THE ROLE OF THE RADIATION ONCOLOGIST IN THE PROCESS OF CARE FOR PATIENTS UNDERGOING RADIATION THERAPY: AN UPDATE

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In December 2000, Drs. Steinberg and Brickner, et al, published a thoughtful assessment of the clinical responsibilities of the radiation oncologist in ASTRONews.¹ Insofar as the process of care for radiation oncology has become increasingly more complex over the past 11 years, the American Society for Radiation Oncology (ASTRO) Health Policy leadership has elected to re-visit this issue. This decision is based in part as a response to the many inquiries ASTRO has received on this subject from both practitioners and payers. This revised article describes the current process of care for radiation oncology patients and re-examines the role of the radiation oncologist.

Introduction

Since the emergence of radiation oncology as a distinct medical specialty and the establishment of ASTRO in 1958, physicians entering the field have been required to undergo a rigorous training program focusing on clinical radiation oncology as well as the natural history of cancer, radiobiology, medical physics and radiation safety that currently extends over a four-year period following internship.²,³ The therapeutic tools employed by the modern radiation oncologist have become significantly more sophisticated with the advent of 3D CRT (three dimensional conformal radiation therapy), IMRT (intensity modulated radiation therapy), IGRT (image-guided radiation therapy), SRS (stereotactic radiation therapy), SBRT (stereotactic body radiation therapy), IORT (intra-operative radiation therapy), HDR (high dose-rate) brachytherapy, and proton therapy over the past decade, in addition to the increasing use of aggressive chemoradiotherapy regimens and hypofractionation.⁴,⁵,⁶,⁷ Such progress, however, comes with an attendant increased risk of significant morbidity for the patient and considerably more physician work. Skillful use of these new tools requires a much deeper understanding of diagnostic imaging and cross-sectional anatomy as well as of normal tissue tolerance. This expanding fund of knowledge is necessary for the modern radiation oncologist to safely prescribe a course of radiotherapy and to manage its effects throughout the continuum of treatment and ongoing follow-up.

Process of Care

The radiation oncology process of care is a series of complex steps that can be separated into five categories that approximate the associated CPT codes.⁴ Codes that fall under the general heading of Medical Physics, Dosimetry, Treatment Devices and Special Services have been included within the various stages of the process of care listed below:

- Patient evaluation
- Preparing for treatment
  - Clinical treatment planning
  - Therapeutic simulation and development of dose distribution
  - Pretreatment QA
Radiation treatment delivery
Radiation treatment management
Follow-up care management

The clinical team, led by the radiation oncologist, provides the medical services associated with the process of care. Other team members involved in the patient's planning and treatment regimen include the medical physicist, dosimetrist, radiation therapist and nursing staff. Ancillary services may include nutritional support by a dietician and involvement of a speech/language pathologist, social worker or psychiatrist as indicated. Certain procedures within each distinct phase of care may be completed before the patient's care is taken to the next phase. Other steps will recur during the course of treatment, insofar as they are, by necessity, repeated during treatment due to patient tolerance, changes in tumor size, need for boost fields or port size changes, protection of normal tissue, or as required by other clinical circumstances. Each phase of care, as outlined below, involves medical evaluation, interpretation, management and decision making by the radiation oncologist with complementary care by other members of the clinical care team.

The scope of knowledge required to provide appropriate medical evaluation, interpretation of complex imaging and laboratory testing, and the decision-making and requisite medical management skills are acquired over years of medical training. A four year residency period is a minimal requirement to fully understand and appreciate the protean biology of a wide variety of cancers, as well as the radiobiology, radiation physics, and imaging that are necessary to obtain successful therapeutic outcomes while minimizing the associated treatment toxicities. Certification by the American Board of Radiology confirms the acquisition of these skills.

Patient Evaluation

The initial step in the process of care is evaluation of the patient by the radiation oncologist. The associated CPT codes are included in the 99xxx series for Evaluation and Management. This is a process that occurs across the spectrum of medical specialties and is not specific to radiation oncology. As such, a detailed discussion of the initial patient evaluation is beyond the scope of this paper.

Preparing for Treatment

Clinical Treatment Planning

Clinical Treatment Planning (77261-77263) is the initial step in preparing a patient for treatment with ionizing radiation. In this step, the radiation oncologist develops the specific parameters of the therapeutic management plan, including the overall clinical, physical, and technical aspects of radiation treatment required for safe and effective therapy for each patient. This includes determining treatment modality, total dose, fractionation, and the need for planned field changes. Both external beam treatment and brachytherapy must be considered. As such, an intense, comprehensive cognitive effort is required to review the pathology and understand the natural history of the patient's disease process, to conceptualize the extent of the disease relative to the adjacent normal anatomical structures by reviewing the three dimensional imaging studies.
and to appreciate the patient's overall medical condition and associated co-morbidities in order to formulate an appropriate plan of therapy. The plan must be concordant with the patient’s goals for treatment. The radiation oncologist is responsible for treatment plan conceptualization and development. A functional knowledge of the roles of chemotherapy and surgery and their integration with radiation therapy is essential. Discussions with physicians of other specialties as well as tumor board presentations are often included in this process.

**Therapeutic Simulation and Isodose Distribution**

The procedural aspects of developing an individual patient’s radiotherapy regimen (77280-77370) define the treatment parameters necessary for safe and efficient radiation treatment delivery. These actions include the therapeutic simulation, construction of immobilization and/or shielding devices and development of an effective isodose plan. In addition, the radiation oncologist must make decisions regarding beam energy, design of beam modifiers, and integration of the requisite clinical medical physics procedures to develop the intended plan and to safely manage the patient undergoing radiation therapy.

*Simulation* is the process of defining the target for radiation treatments and then setting up the appropriate radiation fields for treatment delivery. This includes determining patient position and immobilization, field sizes, and beam angles. This process usually involves contouring the target volume as well as normal anatomic structures using three dimensional images such as CT, MRI, and PET/CT. The process of simulation requires knowledge of the three-dimensional location and extent of the patient’s malignancy or disease process as well as a thorough understanding of the pertinent anatomy and tolerance of normal surrounding tissues to ionizing radiation. Direct physician interaction is required throughout this process.

The *isodose plan* describes the spatial distribution of the dose delivered to the target and also to adjacent normal structures. Several isodose plans may be developed by the radiation physicist using computer algorithms for the radiation oncologist to evaluate and to select among based on the physician’s knowledge of the disease presentation. Three-dimensional review of the isodose distribution relative to target volumes and organs at risk (OAR), as well as dose-volume-histogram analysis, is required for the review of 3D CRT, IMRT, SRS, SBRT and proton plans. Proper interpretation of the dose distribution in relation to tumor volume and normal tissue structures is essential for safe and effective radiation treatment. Direct physician interaction is required throughout this process.

The spatial distribution or the intensity profile of the radiation beams may often need to be modified to protect normal tissue or to improve dose homogeneity within the target volume. This requires the design, construction, and application of shielding blocks, wedges, and/or compensators, both real and virtual (e.g. with multi-leaf collimators). To accomplish this process, the physician must be able to conceptualize each treatment portal with regard to the target volume and the adjacent normal anatomic structures. Direct physician interaction with the clinical team is necessary throughout this process.

**Radiation Treatment Delivery**

*Treatment Delivery* is that component of the process of care during which radiation is delivered to the patient. It may include various forms of external beam therapy, including 3D conformal
and IMRT, stereotactic techniques and proton therapy as well as brachytherapy and intra-operative radiation therapy. The radiation oncologist is responsible for verification and documentation of the accuracy of treatment delivery in accordance with the initial treatment planning and setup parameters. Current technology allows the radiation oncologist to determine the position of the treatment target using Image Guided Radiotherapy (IGRT) by ultrasound, stereotactic kilovoltage X-rays or CT scan localization (megavoltage or kilovoltage). Adjustments in patient position may be required based on the results of these studies and must be checked by the radiation oncologist to ensure that the therapy delivered conforms to the original clinical and dosimetric plans. Various techniques may be utilized to monitor intra-fraction motion of the target and must be supervised by the radiation oncologist. The radiation oncologist must also supervise the weekly chart checks performed by the radiation physicist. For brachytherapy treatments, the radiation oncologist is responsible for implanting radioactive sources or carriers into or adjacent to a specific target within the body and must personally supervise all high-dose rate brachytherapy treatments. Similarly, because of the extreme precision required and the small number of fractions, a radiation oncologist must supervise all stereotactic radiosurgery and all stereotactic body radiation therapy procedures. Again, satisfying each of these responsibilities requires a detailed knowledge of clinical radiation oncology, radiobiology and physics.

**Radiation Treatment Management**

*Treatment Management* includes the medical management of patients going through radiation treatments, including external beam irradiation and more sophisticated techniques such as brachytherapy, SRS and SBRT, proton therapy, and IORT. External beam patients undergo weekly management while stereotactic patients undergo management more frequently. The management of an external beam radiation treatment course can be equated to a surgical procedure that, instead of transpiring over minutes to hours, takes place over a period of days to weeks. Numerous points of decision and treatment management interventions take place during this phase of the process of care. Similar to a surgical procedure, certain aspects of radiotherapy management will be obviously technical and procedural, but the overriding aspect of the management of the patient is cognitive and requires direct face-to-face physician-patient interaction. The radiation oncologist's management of the treatment involves a continual assessment and supervision of the treatment that is delivered, as well as the patient's response to these treatments.

Reactions to treatment must be recognized and cared for in an appropriate fashion. This ongoing assessment of the patient over a course of irradiation is more critical today than ever before given the ability to deliver escalating doses of radiation, often concomitantly with cytotoxic chemotherapy. The day-to day clinical management of the patient is an interactive and cognitive process that requires the expertise of the radiation oncologist.

**Weekly Management (77427)**

*Weekly Treatment Management* is performed on each patient receiving external beam treatment – conventional, 3D CRT, or IMRT. It includes a minimum of one examination of the patient by the radiation oncologist for medical evaluation for each reporting of CPT code 77427. It also includes a wide range of other functions: review of port films; review of dosimetry and cumulative dose to target and critical structures; review of dose delivery, treatment parameters and patient treatment set-up. Radiotherapy management decision-making may include dose, set up or field
modifications. Re-planning may be necessary because of technical, biological and patient related factors, as well as decisions regarding delay or suspension of further treatment. The process includes discussion with other members of the treatment team (therapists, physicists, dosimetrists, nurses, nutritionists, social worker, etc.), dialogue with the family and consultation with the multidisciplinary physician team to coordinate care. Upon completion of the prescribed course of radiotherapy, there is a comprehensive review of all clinical and technical aspects of treatment. Follow up appointments are made with the radiation oncologist and any other members of the physician management team, including the referring physician. The requisite imaging studies may be ordered at this time, as well as referral to the survivorship program, as indicated.

It must be emphasized that the notion that weekly treatment management requires only evaluation and management of treatment related symptoms falls far short of the radiation oncologist's responsibility. The total care of the patient during the treatment course requires the integration of multiple medical and technical functions included in the weekly management code, but their performance may be required on any day during the course of radiotherapy. Management of patients treated with stereotactic radiosurgery or stereotactic body radiation therapy requires an even higher level of technical expertise. The extremely close tolerances utilized in SRS and SBRT and the small number of fractions necessitates a meticulous review of treatment parameters and field set-up. The radiation oncologist must be able to understand and recognize the expected consequences of treatment and to appropriately manage the associated toxicities.

Nurses or other non-physician health care practitioners sometimes participate in the care of patients receiving radiation therapy, typically by providing assistance in the management of some of the minor side effects patients may experience during treatment. These efforts, however, do not constitute comprehensive weekly management. Examination of the patient by the physician is necessary to assess the patient's response to treatment on an ongoing and regular basis throughout the course of therapy. The patient expects and deserves such face-to-face physician time, not only to manage the medical and technical aspects of their treatment, but also to receive the benefit of personal physician contact and emotional support as the patient and family deal with his or her life-threatening disease. Only a radiation oncologist is qualified to incorporate both the clinical and technical aspects of weekly management and, for that reason, each patient under treatment must have a face-to-face encounter with a radiation oncologist every week, even if there are one or more visits with a non-physician practitioner.

**Follow-up Care Management**

Ongoing follow-up of patients treated with a course of radiation therapy has been a hallmark of the radiation oncologist since the earliest days of the specialty when Dr. Juan Del Regato, at the Penrose Cancer Hospital in Colorado Springs, established the first residency program in 1959. Frequent, early follow-up care of patients who have completed radiation therapy is necessary to manage acute morbidity resulting from treatment, whereas long term follow-up is necessary to monitor the patient for tumor recurrence and chronic treatment related morbidity. While follow-up evaluations may appropriately be alternated with surgeons, medical oncologists and primary-care physicians, the radiation oncologist should stay intimately involved in the process insofar as his/her knowledge of the irradiation treatment parameters (volume...
irradiated, dose, fractionation, etc) allows him/her to make the best judgment with regard to sites of relapse relative to the treatment field and potential treatment related side effects. Only the radiation oncologist has the necessary training and experience to evaluate the post-treatment patient to determine if any new signs or symptoms are secondary to the radiation treatments or have a different etiology. The follow-up algorithm (frequency, studies to be obtained, etc) is dependent on disease presentation, treatment intent (curative vs. palliative) and potential for salvage if relapse is discovered. Direct physical examination should be performed. The radiation oncologist should consult with the other members of the radiation therapy team as well as with other involved physicians when unexpected morbidity is observed or reported.

Safety and Quality Assurance

It is essential that every radiation oncology department foster a culture of safety. Each member of the treatment team plays a critical role in ensuring maximum patient safety, all under the supervision of the radiation oncologist. An error at any point in the process of care could lead to a catastrophic misadministration of radiation resulting in significant patient morbidity and potentially death. It is the responsibility of the radiation oncologist, in coordination with the radiation safety committee, to develop a system of checkpoints which can identify any errors before a patient injury occurs. The radiation oncologist must be aware of the possibility of both systemic and random errors. Physics quality assurance, review of portal films and IGRT images, as well regular peer review and relevant continued medical education are essential in a quality assurance program. Once again, this responsibility requires an understanding of all of the technical details of treatment simulation, planning, and delivery by the radiation oncologist, as well as the medical consequences of a potential error.

Pretreatment quality assurance measurements are required for all patients. These may range from port film review to more complicated measurements of the delivered dose distribution and target volumes performed prior to 3D CRT, IMRT, SRS, SBRT, or proton treatments. Additional specialized medical physics procedures such as in vivo dosimetry may be required in particularly complex cases. These, too, must be supervised and approved by the radiation oncologist.

Total Care of the Radiation Oncology Patient

The total care of the radiation oncology patient mandates direct clinical management by the radiation oncologist. It is the radiation oncologist's role and responsibility to provide hands-on, face-to-face patient care to ensure the efficacy and safety in the use of ionizing radiation in the care of patients with malignancies and other disease processes. Use of ionizing radiation in the management of disease requires that the physician:

- Have a full and accurate understanding of the location and extent of the patient's malignancy or disease process within the clinical limitations of the disease presentation;
- Have an understanding of the pathologic cell type of the malignancy or disease process and its level of sensitivity to radiation;
- Understand the biological behavior of the malignancy or disease process and determine whether the treatment would be optimally administered by external beam photons, electrons, combined therapy with brachytherapy, combined modality utilizing chemotherapy, or surgical intervention prior to or subsequent to the radiation therapy course;
- Be able to recognize clinical situations and disease processes that are likely and not likely to benefit from radiation therapy;
- Understand the full inventory of therapeutic modalities that are at his/her disposal and to select from a menu of radiation options including: external beam irradiation, including proton therapy; stereotactic radiosurgery; stereotactic body radiation therapy; low or high dose brachytherapy; intra-operative radiation therapy (IORT); or systemic isotope therapy modalities to be utilized in the treatment process;
- Understand the three dimensional anatomy of the tumor and surrounding normal tissues well enough to contour target volumes and avoidance structures with a high degree of accuracy, and have an understanding of how these associations may change on a daily basis as part of treatment set up techniques and therapy;
- Understand the critical, vital or sensitive structures that are located adjacent to, surrounded by, or involved by the malignancy or disease process and the dose-volume tolerances of these structures to radiation;
- Be able to supervise appropriate radiation therapy planning including: treatment portal placement; selection of beam energy, dose, dose/fraction, and rate of delivery; and to formulate a plan utilizing these parameters to treat the malignancy with minimal damage to normal structures;
- Understand the role of three-dimensional conformal and intensity modulated radiation therapy. In particular, understand how, although these modalities can lead to increased target dose and decreased normal tissue dose; and that slight errors in contouring or treatment delivery can lead to substantial underdosing of the target;
- Be able to interact with other physician specialists in devising appropriate treatment plans for combined modality therapy, stereotactic radiosurgery, stereotactic body radiation therapy and intraoperative irradiation;
- Be able to interpret the results of image guidance to assure proper patient positioning;
- Instill a culture of safety among the treatment team to minimize the likelihood of error at any point along the process of care.
- Possess cognitive skills to determine the necessity for further testing or evaluation prior to and during the treatment course to more accurately assess the needs of the patient as the clinical status changes;
- Understand the possibility of the spread of the malignancy beyond the boundaries of the initial presentation and be able to make an accurate assessment of possible routes of spread and whether these are in fact involved with malignancy (special testing and interpretation of those medical tests may be necessary);
- Decide if a combination of treatment, such as radiation therapy and chemotherapy, are appropriate, whereby the radiation oncologist must coordinate care with other medical specialists, such as medical oncologists or surgical oncologists, and possess adequate knowledge of the radiobiological interrelationships of various modalities that will be used to treat the patient;
- Have the ability to weigh the risks of treatment related to morbidity to the potential benefits of treatment and be able to individualize factors of co-morbidity in patients so as to minimize untoward effects of treatment;
- Be able to integrate, manage and coordinate care regarding the acute effects of treatment, nutritional support and the psycho-social aspects of patients experiencing the
stress of life-threatening disease, and be able to evaluate and initiate care or coordinate care, and refer to appropriate medical specialists as necessary;

- Be able to evaluate treatment-related morbidity and initiate appropriate clinical intervention;
- Be able, from time to time, to consider, evaluate and manage other medical conditions not directly related to the patient's disease process for which the radiation therapy course is given;
- Follow patients for local, regional and distant recurrence, new primary cancers and early and late toxicity, and be aware of early and late outcomes in treated patients.

Summary
The process of care for radiation oncology is a complex series of interrelated steps that may be separated into distinct components with the ultimate goal being the best possible clinical outcome and quality care for the patient. The development of a safe and effective therapeutic plan and subsequent management of the patient requires the radiation oncologist to have the training and expertise necessary to provide the requisite supervision of the various members of the oncology team. The radiation oncologist must have the broad scientific and technical background described in this article to carry out and supervise the entire process of care. In a technically complicated specialty such as radiation oncology, it is imperative that the radiation oncologist has the skills necessary to oversee the evaluation, treatment and management of the patient to ensure a safe and error-free environment.

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