

## Knowledge, Attitudes and Practices Regarding Contrast Media Safety Among Radiology Professionals in Mardan: A Cross-Sectional Study

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### Abstract

**Background:** Contrast media are widely used in diagnostic imaging, however their administration is associated with potential adverse reactions that require prompt recognition and management. Adequate knowledge, positive attitudes, and safe practices among radiology professionals are essential to ensure patient safety.

**Objectives:** This study aimed to assess the knowledge, attitude, and practice regarding contrast media safety among radiology professionals in District Mardan, Pakistan.

**Methods:** A multicenter cross-sectional study was conducted from January to April 2026 across seven hospitals in Mardan. Eighty radiology professionals, including radiologists, technicians, and technologists, were recruited using disproportionate stratified random sampling. Data were collected using a structured questionnaire assessing knowledge, attitudes, and practices regarding contrast media safety. Analysis was performed using SPSS v26, applying descriptive statistics and Chi-square test, with  $p < 0.05$  considered significant.

### Author Details

**Keywords:** Contrast Media Safety, Knowledge, Attitude And Practice, Radiology Professionals

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**Results:** Of the 80 radiology professionals, 61.2% were male and 48.8% had more than six years of experience. Only 41.2% had received formal training regarding contrast media safety. The mean knowledge, attitude, and practice scores were  $7.26 \pm 2.01$ ,  $7.26 \pm 1.59$ , and  $10.26 \pm 3.53$ , respectively. Good knowledge, attitude, and practice levels were observed in 30%, 21.2%, and 68.8% of participants, respectively. Professional designation showed a statistically significant association with knowledge scores ( $p = 0.04$ ). Similarly, years of professional experience were significantly associated with both knowledge ( $p = 0.03$ ) and practice scores ( $p = 0.01$ ). In contrast, no statistically significant association was observed between gender and any of the knowledge, attitude, and practice scores.

**Conclusion:** Radiology professionals demonstrated moderate knowledge and attitudes regarding contrast media safety. Structured educational interventions and continuous professional development programs are recommended to enhance contrast media safety practices.

## Introduction

Radiographic contrast media (CM) are indispensable in modern diagnostic imaging, enhancing the visualization of internal organs, blood vessels, and anatomical structures to improve diagnostic accuracy (1). Globally, contrast agents are administered in approximately 75 million imaging procedures annually (2). Approximately a substantial proportion of the more than 600 million X-ray examinations performed each year (3). The historical evolution of contrast agents has been marked by significant milestones (4). Despite significant advancements in the development and safety profile of contrast agents, their administration remains associated with the risk of adverse reactions ranging from mild discomfort to severe, life-threatening emergencies (5). Consequently, radiologists, radiologic technologists, and other healthcare personnel involved in imaging procedures must possess adequate knowledge and skills for the safe administration of contrast media, early recognition of adverse events, and prompt emergency management (6). Ensuring staff competency through regular training and maintaining appropriate emergency preparedness measures within radiology departments are essential for optimizing patient safety and quality of care (7).

Despite the critical role of healthcare professionals in the safe administration of contrast media and the management of associated adverse reactions, evidence suggests the presence of significant gaps in knowledge and training. A multicountry European survey involving 454 young radiologists from 48 countries assessed participants' training experiences, self-perceived competence, and knowledge regarding contrast media and contrast media-related adverse drug reactions (ADRs). The majority of respondents were employed in university hospitals (70.7%), while 18.5% worked in community hospitals. Notably, most participants rated their residency training in the recognition and management of contrast media-related adverse reactions as poor or average. Furthermore, nearly 41% of respondents reported being unaware of safety guidelines issued by scientific societies for the prevention and management of contrast media-associated ADRs (8).

Evidence from both national and international studies indicates substantial deficiencies in healthcare professionals' knowledge regarding contrast media (CM) and the management of associated adverse drug reactions (ADRs). A study conducted in Peshawar, Pakistan, in 2019 assessed the knowledge of radiology personnel concerning contrast media and the management of related adverse reactions. The study included radiology consultants (16%), radiology residents (61%), and radiology technicians (23%). Although 63% of participants correctly identified severe acute contrast media reactions as type I hypersensitivity reactions, only 7.6% were able to accurately recognize the signs and symptoms of anaphylaxis following contrast media administration (9). Similar

findings have been reported internationally. In the Qassim region of Saudi Arabia, healthcare professionals were assessed using a 30-item questionnaire evaluating their knowledge and attitudes toward the safe use of contrast media. The study revealed that 85.9% of participants had inadequate knowledge, while 80.2% exhibited negative attitudes toward the safe administration of contrast agents (10).

Although modern low-osmolality iodinated contrast media possess a favorable safety profile, they are not entirely free of risk (11). Adverse drug reactions occur in approximately 3–30% of patients, while hypersensitivity reactions have been reported in 1–3% of cases (12). Therefore, ensuring patient safety through the appropriate use of contrast media, early recognition of adverse reactions, and prompt emergency management remains a fundamental component of contemporary radiological practice (13).

Patient safety in contrast-enhanced radiology depends on appropriate contrast media use, early recognition of adverse reactions, and effective emergency response. However, evidence shows ongoing gaps in knowledge and preparedness among radiology professionals.

This study aimed to evaluate the knowledge, attitude, and practice of radiology professionals regarding contrast media safety.

### **Materials and Methods**

A multi-centre cross-sectional study was conducted across seven hospitals in Mardan, Pakistan, from January to April 2026. The sample size was calculated using the OpenEpi sample size calculator ([www.openepi.com](http://www.openepi.com)), based on a 95% confidence interval, 5% margin of error, and an anticipated prevalence of 93.4%, yielding a final sample size of 80 participants.

A disproportionate stratified random sampling technique was applied to ensure adequate representation of radiology professionals across participating centres. Ethical approval was obtained from the Ethics Committee of the Medical Teaching Institution, Bacha Khan Medical

College, Mardan. Participants were included if they were permanently employed radiology professionals (radiologists, radiology technologists, and radiology technicians) with  $\geq 6$  months of clinical experience while interns, administrative staff, and non-clinical support personnel were excluded. Written informed consent was obtained from all participants prior to enrolment.

Data were collected using a pre-validated structured questionnaire developed to assess socio-demographic characteristics, knowledge of contrast media safety, attitudes toward adverse reactions, and clinical practices in the management of contrast media-related complications among radiology professionals.

Data analysis was performed using IBM SPSS Statistics version 26.0. Continuous variables were expressed as mean  $\pm$  standard deviation, while categorical variables were presented as frequencies and percentages. Associations between categorical variables and knowledge, attitude, and practice categories were assessed using the Chi-square test. Results were presented using appropriate graphical representations, including bar charts for categorical variables. A p-value of  $<0.05$  was considered statistically significant.

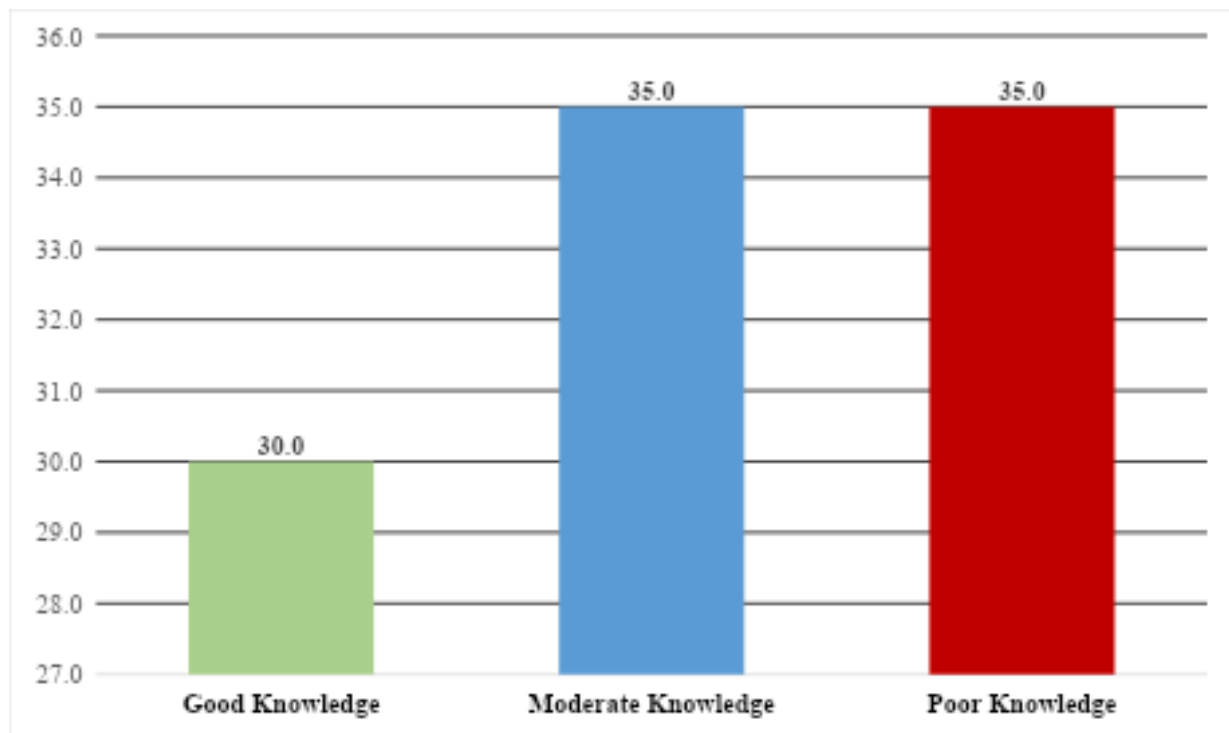
### **Results**

A total of 80 radiology professionals participated in this study. Most participants were aged 35–50 years (48.8%), were male (61.2%), and worked as technicians (43.8%). Nearly half of the respondents had more than six years of professional experience (48.8%), while 58.8% had not received formal training in contrast media safety (Table 01).

**Table 01: Demographic and clinical characteristics of the study participants**

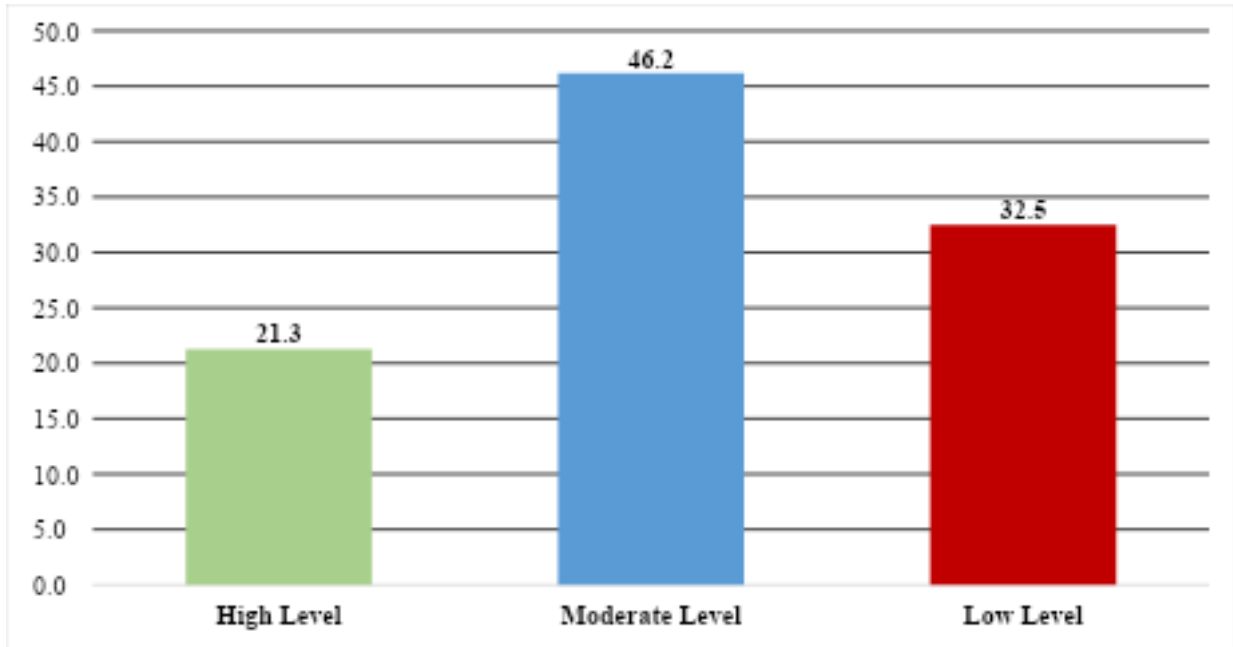
Demographic Variables	Category	Value n (%)
Age in years	20-35	33 (41.2)
	35-50	39 (48.8)
	> 50	08 (10)
Gender	Male	49 (61.2)
	Female	31 (38.8)
Professional Designation	Radiologist	20 (25)
	Technician	35 (43.8)
	Technologist	25 (31.2)
Working experience in years	< 01	03 (3.8)
	1-3	20 (25)
	4-6	18 (22.5)
	> 06	39 (48.8)
Received Training	Yes	33 (41.2)
	No	47 (58.8)

The mean knowledge score among the participants was  $7.26 \pm 2.01$ , reflecting an overall moderate level of knowledge regarding contrast media safety. Among the 80 participants included in the study, 24 (30.0%) demonstrated good knowledge, whereas 28 (35.0%) exhibited moderate knowledge and an equal proportion, 28 (35.0%), showed poor knowledge regarding contrast media safety (Figure 01).



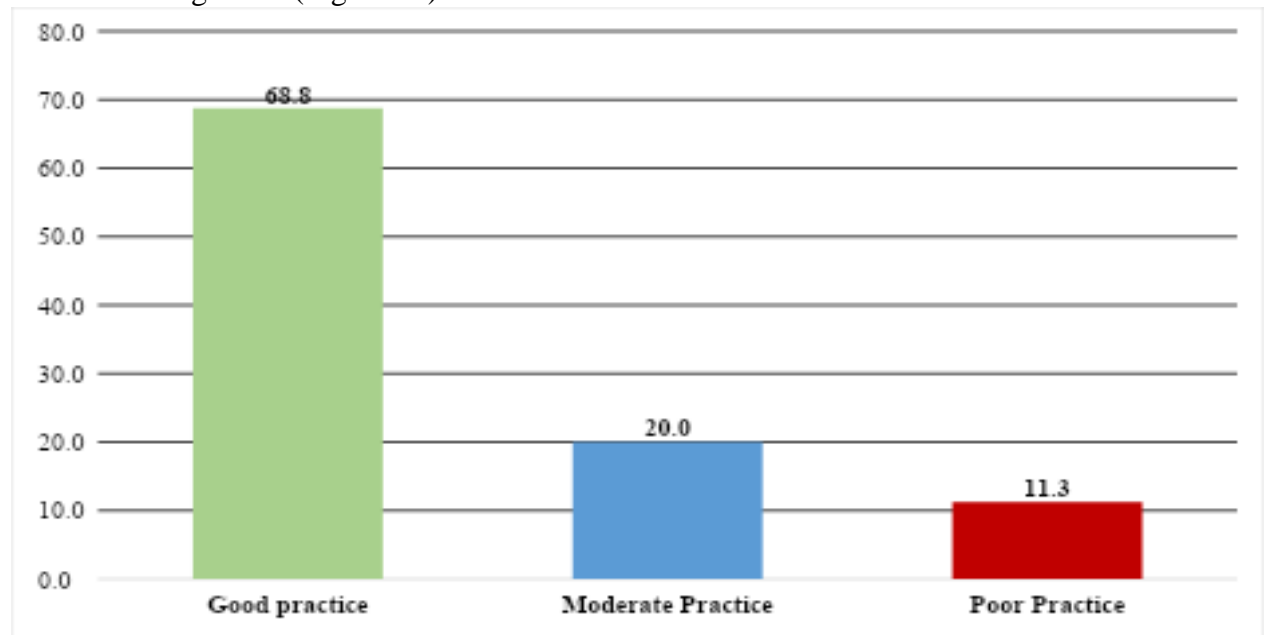
**Figure 01: Level of Knowledge regarding contrast media safety in percentages**

The overall mean attitude score was  $7.26 \pm 1.59$ , suggesting a moderate attitude toward contrast media adverse reactions and safety among the study participants. Among the 80 participants, 17 (21.3%) demonstrated a good attitude, whereas 37 (46.2%) and 26 (32.5%) exhibited moderate and poor attitudes, respectively, toward contrast media safety (Figure 02).



**Figure 02: Level of attitude towards contrast media safety in percentages**

The overall mean practice score was  $10.26 \pm 3.53$ , indicating a generally suboptimal level of practice regarding contrast media safety and the management of adverse reactions among the study participants. Among the 80 participants, 55 (68.8%) demonstrated good practice, while 16 (20.0%) and 9 (11.2%) exhibited moderate and poor practice levels, respectively, in relation to contrast media safety and adverse reaction management (Figure 03).



**Figure 03: Level of Practice regarding contrast media safety and management of adverse reactions in percentages**

No statistically significant differences were observed between male and female participants in knowledge, attitude, or practice scores (knowledge  $p=0.91$ ; attitude  $p=0.55$ ; practice  $p=0.44$ ).

A statistically significant difference was found between professional designation and knowledge scores ( $p=0.04$ ), while no significant associations were observed for attitude ( $p=0.38$ ) or practice ( $p=0.08$ ).

Years of professional experience showed a statistically significant association with knowledge ( $p=0.03$ ) and practice scores ( $p=0.01$ ), whereas no significant association was observed with attitude ( $p=0.70$ ). Overall, professional role and experience were associated with variations in knowledge and practice regarding contrast media safety. (Table 02)

Table 02: Association of Gender, Professional Designation, and Experience with KAP Scores Regarding Contrast Media Safety

Variable	Category	N	Knowledge (Mean $\pm$ SD)	p-val	Attitude (Mean $\pm$ SD)	p-val	Practice (Mean $\pm$ SD)	p-val
<b>Gender</b>	Male	49	7.24 $\pm$ 2.11		7.34 $\pm$ 1.54		10.02 $\pm$ 3.84	
	Female	31	7.29 $\pm$ 1.86	0.55	7.12 $\pm$ 1.68	0.44	10.64 $\pm$ 3.01	
<b>Professional designation</b>	Radiologist	20	8.05 $\pm$ 1.46		7.60 $\pm$ 1.56		10.85 $\pm$ 3.43	
	Technician	35	6.68 $\pm$ 2.16	0.38	7.00 $\pm$ 1.51	0.08	9.28 $\pm$ 3.25	
	Technologist	25	7.44 $\pm$ 1.98		7.36 $\pm$ 1.72		11.16 $\pm$ 3.79	
<b>Experience</b>	<1 year	03	5.33 $\pm$ 1.52		7.00 $\pm$ 1.00		7.33 $\pm$ 0.57	
	1–3 years	20	7.25 $\pm$ 1.97	0.70	7.55 $\pm$ 1.73	0.01	12.15 $\pm$ 3.99	
	4–6 years	18	6.44 $\pm$ 2.35		6.94 $\pm$ 1.69		8.88 $\pm$ 2.86	
	>6 years	39	7.79 $\pm$ 1.71		7.28 $\pm$ 1.53		10.15 $\pm$ 3.30	

## DISCUSSION

The main objective of this study was to determine the knowledge, attitude, and practice regarding of radiology professionals about contrast media safety and adverse reactions.

Overall, the findings demonstrated moderate levels of knowledge and attitude, with comparatively better but variable practice performance among participants. These results are consistent with previous studies by Ali Alamer et al. (10) and Yasser et al., (15) which also reported intermediate knowledge levels ( $7.26 \pm 2.01$ ), moderate attitudes ( $7.26 \pm 1.59$ ), and relatively low practice scores ( $10.26 \pm 3.53$ ). Collectively, the evidence highlights persistent gaps in KAP that warrant targeted educational and training interventions.

As observed in the present study, only 30% of respondents demonstrated a high level of knowledge regarding contrast media safety and adverse reactions, while the majority exhibited either intermediate (35%) or poor (35%) knowledge levels. These findings indicate substantial knowledge gaps among radiology professionals and highlight the need for targeted educational interventions. The results are consistent with previous studies conducted in Pakistan, which similarly reported inadequate knowledge and awareness regarding contrast media safety practices among healthcare professionals (9). In these studies, fewer than half of the respondents possessed sufficient expertise, particularly regarding the classification of contrast media and the identification of adverse reactions. Similar findings have also been reported in Saudi Arabia, where a large proportion of radiology professionals (85.9%) lacked fundamental knowledge related to contrast media safety. Collectively, these findings suggest that deficiencies in knowledge regarding contrast media use and safety are not confined to a single region but represent a broader challenge across different healthcare settings.

Regarding attitudes toward contrast media safety, only 21.2% of participants in the present study demonstrated a positive attitude, indicating an overall moderate perception of safety-related practices. Although most respondents recognized the importance of patient safety, the relatively low proportion exhibiting a positive attitude suggests the need for greater emphasis on fostering safety awareness, adherence to guidelines, and continuous professional development to improve both knowledge and attitudes toward contrast media administration. This is in contrast to the results of Ali et al. (10), who found that 80.2% of participants had negative attitudes. This suggests that while the current study's attitude is not ideal, it is still better than in many foreign situations. Besides, there was a positive correlation between knowledge and attitude, implying that better knowledge leads to better attitudes towards clinical procedures. The moderate level of both indicators points to a positive correlation, despite the fact that the correlation is not significant.

Concerning practice, an interesting result was obtained. Although the mean value indicates the poor practice of the study participants, most of them (68.8%) are considered to have good practice. Such a contradiction may be attributed to varying adherence to the protocols used in assessing good practice. Similar results were reported in a study conducted by Yasser et al. (15) in Saudi Arabia, where only 22% of the participants demonstrated complete knowledge of safety procedures in contrast to 93.4% who knew about safety procedures.

A further investigation of demographic correlations indicated that gender was not significantly correlated with knowledge, attitude, or practice, similarly to earlier studies, which failed to find significant differences between genders with respect to KAP. Professional designation was significantly correlated with knowledge ( $p = 0.04$ ). Radiologists showed the highest level of knowledge compared to technologists and technicians. The latter is supported by a study of Yasser et al. (15), which found a correlation between professional experience/competence and knowledge.

Furthermore, the percentage of subjects who did not receive formal education regarding the safe use of contrast media was 58.8%. This factor is most probably the cause of their moderate knowledge level and poor practices. Most radiologists evaluated their training regarding adverse reactions as low or mediocre, indicating the necessity for further educational programs across the world. In summary, this research shows that despite having basic information about the contrast media, the level of advanced knowledge, readiness to deal with adverse events, and practical skills of radiology professionals remains unsatisfactory.

## Conclusion

Radiology professionals demonstrated moderate knowledge and attitudes toward contrast media safety, while practice levels were relatively better but heterogeneous. Gender showed no significant association with KAP scores; however, professional designation and years of experience were significantly associated with knowledge and practice.

These findings highlight the influence of clinical role and experience on competency and underscore the need for structured, continuous training to improve knowledge and ensure standardized, safe practice in contrast media administration and adverse reaction management.

## Author Contributions

**Aina Shabir, Farhan Hussain, Bibi Romaisa Niaz, Zaid Khan** contributed to conceptualization, data collection, patient recruitment, and initial manuscript drafting.

**Yasir Shahid** conceptualized, supervised the study and review the final version of the manuscript.

**Syed Arshad Ullah** conceptualized and supervised the study, performed statistical analysis, interpreted the data, and critically revised the manuscript for important intellectual content.

All authors reviewed and approved the final version of the manuscript.

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## Data Availability

The datasets generated and/or analyzed during the current study are available from the corresponding author upon reasonable request at [sarshadullah4@gmail.com](mailto:sarshadullah4@gmail.com).

## Declarations Conflict of Interest:

The authors declare that there are no conflicts of interest related to this study.

## Ethical Approval and Informed Consent:

The study protocol was reviewed and approved by the Institutional Ethical Review Committee of Bacha Khan Medical College, Mardan. Written informed consent was obtained from all participants prior to enrollment. All data were handled confidentially and used exclusively for research purposes.

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