

THE ANNALS: 40-YEAR EVOLUTION

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 page 2240).

Neurology and Neurosurgery Clinical Pharmacy Practice: Ignorance, Phobia, or Progress?

Timothy E Welty

A man in his mid-forties had just been admitted to the critical care unit for uncontrolled seizures related to a previously diagnosed astrocytoma. He was alert and neurologically intact upon admission. The seizures were difficult to control, and I was asked to evaluate the patient and make recommendations regarding the phenytoin dose. In an attempt to assess potential adverse effects from the phenytoin, I was in the room, performing a cursory neurological examination. While I was with the patient, there was a ruckus at the nurses' station, directly across the hall from the patient's room. When I finished evaluating the patient and went to note my recommendations in the patient's chart, the nursing staff told me that a senior physician had seen me examining the patient. He was very upset and protested strongly by telling the nurses, "Get him out of that room immediately; he's not supposed to be doing that!" Fortunately, the nurses ignored his demands and followed the order of the patient's physician to have me evaluate and recommend phenytoin dosing.

This was one of my first encounters with medical staff in my newly acquired clinical faculty position in 1983 after completion of fellowship training in neuropharmacology and pharmacokinetics. In many ways it represents the opportunity and challenges in clinical pharmacy practice, especially in the area of neurology and neurosurgery. There are many possible reasons for the response from this physician, but they can be reduced to ignorance, not knowing what was happening or what had been requested, or fear of change represented in this event. Ultimately, it represents progress in the care and management of patients in neurology and neurosurgery.

Clinical pharmacy practice in neurology and neurosurgery has an illustrious history, but remains a rather small area within the discipline. Certainly, the size of neurology and neurosurgery within the larger context of medicine has greatly influenced the meager size of neurology clinical pharmacy practice. To put this in perspective, beginning in 1985, the American Academy of Neurology estimated that there were approximately 5000 board certified neurologists in the US, with less than 500 individuals completing residencies annually.¹ Current estimates place the number of board certified neurologists between 12 000 and 15 000 nationally, greatly lower than the projected

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needs.² Similar numbers are seen for neurosurgery. Reasons for the comparatively small numbers in neurology and neurosurgery are speculative at best, but range from financial constraints and complexity of diagnosing and treating neurological disorders to the limited understanding of neurological disease processes. Couple these issues with the relatively small number of pharmacotherapeutic agents that specifically target neurological diseases and it is easy to understand how neurological and neurosurgical clinical pharmacy practice is represented by a comparatively small group of individuals. Yet, neurological diseases are quite commonly encountered, providing large opportunities for progress in the development of clinical pharmacy practice. Thus, due to small numbers of practitioners and very few therapeutic agents in this area, clinical pharmacy practice in neurology and neurosurgery has either been neglected or feared.

In many ways, the beginnings of clinical pharmacy practice in neurology and neurosurgery can be traced to the few, but complex, drugs that were available for treatment of nervous system diseases. Many of these agents possess characteristics that make them difficult to use (eg, Michaelis–Menten pharmacokinetics, autoinduction, extensive plasma protein binding). Additionally, these drugs result in numerous adverse effects when poorly managed. In the 1960s and 1970s, several publications highlighted these problems and a handful of clinical pharmacists recognized the opportunities.^{3–6} Centers for the development of clinical pharmacy practice in neurology and neurosurgery were created at the University of Kentucky, University of Minnesota, State University of New York at Buffalo, Virginia Commonwealth University, and University of California San Francisco. Pharmacokineticists and basic science researchers at institutions such as the University of Texas, University of Southern California, University of Washington, and several European centers developed tools (eg, strategies for determining phenytoin doses) that proved to be extremely useful in facilitating the development of clinical pharmacy practice in neurology and neurosurgery.^{7,8} Many of the early efforts focused on epilepsy and antiepileptic drugs, due to their complexity and a propensity to cause adverse effects and the fact that pharmacotherapy was the mainstay of treating this disorder. At these centers, the role of clinical pharmacy practice in neurology became firmly established and embraced by both neurologists and neurosurgeons.

From these centers came 2 developments that were vital for the perpetuation of clinical pharmacy practice: residency and fellowship training programs were started at the University of Minnesota and the State University of New York at Buffalo. The positive results of these programs are seen in the fact that many clinical pharmacists practicing in neurology today can trace their heritage to these roots.

Published in leading profession journals, important innovations in clinical practice such as useful dosing schemes for phenytoin,^{9,10} improved methods for intravenous administration of phenytoin,¹¹ and improved understanding of pharmacotherapy¹² came from these initiatives.

Clinical pharmacy practice has increased somewhat in number of practitioners and breadth of subspecialization by practitioners. Clinical pharmacy for neurology and neurosurgery is practiced in many centers and includes specialists in epilepsy, movement disorders, cerebrovascular disease, neuron-rehabilitation, headache, neuro-oncology, multiple sclerosis, and neurological or neurosurgical critical care, just to name a few areas. The benefit of pharmacy practice in this area has been documented and important contributions to neurological care are attributed to this group of pharmacists.¹³ However, despite the increase in neurology and neurosurgical clinical pharmacy practice, the number of training programs has diminished. For example, a search of the American College of Clinical Pharmacy's directory of residencies and fellowships and the American Society of Health-Systems Pharmacists' accredited residencies reveals only one training program that lists neurology as the primary specialty.^{14,15}

The 1990s were declared to be the decade of the brain by the United States Congress. Increased funding for research into neurological disorders and their treatments is now beginning to bear fruit. Numerous new drugs have either been approved or are nearing approval. For example, since 1993, 9 new chemical entities for epilepsy have received approval by the Food and Drug Administration. New information on pathophysiology and new diagnostic approaches enable a more thorough understanding of neurological diseases. Additionally, whole new treatment approaches beyond pharmacotherapy necessitate a careful and complete understanding of neurological diseases by clinical pharmacy practitioners. The challenge for the pharmacy profession is to determine ways to continue the progress that has been made, despite the role that ignorance and fear may play in relationship to this specialty area of practice. If pharmacy is to meet the demand of changes occurring in neurology related to proper pharmacotherapy, increased opportunities for education and training need to be developed. The profession must devise ways to produce clinical pharmacists who possess the expertise to build on the solid foundation that has been laid in the area of neurology clinical pharmacy practice.

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