

Critical Care

Joseph F Dasta

2006 marks the 40th year of publication for *The Annals*. Over that time, *The Annals* has been an important contributor to the development of clinical pharmacy. Throughout 2006, we are publishing articles reflecting on the history of clinical pharmacy through the eyes of practitioners, including those pioneering clinical pharmacy, as well as those who have more recently entered the profession and a well-established specialty. In addition, we are also presenting articles and editorials from the early history of *The Annals* that have given direction and shape to the practice of clinical pharmacy (see pages 740 and 742).

The term “critical care” emerged from the concept that life-endangered patients receiving care from trained physicians and nurses in special care units had a higher likelihood of survival. Critical care began in the 1930s at a 3 bed neurosurgical unit in Baltimore. Shock wards appeared during World War II, and the 1950s ushered in the mechanical ventilator and the development of respiratory intensive care units (ICUs). By the late 1960s, most US hospitals had an ICU.

A major breakthrough in organized critical care occurred in 1970 when the Society of Critical Care Medicine (SCCM) was formed with 100 members. Dr. Max Harry Weil, in his 1972 presidential address at the first SCCM meeting, stressed the notion of the multidisciplinary model when he stated, “I do hope our multidisciplinary commitment will soon be evident by leadership roles for non-physicians.” His hope came to fruition a few years ago when a nurse was elected SCCM president.

There are more than 13 000 members of the society—physicians, nurses, pharmacists, and respiratory therapists. Other advancements in the gestation of critical care included the formation of the American Association of Critical Care Nurses (AACN) in 1969. There are currently 65 000 members representing approximately 400 000 critical care nurses.

At the same time, specialty journals began to blossom, namely *Critical Care Medicine* (SCCM journal) in 1973, *Heart and Lung* (AACN journal) in 1972, *Intensive Care*

Medicine in 1972, *Critical Care Nurse* in 1980, and *Critical Care Clinics of North America* in 1984. Hence, critical care in the late 1960s and early 1970s was evolving into a distinct scientific discipline, with care being provided mainly by physicians and nurses. Drugs were supplied mainly by centralized pharmacists, located far from the patient care unit and with little knowledge of the patient. The multidisciplinary care model was in its infancy.

Although a few hospitals had pharmacists assigned to critical care units in the late 1960s, 2 pioneering pharmacists, David Angaran MS and Thomas Majerus PharmD, made substantial contributions to critical care after starting their practice in 1972 and 1977, respectively. Both had a high level of pharmacotherapy involvement, and their efforts paved the way for future pharmacy practitioners.

When I became interested in critical care, I looked in the book and journal stacks of our library under the letter “C.” I found only a few textbooks and the new journal, *Critical Care Medicine*. Since there were no training programs in critical care pharmacy, I relied on learning from my new colleagues in surgery and anesthesiology and attended local and national critical care meetings. While most of my suggestions during rounds were well received, especially by surgeons, my colleagues were initially skeptical of my aminoglycoside dosing recommendations. Initially I was able to suggest only small changes in doses, obtain serum concentrations that were suboptimal, and then gingerly increase the dosage until the goal was achieved. After they were convinced that we were not going to “kill the patient’s kidneys” with the large doses administered at extended intervals, I was able to achieve the proper dosage

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from the start of therapy. Today, the order “dosing per pharmacist” is common; however, things were slow going at first. The primary reasons for the success of clinical pharmacy in the early days of ICU practice are that there was a pervasive multidisciplinary approach to care and our input minimized patient complications and improved ICU patients’ outcomes. We prevented treatment errors by intervening at the time an order was written. It was not until 1999 that a now famous study reported that the pharmacist on rounds in the ICU reduced the incidence of adverse drug events by 66%.

Of note, *Drug Intelligence and Clinical Pharmacy* initiated a column titled “Critical Care Therapeutics” in 1982. I served as editor for the column, and 43 articles were published. A seminal event for pharmacy was the formation of the Clinical Pharmacy and Pharmacology Section of the SCCM in 1989. The Section continues to grow in both numbers and degree of Society involvement. Dr. Weil’s vision of multidisciplinary involvement has again been realized, as pharmacists occupy key leadership roles in the Society, including positions in the governing body (Council) and membership on the journal’s editorial board.

Consistent with the multidisciplinary model of care, critical care pharmacy today consists of pharmacists practicing, educating, and conducting research as members of the ICU team. Critical care pharmacists have documented meaningful clinical and economic outcomes, such as ensuring appropriate drug therapy, reducing unnecessary drug costs, and substantially reducing the number of adverse drug events. There is a variety of training opportunities for pharmacists interested in critical care, including 38 residencies accredited by the American Society of Health-System Pharmacists and approximately 12 fellowships. This growth has been, in part, due to the recognition of an unmet need for appropriate pharmacotherapy for patients in the ICU, the development of formal training programs in critical care, physicians and nurses who welcomed the addition of pharmacists to the care team, and pharmacists who developed organized groups in pharmacy and “medical” societies.

Despite the successful inclusion of pharmacists as integral members of critical care teams and reports of the positive outcomes in many publications and in lectures at national meetings, there are many ICUs that still do not have a pharmacist prospectively reviewing drug orders at the bedside or during patient care rounds. Recent survey data reveal that direct patient care is provided by pharmacists in only approximately 50% of ICUs in the US. If we assume that a pharmacist is needed to provide care for 20–30 ICU patients, the 87 000 ICU beds in the US would require nearly 3000 pharmacists who spend more than 50–70% of their time in the ICU. While the exact number of ICU pharmacists is unknown, there are about 1000 pharmacists

in both the SCCM and the Critical Care Practice and Research Network of the American College of Clinical Pharmacy. Some are members of both.

How can we ensure that pharmacist positions will exist to meet this projection? Regulatory agencies will need to declare that a pharmacist is required to evaluate the appropriateness of each ICU patient’s pharmacotherapy, ideally as a member of an intensivist-led multidisciplinary team. This is in addition to the requirement of providing medications for the patient. Included among these groups are the Joint Commission on Accreditation of Healthcare Organizations, the Center for Medicare and Medicaid Services, the Leapfrog Group, the Institute for Healthcare Improvement, and large private payers. Statements from these groups, coupled with the existing data on the outcomes of ICU pharmacists, should provide the director of pharmacy, for example, with sufficient information to justify and maintain clinical pharmacy services in the ICU.

What will the ICU look like in the next 10 years, and where does the pharmacist fit? The future ICU will evolve from changes in culture and thinking; quality and cost will therefore be in harmony and disjointed care will be minimized. Specialty hospitals devoted to ICU patients may develop. Care will be driven by a culture of concern for patient safety and will be outcome oriented. There will be integrated technology and decision-support software, intelligent multiple drug infusion devices, and a constant stream of relevant patient data that will be easily transformed into knowledge about the patient’s physiologic needs and response to therapy. The roles and responsibilities of the pharmacist will expand to include ensuring the accuracy and applicability of clinical, economic, and pharmacogenetic drug information contained in integrated information systems. The pharmacist will continue to attend rounds and educate healthcare personnel, although rounds may be virtual. Perhaps the phrase “clinical pharmacist” will be replaced by “ICU pharmacotherapy knowledge manager.” The pharmacist will be reimbursed for these services in a manner similar to that used for physicians and nurses.

When I began my practice in critical care in 1980, I knew that critical care would not go the way of the hula hoop. However, I did not anticipate the degree of growth seen today, and I hope that my projections for the year 2015 and beyond are accurate.

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Published Online, 28 Mar 2006, www.theannals.com
DOI 10.1345/aph.1G394