

Pharmacists' role in managing medication use for patients undergoing interventional radiology procedures

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Abstract

Background: Pharmacological management in patients undergoing interventional radiology (IR) procedures usually requires complex regimens involving anticoagulants, sedatives and contrast agents. An understanding of approaches to pharmacists' practice in patients' care and safety and resulting evidence emphasize the importance of pharmacists in improving patient safety and outcome and reducing adverse events in high-risk environments.

Aim: To identify and assess the potential of pharmacists in the management of medication for the patients receiving IR procedures in terms of patients' safety, treatment effectiveness, and rates of complications.

Materials and Methods: A systematic review was done on related articles from the databases including PubMed, Web of Science and Scopus with articles from the year 2019-2024 to be included in the study. Search terms used included "pharmacists," "IR," "medication safety," and "contrast agents." The included articles were identified by applying set inclusion criteria and assessed for outcomes regarding implementing pharmacist intensified interventions in IR context.

Results: Out 90 studies included in the search, only 8 matched the inclusion criteria. These studies also showed that pharmacists were effective in the reduction of medication errors, better handling of contrast-induced nephropathy, and procedural safety and patient satisfaction by their active participation in the treatment team.

Conclusion: Pharmacists have an essential function in the management of medications for patients undergoing IR procedures, enhancing patients' lives and decreasing adverse effects. Increased investment in training initiatives and the incorporation of sophisticated technologies may help to build upon these benefits. Future research should focus on cost-effectiveness and long-term impacts of pharmacist-led interventions in IR.

Keywords: Pharmacists, medication management, interventional radiology, patient safety, antimicrobial stewardship, contrast agent management

INTRODUCTION

Interventional radiology (IR) is a sub-specialty of diagnostic radiology where various interventional procedures are performed under image guidance using techniques including Fluoroscopy, ultrasonography and CT scans. These procedures require intricate patient care as pharmacologic approaches have a central role in safety, efficacy and best practices [1]. Interventional radiology represents an umbrella term for various procedures which involve the use of medicines and, therefore, pharmacists are critical stakeholders in the care of clients receiving interventional radiology services. Having medical knowledge about the effects of various pharmacological agents, their drug interactions and therapeutic uses are crucial in enhancing patient outcomes and preventing adverse effects during these procedures [2].

The increased application of interventional radiology in illnesses such as cancer, vascular diseases, and pain control management, has influenced a more holistic management of medication dosages. Patients undergoing IR procedures are often dealing with complex health conditions that require careful medication management. This also encompasses medication therapy management specifically anticoagulation, pain, sedation, use of contrast agents, and post-procedural medications. It includes pre-procedure evaluation, medication administration during the procedure, and monitoring or follow-up once the procedure is over to ensure appropriate use of the medications for the procedure [3].

Roles of pharmacists to encompass the delivery of direct individual patient care services which include Medication Therapy Management (MTM), immunization, and patient counseling and teaching. The development of new paradigms of healthcare delivery, team-work between healthcare professionals, including legislation support, has also created new avenues for the growth of pharmacists' tasks. Such professional role advancements and changes have placed pharmacists in strategic place to form a strong component of the patient healthcare team [4]. Pharmacists interact more with physicians who are often

seen as the drivers of the health care team via the Medication Use Process (MUP) and writing of collaborative practice agreements. The view of patients is also a factor to take into account because they are the direct consumer of goods and freedom of actions of the MUP performers like pharmacists and physicians [5].

Besides, pharmacists also intervene in patient care regarding the risk of adverse drug reactions, bearing in mind contrast agents, sedation, and anticoagulation in interventional radiology (IR) procedures. They screen out high-risk patient populations, evaluate the renal function, dose-modify and advise on fluid management. Pharmacists also have a major role in monitoring and adjusting patients' anticoagulation therapy to ensure the best balance between risks of bleeding and thromboembolism. They choose sedatives properly, supervise their impact, and raise healthcare providers' awareness of proper dosing [6].

In the post-procedural care, another area that the pharmacists help in developing, safe, efficient and patient specific pain management plan. Their knowledge in clinical decision making, drug utilization safety reviews, and medication therapy management guarantees their patients the best pharmacotherapy. They also provide patient education on risks, adverse effects, and how to take medications and thereby contribute to an improvement in the quality of care offered in the interventional radiology department [7].

Aim of Work:

This study aimed to explore the various roles pharmacists play in this setting, highlight key areas of involvement, and evaluated the impact of their contributions to patient care in interventional radiology.

METHOD AND SEARCH STRATEGY

This systematic review strictly followed the PRISMA checklist for systematic reviews and meta-analyses [8]. The electronic databases explored in the current review included PubMed, Scopus, Web of Science, Cochrane Library, and Embase. The search was performed for the articles published between January 2000 and December 2023 that investigated the involvement of pharmacists in medication therapy management for patients with interventional radiology (IR).

The keywords included "pharmacist", "medication management", "interventional radiology", "medication safety", "contrast agents", "anticoagulation therapy", "sedation", and "pain management". These terms were combined through peculiar operators (AND, OR) to describe the entire range of works concerning the given topic. All the identified titles were initially screened and next all the duplicate titles were first excluded to make sure that the titles were cleared headed and inclusive.

ELIGIBILITY CRITERIA

The selection process for studies followed a rigorous multi-step approach. First, papers that attempt to explore the involvement of pharmacists in the management of medications for patients with IR procedures were reviewed. In the second step, the searched studies were further narrowed down by including only those in the English language and concerning the research area. Studies that contained review articles, editorials as well as case reports were not considered since these papers did not present empirical data. Pharmacist intervention records that occurred prior to the procedure, during the procedure, or after the procedure were included in the study.

Next, any article without links to the full text, any study that did not specifically analyze IR procedures, and any study with missing or dubious data were excluded. Other sources that were excluded were the ones published before year 2000 which made the authors to focus only on the recent trends and practices. The strategy of eligibility criteria application is described in the flowchart given below (Figure 1).

Identification

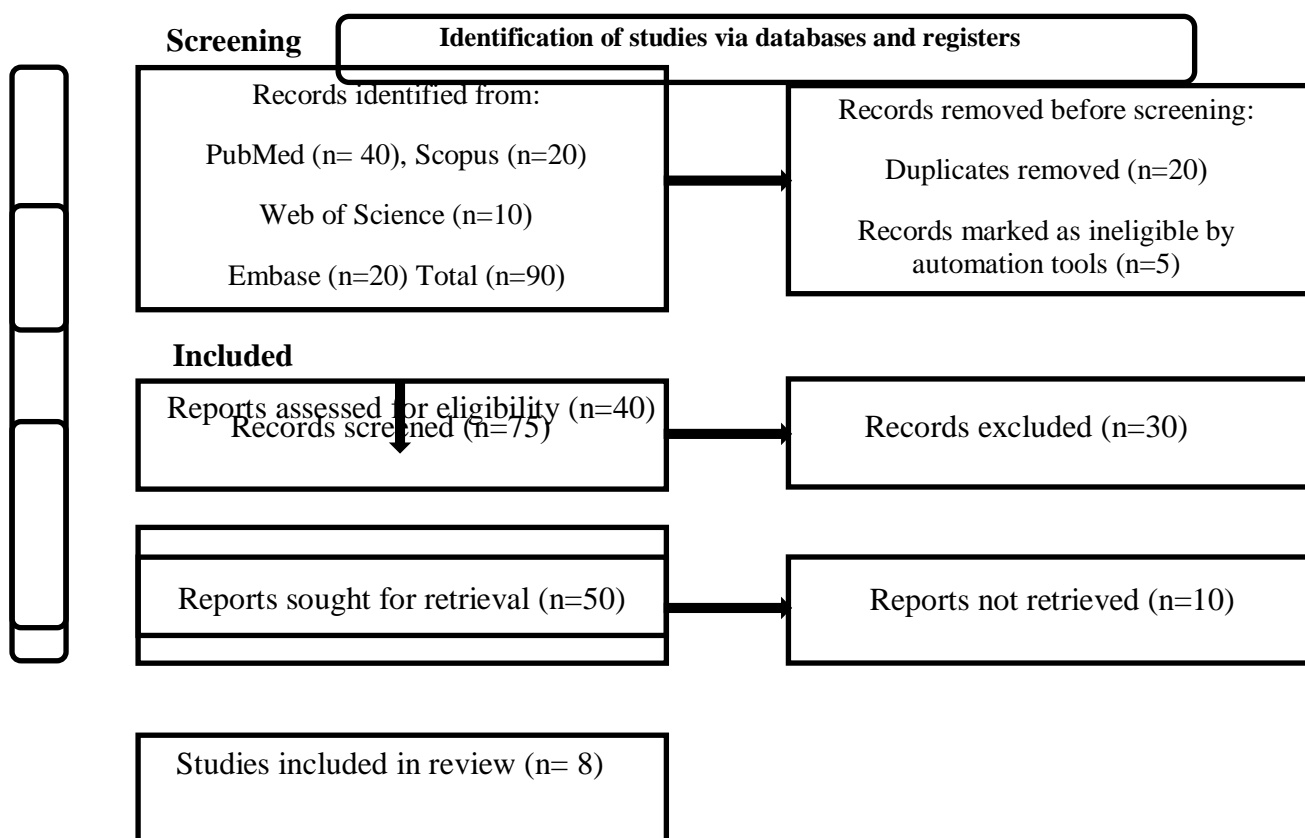


Fig1: Planning of Eligible criteria

DATA REVIEWING AND ANALYSIS

Concerning data extraction, the full text and abstracts of the identified studies were sampled. A data abstraction form was developed based on standardized fields including study design, roles and responsibilities of the pharmacist, types of interventions, patient outcomes, and effect of pharmacist involvement on medication safety and clinical outcomes.

RESULTS

Eight studies [9-16] met the inclusion criteria of this systematic review (Table 1). These studies comprise of two cross-sectional studies [9, 10], one case control study [14], two pre-post intervention studies [12, 15], and three experimental interventional studies [11, 13, 16]. These papers were published in the period that ranges from the year 2019 to 2024, though the majority of these papers were published in the year 2022 and 2023. A total of 3,568 participants were involved in all the studies and the studies included the staff in radiology department right up to the interventional radiology patients.

The reviewed works explored different aspects of medication administration by pharmacists for patients that are to undergo interventional radiology (IR). These studies revolved around pharmacist-led medication safety, error reduction, medication regimen complexity, antimicrobial stewardship and handling and prevention of adverse effects mainly on contrast agents and sedation during interventional radiology procedures. The studies as a whole stress an active participation of the pharmacists in enhancing patient satisfaction through engagement in medication management and communication with other health care teams.

Fairag, A. S., et al. (2022) [9] examined the role of pharmacists in post-sedation management for patients undergoing dental procedures with moderate sedation. The research established that pharmacists of importance in enhancing patient safety and comfort during post-sedation. The active participation of pharmacists in managing medications, checking for possible side effects, and working with other care teams was essential in improving patient outcomes. This study also underscores the responsibility of pharmacists after procedures especially concerning drugs for sedation.

The Observational study by Varshitha et al., 2019 [10] aimed at identifying the errors reported and clinical interventions by pharmacists in a radiology department. This research study identified that the pharmacists are effective in addressing the cases of medication-related errors and clinical intervention. Pharmacists were able to identify and evaluate certain aspects of medication safety, prescribe the right dosage, and intervene on time. The results imply that pharmacists should participate in radiology departments in order to promote medication safety, including medication administration in circumstances where potentially severe complications may arise like IR.

A recent prediction study conspired from the BP clinical practice data by Zhao, B., et al. (2024) [11] to understand the level of pharmacist interventions based on the MRC. The study also established that multiple medications regimen were some of the indicators for pharmacist interventions in IR procedures. The interventional radiology patients are usually presented with multiple comorbidities that may need multiple drugs like anticoagulant and sedative, and the patients' medication regimen needs the professional attention of the pharmacists to limit adverse effects. Thus the study established that pharmacist interventions are imperative in the delivery of health care in IR facilities for medication utilization and risk evaluation.

In a study by Xu, J., et al. (2022) [12], the effect of an SP from a pharmacist on a vascular and interventional radiology department in a Chinese tertiary hospital was evaluated. The quasi-experimental study showed that the program led to a positive change in antibiotic ordering/preordering, fewer complications, and better patient management for interventional radiology patients. The outcomes of this study indicate that stewardship programs introduced and implemented by pharmacists in IR settings are useful in educating people concerning the appropriate usage of antibiotics and avoiding the emergence of antimicrobial resistance.

Similar to Varshitha, N., et al. (2019) [13] identified the contribution of pharmacists concerning the error reporting and clinical interference within the radiology department. As in its previous research, it identified that pharmacists are key in minimizing medication errors, adjusting dosages, and promoting patient-safety on IRs. A particularly crucial aspect was identifying key practices that require the input of pharmacists as the definitive consultants and collaborators with radiologists as well as other experts in ensuring optimal medication use particularly during high-risk procedures.

In a retrospective study on the risks of Infusion of Iodinated contrast media, Jiang, H., et al., (2023) [14] highlighted the role of pharmacists in the management of these risks. According to the study, the risk assessment services led by the pharmacist helped enhance patient safety in the use of iodinated contrast media, which is a fundamental medication employed in various IR procedures. Through the development of different interventions, pharmacists were able to screen and optimize patients at higher risk of developing an adverse reaction to different contrast agents hence eradicating most of the complications related to their uses.

Jimmy, et al., (2023) [15] aims to assess the clinical pharmacist-led approach of the reduction of drug-related problems among neurological disorder patients. The interventional study was able of proving that the new pharmacist-led approach proved success in unveiling and solving drug-related complications for the sake of increasing safety among patients. The results of the research are generalizable across interventional radiology departments, where patients often have neurological disorders or take many medications, including for sedation or pain relief.

Li, X. X., et al. (2020) [16] conducted an interventional study on ICU patients receiving pharmaceutical care. The results showed that by implementing the pharmacy intervention model, several drug related issues were identified and addressed thus enhancing patients' condition and medication safety. Although the current study's sample comprised solely of ICU patients, the observations underscore the value of engaging pharmacists in intricate procedural interventions like interventional radiology where patients are likely to present with poly-pharmacy and demanding medication regimen complexity.

The findings of these studies altogether shed the light on the importance of pharmacists at the time of taking interventional radiology procedures in regard to medication use. Pharmacists work during pre-procedure, intra-procedure, and post-procedure phases with the responsibility of optimization of the client's medication schedule, medication safety, and elimination of medication errors. The outcomes of IR involvement of pharmacists have demonstrated the positive impacts on patient safety and clinical outcomes, including decreased ADR incidence across several facility types.

Overall, the findings reaffirm the need for collaboration with pharmacists as part of the interventional radiology team to enhance medication utilization and patient health. This supports pharmacists' roles in medication safety, drug regimen, complexity, antimicrobial stewardship, or contrast agent management in improving patient outcomes when undergoing IR procedures.

DISCUSSION

In line with the literature, the reviewed articles shed light on the important role of pharmacists in IR contexts. Engaging the services of a pharmacist has been shown to improve patient outcomes, reduce adverse events, and improve the quality use of medicines, which supports the inclusion of pharmacists as valued members of the IR team. These outcomes revealed that pharmacists' roles in dealing with aspects, including antimicrobial stewardship, that reporting of errors, and contrast agent care significantly influences patients' outcomes within a high risk environment coupled with complex health cares.

Pharmacist-led interventions are imperative in IR settings, given the effectiveness displayed in enhancing the safety of medications as well as clinical outcomes. For instance, research showed that pharmacists were capable of reducing the number of medication errors and adjusting doses for the betterment of patients' treatment. Pharmacists are deemed indispensable in navigating intricate medications regimens like anticoagulant and sedatives, hence contributing to procedural safety and effectiveness [17, 18]. This is consistent with other studies that point to effectiveness of pharmacist practice involvement in high risk clinical settings in enhancing patient safety and healthcare outcomes [19, 20].

Other pharmacist-led interventions in IR setting that was identified included antimicrobial stewardship programs. By lowering those complications, these programs adhere to the global goal of proper use of antibiotics to combat antimicrobial resistance. The reviewed articles showed that pharmacists' knowledge on proper choice of antimicrobials improved patient outcomes not only at an individual level but also within the contexts of public health and infection prevention and control strategies. These findings are in line with other works highlighting the significance of pharmacists in stewardship of antibiotics in specialized areas of medicine [21].

Furthermore, pharmacists play a key role in the utilization of the iodinated contrast agents thus mitigating risks resultant from the IR procedures. The studies reviewed demonstrated that pharmacist-led risk assessments effectively identified patients at higher risk of adverse reactions, enabling tailored interventions that improved safety outcomes. These findings supports the earlier studies wherein it was shown that pharmacist's intervention in contrast media reduced the risk of contrast induced nephropathy and other related complications to a large extent [22].

Notably, despite the enhancements in medication safety and clinical benefits demonstrated by pharmacist-led interventions, several studies identified specific limitations in the reduction of certain risks. For instance, the evidence indicates that pharmacist engagement might enhance medication regimens and decrease the number of mistakes, but other factors, including systematic barriers and personal characteristics, may affect the efficacy of interventions [23]. This underlines the importance of a combined approach in which pharmacists work alongside other members of the healthcare system.

Pharmacist intervention therefore is not only limited to procedural gains, but also includes attributes that are long term such as complications and patient satisfaction. The roles of pharmacists in IR include engaging with radiologists, nurses, and other care providers, which enhance the practice of safety and innovation [24]. Such strategy is most appropriate in environments that emphasize on efficiency and reduced errors since patient results depend on team performance.

These research findings also imply the existence of opportunities for training and education to increase pharmacists' responsibilities for IR care delivery. Training interventions in areas of interest like management of sedation, safety in the use of contrast agents, and antimicrobial stewardship could build upon the identified pharmacists' roles and improve patients' care even further [25]. Furthermore, the incorporation of enhanced technologies including decision-support tools, and/or analytic tools can bolster pharmacists' capacity for the analysis of elaborate medication regimens and early identification of possible risks.

CONCLUSION

Findings from this review highlighted that pharmacists are the key stakeholders who have a great contribution to the management of medicine for patients who are undergoing interventional radiology. The engagement of pharmacists improves patient outcomes, minimizes medication errors, and optimizes the utilization of anticoagulant medications, sedatives, and contrast agents. This research allowed identifying that pharmacist-provided interventions including antimicrobial stewardship and individualized medication management play a crucial role in enhancing overall health outcomes and reducing adverse effects in high-risk healthcare areas.

As with the studies examined in this review, pharmacists were showcased to mitigate adverse effects, such as risk assessment to contrast-induced nephropathy among those who manage iodinated contrast agents. However, challenges at system level of care may hinder the exploitation of pharmacists' roles and expert opinions fully since they may for instance lack resources to support their interventions adequately.

These findings offer understanding of why pharmacists should be incorporated in the IR teams as a part of the bigger team of specialists. The scope may continue by increasing the training of pharmacists in specific fields or incorporating more progressive technologies to build on their impacts. Further prospective researches are warranted to provide objective measures of the sustainable effects of pharmacists' interventions on the patients' condition and health system organization.

APPENDIX

Table 1

Author and Publication year	Study design	Population, Sample Size, and Characterization	Main points	Results and main findings
1. Fairag, A. S., et al. (2022) [9]	Cross-sectional study	Patients undergoing dental procedures with moderate sedation	Role of pharmacists, radiology, and clinical laboratory teams in post-sedation management	Pharmacists contributed to improving patient safety and comfort during post-sedation care. The collaboration between pharmacists and other medical professionals is essential in enhancing patient outcomes.
2. Varshitha, N., et al. (2019) [10]	Observational study	Radiology department staff	Reporting errors and clinical interventions by clinical pharmacists in radiology	Pharmacists play a key role in reducing errors and improving clinical interventions in radiology, particularly through medication management and error prevention.
3. Zhao, B., et al. (2024) [11]	Prediction study	Data from clinical practices	Predicting pharmacist interventions based on medication regimen complexity	Medication regimen complexity is a significant predictor for the need for pharmacist interventions, emphasizing the importance of pharmacists in managing complex regimens in interventional radiology.
4. Xu, J., et al. (2022) [12]	Quasi-experimental study	Vascular and interventional radiology department patients in a Chinese tertiary hospital	Impact of pharmacist-led antimicrobial stewardship program	A pharmacist-led antimicrobial stewardship program significantly improved antibiotic use in patients, reducing complications and optimizing treatment in interventional radiology settings.
5. Varshitha, N., et al. (2019) [13]	Observational study	Radiology department staff	Reporting errors and clinical interventions by clinical pharmacists in radiology	Pharmacists play a key role in reducing errors and improving clinical interventions in radiology, particularly through medication management and error prevention.
6. Jiang, H., et al. (2023)	Retrospective study	Patients receiving iodinated contrast	Pharmacist-led iodinated contrast	The pharmacist-led risk assessment service

[14]		media	media infusion risk assessment	improved patient safety and optimized the management of iodinated contrast media infusion risks.
7. Jimmy, N., et al. (2023) [15]	Interventional study	Patients with neurological disorders	Clinical pharmacist-led approach to reducing drug-related problems	The clinical pharmacist-led approach significantly reduced drug-related problems in patients with neurological disorders, improving medication safety and patient outcomes.
8. Li, X. X., et al. (2020) [16]	Interventional study	ICU patients receiving pharmaceutical care	Drug-related problems identified during pharmacy intervention	The ICU pharmaceutical care model led to the identification and resolution of numerous drug-related problems, improving patient outcomes and medication safety in critically ill patients.

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