Original Investigation

Implementation of a Longitudinal Introduction to Radiology Course During Internship Year Improves Diagnostic Radiology Residents' Academic and Clinical Skills: A Canadian Experience

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Rationale and Objectives: In order to ease the transition from internship to diagnostic radiology residency, a year-long didactic introduction to radiology course was offered to post-graduate year one (PGY-1) diagnostic radiology residents during their internship, which consisted of 27 hours of lecture over 9 months. The purpose of this study was to determine the quantitative and qualitative educational value of this course and its effect with respect to on-call preparedness.

Materials and Methods: Two consecutive cohorts of Diagnostic Radiology residents were included: the first cohort (PGY-1s in 2011–2012) did not participate in the new course (Old Curriculum Residents) and the second cohort (PGY-1s in 2012–2013) completed the new course (New Curriculum Residents). These two cohorts were compared both qualitatively and quantitatively. Scores were compared from the standardized Canadian National Pre-Call Observed Standardized Clinical Examination and American College of Radiology Diagnostic Radiology In-Training examination, which are taken in the PGY-2 year, at months 5 and 7, respectively. In addition, staff observation of on-call resident performance and resident self-reported preparedness were considered. Cohorts were compared using Mann-Whitney *U* test with significance defined as *P* value <0.05. *P* values from 0.05 to 0.10 were noted as possibly significant and further analyzed using a Cohen *d* test where the difference was determined to be small (0.2), medium (0.5), or large (0.8).

Results: New Curriculum Residents reported that the content of the PGY1 curriculum was more appropriate than the old curriculum to prepare them for call in PGY2 ($P = 0.013$). New Curriculum Residents scored better than the Old Curriculum Residents on the Diagnostic Radiology In-Training examination ($P = 0.039$) and on the emergency cases of the Canadian National Pre-Call Observed Standardized Clinical Examination ($P = 0.035$). Staff radiologists, who were not blinded, reported that the New Curriculum Residents were better prepared for daytime ($P = 0.006$) and overnight ($P = 0.008$) independent call were better prepared to perform common ultrasound examinations alone ($P = 0.049$), and required less guidance while on call for nine competency areas. There was, however, no statistical difference between the residents' self-reported preparedness for independent call.

Conclusions: Participation in a lecture-based introductory radiology curriculum during the PGY-1 internship year improved both radiology residents' preparedness for call and their performance in PGY-2.

Key Words: Resident education; internship; basic clinical year; on-call.

INTRODUCTION

The transition from internship to radiology residency is challenging. This adjustment is also made more difficult by the added pressure to prepare for independent call, which has become more demanding over the last decade (1–3). While on call, residents are expected to perform a diverse

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range of examinations from routine cross-sectional imaging to fluoroscopic-guided interventions (4). Although staff radiologists are available, residents must still be comfortable with clinical scenarios that require imaging, and attendant knowledge of appropriateness criteria, study protocols, and emergent on-call pathologies.

Several solutions have been proposed to ease the transition from internship into radiology residency. These educational initiatives focus primarily on alleviating the anxiety of independent call and include pre-call examinations, simulations, and web-based applications (5–8). These solutions, however, primarily emphasize "on-call" pathology (eg, aortic dissection, pulmonary embolism, etc.) and do not address the basics of image interpretation, anatomy, and foundational non-emergent pathology. To ease the transition into radiology residency, the Diagnostic Radiology Residency Program at the University of British Columbia introduced a formal lecture-based course for post-graduate year one (PGY-1) residents to attend during their internship year.

In the Canadian training system, the PGY-1 internship year is called a basic clinical training year. This year is a mandatory component of radiology residency and is administered by the radiology residency program. Traditionally, during this year, residents rotate through various medical and surgical specialties with no required radiology teaching time or required radiology rotation (9). After the basic clinical year, Canadian residents then begin their dedicated study of radiology in their second year of post-graduate training (PGY-2). In all Canadian residency programs, PGY-2 residents begin independent call after 5–6 months of study. In some Canadian training programs, "buddy" call or shadow shifts may begin earlier. At our institution, residents assume full independent call responsibilities in November of their PGY-2 year, 5 months after beginning their study of radiology. In many Canadian centers, including the authors', this includes a Tertiary Care Level I Trauma hospital with both acute stroke and neurosurgical services.

The purpose of this study was to determine the educational value of implementing an introductory radiology curriculum into the PGY-1 basic clinical year to expose residents to basic imaging principles and pathologies as well as more specific on-call scenarios. The educational value of the course was assessed both quantitatively and qualitatively. Academic performance assessments included a comparison of resident scores on the Canadian National Pre-Call Observed Standardized Clinical Examination (OSCE) and the American College of Radiology Diagnostic Radiology In-Training (ACR DXIT) examination. Observed clinical assessments included residents' self-reported readiness for and comfort with independent call as well as staff radiologists' observations of post-graduate year 2 (PGY-2) residents' level of independence while on call. To the best of our knowledge, the effectiveness of implementing a formal longitudinal radiology curriculum during the rotating basic clinical year prior to beginning radiology residency training has not been evaluated.

MATERIALS AND METHODS

Study Population

Approval was obtained from the University of British Columbia Research Ethics Board. Two consecutive cohorts of Diagnostic Radiology residents (July 2012 to June 2014) at a single institution were included in the study. The cohort of PGY-1s from July 2012 to June 2013 resident cohort did not participate in the new course (Old Curriculum Residents), and the cohort of PGY-1s from July 2013 to July 2014 completed the new course (New Curriculum Residents). The residency selection committee was the same for both cohorts of residents, and similar academic and personal parameters were used to select and admit these residents to our training program. There were six Old Curriculum Residents and eight New Curriculum Residents. The independent on-call duties of both the Old and New Curriculum Residents were comparable. Both cohorts triaged, protocolled and provided preliminary reports on computed tomography (CT) scans and radiographs between 5 pm and 8 am at two academic hospitals, one of which is a Level I trauma center.

New Curriculum Course Design

The Old Curriculum Residents were not exposed to any dedicated radiology training during their PGY-1 basic clinical year. Traditionally, in Canadian radiology residency programs, the basic clinical year includes only medical and surgical rotations. The goal of this course was to expose the New Curriculum Residents to radiology earlier in their training. Although the educational value of this type of course has been established for PGY-2, our curriculum is novel because it introduces residents to radiology even earlier, during the rotating internship or basic clinical training year (7).

The New Curriculum was a longitudinal introduction to radiology course based on the content from Brant and Helms' *Fundamentals of Diagnostic Radiology* (5th Edition) textbook (10). Content was divided into 27 hours of lecture and delivered over 9 monthly 3-hour sessions including chest, abdomen, neuroradiology, and ultrasound (Fig 1). Lecture content was created and delivered by staff radiologists and more senior radiology residents in PGY-3 to PGY-5 ($n = 18$) on the last Wednesday morning of every month. In total, the course took over 100 hours to prepare over a 6-month period. The PGY-1 residents were given assigned readings to accompany each lecture from Brant and Helms' *Fundamentals of Diagnostic Radiology* prior to each session. These ranged from three to five chapters per month. The lectures for that month were designed to cover the content of the provided readings. The goal was for each PGY-1 resident to have read 85% of the textbook prior to beginning PGY-2 year.

New Curriculum Course Evaluation

Upon completion of the course, the New Curriculum Residents were asked to rate the quality of the PGY-1 course design