

Neuroanesthesia at The Mount Sinai Hospital

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Abstract

The practice of neuroanesthesia at the Mount Sinai Medical Center focused initially on clinical practice, followed by specialization. This article presents a brief history of the division and a description of the areas of interest, presentations, and publications that have originated there.

Key Words: History of anesthesia, neuroanesthesia.

THE TERM "NEUROANESTHESIA" is much younger than our department. Surgeons and their assistants had been providing pain relief for neurosurgical patients for many years before the Department of Anesthesiology existed and before physicians began to specialize in anesthesiology. In 1916, Dr. Charles A. Elsberg, the leading neurological surgeon at The Mount Sinai Hospital, stated (1): "If the laminectomy is done in the cervical and upper dorsal regions, anesthesia by intratracheal insufflation is the best and simplest method." At this time the vast majority of general anesthetic procedures were performed using open mask ether administration.

One can identify three "eras" in the evolution of anesthesia for neurosurgery at our institution over the past 50 years:

From 1950–1964 most members of the Department of Anesthesia probably administered anesthesia during neurosurgical procedures according to an informal roster of rotation. No copies of such a roster have survived, nor do we know whether the individual anesthesiologist's preferences were considered. At that time, it was customary for surgeons (implicitly for neurosurgeons) to indicate their choice of anesthesiologists; in the prevailing circumstances of surgical private practice, their requests were usually granted.

The second period started around 1968, when some anesthesiologists began spending more and more time in the neurosurgical operating room, becoming the "in-house" specialists

for the neurosurgical procedures. The anesthesiologists who began this specialization were Drs. Alex Goldblat, Raymond Miller and David Chadwick. At the same time, a teaching program was started. The regular anesthesia training consisted of a two-year residency with a minimal, informal rotation in the neurosurgical operating room. For the first time, specialized training was offered to select candidates as a third year of residency. Those who entered the program spent a whole year in the neurosurgical operating room. They were expected to participate in some aspects of the postoperative care and encouraged to attend neurosurgical grand rounds. The first resident to hold this third-year position was Dr. Boris Mogos, in 1969–1970. Afterwards, Dr. Mogos specialized in neurosurgical anesthesia in the hospitals of the Albert Einstein College of Medicine (AECOM), where he was the divisional director of Neuroanesthesiology for many years. The same Dr. Mogos, nineteen years later, made his wisdom available to his young colleague, Dr. Irene Osborn, at AECOM. After graduation from his own neuroanesthesia subspecialization training, Dr. Henry Tausk became an attending anesthesiologist at The Mount Sinai Hospital, in place of Dr. Chadwick, in 1971.

It was at this time that the "Society for Neuroanesthesia and Neurological Critical Care" was organized, and the term "neuroanesthesia" started to be widely used. Dr. Raymond Miller and Dr. Tausk joined the new subspecialty group at its inception during the 1972 annual meeting of the American Society of Anesthesiologists. By this time Dr. Goldblat had, unfortunately, passed away.

The third period began in 1984, when the Division of Neuroanesthesia was formally con-

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stituted within the Department of Anesthesiology. The first director of this division was Dr. Tausk. After his retirement from this position in 1990, acting directors ran the division. The first was Dr. Neil Bodner. After Dr. Bodner's departure, Dr. Raymond Miller assumed this position in addition to his responsibilities as vice-chairman of the department. In 1998 Dr. David Adams, coming from the Columbia-Presbyterian Medical Center, was named director of the Division of Neuroanesthesia.

During all these years the division was active in providing anesthesia services to the departments of Neurological Surgery and Neuro-radiology. Providing these services for the latter could be difficult. During the 1960s and 1970s, pneumoencephalography was a frequently performed procedure. We were often asked to anesthetize patients who were strapped into a rotating chair and moved repeatedly into the head-down position. Maintaining the tracheal tube in position, hyperventilating the lungs, and properly supporting the cardiovascular function in our anesthetized patients while these "calisthenics" were performed was a challenge for the neuroanesthesiologist.

Research

During most of these 50 years (until 1984), the general anesthesia services as well as the neuroanesthesia services were provided almost exclusively by a staff consisting of voluntary physician anesthesiologists. Due to these circumstances, the emphasis was always on clinical work and clinical training of residents, while research was a lower priority. Almost all academic pursuits were clinically oriented. Research studies were few in number and hampered by clinical responsibilities. Nevertheless, we made some academic contributions, which we will now survey briefly.

From the very beginning of the subspecialization, Mount Sinai anesthesiologists were concerned with certain aspects of neurosurgical operations. One area of interest was "incidental hypothermia" due to the prolonged operating times; Drs. Goldblat and Miller first described this problem in 1972 (2), and a possible solution was published some years later by Drs. Tausk, Miller, and Roberts (3). The effects of anesthesia during prolonged neurosurgical procedures were presented by our division in 1980 (4).

During the second period, while we were striving to provide specialized neuroanesthesia,

one of our main problems was patient monitoring. Intra-arterial pressure monitoring and blood gas determinations were still in their infancy. Mean arterial pressure was measured by transducing intra-arterial pressure from an indwelling peripheral arterial cannula via a column of air using a simple pressure gauge: the column of air between the arterial blood and the gauge served as a buffer, and the pulsations of the arterial blood were indicated on the gauge. A three-way connector allowed for flushing of the system every five minutes with heparinized saline. This primitive device also allowed for easy arterial blood sampling. Our description of this system, on the occasion of an international meeting of developing countries, attracted widespread interest. For a certain period of time we had a blood-gas analysis apparatus just outside the operating room. This device, which necessitated calibration before every measurement, was quite cumbersome and its use was time-consuming. After it broke down, a resident or an attending physician personally took every sample of arterial-blood gas to the intensive care unit (ICU) laboratory for rapid determinations.

A major breakthrough in our monitoring resulted when Dr. Malis built a custom-made, transducer-based pressure monitor in the early 1970s. It had the capability to transduce three pressures: systemic arterial pressure, central venous pressure, and intracranial pressure. The monitor was calibrated each morning using a 760-mm mercury tube and had to be re-calibrated approximately every six hours. Since the apparatus was the size of a huge cupboard, it was nicknamed "the Monster." Even with these limitations, it was a big step forward in perioperative patient monitoring.

Another major development in patient monitoring occurred in the early 1980s, when we began using electrophysiologic monitoring. Our first device was the cerebral function monitor (Critikon, Inc., Tampa, FL), which was one of the earliest devices developed to simplify EEG monitoring in the operating room. It was a microprocessor-based, single-channel unit, which gave information on global cerebral activity. We used it to measure depth of anesthesia. Soon thereafter we obtained a Nicolet monitor (Nicolet Biomedical Instruments, Madison, WI) and began monitoring somatosensory evoked potentials (SSEPs) in an effort to evaluate the integrity of the central nervous system. A waveform is generated by repetitive stimulation of peripheral sensory nerves. The unchanging

shape (amplitude) and speed of conduction (frequency) of the waveform demonstrate that the neurologic pathway is intact. The goal was to diagnose and prevent possible neurological injury when anesthetized patients are placed in the upright sitting position.

We also documented our interest in patient monitoring, in papers presented at meetings of professional societies (5–7). For a number of years (1984–1987), our department was instrumental in conducting workshops on patient monitoring at the Annual Postgraduate Assembly of the New York State Society of Anesthesiologists.

Our division was also interested in the effects of certain pharmacological agents used during neurosurgical procedures. We studied the effects of neuroleptic agents on cerebrospinal fluid pressure (8). In the 1980s, induced controlled hypotension was a frequent requirement for neurosurgical operations. To achieve it, trimethaphan camsylate, and subsequently sodium nitroprusside, were used. Both drugs were potent and effective hypotensive agents, but both had significant undesirable side effects. We decided to try a prefixed combination of the two drugs. We found that when infusing the mixture, we were able to maintain proper hypotension when extremely low amounts of the drugs were administered, thus avoiding the deleterious side effects. At first, we recorded our efforts in a letter to the editor (9), but at a later date we revisited the problem and published our findings more fully (10).

During the operative career of Dr. Leonard Malis, due to his special interest and expertise, approximately 20% of our cases were performed with the patient in the sitting position. Surgery performed in this way allows for access to the posterior fossa and the cervical spine. It also allows the surgeon an “anatomical” view and results in less bleeding, because of reduced venous pressure. But despite these distinct advantages, the sitting position also poses risks. Patients tend to become hypotensive with decreased venous return and the loss of sympathetic tone. The combined circumstances of the upright position, non-collapsible cerebral veins and the “head above the heart” create potential for air entrainment into the venous system. Anesthetic management requires both monitoring of hemodynamics as well as attention to possible venous air embolism. The anesthetic considerations of the sitting position were described by our group in various publications (11–13).

In the past decade, our clinical practice has shifted toward the neurosurgical interests emphasized by Dr. Post, e.g., pituitary surgery, neurovascular surgery, stereotactic surgery and interventional neuroradiology, so the sitting position for posterior fossa surgery is now seldom necessary. Other changes in general neurophysiologic thinking have led to the 1990s being called the “decade of the brain.” While we had previously monitored and emphasized the control of intracranial pressure, modern practice management now stresses the maintenance of adequate cerebral perfusion.

Neurosurgical practice is now closely connected to refinements in the new procedures of stereotaxis with MRI targeting. Interventional neuroradiology is a dramatically expanding field, which offers “minimally invasive” adjuncts to complex cerebrovascular problems. Neuroanesthesiologists are increasingly involved in these procedures. Electrophysiologic monitoring is on its way to becoming a routine intraoperative neurosurgical practice. In addition, mild hypothermia, as a method of cerebral protection during cerebral ischemia, has gained wide acceptance again. This use of hypothermia has come almost full circle from the days when we tried to avoid it. Volume replacement and “re-hydration” are carefully reconsidered, with new ideas in quantitative and qualitative terms. Finally, new anesthetic agents like propofol and synthetic opiates are transforming our anesthetic techniques, allowing for reliable emergence and neurologic evaluation after the (still prolonged) operative procedures.

Future developments in neuroanesthesia at our institution cannot be predicted, but based on the preceding 50 years, we are optimistic about being able to continue serving not only our patients but also the progress of knowledge.

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