

# Unfractionated Heparin: A Nursing Dilemma

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Nurses face challenges in all aspects of their practice, especially with administering and monitoring drugs in a safe, effective manner. Key factors known to affect drug administration include general drug knowledge, formal nurse education, continuing education needs, clinical experience, and the nationwide nursing shortage. Other factors are advances in technologic aids and quality improvement initiatives. Emphasis on patient safety is growing, especially as it relates to drug therapy and high-alert drugs such as unfractionated heparin (UFH). Specific interventions related to UFH administration can enhance patient care management. Because nurses are at the site of direct patient care, they are often in an opportune position for identifying medication errors. At the same time, and most important, nurses need to collaborate with other health care professionals to actively develop solutions to minimize these errors. Adopting a systems approach and working collaboratively with an interdisciplinary team can result in improved patient outcomes.

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Nurses face many challenges in practice today. Competing priorities for patient care, a nationwide nursing shortage, and increasingly complex medical and social needs of hospitalized patients are significant factors in defining the standards of nursing responsibilities. In addition, nurses receive a constant influx of new patient care information. A significant portion of this data pertains to new pharmacologic agents as well as recent experience with existing drug therapy. In order to provide optimal care, this information must be evaluated and, when appropriate, integrated into clinical practice by each nurse.

Unfractionated heparin (UFH), classified as a high-alert drug, is associated with a high rate of drug-related problems including medication errors. In the 2002 MedMARx summary, UFH was ranked as one of the leading drugs associated with patient harm.<sup>1</sup> In addition, errors involving

improper drug dosage or quantity were reported to this database most frequently for UFH. Because nurses provide direct care to patients, they can enhance the safety and management of UFH therapy. Factors such as a nurse's formal education, continuing development, and clinical experiences can influence the drug administration process. Nurses must work with other health care providers to adopt a collaborative or systems approach to identify solutions to reduce the occurrence of medication errors.

## **Drug Knowledge: Clinical Experience and Nursing Education**

Formal education requirements for registered nurses usually include a 2–3 year diploma program associated with hospitals, a 2-year associate degree program in community colleges, or a 4-year baccalaureate program affiliated with colleges and universities. The baccalaureate programs generally provide a broader pharmacology foundation than the 2-year programs. The effect of educational preparation on medication errors is not well defined. Because nurses are at the point of direct patient care, they

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are often in an opportune position to detect complications and minimize errors.

Perhaps nurses with higher education levels are better prepared, overall, for promoting patient safety. This concept was explored in a recent study that demonstrated the importance of a nurse's education level relative to patient safety.<sup>2</sup> The study provided evidence that nurses with baccalaureate and more advanced degrees foster improved patient outcomes. Also, the authors suggested that patient safety is less influenced by the amount of nursing experience and more influenced by the amount of formal education.

Among the many challenges confronting nurses is the ever-increasing number of new agents available on the market. As these drugs appear on hospital formularies, the nursing staff must quickly develop a competent knowledge level to ensure appropriate administration, monitoring, and safety. In addition, nurses must stay current with the new information continually released for existing drugs. This pharmacologic educational process can become an overwhelming task when considered in the context of primary nursing staff responsibilities. However, the need to implement quality staff development programs is paramount in view of the escalating number of adverse drug events occurring in institutions due to medication errors, and the associated costs.<sup>3</sup> Therefore, the development of targeted educational processes designed to enhance the pharmacologic knowledge of the nursing staff should be a priority in all institutions.

Although formal programs coordinated through the institution's staff development department are the most traditional methods of providing continuing education, another way to enhance drug knowledge is to have a pharmacist on the interdisciplinary care team. For example, adding a pharmacy clinician to the patient care team in a medical intensive care unit was associated with a substantially lower rate of adverse drug events caused by prescribing errors.<sup>4</sup> In addition, the direct presence of a pharmacist in the unit provided assistance to the nursing staff with timely consultations and education. This reduced the extra work involved with contacting physicians to correct orders.

### Information Technology

The use of information technology can help nurses obtain current and timely drug information. When information technology

systems are conveniently accessible at the nurses' station, as well as at the patient's bedside, nursing staff can readily retrieve comprehensive drug information such as specific dosing parameters, drug interactions, administration procedures, compatibility information, and risk of adverse effects. As a result, nurses can immediately apply this newly acquired knowledge to the management of the patients. These systems, particularly when coupled with physician order entry, can reinforce institution-specific policies and procedures as well as enhance communication among health care professionals.

The technology-based strategies to reduce medication error rates include improving access to reference information for providers, enhancing communication among providers, implementing features to achieve compliance or standardization with certain tasks, providing readily available monitoring information, sending alerts when required, and implementing decision support tools.<sup>5</sup> For example, direct nursing access to reference information on drugs such as UFH and automated infusion rate calculators greatly augment bedside nursing care. In addition, the use of a physician order entry system can prevent more than 50% of serious medication errors by reducing transcription errors and missed orders, and improving communication. One study demonstrated that serious medication errors using anticoagulants were reduced by 75% with this technology-based intervention.<sup>6</sup>

In summary, expanding technology to support nursing practice could increase timely access to critical information, promote appropriate drug delivery, and decrease medication errors.

### Nursing Shortage and Drug Safety

At this time, most institutions have fewer than the ideal number of nursing staff and compete to retain their currently employed nurses. Predictions based on the nursing shortage are well documented and provide the inevitable decrease in nurse:patient ratios. The nursing shortage has serious implications pertaining to patient safety. In fact, the shortage of hospital-based nurses is viewed by physicians and the general public as one of the greatest threats to patient safety in the United States.<sup>7</sup> Others have documented the risks associated with insufficient nurse:patient ratios.<sup>8,9</sup> For some institutions, this situation has forced the increased use of travel and temporary staffing agencies, including foreign nurse corps, to supplement hospital

nursing staff.

The National Council of State Boards of Nursing recently conducted a survey of newly licensed nurses. Of the registered nurses surveyed, 49% reported committing medication errors.<sup>10</sup> Nearly 70% cited inadequate staffing as a contributor to medication errors. Another survey of registered nurses, conducted by the *Online Journal of Issues in Nursing*, also identified the nursing shortage as a leading contributor to errors and untoward clinical incidents.<sup>9</sup> Of note, the survey also collected information pertaining to the emotional status of nurses after making an error. This was described as “displaying symptoms of moral distress,” which leads to questions related to job satisfaction and retention. Such reports have implications for nurse managers when they hire new graduate nurses, and for nurse educators when they recruit and prepare new nurses to enter the work force.

### Issues and Potential Solutions

The unpredictable pharmacokinetics associated with UFH have led to the development of numerous administration and monitoring protocols. Targeted nursing education programs, focusing on management of UFH therapy, should be a priority in every institution to enhance appropriate administration and monitoring and to minimize medication errors. These programs should contain important information pertaining to UFH dosing nomograms, integrity of UFH infusions, timing of drawing blood samples for monitoring assays, use of intravenous infusion pumps, and administration of standard UFH solution concentrations.

To improve the clinical and safety outcomes for UFH therapy, the use of weight-based heparin protocols has evolved. The use of such protocols can decrease problems associated with nontherapeutic activated partial thromboplastin times (aPTTs) and avoid complications related to overdosing (with potential for hemorrhage) and underdosing (with potential for thrombosis). However, adoption of numerous nomograms in an institution can cause confusion and increase medication errors. Also, to enhance the success of any weight-based nomogram, a mechanism must be in place to obtain and record accurate patient weight. One report described success with developing and implementing a weight-based protocol to achieve therapeutic anticoagulation in less time, with fewer bleeding complications, and with a shorter hospital stay.<sup>11</sup> A

multidisciplinary team approach used in this example was very effective.

However, even with these UFH dosing protocols or nomograms, issues can arise with UFH administration. One study found that in a series of patients at a large academic medical center, UFH infusions were interrupted 54% of the time.<sup>12</sup> In addition, in well over a third of the patients, interruptions occurred more than one or two times, thus compromising the drug's therapeutic effect. Understandably, interruptions can never be completely eliminated. For example, it may be both impossible and impractical to limit patient travel away from patient care units when diagnostic testing is indicated. However, nurses at the bedside are in the best position to minimize events associated with UFH infusion interruptions provided they recognize the significance of doing so. Efforts to enhance nursing drug knowledge, specifically in terms of maintaining UFH infusions, may result in improved patient outcomes.

When UFH infusions are interrupted, ability to adjust the timing of blood work for monitoring is critical for accurately assessing the effectiveness of therapy. For example, routine orders to obtain the aPTT every 6 hours, without provisions addressing the integrity of the infusion over that 6-hour interval, may be a factor leading to nontherapeutic results. Consequently, this could lead to inappropriate dosage adjustments. Findings of clinical trials have implicated suboptimal dosing and monitoring of UFH in reduced efficacy.<sup>13</sup> These findings further underscore the importance of maintaining infusion rates.

Infusion pumps are a tremendous aid for ensuring safe, continuous intravenous drug infusion. However, inconsistent practices and a lack of policies and procedures for using infusion pumps have negative effects on patient safety. Issues pertaining to patient travel away from the care unit further compound this issue. When patients return, nurses may discover changed infusion rates, deactivated alarms, pumps no longer operating, and infiltrated intravenous sites. Solutions to these problems will require systemwide intervention and education. Developing practical and enforceable institutional policies and guidelines for use of infusion pumps will promote patient safety.

### Safe Drug Practices

Efforts to improve drug administration

processes in general will improve patient safety when treatments such as UFH infusions are administered. Traditionally, safe drug administration can be achieved by observing the five "rights": right drug, right patient, right time, right dose, and right route. These five rights focus on the nurse's performance, which is largely determined by his or her overall drug knowledge. In addition, for optimal UFH administration, other safety assessments are required, such as monitoring intravenous insertion sites for prevention of infection and maintenance of intravenous line patency.

To summarize, errors and exposure to risk associated with UFH therapy can be minimized by adopting institutional UFH policies and procedures that address the administration and monitoring of this agent. In addition, continuing, effective nurse staff development programs should be adopted.

Developing and implementing institutional policies and procedures in a timely manner is often a challenge. Monitoring the outcomes of these initiatives is equally difficult. Adopting a systems approach and working collaboratively with an interdisciplinary team of professionals can frequently overcome barriers to success. Thus, system quality improvements can be developed, implemented, and surveyed at several levels simultaneously for overall enhancement of patient care.

The participation of nurses in morbidity and mortality conferences has also been suggested. These conferences would provide an opportunity to develop and improve institutionwide patient safety standards by giving nurses a forum where they could identify problems, analyze complications, and participate in solutions without fear of punishment.<sup>14</sup> Such an effort clearly could positively affect the quality of nursing care pertaining to UFH therapy. Finally, the ability to report errors in a timely manner is a significant factor in enhancing patient safety. This allows for faster identification of institutional issues and provides the opportunity for resolution.

## Conclusion

For nurses to provide safe drug administration, they must possess a sound foundation in basic pharmacology. The variability of nursing education programs and clinical experience highlights the significance of implementing a multidisciplinary approach to improving continued staff development for nurses in U.S.

institutions. The nationwide nursing shortage and the associated challenges nurses face in today's health care settings further intensify the need for such programs. Recommendations from the Heparin Consensus Group to enhance the safe administration of UFH are provided in Appendix 1.

Several solutions to enhance the pharmacologic knowledge of nursing staff are implementation of patient care unit-based pharmacists, greater use of information technology, and adoption of technologic aids designed to minimize medication errors. Applying these concepts to complex administration and monitoring schedules associated with agents such as UFH has improved patient outcomes and increased job satisfaction for nurses in selected settings. Educational opportunities tailored to improve the administration and monitoring of UFH will be most successful when a systems approach is used and nurses collaborate with professionals from other disciplines to implement and evaluate new interventions.

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**Appendix 1. Recommendations to Enhance the Safe Administration of Unfractionated Heparin**

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1. A continuing education plan pertaining to the use of UFH nomograms and involving all appropriate members of the health care team is recommended.
  2. The number of institutional UFH dosing nomograms should be consolidated and validated in practice to avoid confusion and minimize errors.
  3. A consistent procedure for obtaining accurate patient weight should be used for determining the dosage for weight-based anticoagulants.
  4. An institutionwide standard UFH solution concentration should be established.
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