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Brief Opinion

A Model to Improve the Workflow for Radiation Treatments in the Era of Bundled Payments: A Quality Improvement Project Report

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Abstract

The Centers for Medicare and Medicaid Services has proposed alternate payment models to improve the efficiency and decrease the redundancy of health care. Bundled payments or episode-based care is one example. Herein, we report on the successful implementation of a quality improvement project in which changing the clinical workflow for postoperative radiation treatment to the hip to prevent heterotopic ossification improved the efficiency of patient care and decreased cost by eliminating redundant imaging through multidisciplinary participation. This project is a model for interdisciplinary collaboration to improve patient care and reduce unnecessary health care spending in the era of bundled payment/episodes of care program implementation.

Introduction

The Department of Health and Human Services and Centers for Medicare and Medicaid Services (CMS) have proposed the implementation of alternate payment models (APMs) to improve the efficiency and decrease the redundancy of health care to streamline cost.[1,2] These programs include accountable care organizations, bundled payments, and advanced primary care medical homes.[3] Bundled or episode-based payments link otherwise unconnected payments for individual services provided by clinicians and departments during an episode of care. The health care organization receives a lump sum payment for all services during that episode.[3] Patients and providers are expected to benefit from this system by improving coordinated care and removing inefficiency and redundancy from the patient care protocols.[4,5]

CMS has launched 3 bundled payment models: Bundled Payments for Care Improvement, Comprehensive Care for Joint Replacement, and Oncology Care Model.[6–8] The American Society of Radiation Oncology has expressed concerns regarding the Oncology Care Model because the model could potentially disincentivize the appropriate use of radiation therapy owing to cost concerns.[9] To overcome this issue, the American Society of Radiation Oncology suggested the idea of a radiation oncology (RO) APM, which is a specialty-specific model for RO.[9] CMS announced an RO model on July 10, 2019, to be enacted in 2020, that requires the participation of approximately 40% of RO practices in the United States.[9]

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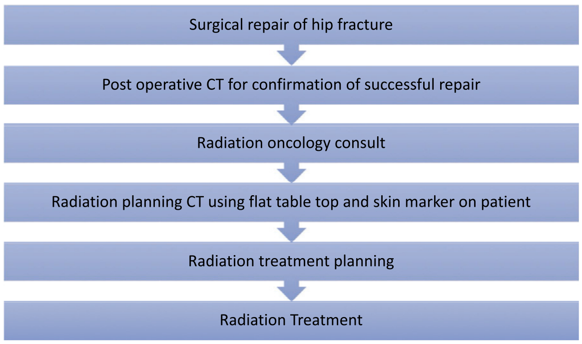

Figure 1 Previous workflow.

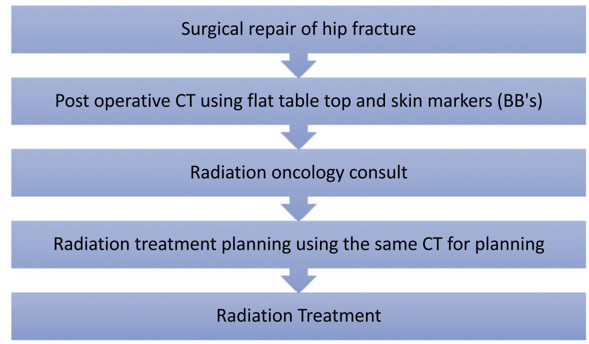

Figure 2 New workflow.

To require episode of care/bundled payments as a payment model incentivizes health care organizations and physicians to improve coordination of care and reduce unnecessary spending. In this report, we discuss how our institution was able to modify the workflow for postoperative radiation treatment for the prevention of heterotopic ossification.

Postoperative radiation treatment is well established as one of the prophylactic modalities to prevent the formation of heterotopic ossification in the muscles of the hip joint.[10] Radiation is reported to be at least as effective as nonsteroidal antiinflammatory drugs to prevent heterotopic ossification.[11] Radiation may be delivered before surgery (<4 hours before operation) or after surgery (within 72 hours). We routinely use postoperative radiation treatment at our institution.

Problem

Heterotopic ossification can occur in the postoperative setting after surgical repair of fractured pelvic bones and can be prevented by single-dose radiation treatment after the operation. Radiation treatment planning requires the placement of a flat tabletop during computed tomography (CT) imaging to reproduce patient positioning accurately between imaging and radiation treatment. Localizing skin markers are placed on the patient's skin at the time of the CT scan, which provides the ability to reproduce patient positioning on the radiation treatment machine.

Frequently, a CT scan is requested by orthopedic surgeons to confirm successful surgical repair. If this postoperative scan is obtained overnight/after hours or if a consultation for radiation treatment occurs after this postoperative scan has been completed, an additional CT scan for radiation planning is required (Fig 1). The repetition of a CT scan results in unnecessary additional radiation exposure, increased patient transfers and discomfort, and increased internal cost for radiology departments. Eliminating this imaging redundancy would increase patient satisfaction and decrease the financial burden.

What Was Done

In 2013, we identified that the CT scan was a source of redundancy (baseline). The solution was to use the postoperative CT scan for radiation planning. An informal agreement with one overnight CT technologist allowed for her to perform postoperative scans with radiation treatment parameters using a diagnostic CT scanner commissioned for therapy planning (test phase). The promising success of this informal agreement led to a formal imaging protocol with a collaboration between the departments of RO, Orthopedics, and Radiology (protocol phase).

The order in the electronic medical records for postoperative CT scan was now designated as CT Pelvis XRT protocol. The CT pelvis XRT protocol requires the use of flat tabletop and the placement of markers on the patient's body to establish the isocenter for radiation planning. A fail-safe system was established where the radiology technician would perform this protocol in any postoperative hip CT scan in case the previous general CT order was placed erroneously. After CT, the radiology technician sends the images to the radiation treatment planning system. The radiation oncologist uses this CT data set for treatment planning (Fig 2). This new workflow ensured that postoperative patients who need radiation received only a single postoperative CT scan with the proper radiation planning techniques.

Outcome

An institutional review board approved the collection of data to evaluate the outcome of this new workflow. Postoperative pelvic fracture patients treated with external beam radiation therapy were identified using MOSAIQ RO tracking software by creating a report of patients with diagnosis code 728.13 (heterotopic ossification), M61.9, or M61.59. We obtained CT image collection data from the electronic medical records. The date and time of the postoperative diagnostic CT scans were recorded, and the date and time of any duplicate CT scan obtained for

Table 1 Details of patient imaging

Time frame	Heterotopic ossification prevention patients (hips)	Patients with diagnostic postoperative CT (n)	Patients with additional CT scan for radiation (n)	Redundant CT imaging (%)
Baseline (2012-2013)	39	17	12	70.6
Test phase (2013-2014)	48	30	14	46.7
Protocol phase I (2014-2015)	71	66	5	7.6
Protocol phase II (2015-2016)	42	42	1	2.4

Abbreviation: CT = computed tomography.

radiation planning were also noted. Excel 2013 was used for the data analysis.

Patients treated during the 12 months immediately before the initiation of the informal imaging protocol were analyzed to determine the baseline rate of duplicate imaging series for this patient population (baseline phase). Beginning in February 2013 the test phase was enacted. One year later, in February 2014, the formal protocol was adopted (protocol phase). Subsequently, the number of redundant CT scans by grouping patients treated during each phase was examined.

A total of 200 patients were included in this evaluation, of which 70.6% of patients during the baseline phase and 46.7% during test phase had duplicate scans. During the first year of the protocol implementation (protocol phase I), only 7.6% of 71 patients underwent a redundant CT scan. In the second year of the protocol implementation (protocol phase II), only 1 of 42 patients (2.4%) had redundant imaging (Table 1; Fig 3).

In summary, we were able to improve the efficiency of patient care and decrease the redundancy of imaging by having a single CT scan used for both confirmation of successful postoperative repair and radiation planning. This new workflow reduces radiation exposure to the patient by eliminating repeat imaging. Additionally, decreased transportation requirements for patients reduces uncomfortable transfers from the bed to the scanner table and may reduce the risk of other transportation-related injuries. Streamlining the workflow to improve patient satisfaction allows for efficient radiation treatment, which could lead to a shorter hospital stay.

Discussion

The rapid increase in health care expenses is a significant economic problem in the United States.[12−15] The United States spent $2.6 trillion per year for health care in 2010, which is equivalent to the entire economy of France, the world's fifth largest economy.[16] The health spending growth in the United States for 2015 to 2025 is projected to average 5.8% points, and is 1.3 percentage points faster than the growth of the gross domestic product.[17] As a result, health care spending is expected to be 20.1% of the total U.S. economy by 2025, which is an increase from 17.5% in 2014.[17]

There have been multiple attempts to control the increasing costs, including the Affordable Care Act.[12,15] APMs are another step in that direction,[1,2,4,5] and CMS has been implementing the bundled payment model as one of their APMs.[6,7,18] Participation is voluntary,[19] and there were >1000 participants in the program as of July 2018. Participants can choose from 48 episodes of care.[7,19] Given the success of these programs, expansions to other clinical scenarios are expected.

At this time, surgical fixation of the hip after a fracture and postoperative radiation treatment are not a part of the Bundled Payments for Care Improvement programs. We expect this trend in payment models to continue and developed and implemented a multidisciplinary quality improvement program to change workflows and improve the efficiency in delivering radiation treatment to prevent heterotopic ossification of the hip. Improved coordination of care, which could potentially decrease the length of hospital stays, would subsequently improve the overall health care cost margin in the setting of bundled payments. Patient satisfaction has become an essential outcome of health care services.[20,21] Better coordination of care could improve patient satisfaction as well.

Through the implementation of this quality improvement project, we were able to reduce the redundancy of CT scans. The redundancy of tests is one contributing factor that affects increasing health care costs with an estimated cost up to 8 billion dollars in 2004.[12,22] Literature states that redundant imaging constitutes 8% to 40% of all imaging, and the main reason is due to lack of information sharing.[23] Policymakers have been pushing for health information exchange programs using electronic medical records, which have led to a 44% to 67% reduction in redundant imaging.[24,25] Hospitals, providers, and patients will benefit from eliminating unnecessary duplicate imaging, especially in the era of bundled payments.[26,27]

Patient safety contributes significantly to the cost of U.S. health care, estimated at 16 billion dollars in 2004.[22] There have been multiple attempts to improve patient

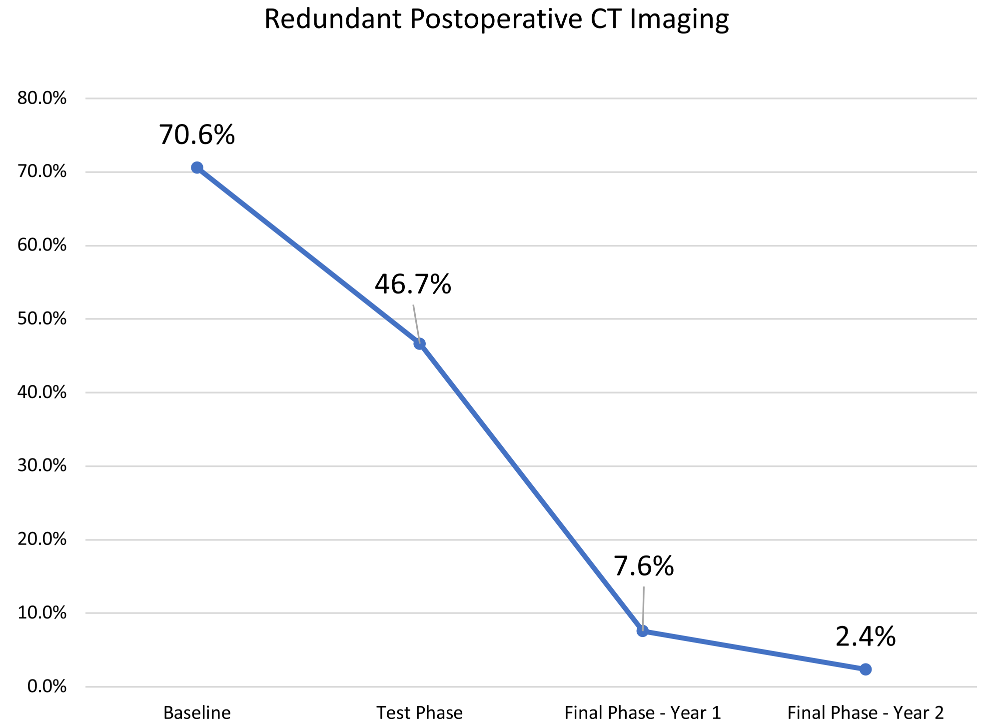

Figure 3 Trend in redundant postoperative computed tomography imaging over years.

safety, and the Joint Commission is an integral part of those efforts.[28,29] Intrahospital transport of patients during hospital stays has been a well-studied factor affecting patient safety.[30,31] Our project is a model for multidisciplinary collaboration that reduces the number of patient transportation episodes and thereby decreases the inherent potential patient safety risks.

Our project is a model to improve the efficiency of multidisciplinary treatment teams in cancer centers. For example, a positron emission tomography (PET)-CT scan is commonly used for the initial staging of many cancers. If radiation treatment is anticipated, these PET-CT scans can be done using radiation planning protocols[32–35] so that a redundant CT scan specifically for radiation planning can be avoided. Using PET-CT scans as the primary CT data set for radiation planning also minimizes errors associated with image fusion.[35] Similarly, this workflow could be used for patients who require emergency radiation treatment as an inpatient. For example, if a patient presents with symptoms of cord compression, the same protocol can be used to use a diagnostic CT imaging obtained in the emergency department for radiation planning if radiation is deemed necessary. Using our proven protocol in these types of specific scenarios could reduce delays in emergency radiation treatment to improve overall patient outcomes.

Conclusions

Improving efficiency and decreasing redundancy in health care are the 2 critical ways to improve reimbursement with bundled payment systems initiated by CMS. Herein, we report on the results of a quality improvement project in which changing the workflow to use a single CT scan for both radiation planning and confirming postoperative stability after a hip repair. This protocol resulted in improved efficiency of postoperative radiation planning and patient convenience, and is a model for the interdisciplinary collaboration in the implementation of future bundled payment programs.

References

1. Burwell SM. Setting value-based payment goals—HHS efforts to improve U.S. health care. *N Engl J Med*. 2015;372:897-899.
2. Miller HD. From volume to value: Better ways to pay for health care. *Health Aff (Millwood)*. 2009;28:1418-1428.
3. Press MJ, Rajkumar R, Conway PH. Medicare's new bundled payments: Design, strategy, and evolution. *JAMA*. 2016;315:131-132.
4. Mechanic RE. Opportunities and challenges for episode-based payment. *N Engl J Med*. 2011;365:777-779.
5. Mechanic RE. When new Medicare payment systems collide. *N Engl J Med*. 2016;374:1706-1709.
6. Centers for Medicare and Medicaid Services. CMS bundled payments for care improvement initiative models 2-4: Year 5 evaluation & monitoring annual report. 2018.
7. Centers for Medicare and Medicaid Services. Bundled payments for care improvement (BPCI) initiative: General information | Centers for Medicare & Medicaid Innovation. Available at: https://innovation.cms.gov/initiatives/bundled-payments/. Accessed July 1, 2019.
8. Kline R, Adelson K, Kirshner JJ, et al. The Oncology Care Model: Perspectives from the Centers for Medicare & Medicaid Services and participating oncology practices in academia and the community. *Am Soc Clin Oncol Educ Book*. 2017;37:460-466.

9. Kavanagh B. Radiation oncology APM: Why us? Why now? *Int J Radiat Oncol Biol Phys*. 2019;105:22-24.
10. Baird EO, Kang QK. Prophylaxis of heterotopic ossification - an updated review. *J Orthop Surg Res*. 2009;4:12.
11. Milakovic M, Popovic M, Raman S, Tsao M, Lam H, Chow E. Radiotherapy for the prophylaxis of heterotopic ossification: A systematic review and meta-analysis of randomized controlled trials. *Radiother Oncol*. 2015;116:4-9.
12. Emanuel EJ. The real cost of the U.S. health care system. *JAMA*. 2018;319:983-985.
13. Papanicolas I, Woskie LR, Jha AK. Health care spending in the United States and other high-income countries. *JAMA*. 2018;319:1024-1039.
14. Emanuel EJ, Fuchs VR. Who really pays for health care? The myth of shared responsibility. *JAMA*. 2008;299:1057-1059.
15. Emanuel E, Tanden N, Altman S, et al. A systemic approach to containing health care spending. *N Engl J Med*. 2012;367:949-954.
16. Emanuel EJ. Where are the health care cost savings? *JAMA*. 2012;307:39-40.
17. Keehan SP, Poisal JA, Cuckler GA, et al. National health expenditure projections, 2015-25: Economy, prices, and aging expected to shape spending and enrollment. *Health Aff (Millwood)*. 2016;35:1522-1531.
18. Navathe AS, Troxel AB, Liao JM, et al. Cost of joint replacement using bundled payment models. *JAMA Intern Med*. 2017;177:214-222.
19. Navathe AS, Liao JM, Polsky D, et al. Comparison of hospitals participating in Medicare's voluntary and mandatory orthopedic bundle programs. *Health Aff (Millwood)*. 2018;37:854-863.
20. Williams B. Patient satisfaction: A valid concept? *Soc Sci Med*. 1994;38:509-516.
21. Fenton JJ, Jerant AF, Bertakis KD, Franks P. The cost of satisfaction: A national study of patient satisfaction, health care utilization, expenditures, and mortality. *Arch Intern Med*. 2012;172:405-411.
22. Jha AK, Chan DC, Ridgway AB, Franz C, Bates DW. Improving safety and eliminating redundant tests: Cutting costs in U.S. hospitals. *Health Aff (Millwood)*. 2009;28:1475-1484.
23. Vest JR, Kaushal R, Silver MD, Hentel K, Kern LM. Health information exchange and the frequency of repeat medical imaging. *Am J Manag Care*. 2014;20:eSP16-eSP24.
24. Jung HY, Vest JR, Unruh MA, Kern LM, Kaushal R. HITEC Investigators. Use of health information exchange and repeat imaging costs. *J Am Coll Radiol*. 2015;12:1364-1370.
25. Lammers E, Adler-Milstein J, Kocher KE. Does health information exchange reduce redundant imaging ? Evidence from emergency departments. *Med Care*. 2014;52:227-234.
26. Rubin GD. Costing in radiology and health care: Rationale, relativity, rudiments, and realities. *Radiology*. 2017;282:333-347.
27. Rosenkrantz AB, Hirsch JA, Allen B Jr, Harvey HB, Nicola GN. Identifying radiology's place in the expanding landscape of episode payment models. *J Am Coll Radiol*. 2017;14:882-888.
28. Weaver SJ, Lubomksi LH, Wilson RF, Pfoh ER, Martinez KA, Dy SM. Promoting a culture of safety as a patient safety strategy: A systematic review. *Ann Intern Med*. 2013;158:369-374.
29. Commission J. Preventing falls and fall-related injuries in health care facilities. *Sentinel Event Alert*. 2015:1-5.
30. Beckmann U, Gillies DM, Berenholtz SM, Wu AW, Pronovost P. Incidents relating to the intrahospital transfer of critically ill patients. *Intensive Care Med*. 2004;30:1579-1585.
31. Fanara B, Manzon C, Barbot O, Desmettre T, Capellier G. Recommendations for the intrahospital transport of critically ill patients. *Crit Care*. 2010;14:R87.
32. Heron DE, Andrade RS, Flickinger J, et al. Hybrid PET-CT simulation for radiation treatment planning in head-and-neck cancers: A brief technical report. *Int J Radiat Oncol Biol Phys*. 2004;60:1419-1424.
33. Bradley J, Thorstad WL, Mutic S, et al. Impact of FDG-PET on radiation therapy volume delineation in non—small-cell lung cancer. *Int J Radiat Oncol Biol Phys*. 2004;59:78-86.
34. Ashamalla H, Rafla S, Parikh K, et al. The contribution of integrated PET/CT to the evolving definition of treatment volumes in radiation treatment planning in lung cancer. *Int J Radiat Oncol Biol Phys*. 2005;63:1016-1023.
35. De Ruysscher D, Wanders S, Minken A, et al. Effects of radiotherapy planning with a dedicated combined pet-ct-simulator of patients with non-small cell lung cancer on dose limiting normal tissues and radiation dose-escalation: A planning study. *Radiother Oncol*. 2005;77:5-10.