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Research Note

Introduction to surgical and perioperative clinical pharmacy for third-year pharmacy students: A pilot study of an elective course

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ABSTRACT

Introduction: The objective of this study was to implement and assess an elective course that exposes pharmacy students to clinical pharmacy in the surgical and perioperative setting.

Methods: A blended-design elective that included synchronous and asynchronous learning was developed and offered to third-year pharmacy students. Students' knowledge and perception regarding clinical topics in perioperative pharmacy was assessed using pre- and post-course assessments, online quizzes, a journal club, and course assignments. Knowledge of pharmacy operations was assessed using course assignments and reflective journal entries.

Results: Pre- and post-course assessment improvement was seen in the categories of perioperative optimization of pharmacotherapy (29.1–70.1%, $p=0.006$), common surgical complications (45.8–91.7%, $p=0.001$), and anesthetic agents (25–71.9%, $p<0.001$). Overall, the course was successful in increasing clinical pharmacy knowledge and was well received by students. Course evaluations were completed by 100% of students, and all rated the course as "excellent." Students demonstrated mastery of course content, though the course may not have provided optimal exposure to operating room/post-anesthesia care unit operations.

Discussion and conclusions: Students agreed that the course was valuable and helped them develop new skills otherwise not developed by the curriculum; this conclusion was supported by objective assessment data. A team-teaching model allowed for minimal resources to operate the course. Moving forward, an early lecture addressing perioperative operations may supplement an area the course was lacking. Additionally, a longer duration of operating room shadowing may provide requested opportunities for observation of direct patient care.

Introduction

Medication use in the surgical and perioperative setting frequently involves the administration of high-risk and fast-acting agents. This practice often circumvents common safety checks such as electronic physician order entry and preemptive order verification. A pharmacist's opportunity to intervene on perioperative medications is often further limited by a lack of perioperative proximity and the time-sensitive nature of perioperative care. Despite the protocolized approach to anesthesia and surgical care, many perioperative medications warrant close monitoring of their use. The Institute for Safe Medication Practices (ISMP) lists the top 22 classes of medications that bear a heightened risk of causing significant harm during a medication error (ME). Of those 22 classes of medications, 16 are routinely used perioperatively, and 19 are used in a combined surgical and perioperative setting.¹ The existence of MEs and adverse drug events (ADEs) in the perioperative setting has been described in the literature.^{2–4} One institution's evaluation

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identified approximately 1 in 20 perioperative medication administrations and every second operation resulted in a ME or ADE. Furthermore, one-third of these errors led to observed patient-harm and the remaining two-thirds had the potential for patient-harm.² Despite this clinical arena of high-traffic and high-risk medications, perioperative clinical pharmacy is not a standard throughout healthcare.

While the ability of the clinical pharmacist to reduce ADEs and mitigate drug-drug interactions in the intensive care unit is well described,⁵⁻⁷ perioperative clinical interventions are absent from the literature. Currently, only a limited number of pharmacists in the United States play a role in perioperative care; however, that number is likely to increase as the number of surgical procedures continues to rise. Based on the 1996 National Hospital Discharge Survey and National Survey of Ambulatory Surgery, all surgical fields are expected to have a 14–47% increase in workload by 2020.⁸ This will undoubtedly lead to more surgical cases and provide more opportunity for perioperative clinical pharmacy oversight.

The need for a surgical and perioperative (SPO) clinical pharmacy elective course is established by the steadily elevated and projected growth of surgical patients, the limited exposure of pharmacy students to surgical and perioperative medications in the required curriculum, and the high-risk of MEs in the perioperative and surgical settings. This elective sought to meet that need and continue to grow the interest in surgical and perioperative clinical pharmacy. To our knowledge, this is the only publication that details an elective curriculum designed to provide an introduction into the role of SPO clinical pharmacy. This elective course is intended to strengthen and complement the University of Kentucky College of Pharmacy (UKCOP) curriculum by providing students exposure to SPO pharmacy specialists, physicians, other healthcare providers, and patients. Design of this course was also centered on the Accreditation Council for Pharmacy Education accreditation standards and the Center for Advancement of Pharmacy Education outcomes, which emphasize the importance of patient-centered pharmaceutical care.

Methods

Course design

A 16-week, two-credit hour elective course focused on SPO clinical pharmacy was offered to third-year pharmacy students (PY3) at the UKCOP in the spring semester of 2016. Prerequisites for the course were successful completion of fall semester for PY3. The majority of the pharmacotherapeutic topics related to the elective course came from the Advanced Pharmacotherapy II (AP2) module of the fall PY3 semester. AP2 consists of a study of the pathology, pathophysiology and optimal treatment of infectious, cardiovascular, and gastrointestinal diseases, as well as critical care pharmacology. It reinforces the skills of integrating pharmacokinetic, pharmaco-economic, and pharmacological concepts into successful patient care.

For the SPO elective, students were expected to meet the learning objectives stated in [Table 1](#). These objectives were satisfied through a combination of didactic lectures, active learning sessions, and perioperative shadowing experiences.

The course was coordinated by two critical care pharmacy faculty members with practice sites in the surgical/trauma ICU and perioperative setting. Between lecture development, didactic instruction, and student assessment, each of the two course coordinators spent approximately 40 hours with coordination, implementation, and execution of the elective. Each faculty member was responsible for developing, facilitating, and grading for five to seven of the weekly course topics. Additional topics came through guest lectures from clinical pharmacists with primary surgical practice settings or an attending anesthesiologist.

The outline for the SPO course is shown in [Table 2](#). Topics were chosen by the two course coordinators. The objective was to provide tangibly useful topics for surgical and perioperative clinical pharmacy. Two 120-min sessions were made available for direct patient care observation of anesthesia providers in the operating room (OR) and post-anesthesia care unit (PACU) setting. The OR setting provided students the ability to witness medication use for scenarios including rapid-sequence intubation, analgesia and sedation, hemodynamic modification, antimicrobial prophylaxis, hemostasis, and other frequent perioperative scenarios. The PACU experience allowed pharmacy students to observe care of a post-operative patient with an emphasis on such topics as neuromuscular reversal, pain control, treatment of nausea and vomiting, and hemodynamic control. To increase learning and retention from OR/

Table 1
Learning objectives and assessment methods.

Learning Objective	Assessment Method
Describe the preparatory and perioperative process for the surgical patient.	Student Reflection
Make recommendations to pharmacologically optimize the perioperative patient, including management of antimicrobials, anticoagulation, and nutrition.	Pre- and Post-Course Assessment, Pre-Lesson Quizzes
Apply best-practice recommendations to a specific patient as it pertains to common post-operative complications (e.g., nausea/vomiting, ileus, shivering, and complications of anesthesia).	Pre- and Post-Course Assessment, Pre-Lesson Quizzes
Identify techniques used for intraoperative hemodynamic monitoring, and understand how patient characteristics drive use.	Pre- and Post-Course Assessment, Pre-Lesson Quizzes
Discuss the mechanism of action, proper dosing, monitoring, adverse effects, and management of anesthetic agents and related medications.	Pre- and Post-Course Assessment, Pre-Lesson Quizzes
Describe the medication use process in the perioperative setting, including how pharmacy impacts the safety of storage, prescription, transcription, dispensing, and monitoring of medications.	Student Reflection
Recall national standards, guidelines, best practices, and established principles for management of the surgical patient.	Student Reflection, Journal Club, Presentation

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