

Knowledge of Radiology Residents on the Prevention and Management of Adverse Contrast Reactions at CT or PET-CT scan in the Philippines

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BACKGROUND

Patient safety is crucial during contrast-enhanced CT and PET-CT scans, and radiologists must be knowledgeable about adverse contrast reactions. This study aimed to assess the knowledge of radiology residents regarding the prevention and management of adverse contrast reactions.

METHODOLOGY

An online self-administered questionnaire was conducted among radiology residents in the Philippines. The questionnaire included demographic data and multiple-choice questions based on the American College of Radiology (ACR) guidelines on contrast media. Descriptive statistics and chi-square tests were used for data analysis.

RESULTS

A total of 96 radiology residents participated, with most from the National Capital Region. The mean knowledge score was 8.6 out of 13, indicating moderate knowledge. The distribution of knowledge scores varied across different year levels and the number of rotations in CT and PET-CT, but no significant associations were found.

CONCLUSION

The knowledge of CT scan or PET-CT radiology residents on the prevention and management of adverse contrast reactions was assessed. This study found that radiology residents have overall moderate knowledge about preventing and managing adverse contrast reactions. Although their level of training or exposure to CT or PET-CT rotations did not significantly impact their knowledge, ongoing improvement is necessary. Future research and education should focus on addressing the identified knowledge gaps to enhance patient care during contrast-enhanced imaging.

INTRODUCTION

Patient care and safety are primary goals on patients undergoing contrast enhanced CT scan.

Although the administration of contrast agents carries a relatively low risk, it is still significant and should not be overlooked. The incidence of adverse reactions associated with low-osmolarity iodinated or gadolinium-based contrast agents is reported to be less than 1%.¹ In the past decade, there is already an increasing availability and use of computed tomography scans which has led to a dramatic growth in CT scan volume.² With this rise in utilization comes a corresponding need for heightened awareness of potential complications and the preparedness to manage them effectively.

Adverse contrast reactions may range from mild reactions or can be life-threatening that require immediate in-

tervention. A study by Lightfoot et al. showed that radiologists have a poor working knowledge of epinephrine administration for severe contrast material-induced allergic reactions.³ This highlights a significant knowledge gap and emphasizes the importance of improved training and preparedness, since radiologists may be the only physicians available during imaging procedures.

Radiologists should also consider screening for the predisposing factors that increase the risk for contrast reaction. Generally, non-ionic contrast agents cause less adverse reactions hence their use in modern practice. Although most reactions occur in the first hour after administration, there are rare instances of late adverse reactions happening up to one week after injection of iodinated contrast agents. Occasionally, extravasation may occur when contrast material escapes the vascular lumen and infiltrates the interstitial tissue during injection.

Prompt recognition and evaluation is also required here to reduce the chance and severity of injury.⁴

The absence of established local guidelines in the Philippines for the use of contrast media in medical imaging has led some local institutions to adopt the American College of Radiology (ACR) Manual on Contrast Media, serving as a guide for screening, administration, and management of adverse reactions. This lack of locally tailored protocols limits the ability to address specific population needs.

Established national guidelines standardize care and ensure more effective management of contrast-related risks within the local context.

The investigators conducted an online self-administered questionnaire, and the aim of the study was to assess the knowledge of CT scan or PET-CT radiology residents on iodinated contrast material and adverse reactions in the local setting.

METHODOLOGY

This is an analytic cross-sectional study among radiology resident rotating at CT or PET CT scan in an accredited training institution in the Philippines in the year 2023 using an online questionnaire.

Participants included in this study were those who met all of the following criteria: they must be radiology residents currently enrolled in an accredited training institution, must have completed at least one rotation in either CT scan or PET-CT, and must have given their consent to participate.

A questionnaire (Appendix 1) was formulated containing seven questions allotted to demographic data. There are also thirteen multiple-choice questions assessing the knowledge based on American College of Radiology (ACR) guidelines on contrast - ACR Manual on Contrast Media (2021).⁵ The interview questionnaire was assessed for face validity and content validity and was modified based on expert opinion. Two radiology experts independently assessed the questionnaire for face and content validity.

The demographic characteristics of the participants were collected with confidentiality and were not linked to identifiable information known to the authors. The knowledge scores of each participant were assessed. A total of 13 points were allocated for the assessment, where one point was assigned for each correct answer and zero points for incorrect answers. The participants' knowledge scores were categorized into three levels based on Bloom's cutoff point: high knowledge (11-13 points), moderate knowledge (8-10 points), and low knowledge (below 8 points).⁶

A total of 224 radiology residents was initially targeted and invited to participate in the study.

The questionnaire was distributed online via a Google Form and shared through various platforms, including Facebook, Viber, and during the scientific meeting of the Resident Training Council of the Philippine College of Radiology (PCR) held via Zoom. The online survey included an informed consent form (ICF) on the first page. No focus groups were conducted.

The data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 23 for Windows® to determine the statistical significance ($p < 0.05$) of the results. Chi-squared test was used to record the statistical significance between participants' answers and their demographic characteristics as well as knowledge scores according to year level in residency training and number of rotations in CT scan or PET-CT.

ETHICAL CONSIDERATIONS

The research adhered to the principles outlined in the Declaration of Helsinki (2013) and followed the guidelines established by the International Conference on Harmonization-Good Clinical Practice (ICH-GCP), specifically E6 (R2) ICH-GCP 6 guidelines (as amended). Additionally, it complied with the National Ethical Guidelines for Health and Health-Related Research (NEG HHRR), 2017.

Before commencing the study, the clinical protocol and all relevant documents underwent a thorough review and received approval from the St. Luke's Medical Center Institutional Ethics Review Committee (SLMC – IERC).

RESULTS

A total population of 96 radiology residents from multiple training institutions participated in this study, yielding a response rate of approximately 42.9%. [Table 1](#) shows the demographic data and characteristics of the respondents. Most of the participants are male. There are 38 first year (39.6%), 14 second year (14.6%), 14 third year (14.6 %) and 30 fourth year residents (31.3%) who participated in the study. The respondents have a mean age of 30 years old and ranging from 26 to 42 years old. Most of the respondents were from the National Capital Region (NCR) with a total of 70 respondents (72.9 %).

The overall mean knowledge score was 8.6 ranging from 2 to 12. The knowledge distribution of the respondents, with a total of 14 respondents (14.6%) had high knowledge, 59 (61.5%) had moderate knowledge and 23 (24%) had low knowledge.

The distribution of knowledge scores among the respondents, categorized by year level and number of rotations in CT and PET-CT, is presented in [Table 2](#). Among first-year radiology residents, the majority had moderate knowledge scores, with fewer achieving high or low scores; similar trends were observed across other year levels, though fourth-year residents had the highest number of individuals with high knowledge scores. When categorized by CT scan rotation duration, participants with 0 to 10 months of rotation had the highest number of high and moderate scores, while those with more than 20 months had no high scores. In terms of PET-CT rotation experience, most respondents with no rotation still demonstrated moderate knowledge, with a smaller number achieving high scores.

The results obtained from the Chi-square test, reveal that there is no significant association between the knowledge scores and year level in residency training ($p = 0.621$, not statistically significant). Similarly, there is no signif-

Table 1. Demographic Data and Characteristics of Respondents.

		n	%
Sex	Male	64	66.7
	Female	32	33.3
Year level	First year	38	39.6
	Second year	14	14.6
	Third year	14	14.6
	Fourth year	30	31.3
Number of rotations CT (months)	0 to 10 months	61	63.5
	11 to 20 months	27	28.1
	> 20 months	8	8.3
Number of rotations PET CT (months)	0 month	72	75.0
	1 month	16	16.7
	> 2 months	8	8.3
Training institution	Private	60	62.5
	Government	36	37.5
Region	NCR	70	72.9
	Region I	1	1.0
	Region IV	8	8.3
	Region VII	11	11.5
	Region VIII	1	1.0
	Region X	1	1.0
	Region XI	4	4.2

icant association observed between the knowledge scores and the number of rotations in CT scan ($p = 0.389$, not statistically significant) or the number of rotations in PET- CT ($p = 0.785$, not statistically significant).

DISCUSSION

Adverse reactions to contrast materials used in CT or PET-CT scans can range from mild to life- threatening. Radiologists play a crucial role in identifying and managing these reactions during imaging procedures.

The results revealed that the overall knowledge of the participants was moderate, with a mean score of 8.6 out of 13. The majority of the residents demonstrated moderate knowledge (61.5%), followed by low knowledge (24%) and high knowledge (14.6%). The findings indicate that there is room for improvement in the residents' understanding of adverse contrast reactions and their management. The distribution of knowledge scores varied across different year levels and the number of rotations in CT and PET-CT. However, no significant associations were found between these factors and knowledge scores. This suggests that the residents' knowledge is not significantly influenced by their level of training or exposure to CT or PET-CT rotations. Other factors, such as the curriculum and training methods, may play a more significant role in shaping their knowledge.

This study has several limitations. The small sample size limits generalizability, and the focus on knowledge scores excludes assessment of practical skills or real-world application. Its cross-sectional design prevents conclusions about causality or changes over time. Future longitudinal studies and evaluation of factors like communication and decision-making could offer a more comprehensive view of residents' competencies and help guide targeted improvements in patient safety.

CONCLUSION

In conclusion, this study evaluated the knowledge of radiology residents on the prevention and management of adverse contrast reactions during CT and PET-CT procedures. The results demonstrated a moderate overall level of knowledge, with no significant associations between knowledge scores and year level or duration of rotations.

Table 2. Knowledge distribution of the respondents according to year level and number of rotations in CT and PET-CT.

		Knowledge							
		High		Moderate		Low		Total	
		n	%	n	%	n	%	n	%
Year level	First year	4	10.5%	27	71.1%	7	18.4%	38	100.0%
	Second year	3	21.4%	8	57.1%	3	21.4%	14	100.0%
	Third year	1	7.1%	8	57.1%	5	35.7%	14	100.0%
	Fourth year	6	20.0%	16	53.3%	8	26.7%	30	100.0%
Number of rotations CT	0 to 10 months	8	13.1%	38	62.3%	15	24.6%	61	100.0%
	11 to 20 months	6	22.2%	14	51.9%	7	25.9%	27	100.0%
	> 20 months	0	0.0%	7	87.5%	1	12.5%	8	100.0%
Number of rotations PET CT	0 month	9	12.5%	45	62.5%	18	25.0%	72	100.0%
	1 month	4	25.0%	9	56.3%	3	18.8%	16	100.0%
	> 2 months	1	12.5%	5	62.5%	2	25.0%	8	100.0%

These findings suggest that training and exposure alone may not sufficiently enhance understanding, underscoring the need for targeted educational initiatives. Strengthening residents' knowledge in this area is essential to ensure patient safety and effective management of contrast-related complications. Future research should focus on addressing the identified gaps to support improved clinical practice.

CONFLICT OF INTEREST

The authors have no conflicts of interest.

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SUPPLEMENTARY MATERIALS

Survey questionnaire

Download: <https://academic-med-surg.scholasticahq.com/article/146024-knowledge-of-radiology-residents-on-the-prevention-and-management-of-adverse-contrast-reactions-at-ct-or-pet-ct-scan-in-the-philippines/attachment/306441.docx>
