

CTR Guide to Coding Radiation Therapy Treatment in the STORE

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Table of Contents

Revision History.....	3
Introduction.....	4
Summary of Coding Principles.....	4
Looking to the Future	7
Case Studies	8
# 1 No Radiation Therapy.....	8
# 2 Single Target Volume – Single Phase.....	9
# 3 Thyroid Cancer Treated with Radioiodine.....	10
# 4 Prostate Cancer, Boost First, Elsewhere	11
# 5 Breast and Regional Nodes with Breast Boost	12
# 6 Prostate Cancer with Concurrent Prostate and SV Boost	13
# 7 Multiple Metastatic Sites Treated Concurrently.....	14
# 8 How Many Phases?.....	15
# 9 How many phases with prophylactic cranial irradiation (PCI)?.....	16
# 10 Total Body Irradiation for Transplant.....	17
# 11 Head and Neck Treatment- Simultaneous Integrated Boost (SIB).....	18
#12 On-line Adaptive Therapy with an MR-Linac	19
Appendix A – STORE Radiation Data Field Items.....	20
Summary Fields.....	20
Phase Fields	21
Appendix B – Coding Modality for the Heavy Equipment of Modern Radiation Therapy	22
Appendix C – Radiation Therapy Useful Abbreviations	23

Revision History

Date	Version	Remarks
03/15/2019	1.0	Initial release

Introduction

By now you undoubtedly know that, with the STORE, coding for radiation treatment has changed significantly. These changes were introduced to provide the NCDB with a more complete and accurate description of contemporary radiation treatment. Consistent coding and reporting of treatment across multiple registry platforms is critical in many dimensions:

- Optimizing quality measure performance scores
- Providing meaningful outcome results for future analysts of NCDB data
- Allowing accurate comparisons of patterns of care by type, size, and location of treating facilities
- Monitoring practice patterns over time
- Offering in-house reports of service utilization and predictions of growth for facility planning.

While the STORE changes offer a significant improvement in the value of radiation treatment data, they also present a challenge for the cancer registrar charged with translating the radiation record into the 31 data fields defined by STORE. To that end, this document has been prepared as a platform for “learning by example”. It is our hope that the clinical examples provided will lead the way to efficient and uniform reporting of radiation data. This initial effort should provide guidance for 95% or more of the clinical situations you will encounter. We hope it will become a living document that evolves as technology changes or we are presented with new clinical situations. To that end, we invite the CTR community to submit cases that do not seem to be covered within to the Commission on Cancer [CA Forum](#).

Note to Cancer Registry Software Developers and Vendors

You will observe that (a) this document does not bear a copyright statement, and (b) it has been provided in a standard, editable, word processing platform. We encourage you to supplement the document with text and graphics that will assist your client registrars in applying the coding standards provided in these case studies to your particular implementation of the radiation data fields. However, in doing so please do not alter the coding guidance of the individual case studies without consulting with the Commission on Cancer.

Summary of Coding Principles

1. First Course

You are responsible for, and the NCDB wants, documentation only of treatment given in the “first course of treatment for this cancer”. Nothing more. Nothing less. Forget the old 4-month rule. The first course of treatment is clearly defined in the STORE as this snippet from STORE2018 page 29 shows.

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.

This doesn't mean you can't collect data from subsequent courses. Just don't put it in the first three (reportable) phases. For an example of treatment that you would not document in these three sets of fields, see Case #9.

We know that, in some cases, you, or your administration, or your radiation oncology team (often the registrar's best friend) may want to collect data on additional first course phases, or treatment given in later courses. If your registry software can support this data, you should put it outside the set of three phases designated by your software vendor as reportable.

2. **Words:** There are few words in the oncology treatment lexicon with more possible interpretations than "course". To the medical oncologist it typically means a series of treatments with a specific combination of drugs, including periodic dose adjustments. To many, if not most, radiation oncologists, it usually describes a series of treatments to one specific target irrespective of possible changes along the way. As we have just seen, the STORE has its own definition.

"Phase" is another term with confusion potential. It appears briefly in the ROADS radiation treatment discussions, and with more conviction in the FORDS, but has now become an anchor term for separating the distinct components of a "course" of radiation. Each phase is meant to reflect the delivered radiation prescription. At the start of the radiation planning process, physicians write radiation prescriptions to treatment volumes and specify the dose per fraction (session), the number of fractions, the modality, and the planning technique. A phase simply represents the radiation prescription that has actually been delivered (as sometimes the intended prescription differs from the delivered prescription.) The STORE definition on page 34 is quite specific:

subsequent phase (Phase II) may be referred to as a boost or cone down. A new phase begins when there is a change in the target volume of a body site, treatment fraction size, modality or treatment technique. Up to three phases of radiation treatment can now be documented.

Many of the case examples that follow are designed to emphasize this definition. Please note that phases can be delivered sequentially or simultaneously which can generate confusion. Case # 9 and #12 highlight potential areas of confusion with this definition of phase.

With respect to the order in which phases should be summarized, our recommendation is that phases should be summarized first in chronological order. If multiple phases start on the same date, then summarize 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.

3. **When there are more than three phases:** In most treatment settings this will occur in a relatively small number of cases, typically with unusually complex treatment plans, occasionally with cases with multiple metastatic sites treated simultaneously. The STORE guidelines are clear. Collect and report the first three phases in detail but report the actual number of first course phases treated in

the field “Number of Phases of Radiation Treatment in this Course”. As above, first summarize the phases in chronological order, then in order from highest to lowest ‘Total Phase Dose’.

4. **Total Dose:** The current language in the STORE is not clear about when and how doses should be summed across phases. It reads “...total cumulative radiation dose administered to the patient across all phases during the first course of treatment”. That statement would make no sense if there are two or more anatomically distinct target volumes documented (say, the hip and the shoulder). In general, the “total dose” to be reported will be the dose at the point in the volume receiving the most radiation. This dose is meant to represent the highest “cumulative” dose across phases to a single point or region. Examine the record carefully. Sometimes you will be documenting phases that describe different sub-volumes, often treated concurrently. Think “regional” and “boost” and combine the numbers in a way that reflects the dose to the region of the overall volume receiving the highest dose (Case #7). If each phase represents a distinct metastatic volume, record the dose given to the volume documented in phase 1. Never add the doses from different, non-overlapping, volumes. As discussed below, never add doses delivered by brachytherapy and external beam radiation (see below). In summary, doses should only be summed across phases to create a Total Dose when all phases were delivered sequentially (not simultaneously) to the same body site using External Beam Radiation Therapy (EBRT).
5. **Phase N Radiation Primary Treatment Volume:** Don’t let the word “primary” confuse you. In a large percentage of cases you will be choosing an item from the list that closely matches the diagnostic primary site code. But not always. The first volume treated may be metastatic and remote from the site of origin of the tumor. From the list presented for this data field, choose the best match to the treatment target volume.
6. **Brachytherapy, radioisotopes and infusion therapy:** Early reports from registrars indicate some confusion here. The rules are quite simple. 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 to 99998 (four 9’s) and the Total Dose should be coded to 999998 (five 9’s). This is because there is no agreed upon standard for documenting a dose by these modalities that can be reasonably combined with an external beam dose.
7. **Where to find the data:** Hopefully, in most cases, you will find all the information you need in the treatment summary letter written by the Radiation Oncologist and generally available promptly after completion of treatment to a volume. Unfortunately, at this time, there is no standard for the content of these letters. There may be times when you must look at more detailed radiation records or need expert guidance. Happily, there are usually several resources within the radiation department. Certainly, the radiation oncologist is a consideration but think also of the physicist(s) and dosimetrist(s). They speak the language and may be more available.

Looking to the Future

Someday most of the radiation data may be automatically downloaded into the registry from the “record and verify” computer systems that control the treatment machines. But don’t go making retirement arrangements just yet. For the more immediate future a plan is afoot.

Inspired by the work of Dr. James Connolly and his team in developing the “synoptic pathology report”, a group has been organized to develop a model for synoptic radiation treatment reporting based on the STORE data set. There is a lot of work to be done yet, and it will take some time to get the radiation oncology community on board, but we are very hopeful.

Case Studies

1 No Radiation Therapy

Clinical

- 87-year old man with mild fatigue is found to have an elevated lymphocyte count on CBC.
- Bone marrow biopsy in your facility confirms a diagnosis of chronic lymphocytic leukemia.
- Physician and patient agree that no treatment is indicated at this time.

Seg	#	Field	Code/Definition
Summary	1	Rad/Surg Sequence	0 No radiation and/or Sur
	2	Reason No Rad	1 Not part of planned 1st
	3	Location of Rad	0
	4	Date Started/Flag	Blank/11
	5	Date Ended/Flag	Blank/11
	6	Number of Phases	00
	7	Discontinued Early	00
	8	Total Dose	000000
Phase 1	9	Volume	00 No Radiation Treatment
	10	Rad to Nodes	
	11	Modality	
	12	Planning Technique	
	13	Number of Fractions	
	14	Dose per Fraction	
Phase 2	15	Total Phase 1 Dose	
	16	Volume	
	17	Rad to Nodes	
	18	Modality	
	19	Planning Technique	
	20	Number of Fractions	
Phase 3	21	Dose per Fraction	
	22	Total Phase 2 Dose	
	23	Volume	
	24	Rad to Nodes	
	25	Modality	
	26	Planning Technique	
Phase 3	27	Number of Fractions	
	28	Dose per Fraction	
	29	Total Phase 3 Dose	

Coding Logic

The committee assigned to the task of updating radiation coding has agreed that the following four radiation fields (not counting Rad/surg sequence) should be completed for each analytic case not receiving radiation as part of the first course of therapy. The redundancy here is deliberate.

- #2: Reason for No Radiation Therapy
- #4: Date Radiation Started – Flag: 11 No radiation planned or given. Depending on your registry software this may be entered in a separate field or directly into the date field.
- #6: Number of phases – clearly 0 if no radiation given
- #9: Phase I Volume – A code of 00 simply reinforces the codes above.

2 Single Target Volume – Single Phase

Clinical

- 78 y/o female with new diagnosis of multiple myeloma
- R hip pain
- Lytic lesion, threatening fracture

Treatment

- Treated locally using opposed conformal¹ 15Mv photons
- 5 fractions at 400 cGy per day - 4/5/18 to 4/9/18
- Chemo started on completion of radiation treatment

Seg	#	Field	Code/Definition
Summary	1	Rad/Surg Sequence	0 No radiation and/or sur
	2	Reason No Rad	0 Radiation was admin..
	3	Location of Rad	1 All RT at this facility
	4	Date Started/Flag	04/05/2018
	5	Date Finished/Flag	04/09/2018
	6	Number of Phases	01
	7	Discontinued Early	01 Radiation completed
	8	Total Dose	002000
Phase 1	9	Volume	84 Hip
	10	Rad to Nodes	00 No RT to nodes
	11	Modality	02 External beam, photons
	12	Planning Technique	04 Conformal or 3D...
	13	Number of Fractions	005
	14	Dose per Fraction	00400
15	Total Phase 1 Dose	002000	
Phase e 2	16	Volume	
	17	Rad to Nodes	
	18	Modality	
	19	Planning Technique	
	20	Number of Fractions	
	21	Dose per Fraction	
22	Total Phase 2 Dose		
Phase 3	23	Volume	
	24	Rad to Nodes	
	25	Modality	
	26	Planning Technique	
	27	Number of Fractions	
	28	Dose per Fraction	
29	Total Phase 3 Dose		

Coding Logic

- #1: Code 0 in this field because there was no surgery.
- #8: Simple math, 400 x 5, but you should always find the total dose in the summary letter.
- #10: Inguinal lymph nodes may be exposed to radiation during treatment of the hip, but they are not being intentionally targeted.
- #12: Here you need to read the record carefully. However, the hip is a complex structure adjacent to radiosensitive organs (bowel and bladder) so, even for palliative treatment, the radiation ports (the radiation oncologist’s term for radiation beams, a.k.a. “fields”) for hip treatment are usually conformally shaped to avoid adjacent soft tissue and organs as much as possible.
- #16: STORE rules say you must code the Volume of the first unused phase to 00. In this case all the fields in phase 3 can be left blank.

¹ “Conformal” simply means that a CT simulation was obtain and that a plan using 3-dimensional information was created to “conform” the radiation dose to the target and/or avoid normal tissue. In conformal or 3D conformal treatments, beams are shaped using lead blocks or a multi-leafed collimator to something other than the basic rectangular beams generated in 2D therapy.

3 Thyroid Cancer Treated with Radioiodine

Clinical

- Thirty-seven-year-old female
- Painless lump in her right lower neck (level VI)
- Ultrasound guided needle biopsy
- Follicular carcinoma, clinical T1bN0M0.

Treatment

- Thyroidectomy, pathologic T2N0M0
- Radiation treatment is delivered with a single injection of 150 millicuries of radioiodine (I-131) on August 7.

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	08/07/2018
	5	Date Finished/Flag	08/07/2018
	6	Number of Phases	01
	7	Discontinued Early	01 Completed
	8	Total Dose	999998
Phase 1	9	Volume	98 Other
	10	Rad to Nodes	00 No RT to draining nodes
	11	Modality	13 Radioisotopes, NOS
	12	Planning Technique	88 Not applicable
	13	Number of Fractions	1
	14	Dose per Fraction	99998
	15	Total Phase 1 Dose	99998
Phase 2	16	Volume	
	17	Rad to Nodes	
	18	Modality	
	19	Planning Technique	
	20	Number of Fractions	
	21	Dose per Fraction	
	22	Total Phase 2 Dose	
Phase 3	23	Volume	
	24	Rad to Nodes	
	25	Modality	
	26	Planning Technique	
	27	Number of Fractions	
	28	Dose per Fraction	
	29	Total Phase 3 Dose	

Coding Logic

- #5: Our recommendation is to consider the injection of a radioisotope as the treatment and thus to set the Date Finished equal to the Date Started. The STORE makes a similar recommendation for brachytherapy treatments, however with some brachytherapy procedures the radioactive seeds are left in place for two or three days then removed. In those situations, code the date of removal as the Date Finished.
- #9: Technically I-131 is effective wherever there are thyroid cancer cells in the body, so there is no specific anatomic treatment volume here. Therefore, we recommend coding radioisotope treatments as “98 Other”. You might think another reasonable option would be to code the volume as “93 Whole Body”. Traditionally, however, the code 93 (Whole Body) has been reserved for whole body treatment with external beam radiation such as is done prior to bone marrow transplantation. So, for the sake of historic consistency, our preference is “98 Other”.
- #10: This is a bit debatable. The surgeon usually tries to remove lymph nodes in the immediate area but, if there are nodes left behind with follicular cancer, the iodine will treat them, regional nodes or otherwise.
- #12: We code this to “88 Not applicable” because with I-131 and other systemic isotopes there is no planning in the conventional sense. The physician selects a dose level based on risks of residual disease and the risk of complications.

4 Prostate Cancer, Boost First, Elsewhere

Clinical

- Otherwise healthy 69 y/o man
- Gleason 9, cT1c prostate Ca.

Treatment

- Treated with iodine seed implant (2/21/2018) at a university hospital
- Returned home for additional treatment.
- 4-field conformal pelvic radiation with 15Mv photons (3/5/2018 to 4/6/2018, 4500cGy in 25 fractions) at your facility.

Coding Logic

- #4: The date of the implant marks the beginning of treatment. Registrars have asked us why the STORE did not include date ranges for each phase. There are two good reasons:
 - No clinical or analytic value,
 - Avoid unnecessary work for registrars.
- #5: The last date of external beam is the only logical choice. For permanent implants and systemic radioisotopes there is no good choice for a Date Finished. See Case #3.
- #8: There is no standard for describing dose from brachytherapy implants and therefore no standard for the total dose from combined implant and external treatment. STORE rules? Code 999998 (5 9's) for Total Dose in this situation.
- #11: With an iodine implant seeds are permanently placed in the prostate tissue and radiation is emitted continuously over a long period of time. The “dose rate” is much lower with iodine implants than it is with iridium-192 seeds, which are in tubes that are removed after a day or two.
- #12: There is actually a lot of planning involved with prostate implants, both before and after the procedure, but code 88 is the only reasonable option from the choices available.
- #14: Four 9's before the terminal “8”.
- #15: Five 9's before the 8.
- #16: The prostate is still the primary target. The next field tells us that pelvic lymph nodes were treated. In FORDS you would have used Volume code 35, “Prostate and pelvis.”

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	2 Regional RT at this Facility
	4	Date Started/Flag	02/21/2018
	5	Date Finished/Flag	04/06/2018
	6	Number of Phases	02
	7	Discontinued Early	01 Completed
	8	Total Dose	999998
Phase 1	9	Volume	64 Prostate - whole
	10	Rad to Nodes	00 No RT to draining nodes
	11	Modality	10 BrachyTx, Interstitial, LDR
	12	Planning Technique	88 Not applicable
	13	Number of Fractions	001
	14	Dose per Fraction	99998
	15	Total Phase 1 Dose	999998
Phase 2	16	Volume	64 Prostate - whole
	17	Rad to Nodes	06 Pelvic lymph nodes
	18	Modality	02 External beam, photons
	19	Planning Technique	04 Conformal or 3D...
	20	Number of Fractions	025
	21	Dose per Fraction	00180
	22	Total Phase 2 Dose	004500
Phase 3	23	Volume	
	24	Rad to Nodes	
	25	Modality	
	26	Planning Technique	
	27	Number of Fractions	
	28	Dose per Fraction	
	29	Total Phase 3 Dose	

² This topic is not addressed with clarity in the first edition of STORE. However, it has been more fully explained in the CoC web publication “The Brief” on 11/15/2018 under the topic “NCDB: The Corner Store”.

5 Breast and Regional Nodes with Breast Boost

Clinical

- 46 y/o female with T2N1M0 breast cancer, and conservation surgery. 3 of 5 nodes positive. ER 100%, PR 10%, Her-2 negative.

Treatment

- Whole breast RT, 5040 cGy in 28 fractions given between 8/13/2018 and 9/19/2018 using 6Mv photons, conformal.
- Axillary and supraclavicular (SC) nodes treated concurrently with 6Mv photons, an anterior field covering both regions and a posterior field (PAB) added to the axilla.
- The medial portion of the anterior field was blocked for the last three treatments to hold the SC region to a maximum of 4500cGy to minimize the risk of brachial plexus injury.
- Between 9/20/2018 and 9/26/2018 the surgical bed received an electron boost of 1000cGy in 5 fractions using fields shaped to surround surgical bed with 1.5 cm margins.

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	01 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	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
Phase 2	15	Total Phase 1 Dose	004500
	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
Phase 3	21	Dose per Fraction	00180
	22	Total Phase 2 Dose	005040
	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
Phase 3	27	Number of Fractions	005
	28	Dose per Fraction	00200
	29	Total Phase 3 Dose	001000

Coding Logic

- #8: The sum the doses reported in Phase 1 2 and 3 (#15 + #22 + #29). In general, the “total dose” to be reported will be the dose at the point in the volume receiving the most radiation. 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, brachytherapy, etc.). If one phase was an external beam treatment and the other was a brachytherapy boost, then don’t sum the dose across the phases.
- #10: In this phase the code “04” represents both axillary and SC regions as a single target. STORE coding does not provide enough granularity to distinguish between the possible combination of targets in this region (i.e. axilla alone, axilla + supraclavicular region, supraclavicular region alone.).
- #17: In this field, code 04 represents just the axilla as it receives three additional treatments.
- #23: This is what is commonly called the “boost” or “cone down” to deliver additional radiation to the region at greatest risk for recurrence, the surgical bed.

6 Prostate Cancer with Concurrent Prostate and SV Boost

Clinical

- 76 y/o man with T3b prostate cancer.

Treatment

- 7/9/2018 to 8/10/2018: Treated initially with whole pelvis RT to 4500 cGy in 25 fractions of 180 cGy using a four-field approach, all fields shaped conformally to pelvic anatomy.
- 8/13/2018 to 9/07/2018: IMRT boost of 19 fractions in which the seminal vesicles receive an additional 3420 cGy while the prostate receives 3800 cGy.

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	01 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	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 e 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

Coding Logic

- #6: Although the volumes described in Phase 2 and Phase 3 were delivered at the same time with the same beams they represent different organs receiving different daily and total doses and, under STORE rules, are treated as separate phases. This is typically accomplished using an IMRT capability known as “dose painting” or “simultaneous integrated boosts”.
- #8: Add the regional dose from Phase 1 to the highest dose delivered within the boost target volumes. That would be the prostate dose. $4500 + 3800 = 8300\text{cGy}$
- #23: The standard setters had to draw the line somewhere for the list of volumes and since seminal vesicles are very rarely the primary target volume they were omitted. That is why we have always (ROADS > FORDS > STORE) had a code 98. For the benefit of future users of the data it would be a good idea to document treatment of seminal vesicles in the radiation comments field.

7 Multiple Metastatic Sites Treated Concurrently.

Clinical

65-year-old male smoker presents with Stage IV adenocarcinoma of the lung and multiple symptomatic sites of metastases:

- Proximal right humerus, lytic, painful but not thought to be at risk of fracture.
- Left hip, minimal radiographic changes but positive on bone scan and painful.
- Mid-shaft right femur, minimal pain but judged to be at risk for path fracture
- T7 lesion with no fracture but extension of tumor into spinal canal and rapid onset of lower extremity weakness.

Treatment

- Treatment to thoracic spine was initiated evening of Saturday, 11/10/2018 and continued until 11/21/2018. Unblocked photon field, 3000 cGy in 10 fractions
- 11/12/2018 to 11/23/2018: Treatment to right femur, unblocked photon field, 3000 cGy in 10 fractions
- 11/12/2018 to 11/16/2018: Left hip treated with conformal fields designed to spare adjacent bowel, bladder, and soft tissues. 2000 cGy in 5 equal fractions.
- 11/12/2018 to 11/16/2018: Right humerus, open square field, 2000cGy in 5 equal fractions.

Coding Logic

- #4 The earliest date of treatment in the first course.
- #5 The last date of treatment in the first course even though it may not be associated with any of the radiation phases that have been documented here.
- #6 Four distinct volumes treated with each treatment represented by a distinct phase.
- #8 Record the maximum dose to first volume/phase. Do not add doses to different treatment volumes.
- #9 STORE does not address the order of assignment of multiple target volumes to phases other than to say that if the tumor primary site is one of the volumes it should take precedence for the first phase or phases. Our recommendation is that phases should be summarized first in chronological order. If multiple phases start on the same date, then summarize 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.

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	02 Regional RT 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	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
Phase e 2	15	Total Phase 1 Dose	003000
	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
Phase 3	21	Dose per Fraction	00300
	22	Total Phase 2 Dose	003000
	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

8 How Many Phases?

Clinical

72-year old male diagnosed with small cell lung cancer on 2/22/2018.

- PET-CT scan shows activity limited to the right upper lobe and right hilum.
- Brain MRI is interpreted as showing a pattern consistent with scattered, age-related microvascular infarcts.
- The patient refuses chemotherapy.

Treatment

- 3/5 – 4/6/2018: Area of PET activity treated with 6Mev photons using an IMRT plan to minimize esophagitis, 180 cGy per day, 25 fractions, 4500 cGy.
- 4/6/2018: Repeat simulation CT scan shows greater than 50% reduction in gross tumor volume. A new plan is developed.
- 4/10 – 4/16/2018: IMRT to upper lobe and hilar nodes, 180cGy per day, 900cGy in 5 fractions
- 6/5/2018: Patient presents with confusion and aphasia. Brain MRI shows numerous sub-centimeter lesions consistent with metastases, most at locations previously interpreted as infarcts.
- 6/7 – 6/13/2018: Whole brain radiation, conformal opposed photon fields. 2000cGy in 5 fractions.

Coding Logic:

- #6 and #16: We have coded only one phase for chest treatment. The patient had a new plan developed in the middle of therapy; but, because the treatment was to the same treatment volumes using the same modality, planning technique and dose per fraction, the new plan does NOT represent a new phase of radiation. This patient had “off-line” plan adaptation, which adapted the radiation targeting to changes in shape of the tumor or surrounding normal tissues. In some cases, this can occur several times throughout the course of radiation. So long as there is no change of targeted organs, modality, planning technique and dose per fraction, all of the adapted plans should be considered one phase. The second important consideration in this case is that treatment to the brain is not coded under STORE rules because treatment to the brain did not occur until after progression occurred in the brain. STORE collects only first course treatment data where first course is defined as:

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.

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	01 All RT at this Facility
	4	Date Started/Flag	03/05/2018
	5	Date Finished/Flag	04/16/2018
	6	Number of Phases	01
	7	Discontinued Early	01 Completed
	8	Total Dose	005400
Phase 1	9	Volume	30 Lung or bronchus
	10	Rad to Nodes	02 Thoracic lymph nodes
	11	Modality	02 External beam, photons
	12	Planning Technique	05 IMRT
	13	Number of Fractions	030
	14	Dose per Fraction	00180
	15	Total Phase 1 Dose	005400
Phase e 2	16	Volume	
	17	Rad to Nodes	
	18	Modality	
	19	Planning Technique	
	20	Number of Fractions	
	21	Dose per Fraction	
Phase 3	22	Total Phase 2 Dose	
	23	Volume	
	24	Rad to Nodes	
	25	Modality	
	26	Planning Technique	
	27	Number of Fractions	
	28	Dose per Fraction	
	29	Total Phase 3 Dose	

9 How many phases with prophylactic cranial irradiation (PCI)?

Clinical

72-year-old male diagnosed with small cell lung cancer on 2/22/2018.

- PET-CT scan shows activity limited to the right upper lobe and right hilum.
- He was treated with concurrent cisplatin, etoposide and radiation as summarized below.
- After completion of his thoracic radiation, he had follow-up imaging including brain MRI which showed no evidence of disease. He then had prophylactic cranial irradiation.

Treatment

- 3/5 – 4/13/2018: Area of PET activity treated with 6Mev photons using an IMRT plan to minimize esophagitis, 200 cGy per day, 30 fractions, 6000 cGy.
- 5/7 – 5/18/2018: whole brain radiation at 25Gy in 10 fractions.

Coding Logic:

- #5: Date finished should be the last day of the last phase of the entire radiation course even if there are gaps between phases, as in this case.
- #8: It is a universal rule that you should NEVER add doses from different target volumes. In the Total Dose field, you will most often be simply recording the phase 1 dose. If the target volume in phase 1 is given a boost in phase 2 you should add the doses. You should rarely have to add the phase 3 dose unless it represents a further change in the size or technique used to give additional radiation within the first boost.
- #6 and #16: We have coded two phases in the first course of therapy, one for the chest treatment and another for the brain treatment. In this case, the whole brain radiation treatment is coded as part of the first course of therapy because it occurred prior to any evidence of progression or recurrence (i.e. it was done prophylactically).

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	01 All RT at this Facility
	4	Date Started/Flag	03/05/2018
	5	Date Finished/Flag	5/18/2018
	6	Number of Phases	02
	7	Discontinued Early	01 Completed
	8	Total Dose	006000
Phase 1	9	Volume	30 Lung or bronchus
	10	Rad to Nodes	02 Thoracic lymph nodes
	11	Modality	02 External beam, photons
	12	Planning Technique	05 IMRT
	13	Number of Fractions	030
	14	Dose per Fraction	00200
	15	Total Phase 1 Dose	006000
Phase e 2	16	Volume	12 Brain
	17	Rad to Nodes	00 No RT to nodes
	18	Modality	02 External beam, photons
	19	Planning Technique	01 External beam, NOS
	20	Number of Fractions	010
	21	Dose per Fraction	00250
	22	Total Phase 2 Dose	002500
Phase 3	23	Volume	
	24	Rad to Nodes	
	25	Modality	
	26	Planning Technique	
	27	Number of Fractions	
	28	Dose per Fraction	
	29	Total Phase 3 Dose	

10 Total Body Irradiation for Transplant

Clinical

43-year-old woman with advanced multiple myeloma is referred for total body irradiation in preparation for a bone marrow transplant.

Treatment

- 11/14 – 11/16/2018: Treated twice daily for three consecutive days in a total body stand at extended distance with open rectangular photon fields, 200cGy to mid-body per treatment.

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	01 All RT at this Facility
	4	Date Started/Flag	11/14/2018
	5	Date Finished/Flag	11/16/2018
	6	Number of Phases	01
	7	Discontinued Early	01 Completed
	8	Total Dose	001200
Phase 1	9	Volume	93 Whole Body
	10	Rad to Nodes	00 No RT to draining nodes
	11	Modality	02 External beam, photons
	12	Technique	03 2-D therapy
	13	Number of Fractions	006
	14	Dose per Fraction	00200
Phase 2	15	Total Phase 1 Dose	001200
	16	Volume	
	17	Rad to Nodes	
	18	Modality	
	19	Technique	
	20	Number of Fractions	
Phase 3	21	Dose per Fraction	
	22	Total Phase 2 Dose	
	23	Volume	
	24	Rad to Nodes	
	25	Modality	
	26	Technique	
	27	Number of Fractions	
	28	Dose per Fraction	
	29	Total Phase 3 Dose	

Coding Logic:

- #9: Volume code 93 is reserved for this circumstance and the now somewhat rare whole-body treatment for bone metastases. Use code 98 for systemic treatment with radioisotopes.
- #10: Obviously lymph nodes are included in a whole-body beam, but they are not the primary target and there is no code describing total lymph node irradiation.
- #12: Without other information in the record we would assume 2-D planning (open field, no blocks) was used. In some centers, particularly if the total dose is greater than 1200cGy, the record may describe lung, liver, or kidney blocks. In these situations, it may be appropriate to code planning technique to 3-D.

11 Head and Neck Treatment-Simultaneous Integrated Boost (SIB)

Clinical

61-year old man with stage IVa, T3N2cM0, HPV-negative squamous cell carcinoma of the tonsil completed his course of radiation therapy (delivered with concurrent weekly cisplatin and, on study, with concurrent nelfinavir for hypoxia modification).

Treatment

- Dates of treatment: 9/10/2018 to 10/29/2018.
- Proton pencil beam scanning
- Areas treated: Primary site + bilateral neck.
- Over the course of 35 treatments, areas of gross disease received 7000 cGy, high risk elective neck regions received 6300 cGy, low-risk elective neck including the supraclavicular regions received 5600 cGy.

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	01 All RT at this Facility
	4	Date Started/Flag	9/10/2018
	5	Date Finished/Flag	10/29/2018
	6	Number of Phases	03
	7	Discontinued Early	01 Completed
	8	Total Dose	007000
Phase 1	9	Volume	22 Oropharynx
	10	Rad to Nodes	01 Neck lymph node regions
	11	Modality	03 External beam, protons
	12	Technique	04 Conformal
	13	Number of Fractions	035
	14	Dose per Fraction	00200
	15	Total Phase 1 Dose	007000
Phase e 2	16	Volume	01 Neck lymph node regions
	17	Rad to Nodes	88 N/A, nodes are primary vol
	18	Modality	03 External beam, protons
	19	Technique	04 Conformal
	20	Number of Fractions	035
	21	Dose per Fraction	00180
22	Total Phase 2 Dose	006300	
Phase 3	23	Volume	03 Neck and thoracic LN reg
	24	Rad to Nodes	88 N/A, nodes are primary vol
	25	Modality	03 External beam, protons
	26	Technique	04 Conformal
	27	Number of Fractions	035
	28	Dose per Fraction	00160
	29	Total Phase 3 Dose	005600

Coding Logic

- #6: This course of RT is an example of a simultaneous integrated boost, with issues similar to Case #7. Three regions of the neck (gross disease, high risk neck nodes, low risk neck nodes) were treated simultaneously using different daily fractions of radiation. In the past, these three regions were treated using sequential radiation phases (the first radiation plan treated gross disease, high- and low-risk neck regions to 5000 cGy in 25 fractions; then, the second plan treated gross disease and high-risk neck regions to 6000 cGy in 30 fractions; finally, the third plan treated gross disease to 7000cGy in 35 fractions). The sequential approach requires three separate radiation plans to be made by the physics team, which is a lot of work! More and more, simultaneous integrated boost (or dose painting) treatments are being used because this approach allows only one radiation plan to be developed which greatly reduces the planning burden on physics teams.
- #10: Note that we coded "01 neck lymph node regions" in this phase. We know from his nodal staging (N2c) that he had gross disease in his neck nodes and the treatment summary that areas of gross disease received 7000cGy in 35 fractions.
- #17 and #24: In phase 2 and 3, neck nodal regions were the primary treatment volume so there is no secondary nodal treatment volume. Radiation to Nodes code 88 is reserved for this situation.
- #24: Because the summary states that the low-risk neck volume includes the supraclavicular regions, this is coded as 03 Neck and thoracic lymph node regions.

#12 On-line Adaptive Therapy with an MR-Linac

Clinical

75-year old woman with average risk muscle-invasive bladder cancer treated with selective bladder preservation. She had a complete transurethral resection followed by neoadjuvant chemotherapy with gemcitabine and cisplatin and finally concurrent mitomycin/5FU and radiation.

Treatment

- Dates of treatment: 9/10/2018 to 10/30/2018.
- She received 180 cGy x 36 to 6480cGy to the whole bladder.
- Her radiation was performed on the MR-linac with IMRT and daily on-line treatment adaptation to account for changes in bladder filling. Seventeen of 36 fraction required a full re-plan.

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	01 All RT at this Facility
	4	Date Started/Flag	9/10/2018
	5	Date Finished/Flag	10/29/2018
	6	Number of Phases	01
	7	Discontinued Early	01 Completed
	8	Total Dose	006480
Phase 1	9	Volume	60 Bladder - whole
	10	Rad to Nodes	00 No radiation to nodes
	11	Modality	02 External beam, photons
	12	Technique	10 MR-guided on-line adaptive
	13	Number of Fractions	036
	14	Dose per Fraction	00180
15	Total Phase 1 Dose	006480	
Phase e 2	16	Volume	
	17	Rad to Nodes	
	18	Modality	
	19	Technique	
	20	Number of Fractions	
	21	Dose per Fraction	
22	Total Phase 2 Dose		
Phase 3	23	Volume	
	24	Rad to Nodes	
	25	Modality	
	26	Technique	
	27	Number of Fractions	
	28	Dose per Fraction	
29	Total Phase 3 Dose		

Coding Logic

- #12: New linear accelerators are attached to such high-quality imaging devices that they can function as both simulation scanners for planning and radiation delivery systems. If a new radiation plan is created while the patient is on the radiation delivery table to take into account that day's anatomy, this is referred to "on-line" (or on-table) adaptive radiation. If a new radiation plan is created while the patient is elsewhere, then it is referred to as "off-line" adaptive therapy. Off-line adaptive therapy treatments are relatively common, but MR-guided and CT-guided online adaptive therapy treatments are just emerging.

This case describes MR-guided online adaptive therapy. If a 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.), then it should be categorized as MR-guided online adaptive therapy. Online adaptive techniques are the most complex and usually include IMRT and/or SBRT techniques within them, so the online adaptive component is most important to capture.

Appendix A – STORE Radiation Data Field Items

Summary Fields

Code	Location of Radiation Treatment
0	No radiation treatment
1	All radiation treatment at this facility
2	Regional treatment at this facility, boost elsewhere
3	Boost radiation at this facility, regional elsewhere
4	All radiation treatment elsewhere
8	Other
9	Unknown

Code	Radiation/Surgery Sequence
0	No radiation therapy and/or surgical procedures
2	Radiation therapy before surgery
3	Radiation therapy after surgery
4	Radiation therapy both before and after surgery
5	Intraoperative radiation therapy
6	Intraoperative radiation therapy with other therapy administered before or after surgery
7	Surgery both before and after radiation
9	Sequence unknown

Code	Reason for No Radiation
0	Radiation therapy was administered.
1	Radiation therapy was not administered because it was not part of the planned first course treatment. Diagnosed at autopsy.
2	Radiation therapy was not recommended/administered because it was contraindicated due to other patient risk factors (comorbid conditions, advanced age, progression of tumor prior to planned radiation etc.).
5	Radiation therapy was not administered because the patient died prior to planned or recommended therapy.
6	Radiation therapy was not administered; it was recommended by the patient's physician, but was not administered as part of first course treatment. No reason was noted in patient record.
7	Radiation therapy was not administered; it was recommended by the patient's physician, but this treatment was refused by the patient, the patient's family member, or the patient's guardian. The refusal was noted in patient record.
8	Radiation therapy was recommended, but it is unknown whether it was administered.
9	It is unknown if radiation therapy was recommended or administered. Death certificate cases only.

Code	Radiation Treatment Discontinued Early
00	No radiation treatment
01	Radiation treatment completed as prescribed
02	Radiation treatment discontinued early - toxicity
03	Radiation treatment discontinued early - contraindicated due to other patient risk factors (comorbid conditions, advanced age, progression of tumor prior to planned radiation etc.)
04	Radiation treatment discontinued early - patient decision
05	Radiation discontinued early - family decision
06	Radiation discontinued early - patient expired
07	Radiation discontinued early - reason not documented
99	Unknown if radiation treatment discontinued; Unknown whether radiation therapy administered

Phase Fields

Phase N Volume	
Value	Description
00	No radiation treatment
01	Neck lymph node regions
02	Thoracic lymph node regions
03	Neck and thoracic lymph node regions
04	Breast/chestwall lymph node regions
05	Abdominal lymph nodes
06	Pelvic lymph nodes
07	Abdominal and pelvic lymph nodes
09	Lymph node primary, NOS
10	Eye/orbit/optic nerve
11	Pituitary
12	Brain
13	Brain (limited)
14	Spinal cord
20	Nasopharynx
21	Oral cavity
22	Oropharynx
23	Larynx (glottis) or hypopharynx
24	Sinuses/nasal tract
25	Parotid or other salivary glands
26	Thyroid
29	Head and neck (NOS)
30	Lung or bronchus
31	Mesothelium
32	Thymus
39	Chest/lung (NOS)
40	Breast - whole
41	Breast - partial
42	Chest wall
50	Esophagus
51	Stomach
52	Small bowel
53	Colon
54	Rectum
55	Anus
56	Liver
57	Biliary tree or gallbladder
58	Pancreas or hepatopancreatic ampulla
59	Abdomen (NOS)
60	Bladder - whole
61	Bladder - partial
62	Kidney
63	Ureter
64	Prostate - whole
65	Prostate - partial
66	Urethra
67	Penis
68	Testicle or scrotum
70	Ovaries or fallopian tubes
71	Uterus or cervix
72	Vagina
73	Vulva
80	Skull
81	Spine/vertebral bodies
82	Shoulder
83	Ribs
84	Hip
85	Pelvic bones
86	Pelvis (NOS, non-visceral)
88	Extremity bone, NOS
90	Skin
91	Soft tissue
92	Hemibody
93	Whole body
94	Mantle, mini-mantle (obsolete after 2017)
95	Lower extended field (obsolete after 2017)
96	Inverted Y (obsolete after 2017)
98	Other
99	Unknown

Phase N Radiation to Draining Lymph Nodes	
Value	Description
00	No radiation treatment to draining lymph nodes
01	Neck lymph node regions
02	Thoracic lymph node regions
03	Neck and thoracic lymph node regions
04	Breast/chestwall lymph node regions
05	Abdominal lymph nodes
06	Pelvic lymph nodes
07	Abdominal and pelvic lymph nodes
08	Lymph node region, NOS
88	Not applicable; Radiation Primary Treatment Volume is lymph nodes
99	Unknown if any radiation to draining lymph nodes

Phase N Radiation Modality	
Value	Description
00	No radiation treatment
01	External beam, NOS
02	External beam, photons
03	External beam, protons
04	External beam, electrons
05	External beam, neutrons
06	External beam, carbon ions
07	Brachytherapy, NOS
08	Brachytherapy, intracavitary, LDR
09	Brachytherapy, intracavitary, HDR
10	Brachytherapy, interstitial, LDR
11	Brachytherapy, interstitial, HDR
12	Brachytherapy, electronic
13	Radioisotopes, NOS
14	Radioisotopes, Radium-232
15	Radioisotopes, Strontium, -89
16	Radioisotopes, Strontium-90
99	Radiation treatment modality unknown; Unknown if administered

Phase N Planning Technique	
Value	Description
00	No radiation treatment
01	External beam, NOS
02	Low energy x-ray/photon therapy
03	2-D therapy
04	Conformal or 3-D conformal therapy
05	Intensity modulated therapy
06	Stereotactic radiotherapy or radiosurgery, NOS
07	Stereotactic radiotherapy or radiosurgery, robotic
08	Stereotactic radiotherapy or radiosurgery, Gamma Knife?
09	CT-guided online adaptive therapy
10	MR-guided online adaptive therapy
88	Not applicable
98	Other, NOS
99	Unknown

Appendix B – Coding Modality for the Heavy Equipment of Modern Radiation Therapy

Associating the Radiation Modality and Radiation Planning Techniques can be confusing when all you have is the name of the piece of “heavy equipment” used to deliver the treatment. We present the following table to help you find the correct codes. Many thanks to Wilson Apollo, MS, CTR, RTT, for sharing his heavy equipment research.

Product	Modality	Applicable Planning Technique(s)
ViewRay MRIdian MR-linac	02	10
Elekta MR-Linac	02	10
Elekta VersaHD	02	03,04,05, 06, 09
Varian TrueBeam	02	03,04,05, 06, 09
Varian Halcyon	02	03,04,05, 06, 09
GammaKnife	02	08
GammaPod	02	06
Cyberknife	02	07
Tomotherapy	02	05, 06, 09
VMAT, RapidArc, Hyperarc	02	05, 06
Zeiss, Xoft, Esteya	02	02
LIAC, NOVAC	04	03, 04
MammoSite, SAVI, Contura	11	88
Accuboot (NIBB)	07	88

Appendix C – Radiation Therapy Useful Abbreviations

Abbreviation	Term	Abbreviation	Term
AP	Anterior-Posterior	LAO	Left Anterior Oblique
BED	Biological Equivalent Dose	LET	Linear Energy Transfer
BID	Twice a day	LL	Left Lateral
BT	Brachytherapy	LPO	Left Posterior Oblique
CAX	Central Axis	M-IMRT	Multifield IMRT
cGy	Centigray, 1/100 th of a Gy	MP	Midplane
CIRT	Carbon Ion Radiation Therapy	MU	Monitor Unit
CTV	Clinical Tumor Volume	OAR	Organs at Risk
CW	Chest wall	OBI	On-Board Imaging
DART	Dynamic Adaptive Radiation Therapy	ODI	Optical Distance Indicator
Dmax	Depth of Maximum Dose	OTT	Overall Treatment Time
DMLC	Dynamic Multileaf Collimator	PA	Posterior-Anterior
DRR	Digitally Reconstructed Radiograph	PRRT	Peptide Receptor Radionuclide Therapy
DVH	Dose-Volume Histogram	PSA	Patient Support Assembly (treatment couch)
Dx	Diagnosis	PTV	Planning Tumor Volume
EBRT	External Beam Radiation Therapy	R&V	Record and Verify
EFRT	Extended Field Radiation Therapy	RAO	Right Anterior Oblique
ENLs	Extranodal Lymphomas	RBE	Relative Biological Effect
EPID	Electronic Portal Imaging Device	RL	Right Lateral
FF	Filter-Flattened	RPO	Right Posterior Oblique
FFF	Flattening-Filter-Free	Rx	Prescription
FiF	Field-in-Field Technique (3D)	SAD	Source-to-Axis Distance
Fx	Fraction	SART	Stereotactic Ablative RT
GTV	Gross Tumor Volume	SBPT	Stereotactic Body Proton Therapy
Gy	Gray, unit of absorbed dose	SBRT	Stereotactic Body RT
H-IMRT	Hybrid IMRT	SCT	Stem Cell Transplant
HR-CTV	High-Risk Clinical Target Volume	SCV (S'clav)	Supraclavicular
HT	Helical Tomotherapy	SDD	Source-to-Diaphragm Distance
IC-BT	Intracavitary Brachytherapy	SGRT	Surface Guided RT
IC/IS BT	Intracavitary/Interstitial Brachytherapy	SIB	Simultaneous Integrated Boost

IFD	Intra-field Distance	SIRMIT	Single Isocenter Radiosurgery for Multiple Intracranial Targets
IFRT	Involved Field Radiation Therapy	SMART	Simultaneous Accelerated RT
IGART	Image-guided Adaptive RT	SSD	Source-to-Skin Distance
IGRT	Image-guided RT	STD	Source-to-Target Distance
IMPT	Intensity Modulated Proton Therapy	T-IMRT	Tangential IMRT
INRT	Involved Nodal RT	T-VMAT	Tangential Volumetric Modulated Arc Therapy
IOERT	Intraoperative Electron RT	TBI	Total Body Irradiation
IORT	Intraoperative RT	TID	Three times a day
IS-BT	Interstitial Brachytherapy	TSEB	Total Skin Electron Boost
ISRT	Involved Site RT		
ITV	Irradiated Tumor Volume		