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Scientific Article

The Impact of Transitioning to Prospective Contouring and Planning Rounds as Peer Review

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Abstract

Purpose: Our peer-review program previously consisted of weekly chart rounds performed before the end of the first week of treatment. In order to perform peer review before the start of treatment when possible, we implemented daily prospective contouring and planning rounds (CPR).

Methods and materials: At the time of computed tomography simulation, patients were categorized by the treating physician into 5 treatment groups based on urgency and complexity (ie, standard, urgent, palliative nonemergent, emergent, and special procedures). A scoring system was developed to record the outcome of case presentations, and the results of the CPR case presentations were compared with the time period 2.5 years before CPR implementation, for which peer review was performed retrospectively.

Results: CPR was implemented on October 1, 2015, and a total of 4759 patients presented for care through May 31, 2018. The majority were in the standard care path (n = 3154; 66.3%). Among the remainder of the charts, 358 (7.5%), 430 (9.0%), and 179 (3.8%) cases were in the urgent, nonemergent palliative, and emergent care paths, respectively. The remaining patients were in the special procedures group, representing brachytherapy and stereotactic radiosurgery. A total of 125 patients (2.6%) required major changes and were re-presented after the suggested modifications, 102 patients (2.1%) had minor recommendations that did not require a repeat presentation, and 247 cases (5.2%) had minor documentation-related recommendations that did not require editing of the contours. In the 2.5 years before the implementation, records of a total of 1623 patients were reviewed, and only 9 patients (0.6%) had minor recommendation for change. The remainder was noted as complete agreement.

Conclusions: Contouring and planning rounds were successfully implemented at our clinic. Pretreatment and, most often, preplanning review of contours and directives allows for a more detailed review and changes to be made early on in the treatment planning process. When compared with historical case presentations, the CPR method made our peer review more thorough and improved standardization.

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Introduction

Peer review is an important aspect of quality assurance in radiation oncology practice. Radiation therapy plans that deviate from standard protocols have been shown to be associated with inferior outcomes.[1,2] Studies have demonstrated the efficacy of implementing regular chart rounds as peer review, with changes made ranging from 7% to 10% of cases.[3] This fact is emphasized in the American Society for Radiation Oncology-sponsored Quality Assurance and Patient Safety White Papers for their Target Safely Campaign.[4] However, most centers conduct peer review through weekly retrospective chart rounds, but there is ostensibly a greater benefit in completing chart rounds in a prospective, daily format.

Prospective peer review has been studied to help improve the quality assurance process.[1,2,5] Retrospective chart rounds result in far greater effort required to create adjustments to treatment plans by duplicating the work for planning, documentation, physics checks, patient-specific quality assurance, and therapist plan checks. The need for additional effort can also act as a deterrent for intervention to re-plan. Moreover, for treatments that require shorter treatment courses, a significant portion of the dose may be delivered already by the time the case is presented. Numerous studies performed on the peer review process emphasize that contour changes make up a significant portion of modifications made to treatment plans.[5–13] These studies also demonstrate the feasibility of performing prospective chart rounds in a format that occurs multiple times a week.

The goal of this study is to describe a department initiative that was undertaken at our institution to implement daily prospective contouring and planning rounds (CPR). We describe the implementation of CPR at our institution and the means by which we utilized preexisting tools in our record-and-verify system (RVS) to create a workflow that reduces the likelihood of modifying treatment plans after patients have begun treatment. Our motivation to implement CPR was to prospectively review contours to prevent possible suboptimal plans from reaching patients and limit the number of re-plans after treatment starts. We also discuss the results of our CPR sessions and the impact on our clinical workflow.

Methods and Materials

The Loyola University Medical Center is an academic medical center in suburban Chicago and affiliated with the Stritch School of Medicine. A wide range of radiation treatment modalities are offered at the center, including standard external beam radiation therapy, stereotactic radiosurgery (SRS), stereotactic body radiation therapy (SBRT), low- and high-dose rate brachytherapy, hyperthermia, and intraoperative radiation therapy. At our clinic, approximately 1100 patients are treated annually with external beam radiotherapy, 65 with SRS, 125 with brachytherapy, and 20 with intraoperative radiation therapy. The development of the prospective CPR program was a multistep process.

Creation of the disease site-specific clinical treatment planning notes

The first step initiated by our department in an effort to improve quality assurance was the creation of the clinical treatment planning note (CTPN). The CTPN was first implemented in March 2015, and included the following elements: Summary of clinical history, rationale underlying target delineation, dose fractionation/energy request, patient-specific dose constraints, intensity modulated radiation therapy justification, special procedure justification, and image guided radiation therapy request.

The CTPN required approval before the initiation of treatment planning for the patient and had to list the intended start timeframe for treatment. In order to have this note visible to referring physicians, we decided to put this on our hospital electronic medical record system (Epic Verona, WI). A template CTPN was created for each disease site, including dose constraints that are customized for each patient by the treating radiation oncologist.

Creation of treatment planning groups based on urgency and complexity of treatment

Five different treatment planning groups were created. At the time of the computed tomography (CT) simulation request, patients were placed into one of 5 categories by the attending physician (Table 1).

For the standard group of patients, contours are reviewed at CPR before the start of planning. For the urgent group, planning begins immediately to avoid delays, but contours and directives are reviewed before the start of treatment. For the palliative nonemergent group, treatment fields are reviewed at CPR before the start of treatment. Patients in the emergent group are reviewed retrospectively after the start of treatment because they

Table 1 Definition of contouring and planning rounds categories based on urgency of treatment start time

CPR categories	Definition
Standard	Patients undergoing treatment that could start ≥5 days after CT simulation
Urgent	Patients need to start treatment ≤4 days after simulation
Palliative nonemergent	Patients who require relatively simple planning (eg, AP/PA for bone metastasis) with anticipated start ≤4 days after simulation
Emergent	Patients who must start treatment prior to next CPR
Special procedures	Patients who receive special procedures, such as radiosurgery and brachytherapy

Abbreviations: AP/PA = anterior-posterior/posterior-anterior; CPR = contouring and planning rounds; CT = computed tomography.

must start treatment right away. Patients assigned to the special procedures group are reviewed at CPR before treatment when possible. For cases such as high-dose rate brachytherapy, because of the urgency of the treatment, care was taken by the radiation oncologists to review the contours with another radiation oncologist before treatment, but these cases were represented during the CPR post-treatment period for training purposes.

For each of these 5 treatment planning groups, a corresponding clinical care path was developed in the Aria RVS (Varian Medical Systems, Palo Alto, CA) with specific tasks implemented on the basis of the group to which the patient had been assigned. Staff members were trained on the specifics of the 5 different groups and the care paths that correspond to each group to promote patient safety and ease the transition into the newly implemented CPR format. There was a department-wide standard of prioritization for CPR, and emergent and urgent patients were clearly delineated to be of a higher priority for discussion at CPR compared with standard patients so that time would be appropriately designated for CPR that day.

Development of a scoring system

A scoring system was developed to record the outcome of case presentations, and scores were recorded at each session. Three different grades were determined: grade 1 (approved without significant changes and ready for planning, which includes patients with minor documentation or nomenclature changes), grade 2 (change in target or dose/fractionation required before planning), and grade 3 (not appropriate candidate for treatment approach). Small changes to cases were agreed upon to be made during CPR, but changes of a greater magnitude necessitated presentation once more at CPR.

Infrastructure changes and scheduling

In October 2015, our institution officially implemented daily prospective CPR and was to take place every day for 45 minutes at 12:15 PM (ie, time of day when members of the treatment team are more likely to be available to promote attendance by as many team members as possible). Team members who were encouraged to attend CPR included attending physicians, resident physicians, medical students, medical physicists, medical physics residents, nurses, dosimetrists, and radiation therapists.

At CPR, data from patients who were treated at our main and satellite sites were reviewed. Technology incorporated into the CPR included television monitors to visualize the imaging presented and the CTPN presented on an additional monitor. Teleconferencing was established to allow physicians at other sites to participate in rounds.

The outcome for each patient and staff attendance was recorded by departmental staff members as part of the quality and safety program. For this study, descriptive statistics were performed to evaluate the frequency and nature of changes as a result of CPR sessions. Descriptive statistics also tracked attendance by attending physicians and changes in the time from CT simulation to the start of treatment as a result of the new extra step of having CPR earlier on in treatment planning for most patients.

The results of the case presentations after CPR implementation were also compared with the 2.5 year time period prior when peer review was performed in the retrospective chart rounds format.

Results

CPR was implemented on October 1, 2015 using the RVS care paths.

Contouring and planning rounds categories

In the standard care path (Fig 1A), the CPR standard task becomes available after the physician completes drawing the tumor volume (ie, draw televisions task). The generate plan task does not become available for dosimetrists until the case is presented at the time of CPR rounds. In the urgent care path (Fig 1B), the CPR urgent task becomes available after the tumor volume has been drawn, but simultaneously permits the generation of a plan to allow for sufficient time to review and prepare the plan for treatment in the interim.

The palliative nonemergent care path (Fig 2A) was reserved for patients who are treated with fields placed

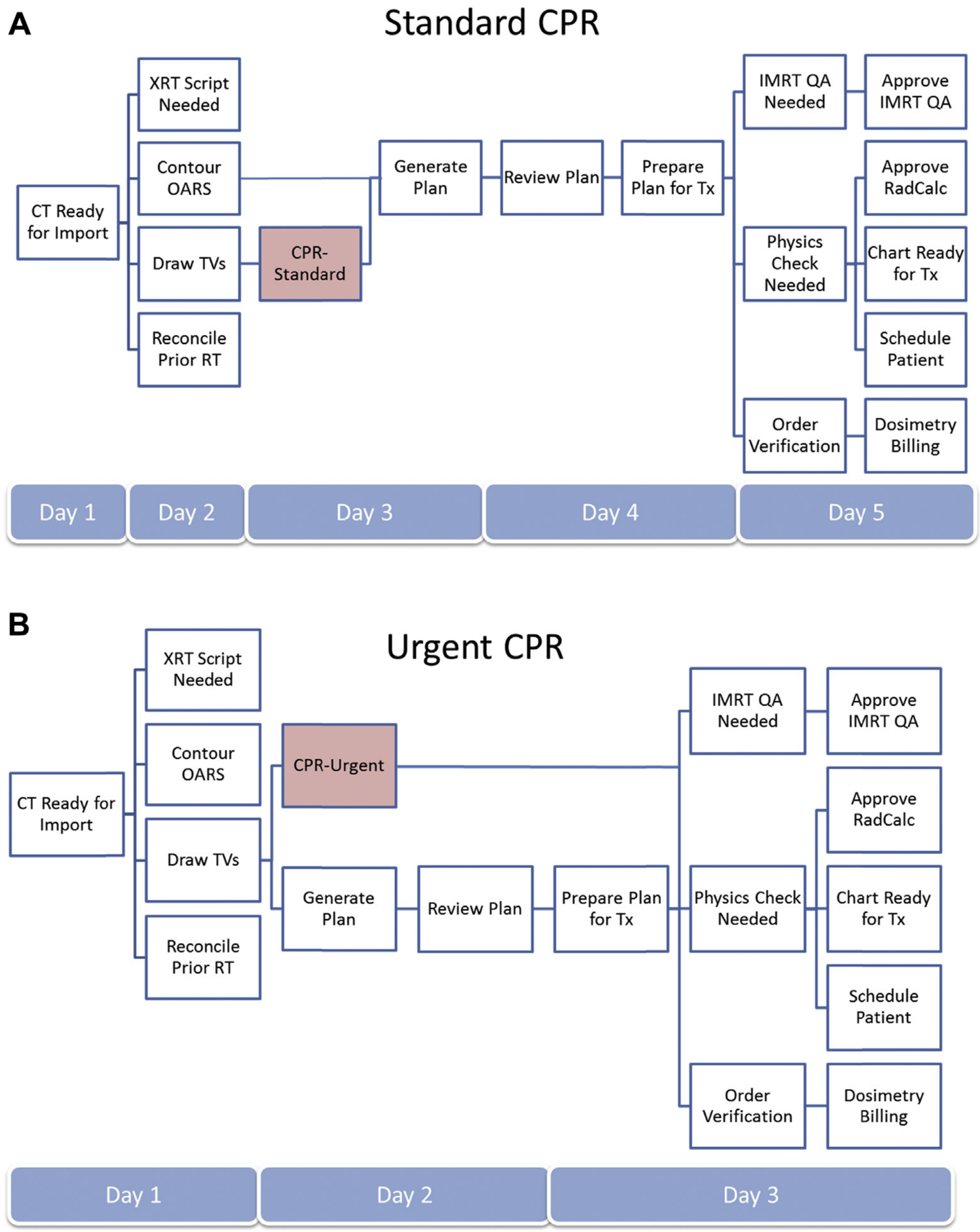

Figure 1 (A) Standard care path for patients undergoing treatment that could start ≥5 days after computed tomography simulation. Contours are reviewed at rounds before the start of planning. (B) Urgent care path for patients who need to start treatment ≤4 days after simulation. Planning begins immediately to avoid delay, but contours and directives are reviewed before the start of treatment.

with the guidance of the physicians rather than tumor volumes, such as palliative spine irradiations or conventional breast planning. The CPR nonemergent palliative task becomes available after the plan has been generated and reviewed. The treatment fields are reviewed at rounds before the start of treatment with a required physics chart check before treatment.

During the implementation phase, the authors did not want to add any delays to the treatment of patients, especially for patients who need radiation urgently. In the emergent care path (Fig 2B), the workflow permits the generation of the plan with preparation for treatment and simply requires a physics quality assurance check before treatment. The CPR emergent task is available at the end of the care path because these cases are generally reviewed retrospectively.

Not all treatment planning can be categorized using the urgency of planning, and some require different workflow considerations. To address these situations, we implemented multiple special procedure care paths for treatments such as stereotactic radiation therapy and brachytherapy. We depict the special procedure care path for high-dose rate brachytherapy as an example in Figure 3A. CPR is held around noon each day, so if the contours are ready by that time, we present them to the group. Otherwise, they are presented the next day.

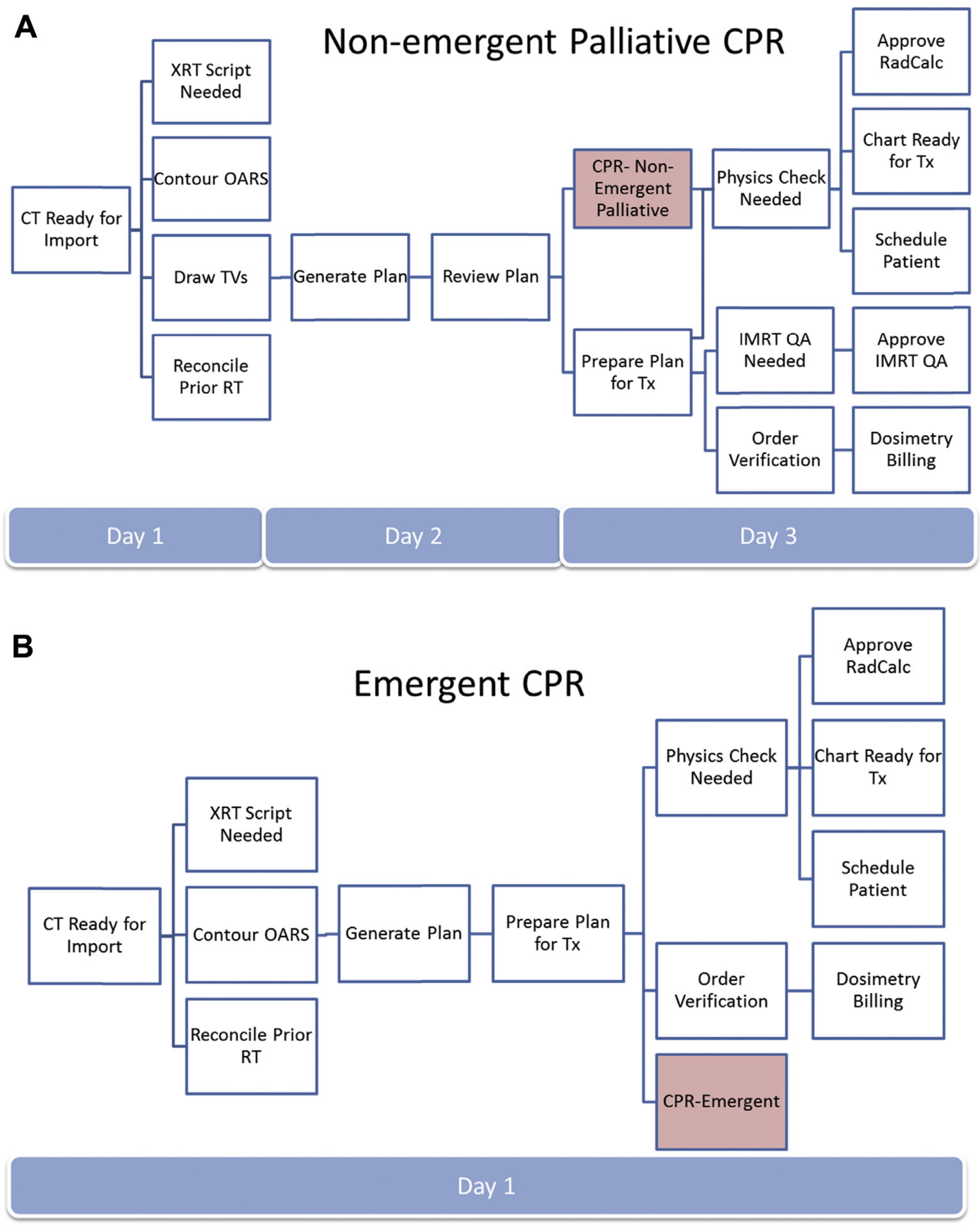

Figure 2 (A) Palliative nonemergent care path for patients who require relatively simple planning with anticipated start ≤4 days after simulation. Fields are reviewed at rounds before the start of treatment. (B) Emergent care path for patients who must start treatment before the next contouring and planning rounds. Patients are reviewed retrospectively after the start of treatment.

Case presentations

Since the initiation of CPR, a total of 4759 patients have been presented through May 31, 2018. The majority of these patients were in the standard care path (n = 3154; 66.3%), and 358 (7.5%), 430 (9.0%), and 179 (3.8%) cases were in the urgent, nonemergent palliative, and emergent care paths, respectively. A total of 124 SRS (2.6%) and 514 brachytherapy (10.8%) cases were reviewed. The number of cases assigned to each treatment planning group, categorized by disease site, are described in Table 2. A total of 125 patients (2.6%) required major changes and were re-presented after the suggested modifications, 102 patients (2.1%) had minor contouring or dose recommendations that did not require repeat presentation, and 247 cases (5.2%) had minor documentation-related recommendations that did not require editing of the contours.

Historically, the results of our retrospective chart rounds were recorded in 3 outcomes, such as complete agreement, minor recommendation for change, and considerable disagreement with the treatment plan. The authors reviewed the results of the weekly retrospective chart reviews from January 2013 to September 2015. Within this 2.5-year period, a total of 1623 patients were reviewed, and only 9 patients (0.6%) had a minor

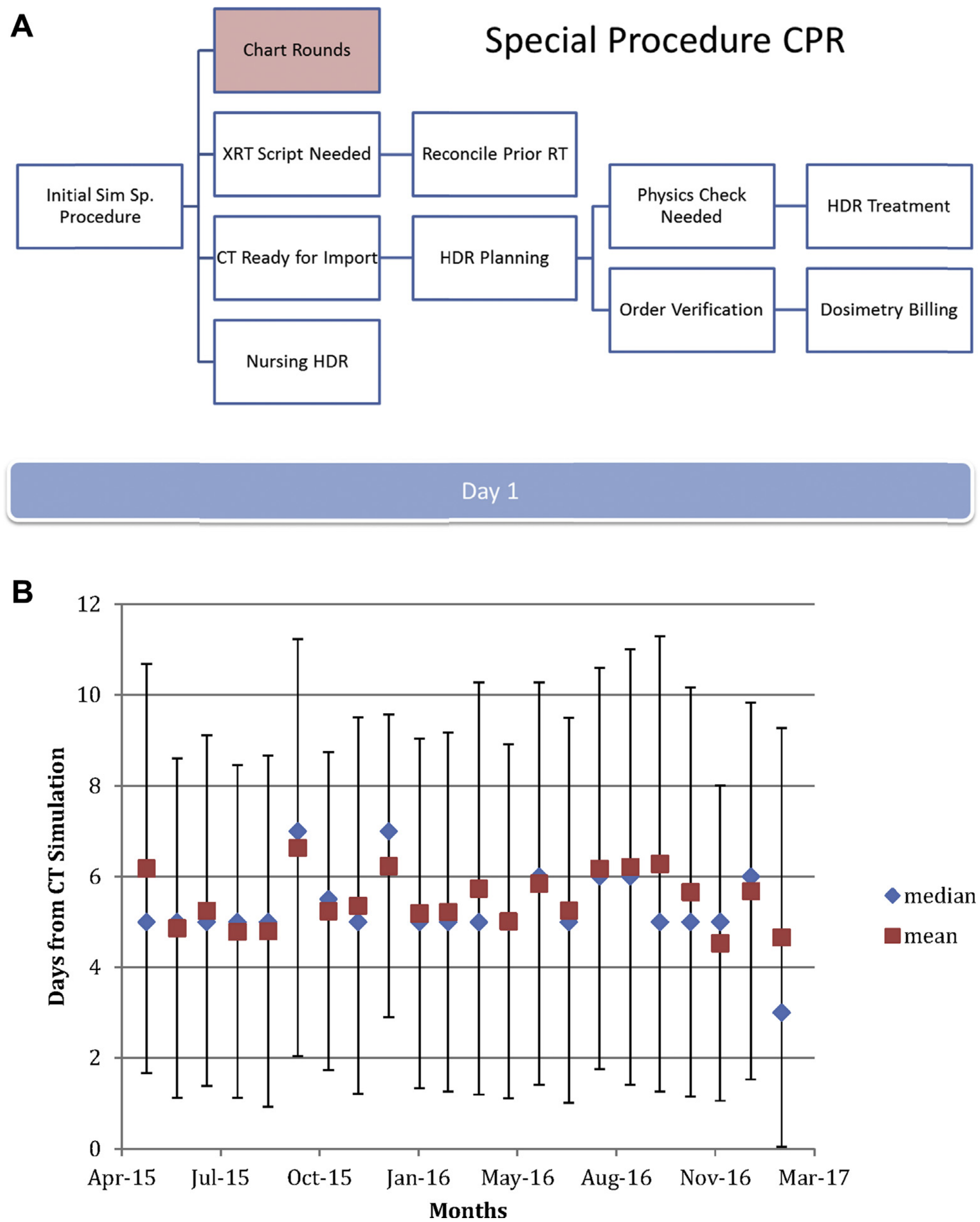

Figure 3 (A) Special procedures care path for patients receiving special procedures, such as stereotactic radiosurgery or brachytherapy. Patients are reviewed before treatment when possible; however, most present retrospectively after the first treatment. (B) Time from computed tomography simulation to initiation of treatment between May 2015 and March 2017. Contouring and planning rounds were implemented in October 2015.

recommendation for change, no patients had a considerable disagreement with the treatment plan, and the remainder were annotated as complete agreement.

Effect of contouring and planning rounds implementation on time from computed tomography simulation to treatment

The time from CT simulation to the start of treatment between April 2015 and March 2017 is reported in Figure 3B. The median time from CT simulation to treatment initiation in the 5 months before initiation of CPR at our institution was 5 days, and the median time from CT simulation to treatment initiation in the 5 months after implementation of CPR was 6 days. In the 12 months after implementation of CPR, the median time from CT simulation to the start of treatment decreased to 5 days.

Discussion

The implementation of CPR using the workflow tools available in our RVS was successful, and our department

Table 2 Distribution of cases by body site and contouring and planning rounds groups

	Abdominal	Brain	Breast	Extremities	Head and neck	High-dose-rate brachytherapy	Hip	Lung	Miscellaneous	Multi-site	Pelvis	Prostate	Stereotactic body radiation therapy	Spine	Stereotactic radiosurgery	Grand total	%
Standard	316	167	651	75	569		20	391	35	45	287	377	157	64		**3154**	**66.3**
Urgent	31	74	14	13	65		17	32	14	7	38	1	20	32		**358**	**7.5**
Nonemergent palliative	23	59	25	57	18		37	21	23	42	16	2	16	91		**430**	**9.0**
Emergent	12	38	3	7	1		14	16	9	11	3			65		**179**	**3.8**
Special procedures						514									124	**638**	**13.4**

efficiently carried out the tasks designated by the RVS care paths for each treatment planning group between October 1, 2015. and May 31, 2018, and continuing today. After CPR implementation, almost 5% of presentations required changing the contours/dose, and an additional 5% required changes in the documentation. When comparing the results after CPR implementation with the 2.5-year period before implementation (0.9% minor change recommendations), the prospective CPR implementation made our peer-review process more thorough and improved our standardization and documentation.

Existing literature suggests that there is significant benefit in chart rounds focusing on contouring variations to ensure appropriate target delineation in addition to treatment planning.[7] Rooney et al performed weekly chart rounds for all patients who received radical radiation therapy for lung cancer and found that the peer review process resulted in changes made to 27% of patients analyzed, with 63.6% of the changes resulting from changes in target volume delineation.[8] In another study, Ballo et al performed a twice-weekly peer-review conference for nonpalliative cases and found that changes were recommended in 12.2% of the reviewed cases, with a target change recommended in 69.1% of cases.[9]

A study performed by Cox et al analyzed external beam radiation therapy cases that were peer reviewed at prospective daily contouring rounds, and 36% of the plans required modifications before the initiation of treatment planning. The most common reasons for delays were incomplete contours and the need for target modification.[10] Most recently, Mitchell et al instituted a prospective peer-review process with chart rounds held 3 to 4 days weekly and found that 10% of cases carried a recommendation for a change in contours.[11] These data suggest that target delineation errors are an important cause for changes in both retrospective and prospective peer review.

In the initial implementation phase, the proposed change to CPR was discussed at faculty and departmental meetings. The distinction of placing the type of patient in the proper CPR groups required ongoing training during the initial stage where feedback was given to radiation oncologists. The CT simulation orders in our hospital electronic medical record system were updated to include a question about the urgency of the treatment, so radiation oncologists were asked to place the patient in the proper CPR group. Ongoing re-training is needed for optimal CPR group assignment as new staff members join our department.

The median time from CT simulation to treatment changed from 5 days in the 5 months preceding implementation of CPR to 6 days in the 5 months post-implementation; however, the number of days between CT simulation and initiation of treatment returned to

5 days for the next 12 months. This return to baseline implies that, although the time between CT simulation to treatment increased immediately after CPR implementation while the system was starting out, the department became accustomed to the system over time and improved its workflow.

The median percentage of chart rounds for which each attending radiation oncologist in the department was present was 66.67% and ranged from 57.1% to 71.0% for each month, indicating that faculty support of CPR was consistently strong, with the opportunity for attending radiation oncologists to lend even stronger support moving forward. The department-wide standard to prioritize patients based on their treatment planning group was adhered to by members of the treatment team, and CPR was regularly attended by attending physicians, resident physicians, medical students, physicists, dosimetrists, and radiation therapists. Over time, CPR improved the quality and accuracy of completion of the CTPN in addition to facilitating compliance with the various requirements listed in the note.

One of the positive attributes noted in performing prospective, daily, peer-review rounds is that the time allotted per patient, in addition to the time dedicated to academic teaching, increased significantly when chart rounds occurred daily rather than weekly. CPR served to complete a thorough evaluation of tumor target volumes, dose prescriptions, dose-volume histograms (if available), dose constraints and planning goals, patient history, diagnosis, and staging in addition to serving as an opportunity for teaching. A study conducted by Lawrence et al found that the estimated amount of time spent per patient in weekly chart rounds was 2.7 minutes, including time spent quizzing radiation oncology residents, which is insufficient time for the numerous goals that chart rounds are expected to accomplish.[12] Cox et al and Mitchell et al conducted daily or near-daily prospective peer-review rounds, and reported spending an average of 8 and 7 minutes per case, respectively.[10,11] In our implementation, on average, we presented 6 to 7 patients in 45 minutes, which correlates to 6 to 8 minutes per case.

Resident education is an important aspect of chart rounds that is enhanced with daily prospective CPR because contouring is one of the most important aspects of a radiation oncologist's work, which was emphasized in the CPR format we implemented. Daily CPR provides a forum for brainstorming on what to include in contours, with peer advice provided on difficult cases during the planning phase. Daily CPR allows for standardization among disease and network sites because target volume selection has been shown to display a great amount of inter- and intraphysician variability for various tumor sites.[13-18] In addition to serving as an opportunity to provide quality resident education, daily CPR serves to mentor junior attending radiation oncologists with, as Lefresne et al described, a higher association of cases with significant changes needed with radiation oncologists having fewer years of experience.[13] This finding was emulated by the work by Matuszak et al, who described that there were significantly lower odds of making a change in peer-reviewed SBRT cases when radiation oncologists had more experience with SBRT.[14]

There were many merits to CPR at our institution and its implementation was overall successful, but there are limitations to this approach. The median time to initiation of treatment after CT simulation increased by 1 day immediately after implementation of CPR, and this change vanished as time went on over the following year. The opportunity for in-depth discussions about appropriate contouring in CPR had the potential to create delays in treatment planning and lead to rushed planning for timely treatments. In addition, we do not always review the final plans or port films because of time constraints.

Support from department administration, leadership, and frontline staff was crucial to the successful implementation of CPR at our institution. Buy-in from administrators and leadership encouraged a department-wide attendance at CPR, which lent itself to greater interprofessional exchanges at daily rounds and an enhanced department-wide desire to promote patient safety and quality assurance measures in each step of the treatment process. The efficacy of leadership in promoting quality assurance has been previously described by Chao et al, who documented fewer errors in their workflow and processes after assembly of a workflow enhancement team composed of administrators and frontline staff.[19] Support from leaders, both in the department and the treatment team, will continue to be beneficial as we continue to develop CPR at our institution.

Conclusions

Peer review is essential to the practice of radiation oncology. The initiative to develop and implement daily prospective peer reviews in the format of chart rounds that focus on contouring and planning was successful at our institution. Data from 4759 patients were presented at CPR over the course of 2.5 years and showed that the median time from CT simulation to treatment initiation remained the same before and after CPR implementation. The development of 5 different treatment planning groups successfully allowed for the creation of a differential of prioritization for patient management to guide treatment planning decisions.

CPR was widely attended by various members of the treatment team who benefited from the support of treatment team leaders and administrators. We plan to further analyze CPR to assess its impact on patient outcomes at our institution.

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