

Break

Return at 10:35

Radiation 101



Radiation Delivery Approaches



Radiation therapy can be given in 3 ways:

External Beam Radiation

Internal Radiation

Systemic Radiation



The type of radiation administered depends on the type of cancer being treated and where it is

In some cases, more than one type is used



External Beam Radiation

External beam radiation is the most common type of radiation therapy used for cancer treatment
A machine is used to aim high-energy rays (or beams) from outside the body into the tumor

Types of External Beam Radiation Therapy

- ✱ 3D conformal radiation
- ✱ Image-guided radiation therapy (IGRT)
- ✱ Intensity-modulated radiation therapy (IMRT)
 - ✱ Stereotactic radiosurgery (SRS)
- ✱ Stereotactic body radiotherapy (SBRT)

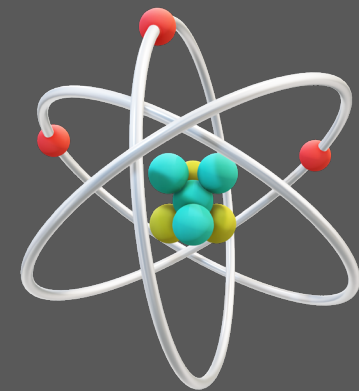


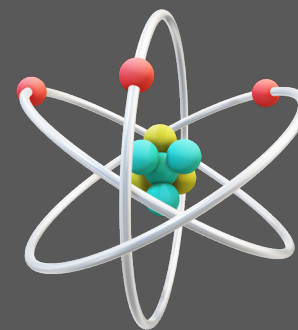
Linear Accelerators

A **medical linear accelerator** (LINAC) is the device most commonly used for external beam radiation treatments (EBRT) for patients with cancer

It delivers high-energy x-rays (aka, photons) or electrons to the region of the patient's tumor

- ⚡ Used in 90% of all radiation treatment
- ⚡ Uses Photons and Electrons



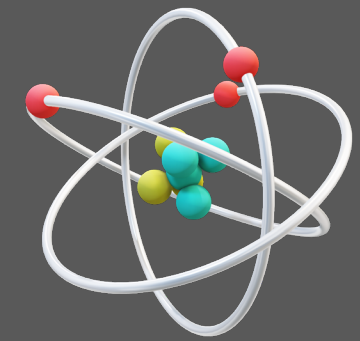


PHOTON BEAMS

Referred to as: **X or MV**

- ⦿ Photon radiation therapy is the *most commonly used* form of radiation oncology
- ⦿ When the treatment summary refers to beam energy with **X or MV** (example, 6X, 12MV)
 - ⦿ Treatment Modality should be coded to **02: External Beam, photons**





ELECTRON BEAMS

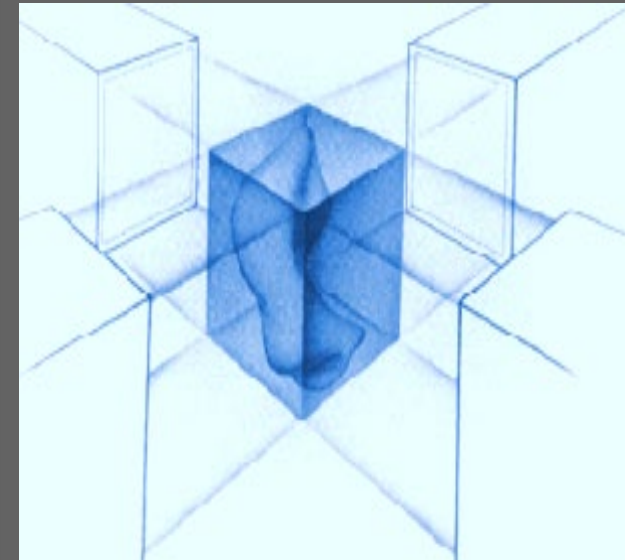
Referred to as : **E, eboost, MeV and “en face”**

- ⦿ Electrons have become a viable option in treating superficial tumors up to a depth of about 5 cm
- ⦿ Electron depth dose characteristics are unique in that they produce a high skin dose but exhibit a falloff after only a few centimeters.
- ⦿ **Common uses:** The treatment of skin lesions, such as basal cell carcinomas, and boosting of areas that have previously received photon irradiation, such as the postoperative lumpectomy or mastectomy scar in breast cancer patients, as well as select nodal areas in the head and neck.
- ⦿ RT treatment summary refers to beam energies using **E, eboost, MeV, or “en face”**
 - ⦿ Treatment modality will be assigned: **(04: external beam, electrons)**



2D Radiation Therapy

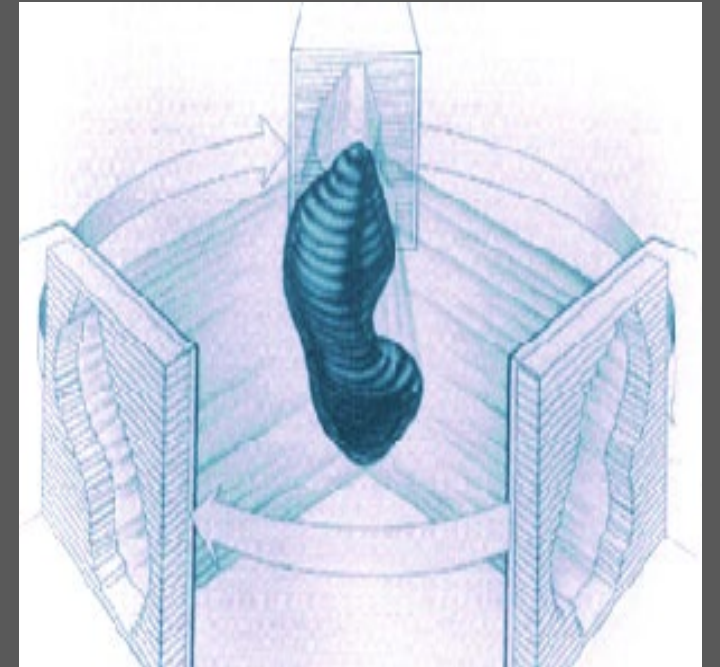
- ❁ **Conventional (2D) radiation therapy** refers to the old techniques of radiation therapy
- ❁ Treatments planned using a limited number of beams with the boundaries outlined from the patient's x-rays
- ❁ Replaced by other conformal external beam radiation therapies, which use CT images to plan the treatment
- ❁ Though 2D radiotherapy is now rarely used, it still has a role in **urgent and/or palliative** treatments which use generous margins and where the simplicity of the planning process allows same-day treatment



3D Conformal

3D conformal radiation therapy is a cancer treatment that shapes the radiation beams to match the shape of the tumor

- Uses the targeting information to focus precisely on the tumor, while avoiding the healthy surrounding tissue
- This exact targeting makes it possible to use higher levels of radiation in treatment thus, is more effective in shrinking and killing tumors
- Imaging equipment used to take a 3D image of the tumor will analyze the shape of the tumor, and radiation beams are conformed to the shape of the tumor



Field-in-Field and E-comp

Electronic tissue compensation (eComp) is an external beam planning technique allowing user to manually generate dynamic beam fluence to produce more uniform or modulated dose distribution

- ⦿ Electronic compensator designed for curved surfaces
- ⦿ Results in a plan customized to the patient's body outline
- ⦿ Particularly helpful in the treatment of breast cancer

Field-in-Field (FIF) or (FnF), this technique uses several less-weighted fields with a small field size to optimize dose distribution

Widely used in whole breast irradiation

CODING TIP

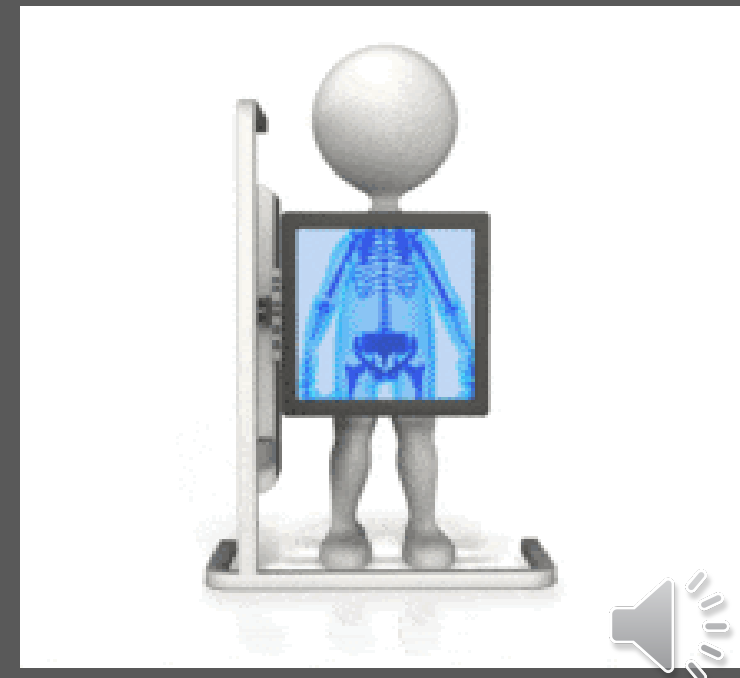
When the treatment summary states FnF or e-comp: **Planning Technique coded: 04-3D conformal** (Unless stated otherwise, IMRT)



Image-Guided Radiation Therapy (IGRT)

Image-guided radiation therapy (IGRT) is the use of x-ray images taken immediately before, during or after radiation therapy treatment session to improve the accuracy and precision of treatment

- IGRT may be used in conjunction with other radiation therapy treatments, including:
 - Three-dimensional conformal radiation therapy
 - Intensity-modulated radiation therapy
 - Volumetric modulated radiation therapy
 - Stereotactic radiosurgery
 - Stereotactic body radiation therapy
 - Gated radiation therapy
 - Adaptive radiation therapy



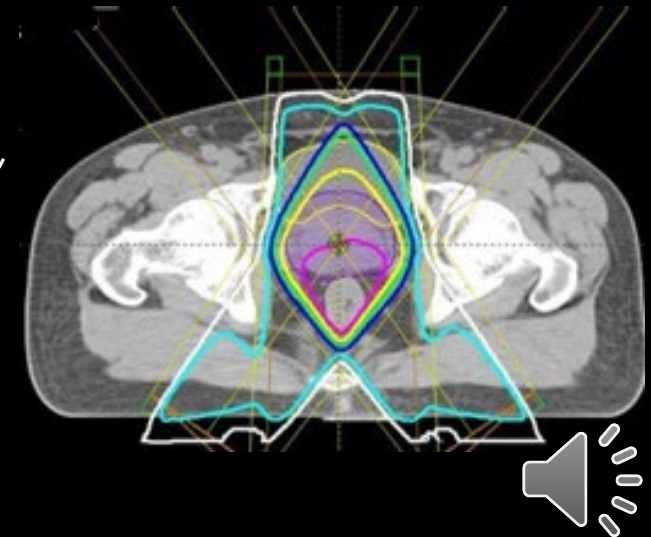
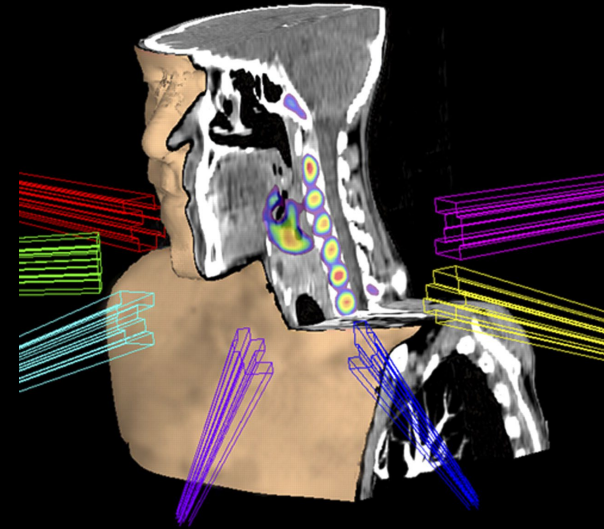
Intensity-Modulated Radiation Therapy (IMRT)

- ☢ IMRT is an advanced form of 3D Conformal Radiotherapy
- ☢ IMRT uses the same type of radiation as other radiation therapy treatments
- ☢ Uses multiple beams with varying intensities, delivering the highest dose to the tumor while minimizing exposure to surrounding tissue
- ☢ Shields move while the radiation beam is on, allowing the amount of radiation dose to be varied
- ☢ Using many beams from different directions, allows the radiation dose to be sculpted even more precisely, following the shape to “paint” the radiation dose onto the tumor
- ☢ IMRT is used in conjunction with image-guided radiation therapy (IGRT), where imaging is done before treatment, ensuring accuracy of treatment delivery



IMRT Targeted Cancers

- Head and neck cancers, as well as prostate cancer are most commonly treated using IMRT, in part because these tumors tend to be located close to critical organs and tissues in the body
- Can also be used to treat lung cancer, brain cancer, gastrointestinal cancers, and breast cancer.
- It may also be used to treat lymphoma, sarcoma, gynecologic cancers, and select pediatric cancers



Volumetric Modulated Arc Therapy (VMAT)

Rotational Therapy

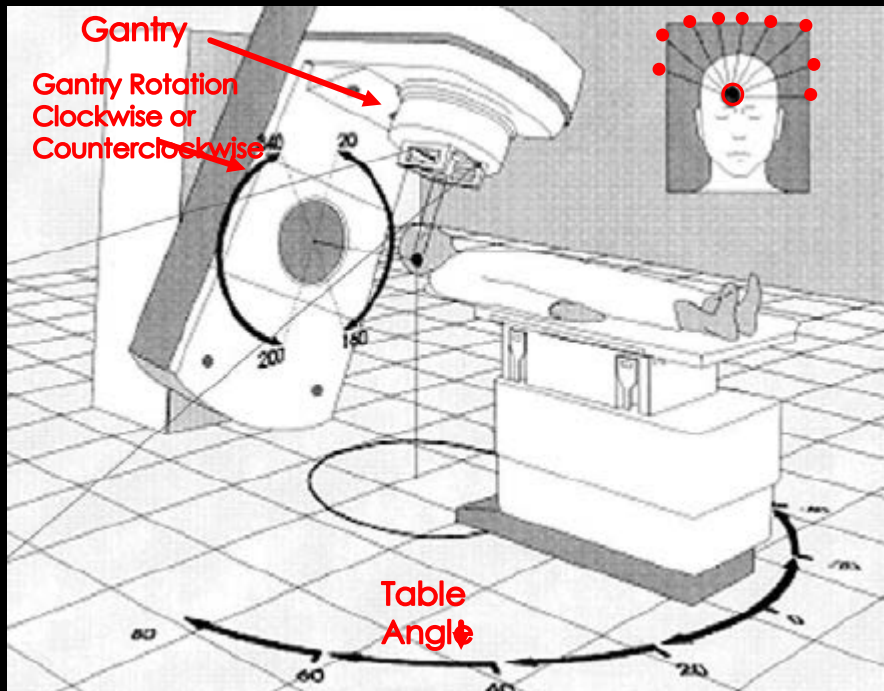
- ⦿ An advanced form of IMRT
- ⦿ VMAT works similarly to intensity-modulated radiation therapy (IMRT) in the way the radiation dose is varied throughout treatment
- ⦿ Delivers the radiation dose continuously as the treatment machine rotates Accurately shapes the radiation dose to the tumor while minimizing the dose to the organs surrounding the tumor
- ⦿ VMAT is particularly useful for delivering radiation therapy to tumors near sensitive body organs and can be an effective treatment for many types of cancer.

Coded: **05-Intensity modulated therapy**



VMAT

Understanding the Treatment Plan Information

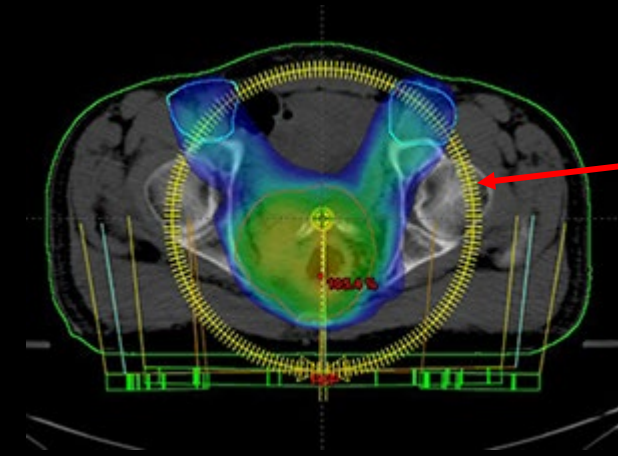


VMAT Machine

Table 2 Gantry, collimator, and couch angles for the coplanar and non-coplanar VMAT beam arrangements

Beam name	Gantry (degree)	Collimator (degree)	Couch (degree)
Coplanar beam arrangement			
V1	CW181-180	45	0
V2	CCW180-181	45	0
V3	CW181-180	45	0
V4	CCW180-181	45	0
Non-coplanar beam arrangement			
V1	CW181-180	45	0
V2	CCW180-181	45	0
V3	CW181-180	45	0
V4	CCW180-181	45	0
V5	CW190-310	330	70

CW, clockwise; CCW, counterclockwise; VMAT, volumetric-modulated arc therapy.



Treatment Images: rotation/arc grid
Seeing this on a treatment image is an indicator that rotation therapy was used

Arc	Plan	Gantry start angle (°)	Gantry stop angle (°)	Gantry rotation direction	Table angle (°)
1	2-arc, 4-arc	181	179	Clockwise	0
2	2-arc, 4-arc	181	10	Clockwise	90
3	4-arc	10	181	Counterclockwise	45
4	4-arc	179	350	Counterclockwise	315

Treatment Plan Summary
Look for the gantry range of rotation/arc.
CW: Clockwise
CCW: Counterclockwise



Stereotactic radiosurgery (SRS)

Stereotactic radiosurgery is a type of radiation treatment that gives a large dose of radiation to a small tumor area

- Used for brain tumors and other tumors inside the head
- Despite its name, SRS is a non-surgical procedure
- Delivers precisely-targeted radiation at much higher doses, in only a single or few treatments
- Permits maximum dose delivery within the target while minimizing dose to the surrounding healthy tissue
- Once the exact location of the tumor is known from brain scans, radiation is sent to the area from many different angles
- The radiation is very precisely aimed to affect nearby tissues as little as possible



Stereotactic Body Radiation Therapy (SBRT)

Hypofractionation Treatment: A treatment schedule in which the total dose of radiation is divided into large doses and treatments are given once a day or less often

This is a specialized type of external beam radiation that allows highly precise delivery of high doses of radiation to small targets outside of the brain

How SBRT Differs from Conventional Therapy

- ⊛ Conventional therapy, radiation is delivered in relatively small doses over the course of several weeks, with patients receiving daily treatments during that time. (average dose per fraction is 180-200 cGy)
- ⊛ SBRT, delivers a greater combined dose of radiation over fewer treatments. Typically, treatment is completed in 3-5 treatments over the course of 1-2 weeks, opposed to the daily standard external beam radiation treatment.
 - ⊛ Example: 1200cGy x 3fx (400 cGy per fraction)

CODING TIPS

Treatment summary may refer to this planning technique as IMRT/VMAT/SBRT
Maybe used for certain lung, spine, and liver tumors.

Code: 06-Stereotactic radiotherapy or radiosurgery, NOS



Intraoperative Radiation Therapy (IORT)

Intraoperative radiation therapy (IORT), radiation treatment administered during surgery

- ⦿ Early Stage (I and II) and localized cancers
- ⦿ Administered directly into the cavity where the tumor has just been removed
- ⦿ Used to treat cancers that are difficult to remove during surgery
- ⦿ When there is a concern that microscopic amounts of cancer may remain



IORT Delivery Methods

External Beam Photons

Treatment Modality:

02: Photons

Planning Technique:

02: Low energy x-ray/photons

External Beam Electrons

Treatment Modality:

04: Electrons

Planning Technique:

03: 2-D therapy
04: 3-D conformal (in most cases)

Brachytherapy Intracavitary, HDR

Treatment Modality:

09: Brachytherapy

Planning Technique:

88: NA

- ⦿ Used in accelerated partial breast irradiation (APBI)
- ⦿ Seeds implanted during surgery



Electronic Brachytherapy eBx IORT

Equipment:

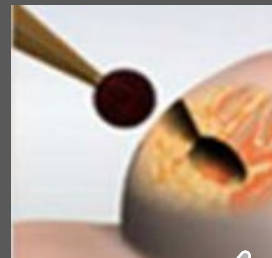
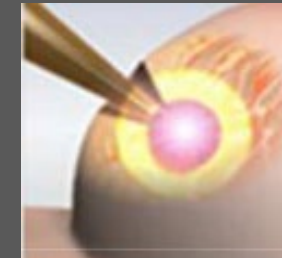
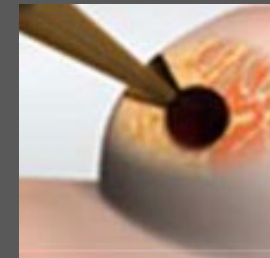
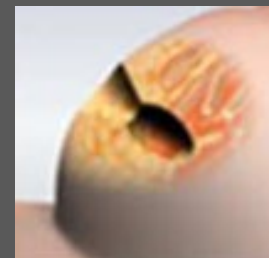
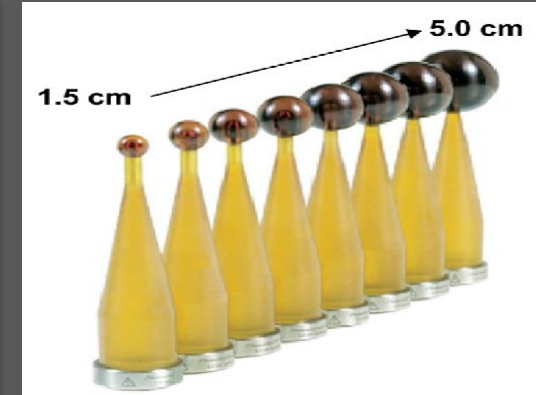
Zeiss Intrabeam

XOFT Axxent

Delivers low-energy photon therapy (50 kV range)

Modality code: 02-photons

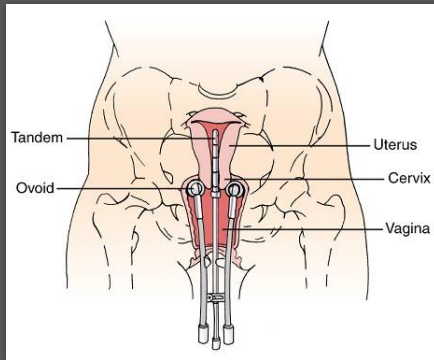
Planning technique: 02-Low energy x-ray/photon



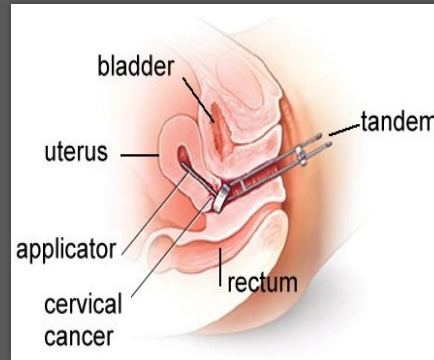
Brachytherapy - GYN Cancers

Uses intracavitary applicators

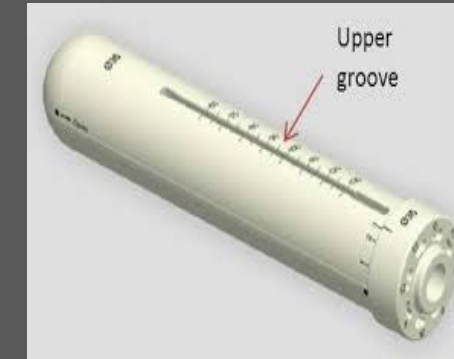
Tandem and Ovid (T&O)



Tandem and Ring (T&R)



Vaginal Applicator



T&O/T&R Usage:

Treats women who still have a uterus

- ⊕ Cervical Cancers
- ⊕ Endometrial Cancers when the patient is not a surgical candidate

Vaginal Applicator Usage:

Treats women who have had a hysterectomy

- ⊕ Uterine Cancer post hysterectomy
- ⊕ Cervical Cancer post hysterectomy
- ⊕ The radioactive material is placed in a tube in the vagina

Uses Isotopes

- ⊕ C-137 (LDR)
- ⊕ Ir-192 (HDR)
- ⊕ Dwell time ranges between just a few minutes-25 minutes



Vaginal Cuff Brachytherapy IR-192

Treatment Modality	09-Brachytherapy, Intracavitary, HDR
Planning Technique	88-NA
Treatment Volume	72-Vagina
RT to Draining Lymph Nodes	00-No RT to draining lymph nodes

Coding Tips!

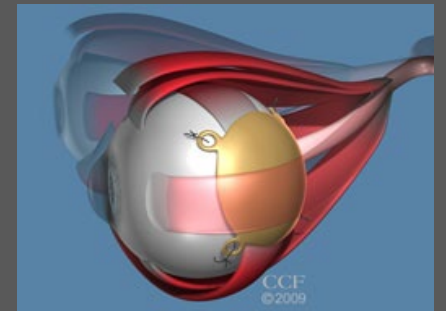
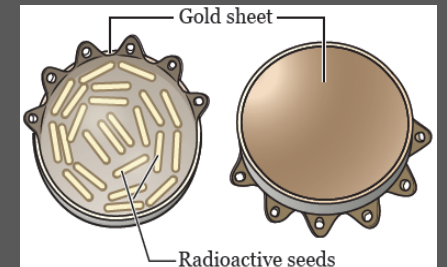
- ⚠ Brachytherapy is localized and irradiates small volumes thus, it does not include lymph nodes
- ⚠ If treatment summary states Brachytherapy-Vaginal Cuff, it will be coded to Intracavitary
- ⚠ If Interstitial and Intracavitary are delivered simultaneously, Code: **07-brachytherapy, NOS**



Plaque Radiotherapy

Episcleral plaque radiotherapy or episcleral plaque brachytherapy (EPBRT)

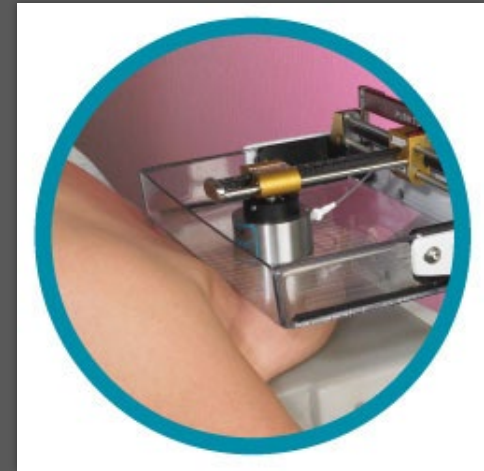
- ⚠ Used for the “eye-sparing” treatment for retinoblastoma (childhood eye cancer), choroidal melanoma and for metastatic tumors (that have spread from another part of the body to the eye)
- ⚠ Radiation source used for brachytherapy
- ⚠ Radioactive seeds (I-125) are placed in the plaque and is temporarily sewn to the eyeball over the tumor
- ⚠ The plaque gives off radiation constantly while in place on the wall of the eyeball
- ⚠ Once the plaque is removed, no radioactivity is left inside the body
- ⚠ A plaque is a small, gold covered, dish-shaped device
- ⚠ Plaques are custom made to the dimensions of the tumor, can range in size from 12 to 22 mm in diameter (about the size of a quarter)
- ⚠ Once the plaque is removed, no radioactivity is left inside the body
- ⚠ **Code: 07-Brachytherapy, NOS**



Accuboot

Non-invasive Breast Brachytherapy (NIBB)

- Delivers partial breast radiation therapy for Breast Conservation Therapy (BCT).
- Dose is delivered via Ir-192 HDR sources
 - The source is not implanted into the patient
 - Avoids having indwelling as used in intracavitary or interstitial breast brachytherapy, reducing complications/infection
- It employs a common platform to immobilize, image, target and deliver radiation to the tumor bed
- Mammography imaging to identify the tumor bed
 - The immobilization minimizes breast motion during treatment
 - Allowing for minimal margins and smaller treatment volumes
- Delivers a targeted and conformal dose to the tissue at risk under image guidance, precisely pinpointing the radiation field
 - Allows delivery of the full dose to the target tissue while exposure to healthy tissue
- Modality: Best choice is: **07, Brachytherapy, NOS**



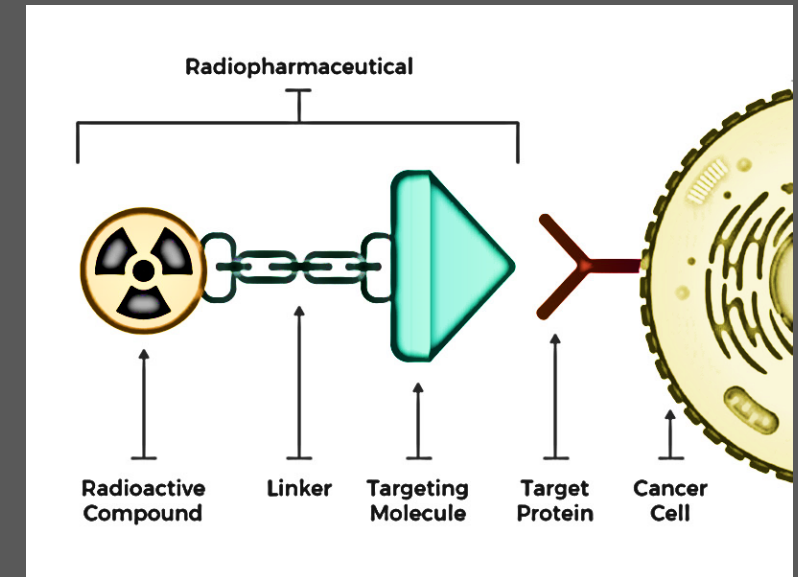
Radioisotopes

What is Radioisotope Therapy?

Precision treatment in which a radioactive drug compound seeks and destroys cancer cells

Benefits

- ⦿ Highly selective, it kills cancer cells while sparing healthy cells
- ⦿ Can be tailored to the unique biologic characteristics of the patient and the molecular properties of the cancer
- ⦿ Usually, all treatment is performed outpatient
- ⦿ Side effects are less than other forms of therapy



Radioisotopes

Use code 13-Radioisotopes, NOS for radioembolization procedures, (e.g., intravascular Yttrium-90 for cases diagnosed January 1, 2019 and later

Don't forget about codes 14, 15 and 16!

13	Radioisotopes, NOS
14	Radioisotopes, Radium-223
15	Radioisotopes, Strontium-89
16	Radioisotopes, Strontium-90



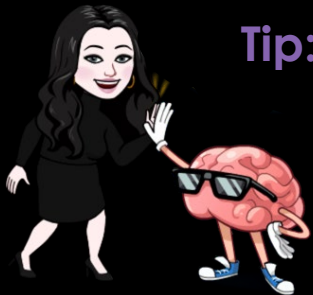
Brain

Whole vs Limited

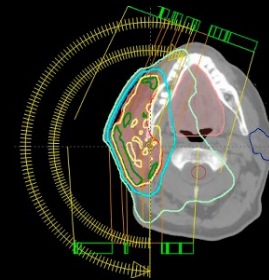
- Most all radiation administered to the brain will be EXRT/IMRT/VMAT
 - Treatment Volume Coded: 13 Brain-Limited**
- The whole brain is targeted when treating widespread brain metastases
 - In those cases, **Treatment Volume is Coded: 12-Brain**

And Remember: The brain does not have draining lymph nodes

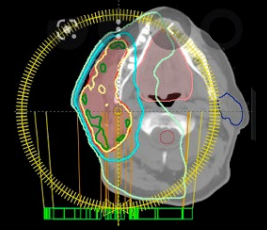
Tip: Look for the rotation arc/grid on treatment imaging



Limited

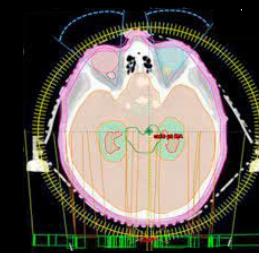


Partial arc grid



Complete arc grid that not encompass /surround the entire head

Whole



Complete arc grid that does encompass /surround the entire head



Get in the Know!

Know your facility!

- ⦿ Know what services your facility offers
- ⦿ Know what equipment they have
- ⦿ If your facility uses an outside source, know what they offer and what equipment they use



Coding Radiation



The Process

At the start of the radiation planning process:

- Physicians write radiation prescriptions
 - These prescriptions state the details of what is **intended**:
 - treatment volume(s)
 - dose per fraction
 - number of fractions
 - modality
 - planning technique

The phase, represents the radiation prescription that was **actually delivered**

- Sometimes, the **intended** prescription differs from the **delivered** prescription

Remember: If a patient is diagnosed with 2 primaries and 2 separate abstracts are prepared, only record the radiation treatment(s) that are associated with each primary.



Summary of Coding Principles

First Course Treatment

You are responsible for the documentation of treatment given in the “first course of treatment for this cancer” only.

The first course of treatment is clearly defined in the STORE.

First Course of Treatment

The first course of treatment includes all methods of treatment recorded in the treatment plan and administered to the patient before disease progression or recurrence.

- **So, its important to remember, if scrans and/or tests show that the disease is processing, then first course treatment ends. Any treatment preformed after disease progression is not first course treatment.**



Definitions and Equivocal Terms

Phase: replacing the traditional terms of “regional” and “boost.”

Phase I: first phase, initial plan

Phase II: subsequent phase, may be referred to as a boost or cone down

Course: made up of one or more phases



Phases can be delivered simultaneously or sequentially

- **When phases are delivered simultaneously**, doses are delivered at the same time.
 - This is sometimes referred to as “**dose painting**” or “**simultaneous integrated boost (SIB)**”.
- **In sequential phases**: A **new** phase **begins** when there is a **change** in one of the following:
 - **Treatment volume of a body site**: Where the dose is going
 - **Dose per fraction**: How much radiation the targeted site will get
 - **Treatment modality**: What type of radiation is given
 - **Planning technique**: What is used to deliver the radiation



Adaptive Therapy

On-line adaptive therapy (or on-table): New linear accelerators may now be attached to such high-quality imaging devices that they can function as both simulation scanners for planning and radiation delivery systems. A new radiation plan is created while the patient is on the radiation delivery table and takes into account that day's anatomy.

Off-line (or “off-table”) adaptive therapy: Is relatively common and is when a new radiation plan is created while the patient is not on the delivery table.

Adaptive radiation may be a source of confusion because, with adaptive therapy, new radiation plans are created to account for changes in the position or shape of a target volume. However, this does NOT mean that there has been a change in “phase”.

In adaptive therapy paradigm, a new phase should be documented only when there has been a change in:

- Primary Treatment Volume (example: a change from whole prostate to partial prostate)
- Draining lymph nodes: (example: removing certain lymph nodes from the target field)
- Dose per fraction,
- Modality
- Planning technique

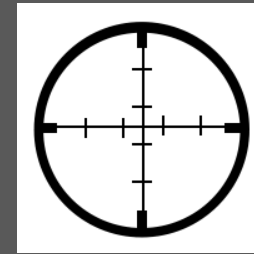


Radiation Primary Treatment Volume

Don't let the word "primary" confuse you.

- **Primary Treatment Volume:** The intended target, the site receiving the most/majority of the radiation.

Its the area in the crosshairs where the radiation will be the most intense.



Phase I: The primary treatment volume is typically the site of the primary tumor or tumor bed. However, it can be other sites of interest.

- An example would be palliative radiation for lytic lesions on the bone.
- Draining lymph nodes targeted concurrently would be another.

Phase II – III: This is the subsequent treatment and may be referred to as a boost or cone-down. If one or more discrete volumes are treated and one of those included the primary site, record Phase II-III treatment volume to the primary site.



For many of the treatment volumes, the same code should be used when the anatomic structure is targeted or when the surgical bed of the resected anatomical structure is targeted.

Examples:

Code 64 (Prostate – Whole): Prostate cancer is treated with radiation alone

Code 64 (Prostate – Whole): Prostate cancer is treated with radiation after radical prostatectomy (tumor bed).

There is an exception to the rule:

- **Code 41** (Breast- Partial): Patients who have had a lumpectomy and treated with partial breast irradiation
- **Code 40** (Breast – Whole): Patients had a lumpectomy and whole breast radiation
- **Code 42** (Chest Wall): Patients had a mastectomy and post-mastectomy radiation



Tips!

- **Code 64** (Prostate – Whole): when the patient is being treated for prostate cancer and the order states to Pelvis.
- When patient has prostate cancer and the orders state Pelvis/Prostate or Whole Pelvis
 - Treatment Volume: Code 64 (Prostate – Whole) **and**
 - Draining Lymph Nodes: Code 06 (Pelvic Lymph Nodes)



Radiation to Draining Lymph Nodes

Radiation treatment commonly targets both the primary tumor (or tumor bed) and draining lymph nodes as a secondary site.

- When the primary volume is lymph nodes, draining lymph nodes are coded 88.
- When patient has prostate cancer and the orders state Pelvis/Prostate or stated as Whole Pelvis
 - Treatment Volume: Code 64 (Prostate – Whole) **and**
 - Draining Lymph Nodes: Code 06 (Pelvic Lymph Nodes)
 - When the pelvis is specifically mentioned in the treatment summary, we can assume that regional lymph nodes were targeted.

TIPS

- When treatment is directed at a portion of the treatment volume (ie, Prostate – Partial) you can assume the lymph nodes are not to be coded as part of the target, unless otherwise specified.
- Pay attention to the TNM. If you have positive nodes you will assume they will be treated.
- If you have positive margins, this will also be an indicator that lymph nodes might be treated.
- If there are no positive lymph nodes and margins are negative, there is no reason to treat the lymph nodes.



Phase I-II-III Radiation Treatment Modality

- For purposes of this data item, photons, x-rays and gamma-rays are equivalent
- Use code 13 - Radioisotopes, NOS for radioembolization procedures
- If Radiation Treatment Modality is coded to any of the Brachytherapy or Radioisotopes codes (07-16) the code of 88 must be recorded in the data item Phase I-II-III External Beam Radiation Planning Technique.

Tips

- Radioiodine (I-131), is coded to Modality 13 (Radioisotopes, NOS)



External Beam Radiation Planning Technique

Identifies the external beam radiation planning technique used to administer the first phase of radiation treatment during the first course of treatment.

- If treatment is described as both MR-guided (or CT-Guided) on-line adaptive as well as another external beam planning technique (e.g. IMRT, SBRT, etc) code as MR-guided (or CT-Guided) online adaptive therapy.
 - On-line adaptive techniques are the most complex and usually include IMRT and/or SBRT techniques within them, so the on-line adaptive component is most important to capture.
- If a treatment is described as off-line adaptive then the on-line adaptive codes should **NOT** be used to describe the phase planning technique.



Dose per Fraction

Records the dose that is to be delivered during the fraction (treatment session) during phases I, II, and III.

fractions X dose per fraction = Total Dose
(total dose/# of fractions)= dose per fraction

- The unit of measure is centi-Gray (cGy).
 - For proton treatment, dosage may occasionally be specified as in CGE units (Cobalt Gray Equivalent).
 - 1 CGE = 1 Gy = 100 cGy
 - If specified in "rads". 1 rad = 1cGy
- If cGy is presented in a fraction, round to the nearest cGy
 - For example, 180.5 cGy should be rounded up to 181 cGy and
 - 180.4 cGy should be rounded down to 180cGy.

Brachytherapy, radioisotopes and infusion therapy:

- If any phase of treatment to a volume has the Treatment Modality coded to anything between 07 and 16, the dose for that phase should be coded in cGy, when available.
 - If not coded in cGy, Code 99998



Number of Fractions

Records the total number of fractions (treatment sessions) delivered to the patient in the first phase of radiation during the first course of treatment.

$$\text{(total dose/dose per fraction)} = \text{Number of Fractions}$$

- A treatment session may include several treatment beam positions delivered within a relatively confined period of time, this is still considered one session.
- Multiple fractions may be delivered in a single day. This may be documented as BID treatment or twice daily treatment.
- Count each separate administration of brachytherapy or implant as a single fraction or treatment.



Phase Dose

Identifies the total radiation dose delivered to the patient during phase I-II-III during the first course of treatment.

- Each phase is meant to reflect the delivered radiation prescription.
- The unit of dose is centi-Gray (cGy).

Brachytherapy, radioisotopes and infusion therapy:

- If any phase of treatment to a volume has the Treatment Modality coded to anything between 07 and 16, the dose for that phase should be coded in cGy, when available.
 - If not coded in cGy, Code 99998



Radiation/Surgery Sequence

- For the purpose of coding the data item, 'Surgery' is defined as:
 - Surgical Procedure of Primary Site (codes 10-90) or
 - Scope of Regional Lymph Node Surgery (codes 2-7) or
 - Surgical Procedure of Other Site (codes 1-5)
- If it is not known whether the patient received both surgery and radiation, then this item should be coded 0.
- Assign codes 2-9 when first course of therapy includes both cancer-directed surgery and radiation therapy.



Reason for No Radiation

Based on documentation in patient record, record the reason no radiation was administered, If any of the following are coded to 00:

- Number of Phases of Radiation Treatment to this Volume is coded 00
- Phase I Radiation Primary Treatment Volume
- Radiation Treatment Discontinued Early
- Total Dose

If the treatment plan offered multiple alternative treatment options and the patient selected treatment that did not include radiation therapy.

- Code 1: Radiation therapy was not administered because it was not part of the planned first course treatment.



Date Radiation Started and Ended

- **Date Radiation Started [1210]:** The date that the first radiation treatment was given.
- **Date Radiation Ended [3220]:** The date that the last radiation treatment was given.
- These represents all the phases within first course of radiation therapy, not just the 3 phases outlined in the abstract.
 - If 4 or more phase were given, the date radiation ended is the last day of the last phase.



There are situations where everything is not all “cut and dry” so, let's take a look at Date Radiation Ended in certain situations.

Radioisotopes

- **Radioisotopes that are injected or permanently implanted:**

- Radioisotopes can take months and in some cases, years for all the radiation to decay or be emitted. Since, there is no way to predict how long the disbursement process will take, the STORE Manual has directed registrars to enter the same date for both Date Radiation Started and Date Radiation Ended. Below are some examples of these types of treatments.
 - The use of I-131 (ie, Thyroid cancer), it is a 1 phase technique involving a single one-time injectable dose of radiation.
 - The use of iodine implant seeds that are **permanently** placed and designed to stay in the site (ie, Prostate) and slowly emit radiation over time.

- **Radioisotopes that are temporarily implanted:**

- The use of radioactive seeds that are left in place for a short period of time (2-3 days) (ie, iridium-192 seeds), enter the date the seeds are implanted for Date Radiation Started. Date Radiation Ended will be the date the seeds were removed.

Because of the difference with permanent and temporary seed implantation, it is important to pay close attention to the intention of the seed placement.

Stereotactic Radiosurgery (ie, Gamma Knife)

The date the patient undergoes the radiosurgery will be the same date entered for both Date Radiation Started and Date Radiation Ended.



Number of Phases

Up to **three (3)** phases of radiation treatment can be entered

- You can have **more** than 3 phases prescribed and carried out

Order in which phases should be summarized, our recommendation is:

- First in chronological order.
- If multiple phases start on the same date, then list the phases in order from highest 'Total Phase Dose' to lowest 'Total Phase Dose'.
- If multiple phases start on the same date and have the same Total Phase Dose, then any order is acceptable.

When there are more than three phases:

- Collect and report details of the first three phases as instructed above.
- In the "Number of Phases of Radiation Treatment in this Course" field, record the actual number of phases treated.



Radiation Treatment Discontinued Early

- Currently, the total dose of radiation reflects what was actually delivered rather than what was intended.
- When a patient does not complete a radiation course as initially intended this is typically commented on within the radiation treatment summary.
- By flagging these patients within the cancer registry database, these patients can be excluded from analyses attempting to describe adherence to radiation treatment guidelines or patterns of care analyses.



Total Dose

Identifies the total radiation dose delivered at the point in the volume receiving the most radiation during all phases of radiation treatment during the first course of treatment. The unit of dose is centi-Gray (cGy).

- This dose is meant to represent the “**cumulative**” dose across phases to the **same** point or region (receiving the **highest** dose).
- Importantly, this field should report the cumulative dose to the highest dose treatment volume, **so long as** the phases were performed using the **same** modality (i.e. external beam).
- Do **not** add doses to different treatment volumes.
- If **all** treatment volumes are **different** for all phases, Total Dose will be the phase I dose.

Brachytherapy, radioisotopes and infusion therapy:

- If there is only one phase in the entire course of radiation, and the phase dose is in cGy, then the **phase total dose in cGy** can be used to record the Radiation **Course Total Dose**.
- However, because there is no agreed upon standard for summing doses across radiation modalities, if there are **multiple** phases in a radiation course and **any** of the phases use a brachytherapy, radioisotopes or infusion therapy, then the **Radiation Course Total Dose** should be coded to **999998** (five 9's).



Let's Test Our Knowledge

You have 15 minutes!

Seg	#	Field	Code/Definition
Summary	1	Rad/Surg Sequence	3 Radiation after surgery
	2	Reason No Rad	0 Radiation was administered
	3	Location of Rad	1 All RT at this facility
	4	Date Started/Flag	08/13/2018
	5	Date Finished/Flag	09/26/2018
	6	Number of Phases	3
	7	Discontinued Early	01 Completed
	8	Course Total Dose	006040
Phase 1	9	Volume	40 Breast - whole
	10	Rad to Nodes	04 Breast/chest wall LN region
	11	Modality	02 External beam photon
	12	Planning Technique	04 Conformal or 3D Conformal
	13	Number of Fractions	025
	14	Dose per Fraction	00180
	15	Total Phase 1 Dose	004500
Phase 2	16	Volume	40 Breast - whole
	17	Rad to Nodes	04 Breast/chest wall LN region
	18	Modality	02 External beam photon
	19	Planning Technique	04 Conformal
	20	Number of Fractions	003
	21	Dose per Fraction	00180
	22	Total Phase 2 Dose	000540
Phase 3	23	Volume	41 Breast - partial
	24	Rad to Nodes	00 No RT to draining nodes
	25	Modality	04 External beam, electrons
	26	Planning Technique	04 Conformal
	27	Number of Fractions	005
	28	Dose per Fraction	00200
	29	Total Phase 3 Dose	001000

The same point or region (receiving the highest dose) was the partial breast, which was part of each volume for all 3 phases.

$$\begin{array}{r}
 004500 \\
 000540 \\
 + 001000 \\
 \hline
 006040
 \end{array}$$

Seg	#	Field	Code/Definition
Summary	1	Rad/Surg Sequence	0 No radiation and/or surg
	2	Reason No Rad	0 Radiation was administered
	3	Location of Rad	1 All RT at this facility
	4	Date Started/Flag	07/09/2018
	5	Date Finished/Flag	09/07/2018
	6	Number of Phases	03
	7	Discontinued Early	01 Completed
	8	Course Total Dose	008300
Phase 1	9	Volume	64 Prostate - whole
	10	Rad to Nodes	06 Pelvic lymph nodes
	11	Modality	02 External beam photons
	12	Planning Technique	04 Conformal or 3-D
	13	Number of Fractions	025
	14	Dose per Fraction	00180
	15	Total Phase 1 Dose	004500
Phase 2	16	Volume	64 Prostate - whole
	17	Rad to Nodes	00 No Treatment to Nodes
	18	Modality	02 External beam photons
	19	Planning Technique	05 IMRT
	20	Number of Fractions	019
	21	Dose per Fraction	00200
	22	Total Phase 2 Dose	003800
Phase 3	23	Volume	98 Other
	24	Rad to Nodes	00 No Treatment to Nodes
	25	Modality	02 External beam photons
	26	Planning Technique	05 IMRT
	27	Number of Fractions	019
	28	Dose per Fraction	00180
	29	Total Phase 3 Dose	003420

The same point or region (receiving the highest dose) was the whole prostate, which was part of the volumes in phases I and II.

$$\begin{array}{r}
 004500 \\
 + 003800 \\
 \hline
 008300
 \end{array}$$

Seg	#	Field	Code/Definition
Summary	1	Rad/Surg Sequence	0 No radiation and/or sur
	2	Reason No Rad	0 Radiation was administered
	3	Location of Rad	1 All treatment at this facility
	4	Date Started/Flag	11/10/2018
	5	Date Finished/Flag	11/23/2018
	6	Number of Phases	04 '4 or more phases'
	7	Discontinued Early	01 Completed
	8	Course Total Dose	003000
Phase 1	9	Volume	81 Spine
	10	Rad to Nodes	00 No RT to nodes
	11	Modality	02 External beam, photons
	12	Planning Technique	03 2-D therapy
	13	Number of Fractions	10
	14	Dose per Fraction	00300
	15	Total Phase 1 Dose	003000
Phase 2	16	Volume	88 Extremity Bone, NOS
	17	Rad to Nodes	00 No RT to nodes
	18	Modality	02 External beam, photons
	19	Planning Technique	03 2-D therapy
	20	Number of Fractions	010
	21	Dose per Fraction	00300
	22	Total Phase 2 Dose	003000
Phase 3	23	Volume	84 Hip
	24	Rad to Nodes	00 No RT to nodes
	25	Modality	02 External beam, photons
	26	Planning Technique	03 2-D therapy
	27	Number of Fractions	05
	28	Dose per Fraction	00400
	29	Total Phase 3 Dose	002000

All 3 volumes are different; thus Course Total Dose will be Phase Dose I

Seg	#	Field	Code/Definition
Summary	1	Rad/Surg Sequence	3 Radiation after surgery
	2	Reason No Rad	0 Radiation was administered
	3	Location of Rad	1 All RT at this facility
	4	Date Started/Flag	02/07/2021
	5	Date Finished/Flag	03/18/2021
	6	Number of Phases	02
	7	Discontinued Early	01 Completed
	8	Course Total Dose	999998
Phase 1	9	Volume	71 Uterus or Cervix
	10	Rad to Nodes	06 Pelvic lymph nodes
	11	Modality	02 External beam, photons
	12	Technique	05 IMRT
	13	Number of Fractions	025
	14	Dose per Fraction	00180
	15	Total Phase 1 Dose	004500
Phase 2	16	Volume	72 Vagina
	17	Rad to Nodes	00 No RT to draining LNs
	18	Modality	09 Brachytherapy, intracavitary, HDR
	19	Technique	88 NA
	20	Number of Fractions	02
	21	Dose per Fraction	00600
	22	Total Phase 2 Dose	001200
Phase 3	23	Volume	00
	24	Rad to Nodes	
	25	Modality	
	26	Technique	
	27	Number of Fractions	
	28	Dose per Fraction	
	29	Total Phase 3 Dose	

You cannot add dose from a brachytherapy phase with dose from EBRT phase, regardless if the volume was the same.

Course total dose is to be coded to 999998

Treatment

2/5/21-3/6/21: Right upper lobe and right hilar nodes, treated with 6MV photons using an IMRT plan, 180cGy per day, 25 fractions, 4500 cGy

3/6/21: at 4500 cGy a repeat CT simulation showed shrinkage of the primary tumor volume, a new plan was generated.

3/10/21- 3/12/21: IMRT to right upper lobe and right hilar nodes was restarted with new plan, 180cGy per day, 3 fractions to 540cGy.

3/14/21 – 3/16/21: Third CT simulation scan showed even further improvement of the primary tumor and there is no evidence of hilar nodes . Field revised to include only the primary tumor. 900 cGy prescribed and delivered in 5 fractions using conformal planning technique.

Field	Phase I
Volume	30 Lung or Bronchus
Rad to Nodes	02 Thoracic Lymph Nodes
Modality	02 External beam, Photon
Technique	05 IMRT
Number of Fractions	025
Dose per Fraction	00180
Total Phase I Dose	004500

Treatment

2/5/21-3/6/21: Right upper lobe and right hilar nodes, treated with 6MV photons using an IMRT plan, 180cGy per day, 25 fractions, 4500 cGy

3/6/21: at 4500 cGy a repeat CT simulation showed shrinkage of the primary tumor volume, a new plan was generated.

3/10/21- 3/12/21: IMRT to right upper lobe and right hilar nodes was restarted with new plan, 180cGy per day, 3 fractions to 540cGy.

3/14/21 – 3/16/21: Third CT simulation scan showed even further improvement of the primary tumor and there is no evidence of hilar nodes . Field revised to include only the primary tumor. 900 cGy prescribed and delivered in 5 fractions using conformal planning technique.

Field	Phase I	Phase II
Volume	30 Lung or Bronchus ✓	30 Lung Bronchus ✓
Rad to Nodes	02 Thoracic Lymph Nodes ✓	02 Thoracic Lymph Nodes ✓ 02 External bean, Photon ✓
Modality	02 External bean, Photon ✓	05 IMRT ✓
Technique	05 IMRT ✓	3
Number of Fractions	025	00180 ✓ 540
Dose per Fraction	00180 ✓	
Total Phase I Dose	004500	

Treatment

2/5/21-3/6/21: Right upper lobe and right hilar nodes, treated with 6MV photons using an IMRT plan, 180cGy per day, 25 fractions, 4500 cGy

3/6/21: at 4500 cGy a repeat CT simulation showed shrinkage of the primary tumor volume, a new plan was generated.

3/10/21- 3/12/21: IMRT to right upper lobe and right hilar nodes was restarted with new plan, 180cGy per day, 3 fractions to 540cGy.

3/14/21 – 3/16/21: Third CT simulation scan showed even further improvement of the primary tumor and there is no evidence of hilar nodes . Field revised to include only the primary tumor. 900 cGy prescribed and delivered in 5 fractions using conformal planning technique.

Field	Phase I	Phase II	New Phase 1
Volume	30 Lung or Bronchus ✓	30 Lung Bronchus ✓	30 Lung Bronchus
Rad to Nodes	02 Thoracic Lymph Nodes ✓	02 Thoracic Lymph Nodes ✓	02 Thoracic Lymph Nodes
Modality	02 External beam, Photon ✓	02 External beam, Photon ✓	02 External beam, Photon
Technique	05 IMRT ✓	05 IMRT ✓	05 IMRT
Number of Fractions	025	3	28
Dose per Fraction	00180 ✓	00180 ✓	00180
Total Phase Dose	004500	540	5040

Treatment

2/5/21-3/6/21: Right upper lobe and right hilar nodes, treated with 6MV photons using an IMRT plan, 180cGy per day, 25 fractions, 4500 cGy

3/6/21: at 4500 cGy a repeat CT simulation showed shrinkage of the primary tumor volume, a new plan was generated.

3/10/21- 3/12/21: IMRT to right upper lobe and right hilar nodes was restarted with new plan, 180cGy per day, 3 fractions to 540cGy.

3/14/21 – 3/16/21: Third CT simulation scan showed even further improvement of the primary tumor and there is no evidence of hilar nodes . Field revised to include only the primary tumor. 900 cGy prescribed and delivered in 5 fractions using conformal planning technique.

Field	New Phase I	Phase II
Volume	30 Lung or Bronchus ✓	30 Lung Bronchus ✓
Rad to Nodes	02 Thoracic Lymph Nodes	00 No Nodes ✗
Modality	02 External beam, Photon ✓	02 External beam, Photon ✓
Technique	05 IMRT	04 Conformal ✗
Number of Fractions	028	5
Dose per Fraction	00180 ✓	00180 ✓
Total Phase Dose	5040	900

Treatment

2/5/21-3/6/21: Right upper lobe and right hilar nodes, treated with 6MV photons using an IMRT plan, 180cGy per day, 25 fractions, 4500 cGy

3/6/21: at 4500 cGy a repeat CT simulation showed shrinkage of the primary tumor volume, a new plan was generated.

3/10/21- 3/12/21: IMRT to right upper lobe and right hilar nodes was restarted with new plan, 180cGy per day, 3 fractions to 540cGy.

3/14/21 – 3/16/21: Third CT simulation scan showed even further improvement of the primary tumor and there is no evidence of hilar nodes . Field revised to include only the primary tumor. 900 cGy prescribed and delivered in 5 fractions using conformal planning technique.

Field	Code
Rad/Surg Sequence	0 No Rad and/or Surg
Reason No Rad	0 Radiation was Admin
Location of Rad	1 All RT at this facility
Date Started/Flag	02/05/2021
Date Ended Flag	03/16/2021
Number of Phases	2
Discontinued Early	01 Completed
Course Total Dose	5940

Field	Phase I	Phase II
Volume	30 Lung or Bronchus ✓	30 Lung Bronchus ✓
Rad to Nodes	02 Thoracic Lymph Nodes	00 No Nodes ✗
Modality	02 External beam, Photon ✓	02 External beam, Photon ✓
Technique	05 IMRT	04 Conformal ✗
Number of Fractions	028	5
Dose per Fraction	00180 ✓	00180 ✓
Total Phase Dose	5040	900

Resources

STORE Manual

Introduction: Pages 61-63

Data Fields: Pages 257-284

CTR Guide to Coding Radiation Therapy Treatment in the STORE

Version 3.0 updated February 2021

Scenario examples have been added

Helpful quick guide with tables (pages 38-43)

Canswer Forum:

<http://cancerbulletin.facs.org/forums/>

CTR Guide to Coding Radiation Therapy Treatment in the STORE

Version 3.0 February 2021

Prepared by

Ted Williamson, MD, PhD, CTR
Salem Health Radiation Oncology (Emeritus)
Medical Director, Onco, Inc.

Wilson Apollo, MS, CTR
WHA Consulting

Susanne Kessler, MSM, RHIT, CTR
Manager, NCDB Information and Data Standards,
Commission on Cancer

John Christodouleas, MD, MPH
Department of Radiation Oncology,
Hospital of the University of Pennsylvania
Medical Affairs, Elekta Inc.

On behalf of the Commission on Cancer
Radiation Oncology Working Group

Shelly Gray (aka. Daisy)
QA Manager of Abstracting and Training
Kentucky Cancer Registry
michelle.gray@uky.edu
859-281-2101

