Intensity Modulated Radiation Therapy for Tumors of the Central Nervous System

Radiation therapy is an integral component in the treatment of many brain tumors, both benign and malignant. Intensity modulated radiation therapy (IMRT) has been proposed as a method of radiation therapy that allows adequate radiation therapy to the tumor while minimizing the radiation dose to surrounding normal tissues and critical structures.

Background

Radiation therapy and brain tumors

The standard approach to the treatment of brain tumors depends on the type and location of tumor. For glioblastoma multiforme (GBM), a malignant high-grade tumor, treatment is multimodal, with surgical resection followed by adjuvant radiation therapy and chemotherapy. For benign and low-grade brain tumors, gross total resection remains the primary goal. However, radiation therapy may be used in selected cases. Some examples are when total resection is not possible, when a more conservative surgical approach may be necessary to achieve long-term treatment goals, and with atypical tumors that may need radiotherapy even after gross total resection to reduce the risk of local recurrence. Therefore, radiation therapy, either definitive or in the postoperative adjuvant setting, remains an integral component in the management of residual, recurrent, and/or progressive benign and low-grade brain tumors for maximizing local control.

Brain metastases occur in up to 40% of adults with cancer and can shorten survival and detract from quality of life. Many patients who develop brain metastases will eventually die of progressive intracranial disease. Among patients with good performance status, controlled extracranial disease, favorable prognostic features, and a solitary brain metastasis, randomized studies have shown that surgical excision followed by whole brain radiotherapy (WBRT) prolongs survival. Stereotactic radiosurgery (SRS) may be able to replace surgery in certain circumstances, delivering obliterateally high single doses to discrete metastases. For bulky cerebral metastases, level one evidence has also shown that delivering a higher radiation dose with an SRS boost is beneficial in addition to standard WBRT. The use of a concomitant boost with IMRT during WBRT has been attempted to improve overall local tumor control without the use of SRS to avoid additional planned radiation after WBRT (“Phase 2” or SRS) and its additional labor and expense.

Radiation techniques

Conventional external beam radiation therapy. Over the past several decades, methods to plan and deliver radiation therapy have evolved in ways that permit more precise targeting of tumors with complex geometries. Most early trials used 2-dimensional treatment planning based on flat images and radiation beams with cross-sections of uniform intensity that were sequentially aimed at the tumor along
Intensity Modulated Radiation Therapy for Tumors of the Central Nervous System

2 or 3 intersecting axes. Collectively, these methods are termed “conventional external beam radiation therapy.”

3-dimensional conformal radiation (3D-CRT).

Treatment planning evolved by using 3-dimensional images, usually from computed tomography (CT) scans, to delineate the boundaries of the tumor, and discriminate tumor tissue from adjacent normal tissue and nearby organs at risk for radiation damage. Computer algorithms were developed to estimate cumulative radiation dose delivered to each volume of interest by summing the contribution from each shaped beam. Methods also were developed to position the patient and the radiation portal reproducibly for each fraction, and immobilize the patient, thus maintaining consistent beam axes across treatment sessions. Collectively, these methods are termed 3-dimensional conformal radiation therapy (3D-CRT).

Intensity-modulated radiation therapy (IMRT).

IMRT, which uses computer software and CT and magnetic resonance imaging (MRI) images, offers better conformality than 3D-CRT as it is able to modulate the intensity of the overlapping radiation beams projected on the target and to use multiple shaped treatment fields. It uses a device (a multileaf collimator, MLC) which, coupled to a computer algorithm, allows for “inverse” treatment planning. The radiation oncologist delineates the target on each slice of a CT scan and specifies the target’s prescribed radiation dose, acceptable limits of dose heterogeneity within the target volume, adjacent normal tissue volumes to avoid, and acceptable dose limits within the normal tissues. Based on these parameters and a digitally reconstructed radiographic image of the tumor and surrounding tissues and organs at risk, computer software optimizes the location, shape and intensities of the beams ports, to achieve the treatment plan’s goals.

Increased conformality may permit escalated tumor doses without increasing normal tissue toxicity and thus may improve local tumor control, with decreased exposure to surrounding, normal tissues, potentially reducing acute and late radiation toxicities. Better dose homogeneity within the target may also improve local tumor control by avoiding underdosing within the tumor and may decrease toxicity by avoiding overdosing.

Since most tumors move as patients breathe, dosimetry with stationary targets may not accurately reflect doses delivered within target volumes and adjacent tissues in patients. Furthermore, treatment planning and delivery are more complex, time-consuming, and labor-intensive for IMRT than for 3D-CRT. Thus, clinical studies must test whether IMRT improves tumor control or reduces acute and late toxicities when compared with 3D-CRT.

Methodological issues with IMRT studies

Multiple dose planning studies have generated 3D-CRT and IMRT treatment plans from the same scans, then compared predicted dose distributions within the target and in adjacent organs at risk. Results of such planning studies show that IMRT improves on 3D-CRT with respect to conformality to, and dose homogeneity within, the target. Dosimetry using stationary targets generally confirms these predictions. Thus, radiation oncologists hypothesized that IMRT may improve treatment outcomes compared with those of 3D-CRT. However, these types of studies offer indirect evidence on treatment benefit from IMRT, and it is difficult to relate results of dosing studies to actual effects on health outcomes.

Comparative studies of radiation-induced side effects from IMRT versus alternative radiation delivery are probably the most important type of evidence in establishing the benefit of IMRT. Such studies would answer the question of whether the theoretical benefit of IMRT in sparing normal tissue translates into real health outcomes. Single-arm series of IMRT can give some insights into the potential for benefit, particularly if an adverse effect that is expected to occur at high rates is shown to decrease by a large amount. Studies of treatment benefit are also important to establish that IMRT is at least as good as other types of delivery, but in the absence of such comparative trials, it is likely that benefit from IMRT is at least as good as with other types of delivery.
Intensity Modulated Radiation Therapy for Tumors of the Central Nervous System

Regulatory status
The U.S. Food and Drug Administration (FDA) has approved a number of devices for use in intensity-modulated radiation therapy (IMRT), including several linear accelerators and multileaf collimators. Examples of approved devices and systems are the NOMOS Slit Collimator (BEAK™) (NOMOS Corp.), the Peacock™ System (NOMOS Corp.), the Varian Multileaf Collimator with dynamic arc therapy feature (Varian Oncology Systems), the Saturne Multileaf Collimator (GE Medical Systems), the Mitsubishi 120 Leaf Multileaf Collimator (Mitsubishi Electronics America Inc.), the Stryker Leibinger Motorized Micro Multileaf Collimator (Stryker Leibinger), the Mini Multileaf Collimator, model KMI (MRC Systems GMBH), and the Preference® IMRT Treatment Planning Module (Northwest Medical Physics Equipment Inc.).

Related Policies:
Intensity-Modulated Radiation Therapy (IMRT) of the Prostate
Intensity-Modulated Radiation Therapy (IMRT) of the Head and Neck
Intensity-Modulated Radiation Therapy (IMRT) of the Chest
Intensity-Modulated Radiation Therapy (IMRT) of the Abdomen and Pelvis
Maximum Units of Service

***Note: This Medical Policy is complex and technical. For questions concerning the technical language and/or specific clinical indications for its use, please consult your physician.

Policy

BCBSNC will provide coverage for Intensity Modulated Radiation Therapy (IMRT) for the treatment of tumors of the Central Nervous System (CNS), when determined to be medically necessary because the medical criteria and guidelines shown below are met.

Benefits Application
This medical policy relates only to the services or supplies described herein. Please refer to the Member's Benefit Booklet for availability of benefits. Member's benefits may vary according to benefit design; therefore member benefit language should be reviewed before applying the terms of this medical policy.

When Intensity-Modulated Radiation Therapy for Tumors of the Central Nervous System is covered
Intensity Modulated Radiation Therapy (IMRT) may be considered medically necessary for the treatment of tumors of the central nervous system when:

1) the tumor is in close proximity to tissues at risk (See Policy Guidelines); AND

2) 3-D CRT planning is not able to meet dose volume constraints for normal tissue tolerance; AND

3) IMRT dosimetry demonstrates reduced toxicity of non-target areas.

When Intensity-Modulated Radiation Therapy for Tumors of the Central Nervous System is not covered
Intensity Modulated Radiation Therapy for Tumors of the Central Nervous System

Intensity Modulated Radiation Therapy (IMRT) is considered investigational and therefore not covered when above criteria are not met.

Policy Guidelines

Organs at risk are defined as normal tissues whose radiation sensitivity may significantly influence treatment planning and/or prescribed radiation dose. These organs at risk may be particularly vulnerable to clinically important complications from radiation toxicity:

- brain stem
- spinal cord
- cochlea
- eye structures, including optic nerve and chiasm, lens, and retina

Because IMRT maximizes radiation dose distributions to the target while reducing exposure of adjacent non-target structures, it is more commonly utilized when there is particular concern about damage to an adjacent organ or vital tissue. A potential advantage to IMRT is its ability to limit dose to surrounding normal tissues of the central nervous system, such as the optic nerve, chiasm, lens, and brainstem, thereby possibly minimizing radiation morbidity.

The body of evidence available to evaluate IMRT in the treatment of CNS tumors consists of dose planning studies and case series. The case series are limited by small numbers, heterogeneous patient populations, and different types of tumors. No randomized trials have been reported that compare results using IMRT to other conformal radiation therapy modalities, nor do any of the reported case series using IMRT include concurrently treated control groups.

CPT 77338 is reported once per IMRT plan and is limited to 3 units per 60 day treatment course.

Billing/Coding/Physician Documentation Information

This policy may apply to the following codes. Inclusion of a code in this section does not guarantee that it will be reimbursed. For further information on reimbursement guidelines, please see Administrative Policies on the Blue Cross Blue Shield of North Carolina web site at www.bcbsnc.com. They are listed in the Category Search on the Medical Policy search page.

Applicable codes: 77301, 77338, 77385, 77386, G6015, G6016

BCBSNC may request medical records for determination of medical necessity. When medical records are requested, letters of support and/or explanation are often useful, but are not sufficient documentation unless all specific information needed to make a medical necessity determination is included.

Scientific Background and Reference Sources


Intensity Modulated Radiation Therapy for Tumors of the Central Nervous System


Specialty Matched Consultant Advisory Panel 8/2012

Policy Implementation/Update Information

10/26/10 New policy implemented. Intensity Modulated Radiation Therapy (IMRT) may be considered medically necessary for the treatment of malignant (primary and secondary) and benign neoplasms of the Central Nervous System (CNS), including brain, brain stem, and spinal cord, when those lesions are in close proximity to the optic nerve or brain stem.

9/13/11 Specialty Matched Consultant Advisory Panel review 8/31/2011. No changes to policy statement. (lpr)

11/13/12 Extensively revised the Description and Policy Guidelines sections. Deleted table for radiation tolerance doses. Under “When Covered” section: added statement 3)IMRT dosimetry demonstrates reduced toxicity of non-target areas. No change to policy statement. Specialty Matched Consultant Advisory Panel review 8/15/12. (lpr)

6/11/13 Specialty Matched Consultant Advisory Panel review meeting 5/15/2013. No changes to policy statement. Reference added. (lpr)

7/29/14 Specialty matched consultant advisory panel review meeting 6/24/2014. No changes to policy statement. Reference added. (lpr)

12/30/14 Added CPT codes 77385, 77386 and HCPCS codes G6015, G6016; Deleted CPT codes 77418, 0073T from Billing/Coding section effective 1/1/2015 for code update. (lpr)

7/1/15 Under Policy Guidelines section added the statement: “CPT 77338 is reported once per IMRT plan and is limited to 3 units per 60 day treatment course.” Also added “Maximum Units of Service” to Related Policies under Description section. Reference added. Specialty Matched Consultant Advisory Panel review 5/27/2015. No change to policy statement. (lpr)

Medical policy is not an authorization, certification, explanation of benefits or a contract. Benefits and eligibility are determined before medical guidelines and payment guidelines are applied. Benefits are determined by the group contract and subscriber certificate that is in effect at the time services are rendered. This document is solely provided for informational purposes only and is based on research of current medical literature and review of common medical practices in the treatment and diagnosis of disease. Medical practices and knowledge are constantly changing and BCBSNC reserves the right to review and revise its medical policies periodically.