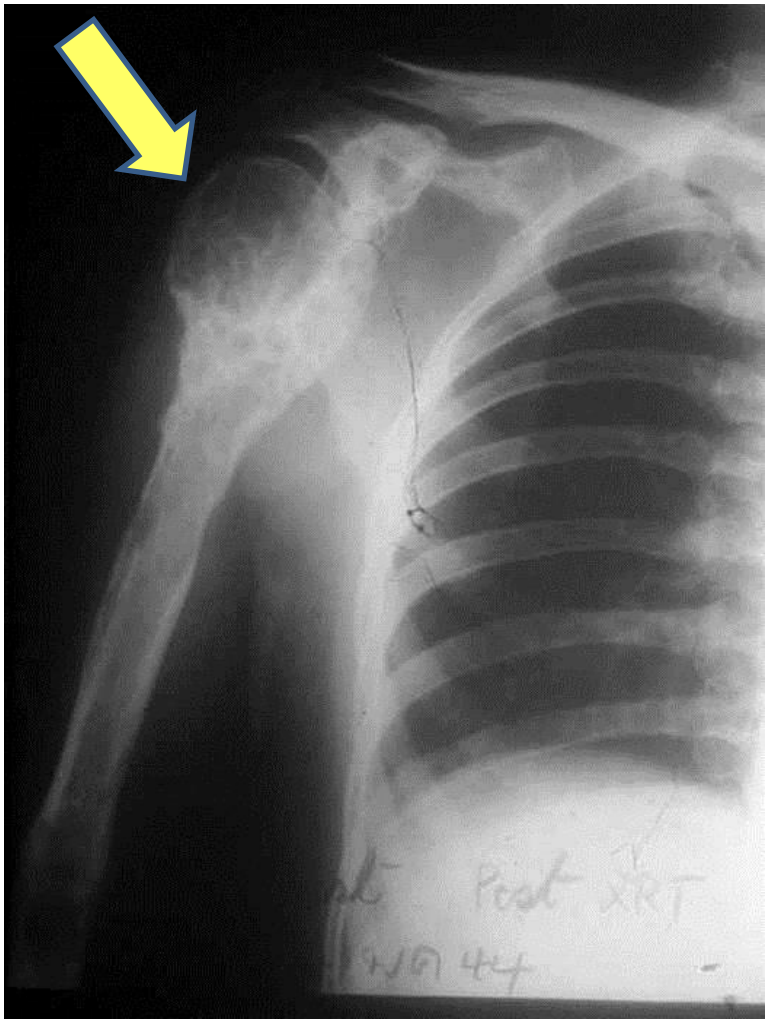
After RT



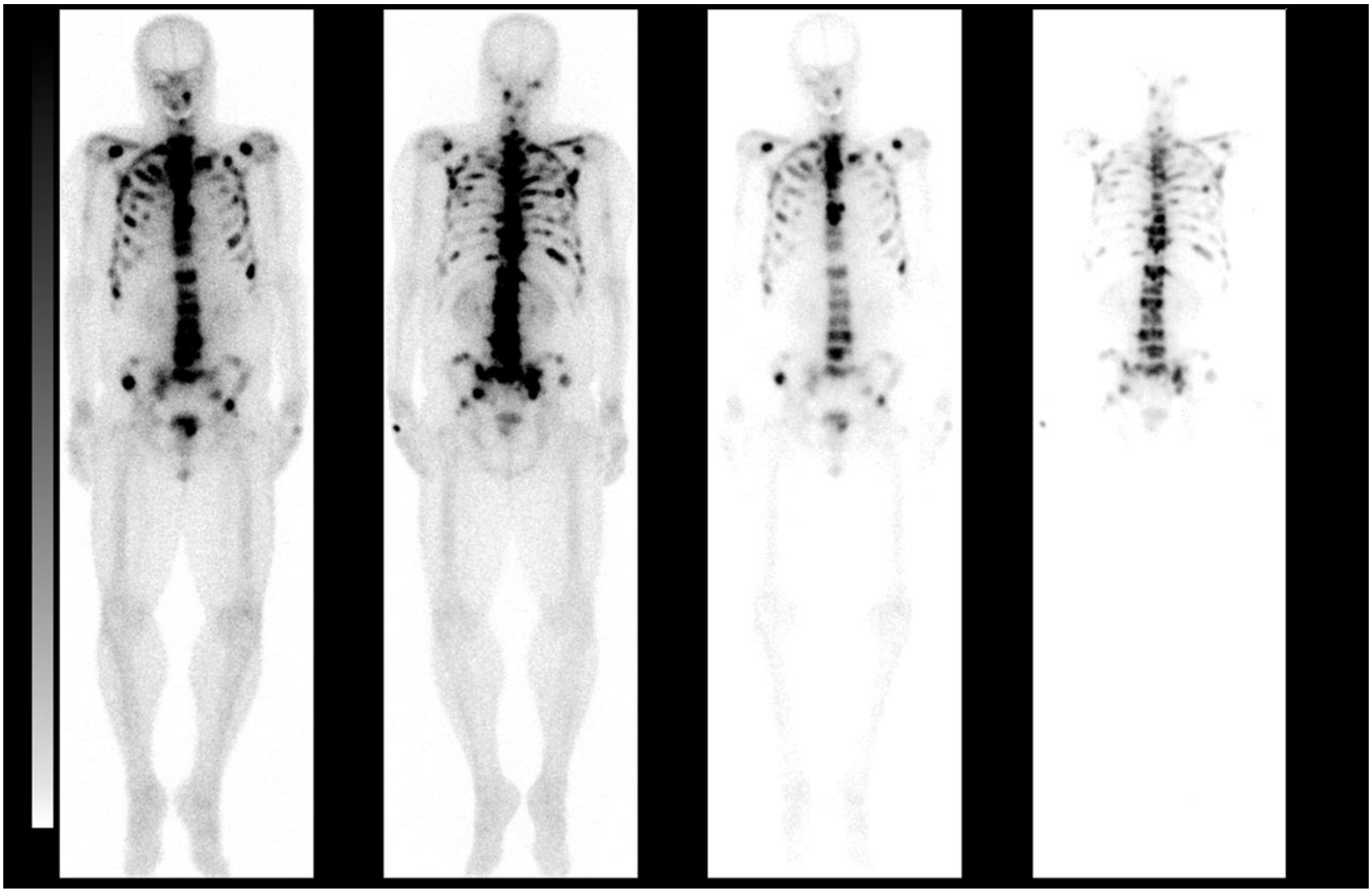
Before RT



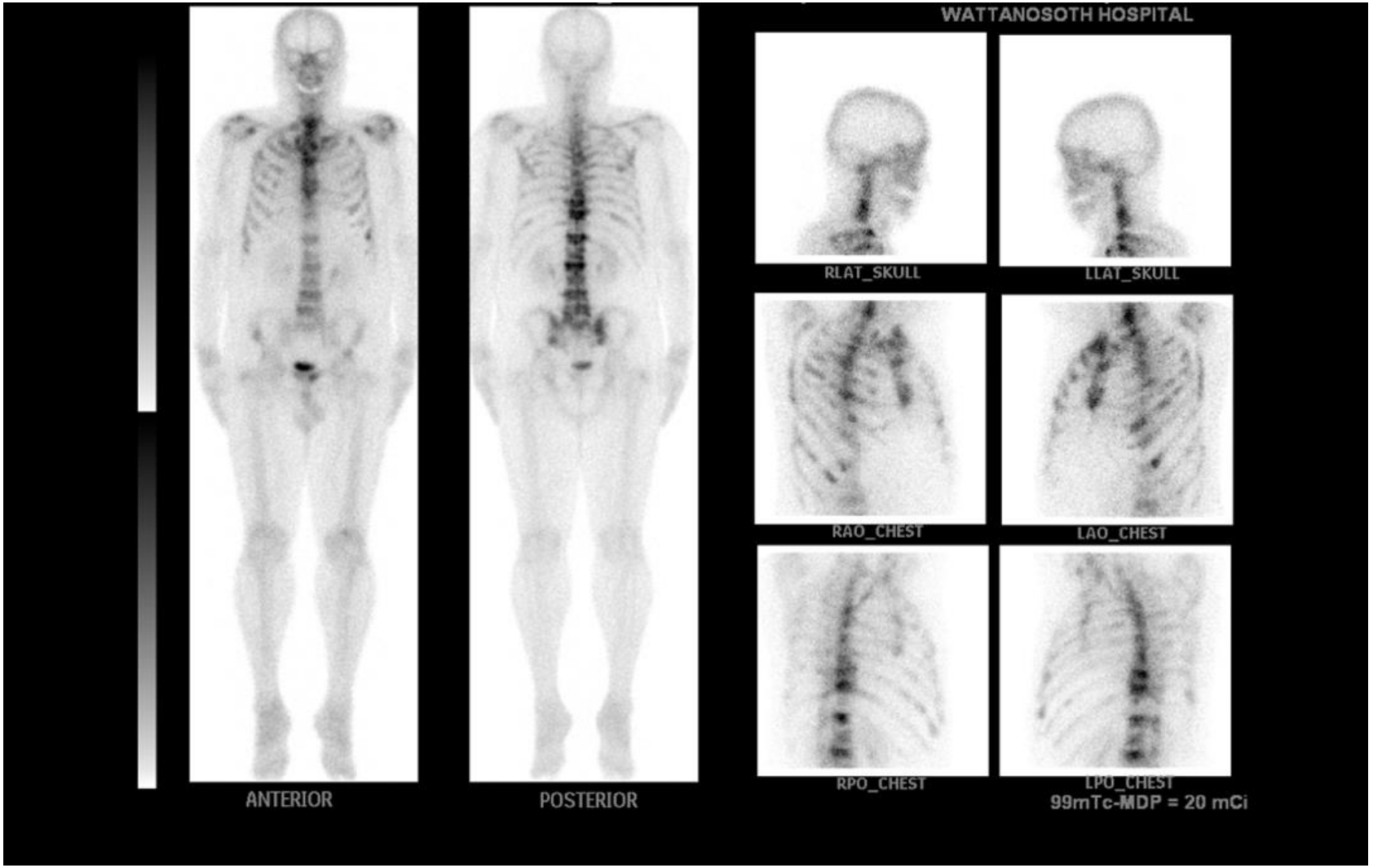
After RT



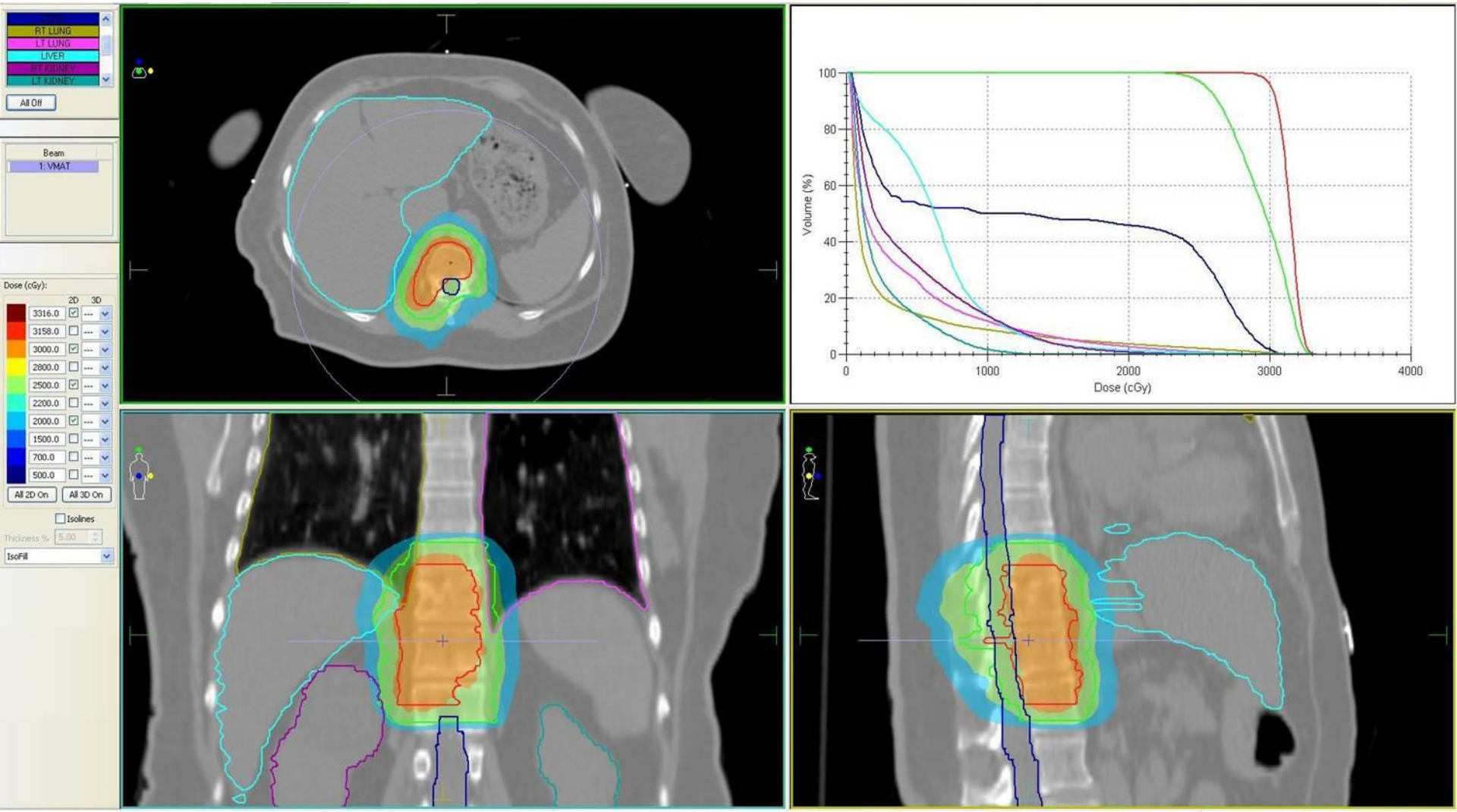
CA Prostate with diffuse bone metastasis , Feb 2012



Bilateral Orchidectomy and RT to T10-12 L2-3 , Feb 2013



Palliative RT to T10-12
IMRT / SBRT



Brain Metastasis

Brain Metastasis

- An autopsy found 10-30% of cancer patients have brain metastasis
- Brain metastasis common from :-

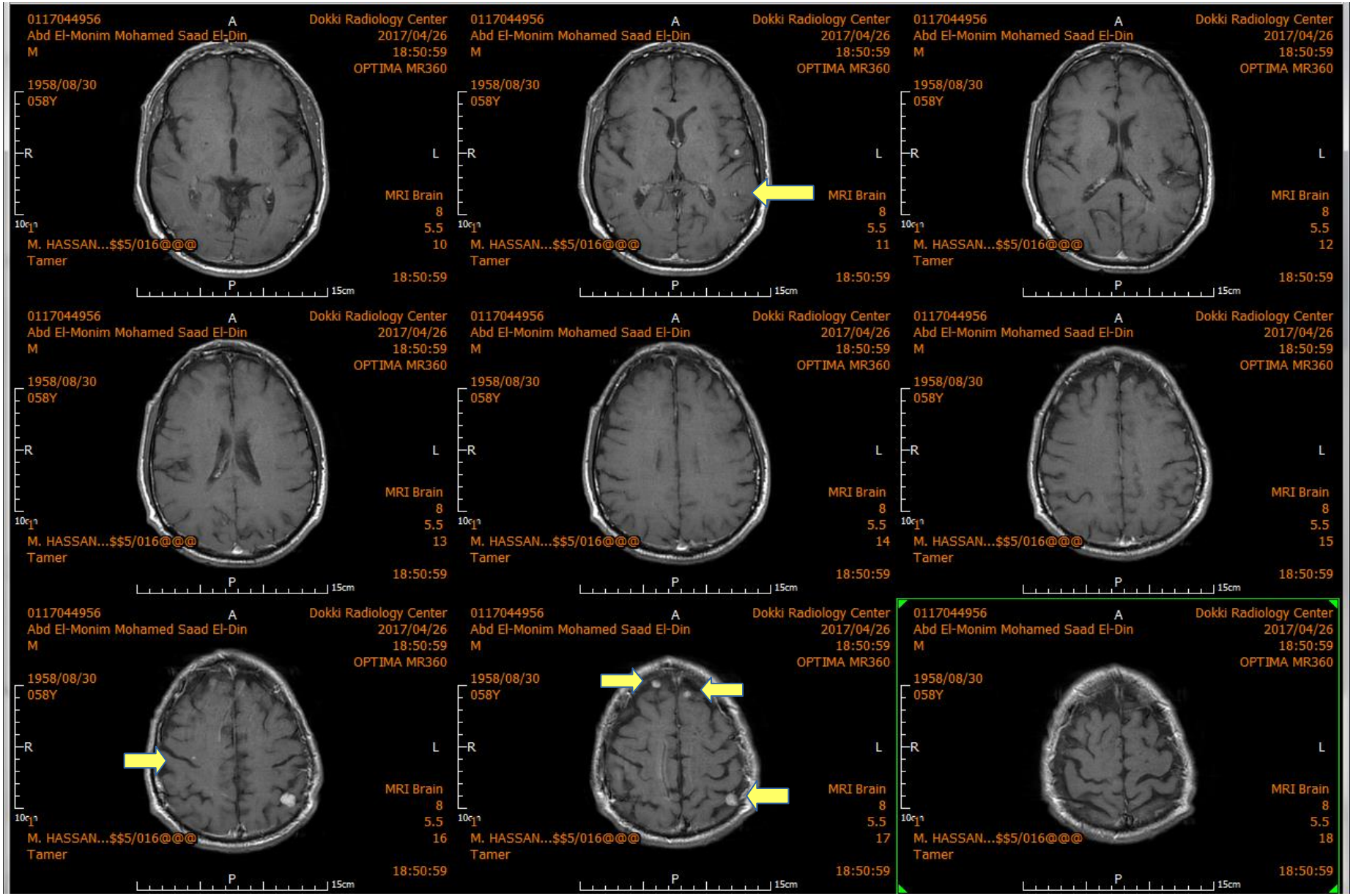
Lung	34 %
Breast	30 %
Melanoma	72 %

Radiation Therapy for Brain Metastasis

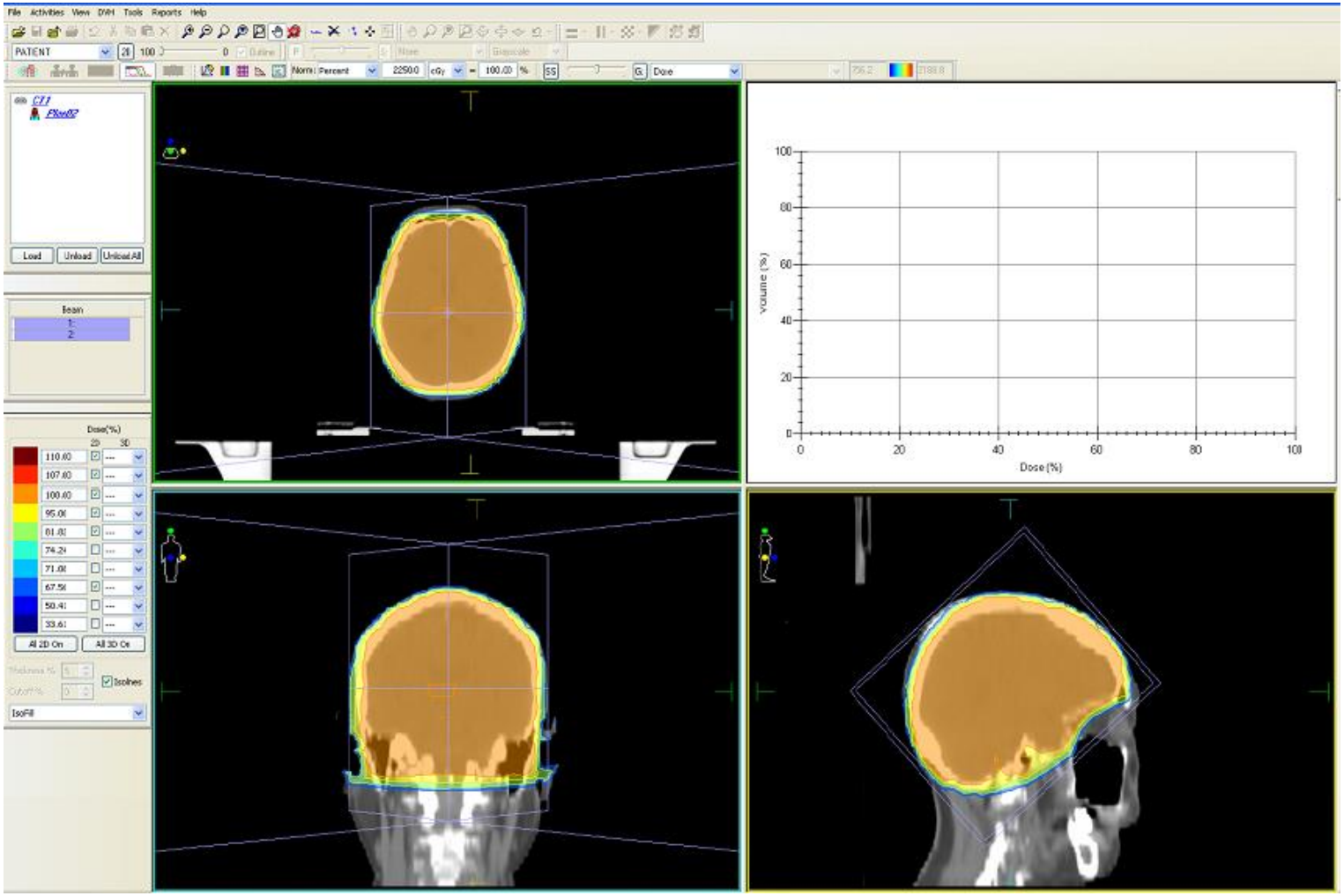
- Radiation techniques :-

1. Whole brain radiation (WBRT) :- 20Gy/5F , 30Gy/10F , 37.5Gy/15F
2. Stereotactic Radiosurgery (SRS) :- single high dose fraction 18-24 Gy
3. Stereotactic Radiotherapy (SRT) :- 25-30Gy/5-6F (5-6Gy/F)
4. Combine WBRT+/- SRS

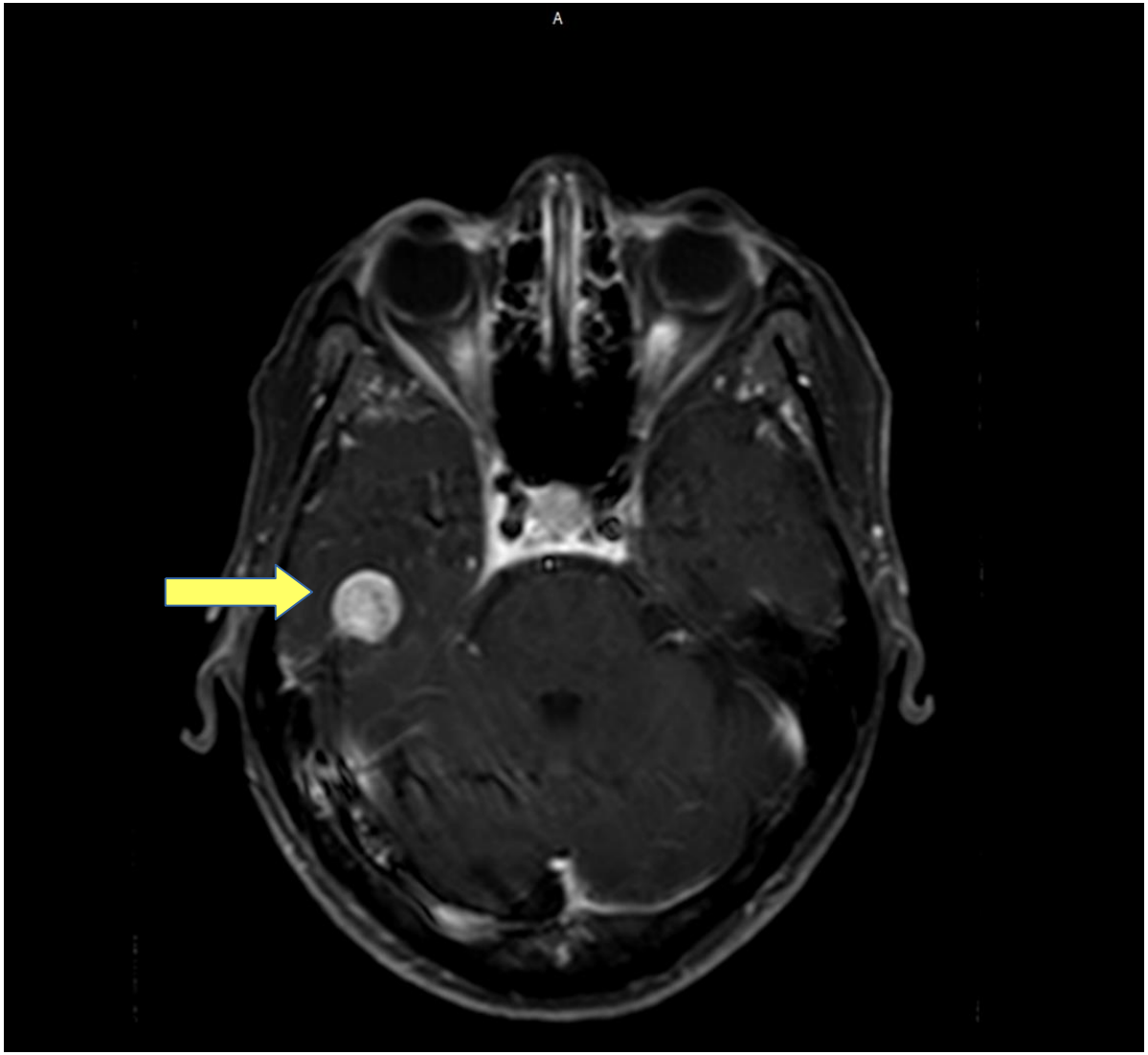
Multiple brain metastasis



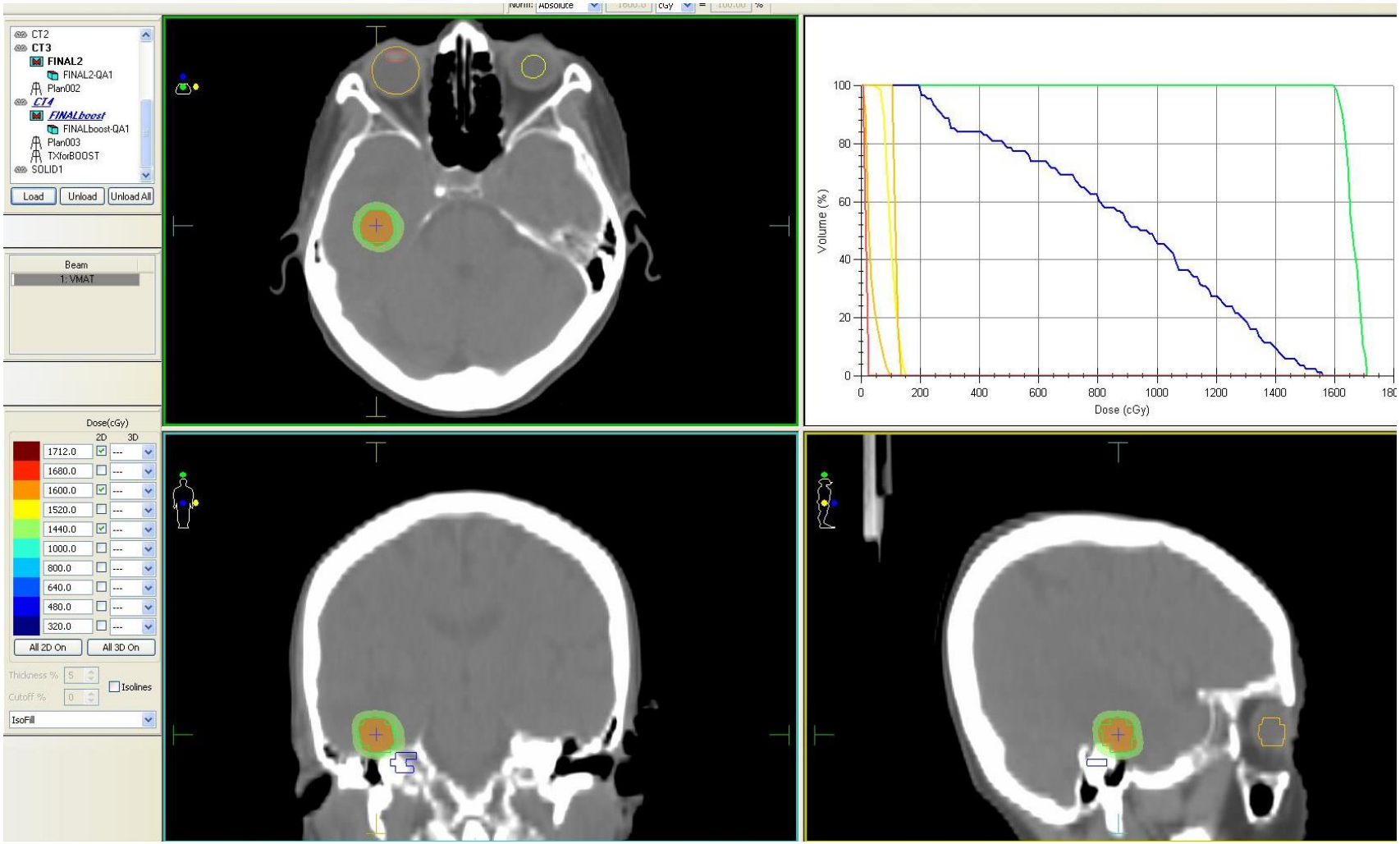
Whole Brain Radiation



Single brain metastasis

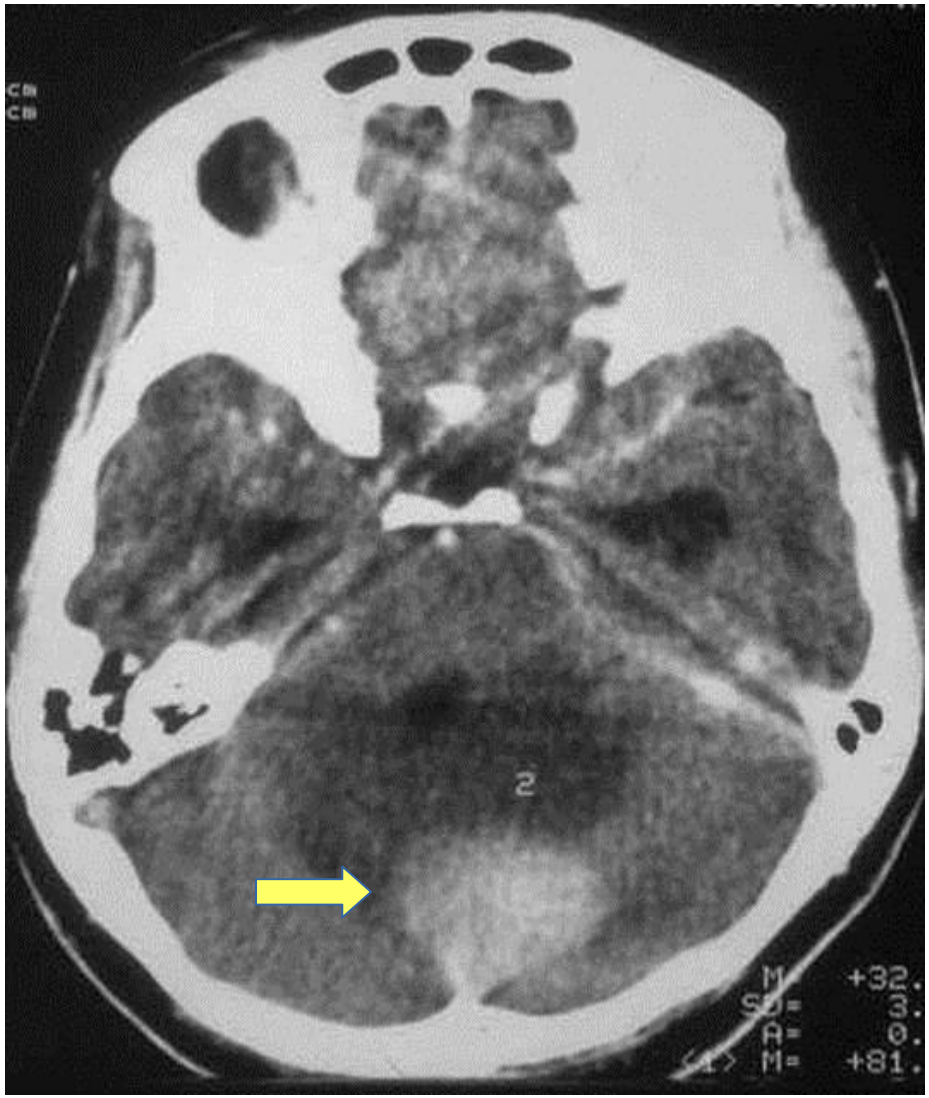


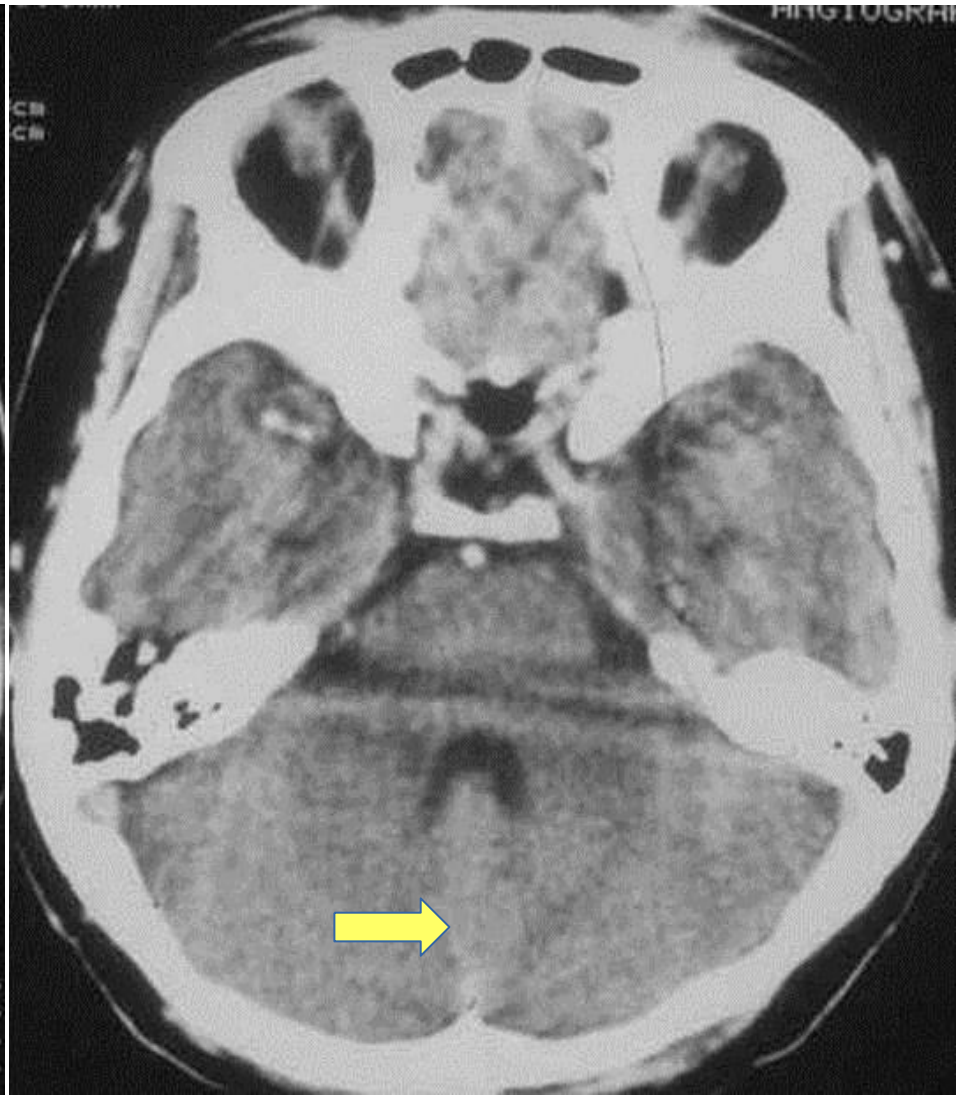
SRS/SRT


CT2
CT3
FINAL2
FINAL2-QA1
Plan002
CT4
FINALboost
FINALboost-QA1
Plan003
TXforBOOST
SOLID1
Load
Unload
Unload All
Beam
1: VMAT
Dose(cGy)
2D
3D
1712.0
1680.0
1600.0
1520.0
1440.0
1000.0
800.0
640.0
480.0
320.0
All 2D On
All 3D On
Thickness %
Cutoff %
Isolines
IsoFill
Volume (%)
Dose (cGy)
0
20
40
60
80
100
200
400
600
800
1000
1200
1400
1600

Before RT

After RT

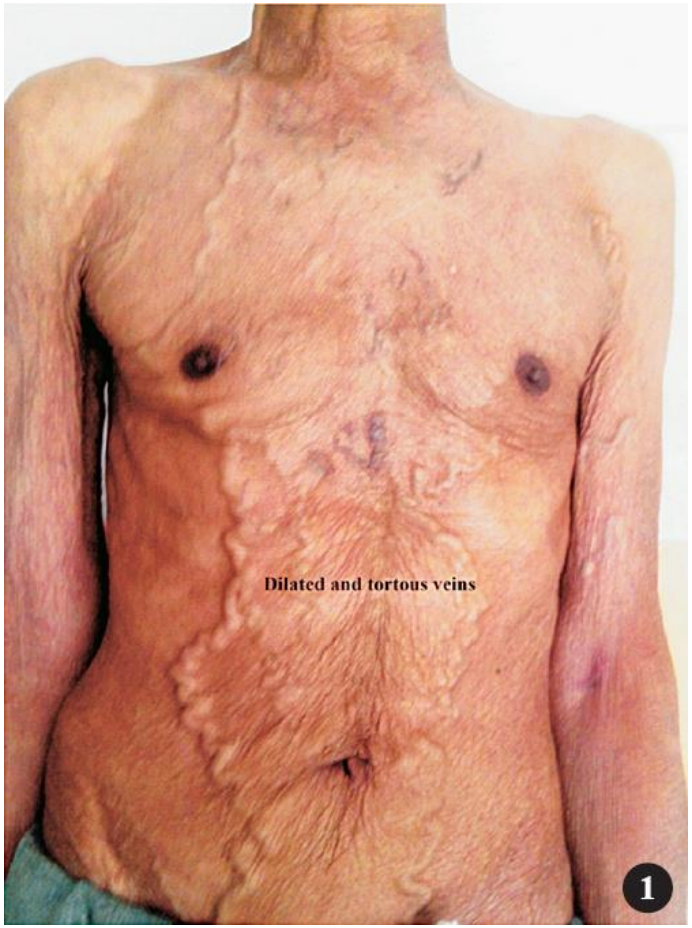




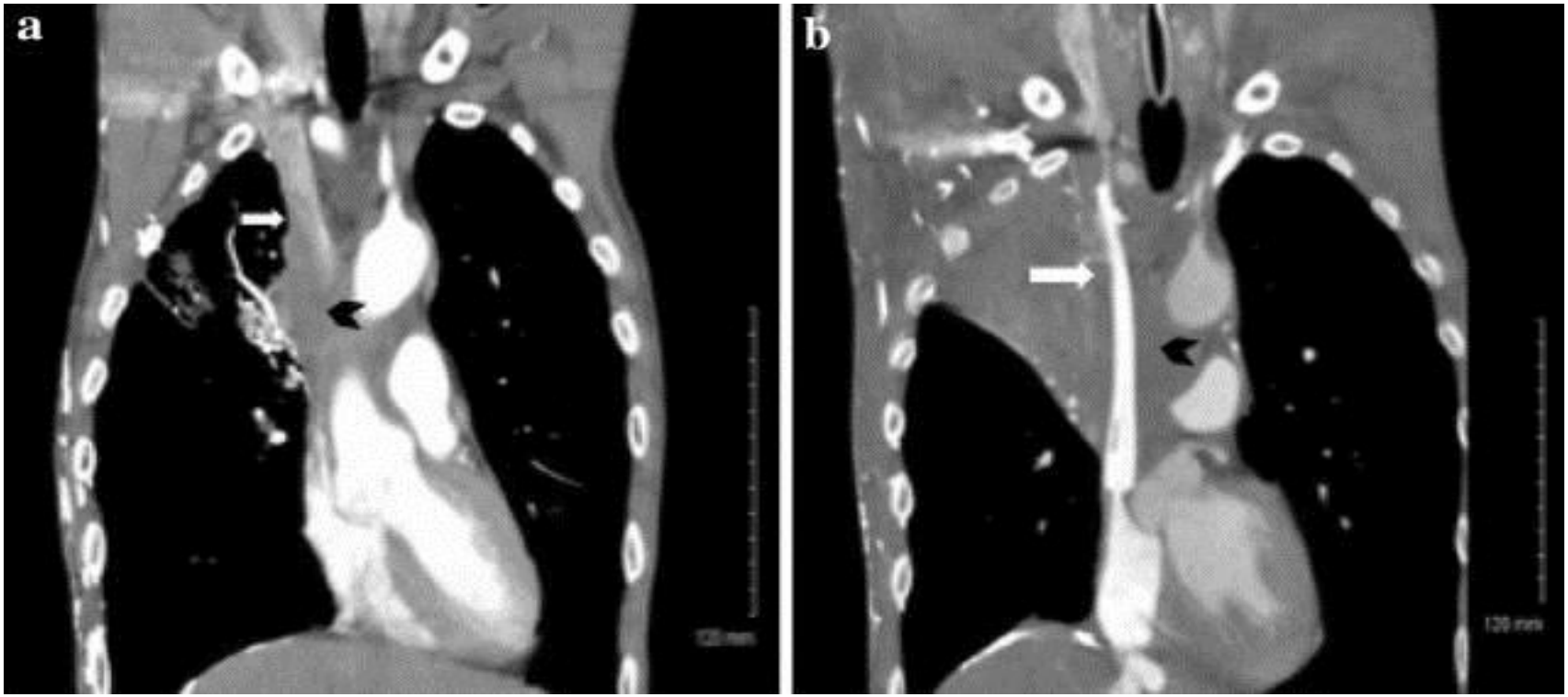
Superior Vena Cava Obstruction

(SVCO)

Superior Vena Cava Obstruction (SVCO)



Large mediastinal mass causing SVCO



Before RT

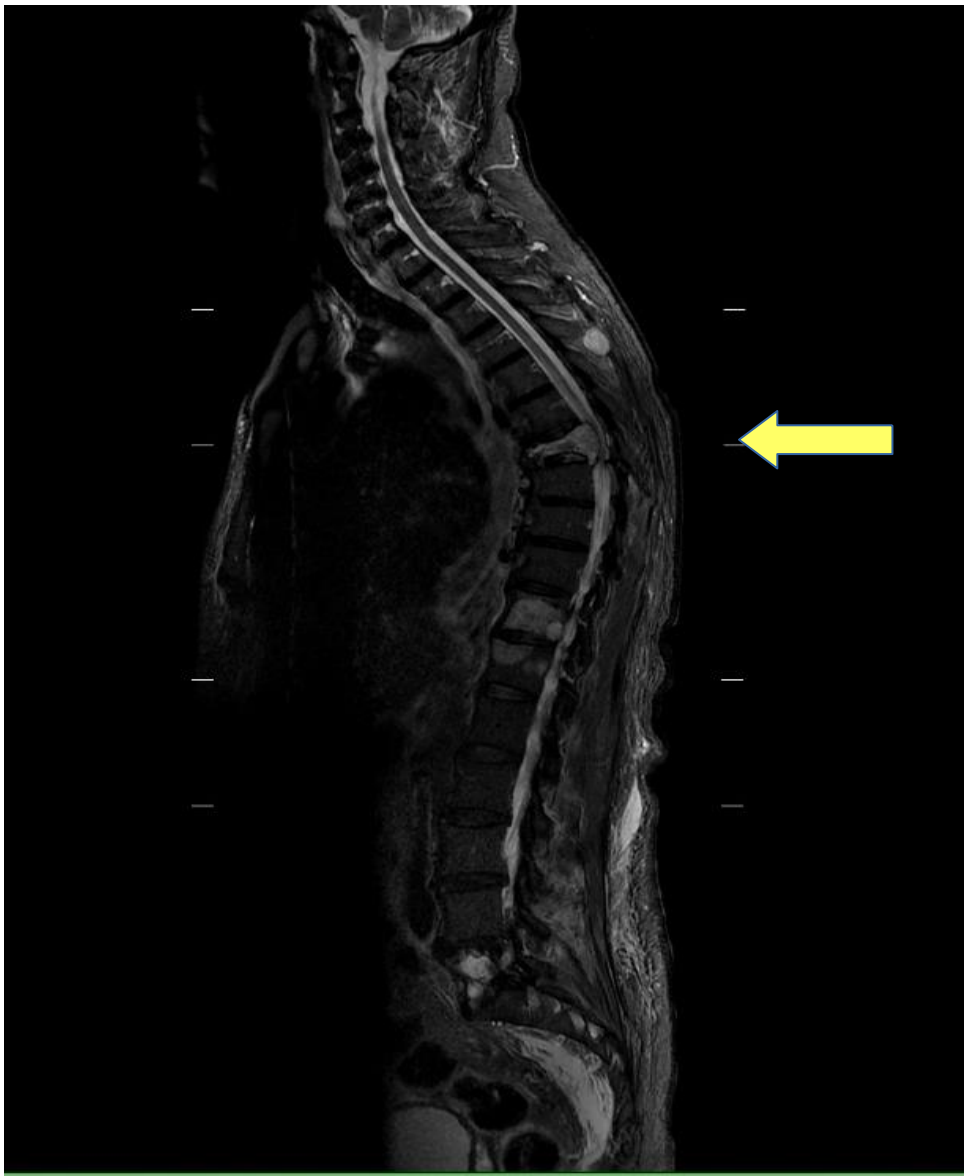
After RT

Spinal Cord Compression

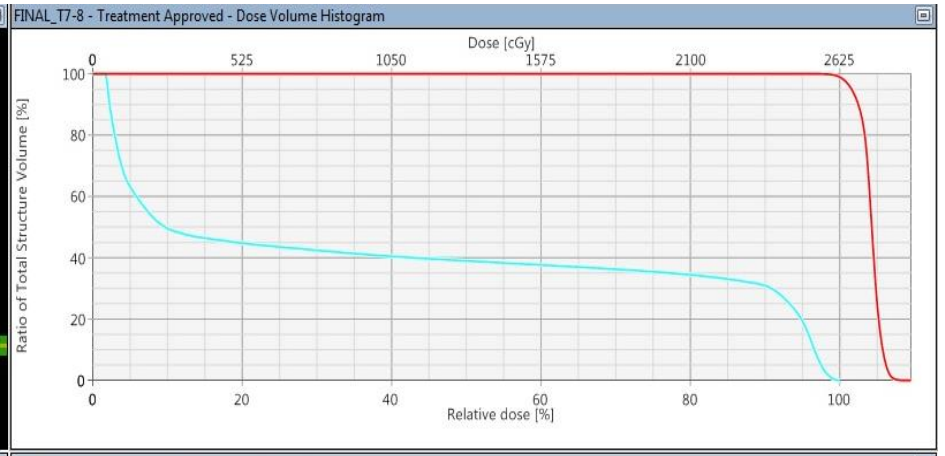
- 5-10% of patients with cancer
- The most debilitating complications
- Most common from :- lung, Breast, Prostate

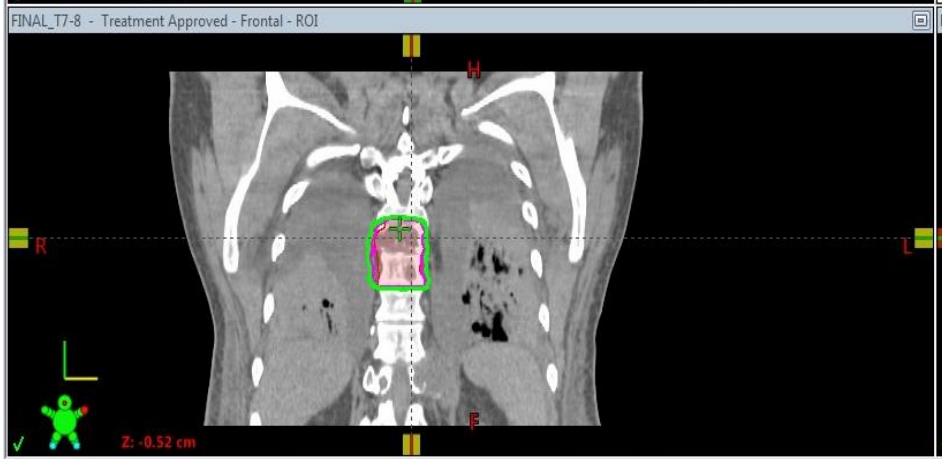
- Treatment :-
- External beam radiation (EBRT)
- Surgical decompression/fixation follow by EBRT

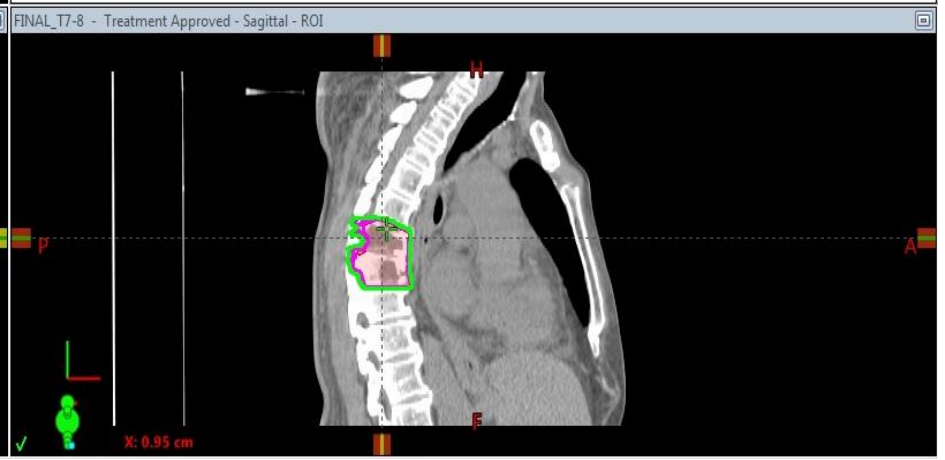
Ca Thyroid with bone metastasis and T-7 cord compression




FINAL_T7-8 - Treatment Approved - Transversal - ROI
Isodoses (%)
110.0
107.0
100.0
95.2
A
R
L
P
Y: -0.60 cm


FINAL_T7-8 - Treatment Approved - Dose Volume Histogram
Dose [cGy]
0
525
1050
1575
2100
2625
Ratio of Total Structure Volume [%]
100
80
60
40
20
0
0
20
40
60
80
100
Relative dose [%]


FINAL_T7-8 - Treatment Approved - Frontal - ROI
H
R
L
F
Z: -0.52 cm


FINAL_T7-8 - Treatment Approved - Sagittal - ROI
H
P
A
F
X: 0.95 cm

Advanced/Recurrence Cancer

- Causing :-

- Pain
- Bleeding
- Ulceration
- Compression

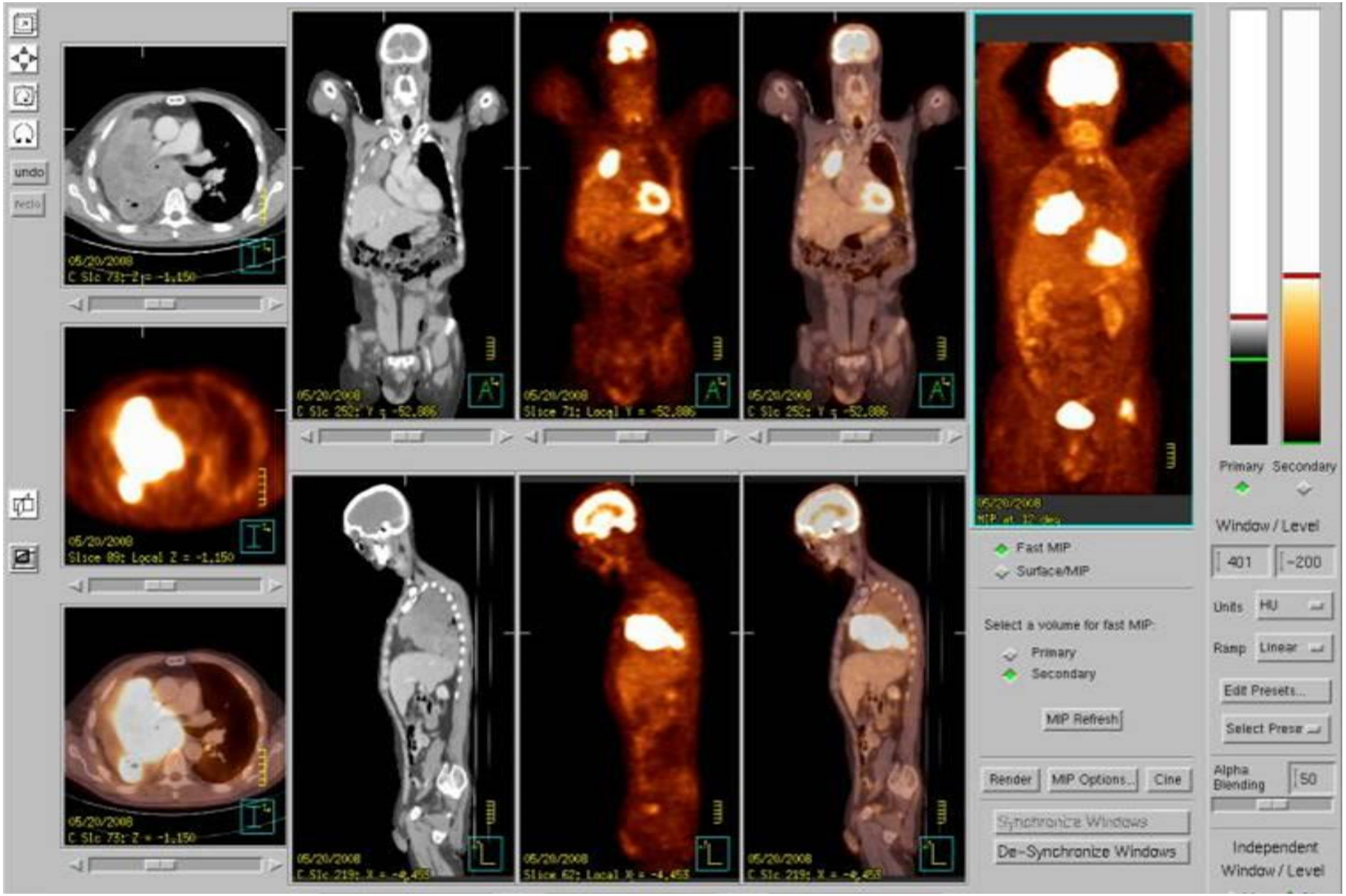
Before RT

After RT

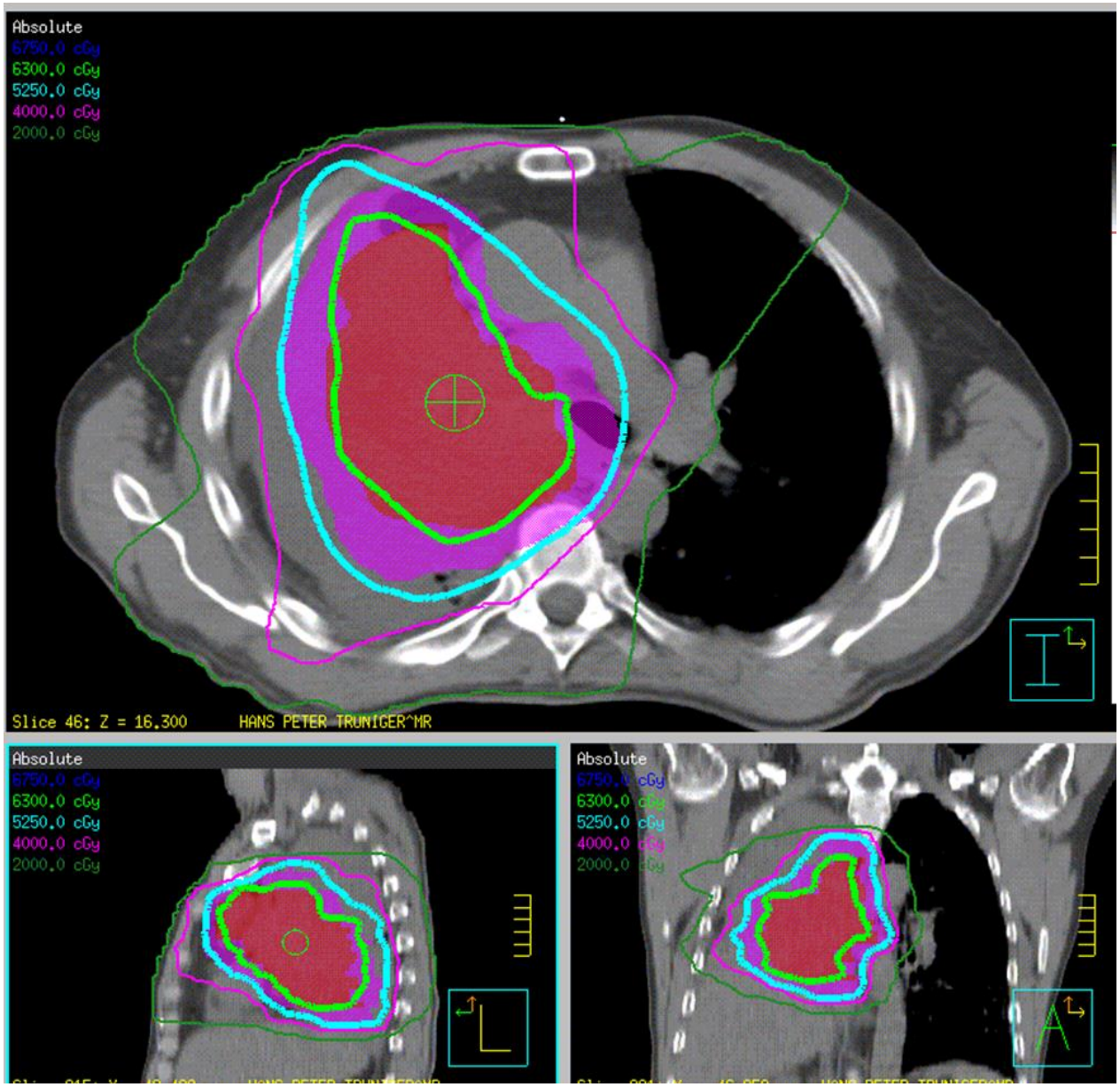



CA Lung with Obstruction

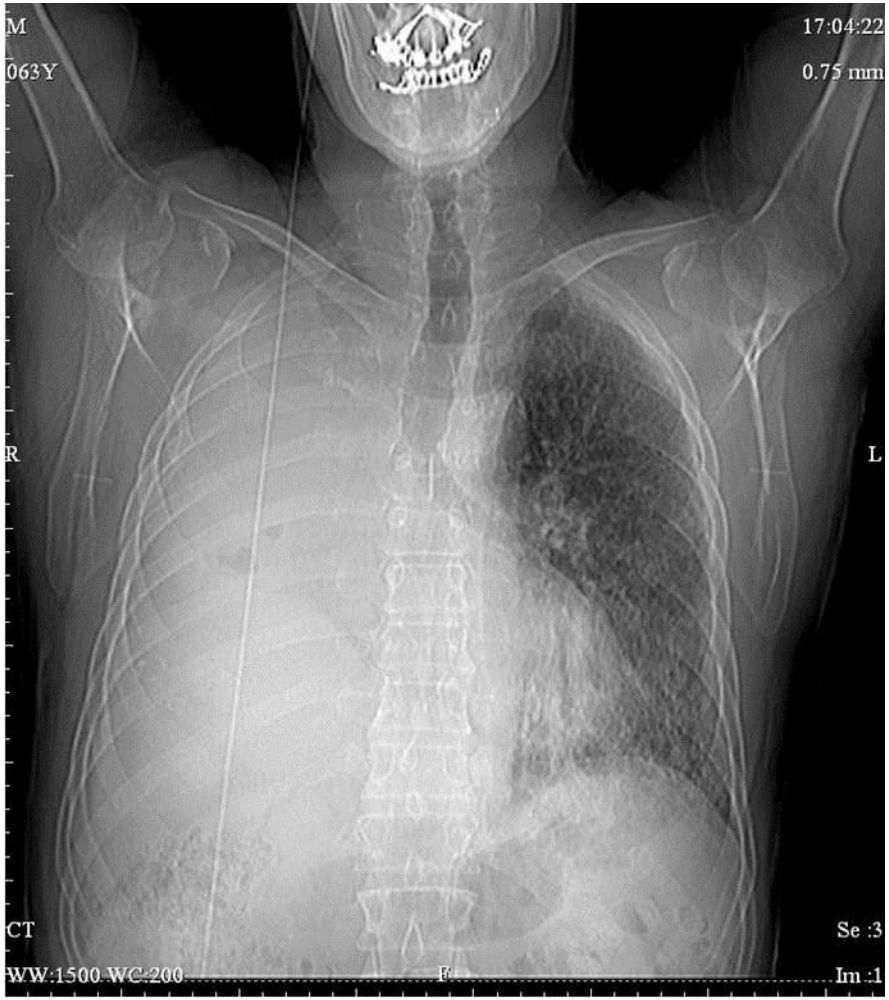
PET/CT Large right lung mass with atelectasis



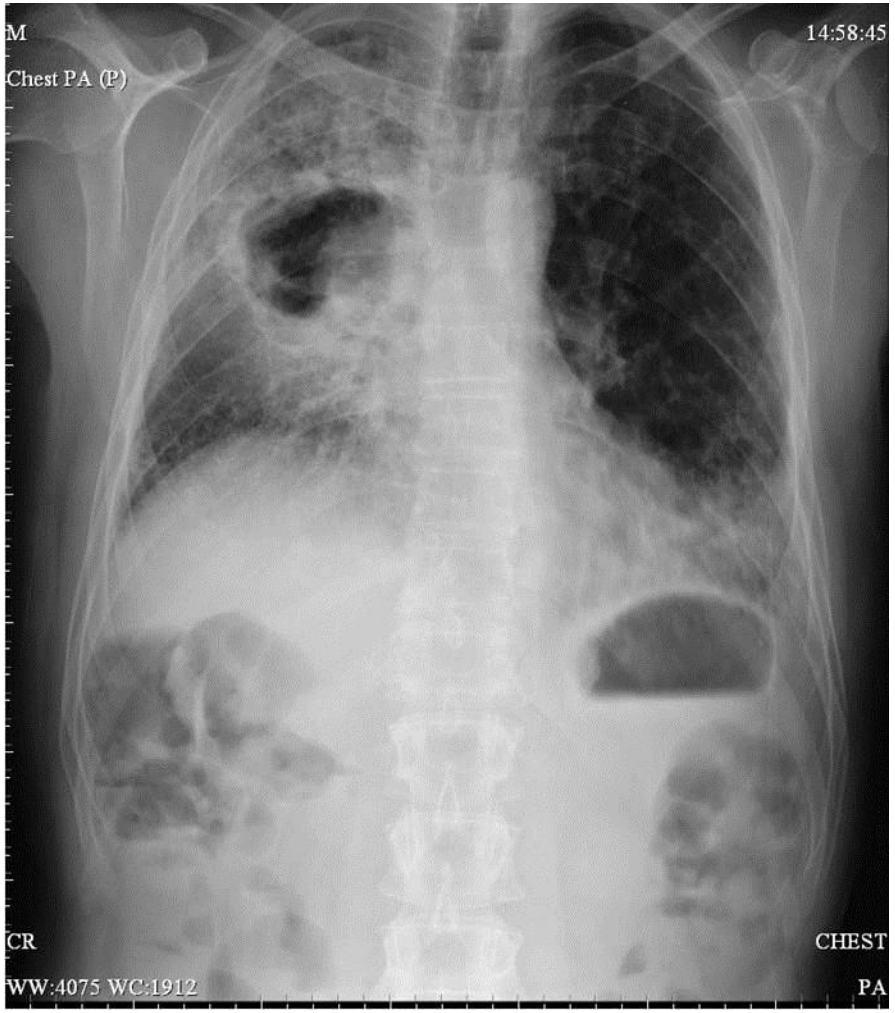
Palliative radiation IMRT



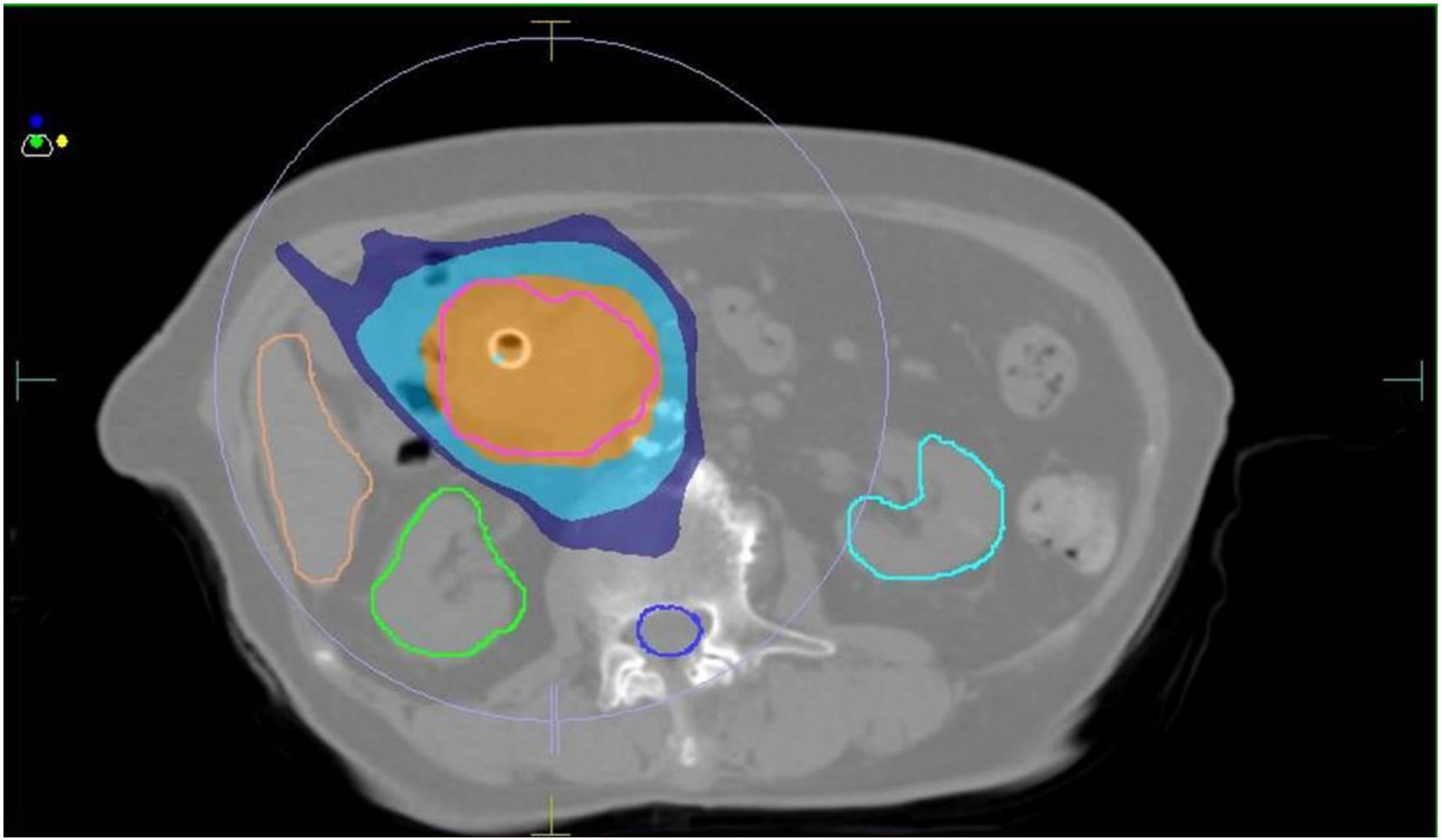
Before RT



After RT



Inoperable CA Pancreas(VMAT)



Radiotherapy and Immume effect

Biological Process

- Cellular senescence is now recognized as a potent tumor-suppressive mechanism that arrests the growth of cells at risk for malignant transformation
- Cellular senescence can be induced by X-ray and chemical agents.
- Different senescence states can cause downregulated or upregulated.

Prolong Radiation Exposure

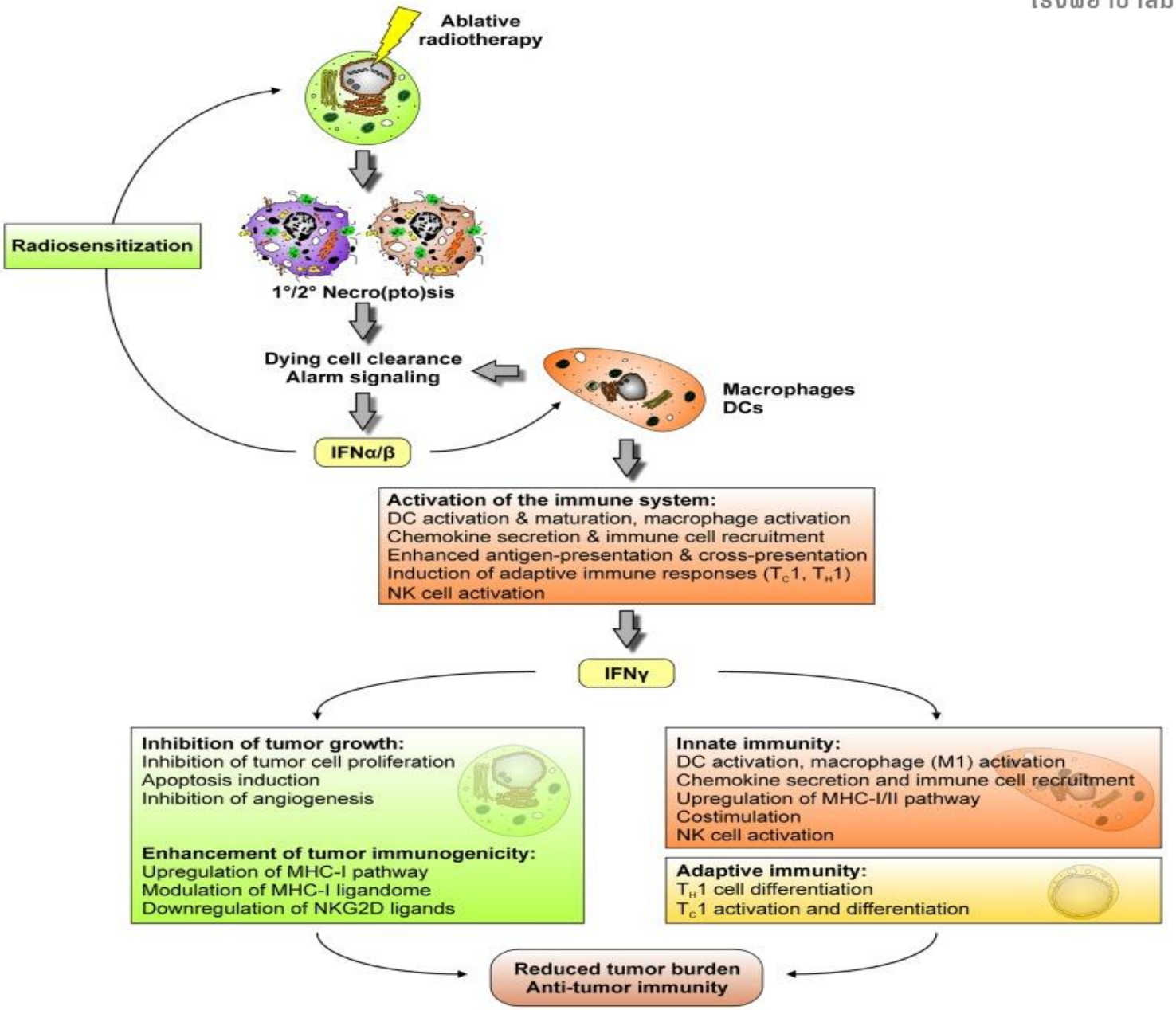
- Multiple fractions of low dose RT depleted T effector cells , there by reversing any potential benefit of radiation as an “ Immune Vaccine”
- The synergy between an altered microenvironment and the genetic alterations acquired by tumor cells allows these cells to evade preventive mechanism and become fully malignant.

SRS/SBRT and Immune-stimulation

- RT can eradicate inhibitory tumor-infiltrating T regulatory cells which dampen the immune response :- eradication of T regs allows tumor killing by T effector cells
- High Dose RT can cause rapid cell death , releasing neoantigens and mounting an immune response and newly-primed T effector cells.

The immunomodulatory effects of RT

- RT cause the releases tumor antigen and can modulate immunological pathway , leading to increased tumor antigen presentation , priming of tumor-specific cytotoxic T cells , as well as enhanced T cell homing , engraftment and function in tumors.
- CA Cancer J Clin 2017; 67 : 65-85



Radiotherapy and Immume effect

- The Abscopal Effect
- Ab = far away from
- Scopos = target

The Abscopal Effect

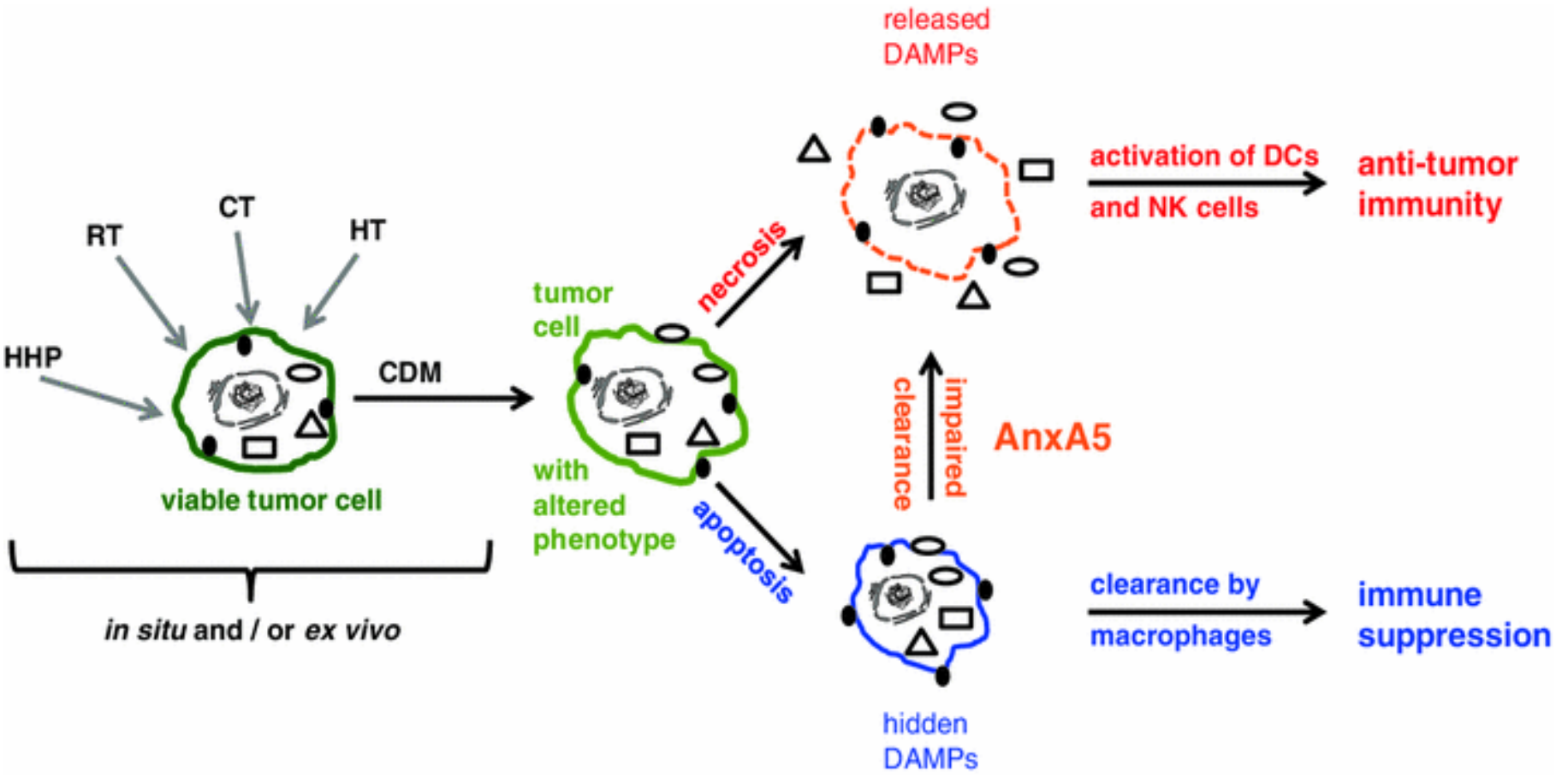
- Radiotherapy induces inflammation which induces an immune response
- Radiotherapy has preclinical and clinical data suggesting an immunostimulation effect
- Tumor regression out side of the irradiated fields

- Summary:-
- The accumulation evidence suggests that the success of radiotherapy does not only derive from direct cytotoxic effects on the tumor cells alone , but also depend on innate adaptive immune responses , which can target tumor cells that survive local irradiation.

- Frontiers in Oncology
- Sep 2013 Volume 2 Article 116 ,p1-14

- Summary:-

- Ionizing radiation induce DNA damage and result in direct tumor cell death.
- RT not only contributes to local control of the target lesions , but may result in the control of metastases distant to the treatment site-----→Abscopal Effect, the systemic effects of radiation on " Out-of-Field" tumor effect.
- CA Cancer J Clin 2017;67: 65-85




BrainLAB

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