

EMERGENCY RADIOLOGY TRAINING MODULE: EFFECT ON RADIOLOGY RESIDENT'S PREPAREDNESS FOR ON-CALL COVERAGE

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ABSTRACT

BACKGROUND: Imaging plays a crucial role in the day-to-day clinical working of the emergency department. Currently, there is no dedicated emergency radiology rotation at our university to prepare the residents for independent call coverage. **OBJECTIVE:** To determine the effect of an emergency radiology core curriculum training module on the preparedness of residents for on-call coverage. **METHODS:** The study was conducted in the Department of Radiology, using a Quasi-experimental design comprising of one group pretest-posttest design. A dedicated course on emergency radiology was developed and delivered to radiology residents of year II and year III. A computer-based test was conducted. Paired t-test was applied to assess the difference between pre-and post-test scores. A survey was also conducted to measure the perceived confidence gained by the residents. **RESULTS:** A total of 10 residents comprised the final sample for the study; Overall the mean pretest total score was 93.60 – 15.06 and the mean post-test total score was 122.60 – 11.80 and a highly significant difference between the pre-and post-scores was observed (p-value=0.001). The results of the survey also showed an improvement in the perceived confidence of residents for on-call coverage with a significant p-value (<0.05). **CONCLUSION:** The study reveals improvement in knowledge and overall perceived confidence of radiology residents after attending the course covering topics from whole body trauma. The study also highlights the importance of implementing dedicated teaching and learning strategies that can lead to enhanced preparedness for on-call coverage.

Key Words: Emergency radiology; postgraduate; call preparedness; teaching and learning; assessment; simulation

Introduction

Radiology has emerged as a fundamental diagnostic tool in clinical practice. The patients presenting to the emergency department (ED) require urgent decision-making by the attending ED physician and often undergo some form of radiological imaging, like chest x-ray, computerized tomography (CT), magnetic resonance imaging (MRI,) or ultrasound.^{1,2} This becomes much more important in the management of trauma patients where the imaging ranges from X-rays for limb trauma to CT for a head injury.³ The

subspecialty of emergency radiology relates to the clinical context and uses the same tools of general diagnostic radiology.⁴ The difference is not only due to the varied case mix and pathologies which relate mostly to trauma and acute critical illness but also due to the need for rapid reporting aiding in the provision of instant and timely surgical or intensive care.

The independent call coverage by the residents is a valuable learning experience and adequately prepares

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residents to timely report critical findings that influence patient care.⁵ Thus, balancing the high quality of patient care with the resident's educational experience of independent decision-making skills leads to the fulfillment of an essential component of a radiology residency programme.⁶

In our institution, the independent call coverage starts in the third year of radiology residency program, however there is no dedicated emergency radiology rotation during the entire residency period. Generalized knowledge of radiological cases including oncology, infectious and other chronic diseases encompassing modalities like CT, MRI, US etc. are imparted to the residents in their dedicated rotations throughout the residency with increase in difficulty and complexity as seniority increases. Lack of a planned curriculum encompassing the case mix typically encountered during emergency coverage like trauma, stroke, pulmonary embolism, acute abdomen, ectopic pregnancy etc. affects the residents learning and hence patient care.⁷

A difference in competence and confidence of residents at the same level has also been observed which is attributed to the lack of standardized or dedicated teaching strategy, the difference in clinical exposure of the residents, and to the self-motivation to learn and explore through text and the available literature. The current study was conducted to determine the effect of an emergency radiology core curriculum training module on the preparedness of residents for on-call coverage. The pretest-posttest design was selected for the study to determine the effectiveness of the module.⁸

Another objective was to determine the difference in the level of self-perceived confidence of on-call residents going through an emergency radiology core curriculum training module for correctly interpreting and reporting during on-call coverage.

Material and Methods

This quasi-experimental study comprising one group pretest-posttest design was conducted in the radiology department of a tertiary care hospital. The study was approved by the Ethics review committee, and informed written consent was obtained from each par-

ticipant. Purposive sampling technique was adopted and the residents from years II and III were included in the study because they were close in knowledge and experience i.e., year III had just started the independent call coverage and year II was about to start the experience.

Residents in the experimental group, who did not attend the training module, not attempted the pre and/or the post-test, and were not willing to participate in the study were excluded.

Data Collection Tool

Pre and Posttest cases: A computer-based imaging test was developed based on 15 cases referred from emergency department for radiological studies of patients presenting with trauma, during the last 6 months and with positive findings. The images were from different modalities i.e. CT, MRI, plain x-rays, ultrasound and fluoroscopy and covering the topic of imaging for whole body trauma. The cases were representative of abnormalities typically encountered during on-call coverage, to ascertain the face validity of the test.

The construct and the content validity of the test were ensured as two subject experts selected the cases. The constructs that were studied included resident's diagnostic ability, interpretive and reporting skills. The cases were selected based on the American Society of Emergency Radiology (ASER) core curriculum and the department work list from the last 6 months.⁹

The key for scoring of the pre and posttest and the survey questionnaire underwent peer review by two radiologists with a minimum of 10 years experience in radiology for call coverage and a Master's degree in medical education and their comments were incorporated.

Pre and Post Course surveys to measure the perceived confidence of the residents for independent on-call coverage were conducted before and after the course. Variables were measured on a five-point Likert scale (1= strongly disagree, 2=disagree, 3= Neutral, 4= agree, 5= strongly agree).¹⁰

Statistical Methods: The independent variable was the emergency radiology core curriculum training module, and the dependent variable was the total score obtained in the post-test. The difference in the

overall scores of residents pre and post-test scores was calculated.

Mean and standard deviation of quantitative variables like age (which provided the basic demographic information for the study), pre and post-test scores in percentage, and items of the survey questionnaire were computed.

Paired t-test was applied to assess the difference between pre-post-test test scores. A p-value equal to or less than 0.05 was considered significant. Statistical Package for Social Science version 22.0 (SPSS Inc., Chicago) was used for performing statistical analysis.

Results

A total of ten (10) residents (three females and seven males) comprised the final sample for the study; five were in year II and five in year III. One resident from year III did not attempt the pretest and was excluded. The mean age +SD of year II was 28.6 +0.89 and of year III was 29.8+1.60

Quantitative data analysis

(Tab.1) shows the pretest and posttest scores (in percentage) of each resident, depicting improvement in post-test scores of all residents except one year III resident.

Residents	Year	Pretest score (%)	Posttest score (%)	Difference in scores
1	II	57	85	+ 28
2	II	49	77	+28
3	II	65	91	+26
4	II	63	77	+14
5	II	45	79	+34
6	III	78	71	-7
7	III	60	87	+27
8	III	69	92	+23
9	III	70	86	+16
10	III	68	71	+3

Table 1: Score percentage of pretest and posttest of each resident

The maximum score that could have been attained on the fifteen (15) cases was 150. Overall, the mean of the pretest total score was 93.60 – 15.06 and the

mean of the post-test total score was 122.60 – 11.80. The scores in the percentage of the pre and post-test of the residents show an overall improvement of 19.3 % in the post-test scores.

Inferential statistics:

In order to determine whether there was a significant difference between the pre and post-scores, a paired t-test statistic was applied. There was a highly significant difference observed between the two groups (pretest total post-test total scores).

Mean – SD: 29.00 – 19.53, t=-4.69, df=9, p-value = 0.001

The results showed that with the intervention (course on emergency radiology) there was a significant improvement in the interpretation and reporting skills of residents, which resulted in an improvement of the mean pretest course from 62% to 81%, p-value<0.001. Further analysis using Mann Whitney U-test was initiated to determine the performance of year II verses year III in the pre and posttest. A p-value of <0.05 was considered to be significant. The analysis showed a p-value of 0.028. This shows that the year II scored (statistically moderately significant) lower than the senior level residents in the pretest but the post test scores of the two years are comparable. (Tab.2)

The data was also analyzed to determine the difference in the performance of the residents based on gender. Mann Whitney U-test was applied and a

Variables	Mean score ± SD	p-value
Year II		0.28
• Pretest	83.60 ± 12.97	
• Post test	122.33 ± 8.89	
Year III		0.732
• Pretest	103.60 ± 9.60	
• Post test	122.40 ± 15.30	
Female		0.732
• Pretest	92.33 ± 21.07	
• Post test	128.33 ± 10.02	
Male		
• Pretest	94.14 ± 13.82	
• Post test	120.14 ± 12.33	

Table 2: Difference in performance in the pre-posttest with respect to a) Level of residency i.e. Year II verses Year III and b) gender

p-value of <0.005 was considered to be significant. The analysis depicted a p-value of 0.732 showing that there was no difference in the performance of the residents with respect to gender. (Tab.2)

Analysis of the survey to determine the perceived confidence of the residents:

Pearson's correlation coefficient was applied to determine pre and post-intervention self-perceived confidence. The result of the analysis showed $\rho=0.667$, $p\text{-value}=0.035$, depicting a strong and positive correlation between residents' self-perceived confidence in reporting during on-call coverage after the intervention (ER course).

Level of residency	Precourse survey Mean \pm SD	Post course survey Mean \pm SD
Year II	25.80 \pm 1.92	33.40 \pm 0.89
Year III	27.40 \pm 3.28	32.20 \pm 1.92
Year II & III	26.60 \pm 2.67	32.80 \pm 1.54

Table 3: The mean score with SD of the survey for perceived confidence of year II and year III

Discussion

Dedicated teaching of emergency radiology is an important task. In the best interest of patients, it is essential to appropriately prepare and educate trainees so that critical findings and obvious abnormalities are neither missed nor misinterpreted and high-quality patient care is achieved.^{11,12}

The course was developed to determine the effectiveness of dedicated teaching and evaluation methods on the preparedness of residents for on-call coverage. To enhance the critical thinking and problem-solving ability of the residents it was combined with case-based interactive session which is described as a popular mode of teaching and learning amongst the trainees.¹³

In the study, we used a computer-based testing module for residents' evaluation in the pre and post-test. It simulated the actual reporting of emergency cases and ensured close replication of the routine radiology reporting practice. Other studies have also reported similar methodologies.^{14,15}

The implementation of this course showed that overall mean pre and post-test score of all participants in

this study showed improvement from 93.60 – 5.06 to 122.60 – 11.80. The findings from this study support the utilization of intensive courses as a standard for training as is also recommended consistently by other authors.

Overall, 90% of our course participants showed a significant improvement in their interpretive skills after attending the course with the mean increase of 19.3% in the test score which is close to improvement of 17% as reported previously.¹⁷

In this study a statistically significant difference was found in the pretest scores of the residents of the two years. The year III residents achieved higher average score in the pretest as compared to the year II. However, there was no significant difference in the post test. The number of participants in each group was relatively low; therefore, the conclusions should be cautiously derived. This however is likely related to the fact that the experience gained during the residency period also contributes towards residents' preparation for on call coverage. An adequately prepared resident through teaching and assessment is expected to timely and accurately report critical findings that influence patient care.¹⁸

It is essential to measure the long-term retention of knowledge from an educational intervention so that further reinforcement through a refresher course is instituted at an optimum time.¹⁹ In the present study the participants attempted the posttest after one week of the course and the long-term retention of knowledge cannot be ascertained.

The data from our study survey showed that there was an overall gain in perceived confidence of the residents with respect to interpretation of studies done during emergency coverage with the mean total score of 25.80 – 1.92 prior to the course increasing to 33.40+0.89 after the course with the p-value of < 0.05.

The results of the current study were similar to other studies which used a computer-based radiology simulator and reported the subjective feeling of more preparedness and less nervousness in the study group as compared to the control group.^{20,21}

The limitation of the study was the small sample size as this was a single-center study and is often a challenge in educational research. The other limitation was the purposive sampling as the course was offered to all year II and year III residents of our department

and lack of a control group. The study focused on the interpretation and reporting skills and the perceived confidence of the residents but its impact on patient outcome was not evaluated.

This testing module was arranged in a protected time and setting was not realistic in comparison to a real overnight call when a resident has to deal with distractions which are not easy to handle and include paging, telephone calls, queries from the department's technologist and opinions and consultations to the referring physicians etc.


Conclusion

The study reveals improvement in knowledge and perceived confidence of residents for interpretation and reporting, after attending the emergency radiology core curriculum training module. A significant improvement of score highlights the importance of implementing dedicated teaching and learning strategies that can lead to enhanced preparedness for on-call coverage.

However, a national initiative for residents teaching and learning is required to minimize performance gaps between centers that provide emergency coverage, and further follow-up is needed to establish the long-term impact of the course on patient outcome.

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