Neurospine 2019;16(4):631-636.
https://doi.org/10.14245/ns.1938378.189

Neurospine
pISSN 2586-6583 eISSN 2586-6591

Essay

Brief History of Spinal Neurosurgical Societies in the United States: Part 1

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Received: November 8, 2019
Revised: December 13, 2019
Accepted: December 15, 2019

EARLY SPINE SURGERY AND SOCIETIES IN THE UNITED STATES

In 1829, Alban Smith, a general surgeon known for performing the third ovariectomy in the United States, encountered a patient with a low cervical spinal cord injury after falling from a horse 2 years earlier. On examination, he discovered the spinous process was eccentric to the right. Intraoperatively, he observed bone fragments pressed into the spinal cord. Unaware that posterior cervical laminectomies were considered uniformly fatal by European surgeons after an unsuccessful attempt 15 years earlier,[1] Alban Smith, removed the lamina using a saw.[2] He performed the first successful laminectomy in 1,500 years.[3] A week later, the patient reported improved sensation in his hands and thighs.[1,2] Building on the work of Smith, Victor Horsley adapted the technique to perform the first successful spinal cord tumor resection in 1887.[4-6]

In the early 1800s and 1900s, progress in spine surgery was measured. Surgical mortality approached 25% and the pathology treated by surgeons consisted of trauma, Pott's disease and correction of subsequent deformity (often through plaster casts).[7-13] In 1911, Frederick Albee, a surgeon practicing in New York City, devised a technique using bone grafts to perform spinal fusions in deformity related to Pott's disease.[10,14] The following year he invented the Albee Bone Mill greatly reducing surgical time, a significant feat given the anesthetic constraints of the time. By 1915, he published *Bone Graft Surgery* and dedicated a substantial portion of the text to the treatment of spinal pathology.[15]

Craniospinal trauma in World War I, enabled Cushing and others to define the burgeoning field of neurosurgery.[9,16-19] Shortly after neurological surgery was declared a surgical specialty at the meeting of the American College of Surgeons in 1919, Harvey Cushing and Ernest Sachs established the Society of Neurological Surgeons (SNS).[20-22] The semiannual meetings of the newly formed society included operative clinics in the morning with a review of scientific literature in the afternoon. Given the inherent limitations of the meeting

format, membership was highly selective. During the 1920s, the number of dedicated neurosurgeons in the United States grew from a small handful to a larger community, with many well-trained neurosurgeons excluded from membership to the SNS. Eustace Semmes, William Van Wagenen, Temple Fay and Glen Spurling identified the need for a new neurosurgical society.[22] While the aforementioned neurosurgical pioneers were in the midst of forming a new society, Walter Dandy unintentionally performed the first discectomy in 1929. Believing he was removing a tumor he was surprised to discover loose cartilaginous tissue.[23] This was followed by the first intentional discectomy for sciatica by Mixter and Barr in 1932,[24,25] a year after the Harvey Cushing Society was established. However, like the SNS, the Cushing Society was highly selective. Small professional societies were effective in cultivating intimate, professional relationships between members; so organized neurosurgery continued as exclusive clubs until 1951.

SPINAL NEUROSURGERY AND SOCIETIES IN THE UNITED STATES AFTER WORLD WAR II

In an interview with Roy Selby, Ralph Cloward (Fig. 1) reflected on the Cushing Society reaction to his presentation of 100 posterior lumbar interbody fusions in 1946. Cloward recalled the prevailing sentiment of the time, "We are neurosurgeons, and as such we should confine our activities to the trephine and the rongeur and leave the chisel to the orthopedic surgeons," James Watts said to a standing ovation. However, this did not deter Ralph Cloward from publishing "The Treatment of Ruptured Lumbar Intervertebral Discs by Vertebral Fusion," in the *Journal of Neurosurgery* in 1953[26] or "The Anterior Approach for Removal of Ruptured Cervical Disks" in 1958.[27] At the same time, orthopedic surgeon Paul Harrington, created a hook and rod system of instrumentation that transformed spinal deformity surgery.[16] Harrington rods made from stainless steel were used to reduce coronal curvatures and provide additional stability to spinal fusions. Paul Harrington constructed the rods the night before surgery and made changes in his system based on their performance in the previous patient.[8,28,29]

Fig. 1. Ralph Cloward (courtesy of the Western Neurosurgical Society).

While Harrington and Cloward advanced spine surgery, there was a dramatic rise in the number of neurosurgeons after World War II. In 1951, a new society, the Congress of Neurological Surgeons (CNS), was established.[30,31] The CNS was the first inclusive organization without a limit on the number of members. To promote the professional development of junior neurosurgeons, the CNS instituted an age limit of 45 years on leadership. During this time, The Harvey Cushing Society and the CNS became the 2 most prominent neurosurgical societies in the United States. The CNS used an educational format to engage young neurosurgeons and residents while the Cushing Society focused their efforts on scientific advancement through research. Recognizing the need for neurosurgery to speak with one voice in the political arena, Frank Mayfield, the president of the Harvey Cushing Society, declared the Harvey Cushing Society to be the official organization representing neurological surgeons of the United States in 1966.[32] The following year, the Harvey Cushing Society changed its name to the American Association of Neurological Surgeons (AANS) and the rules were revised to include members from the North American continent. In the years that followed, the 2 organizations worked in parallel and concert, forming several joint committees and sections, most notably the AANS/CNS Joint Section on Disorders of the Spine and Peripheral Nerves.

Albert Rhoton played a crucial role in the creation of the Joint Section on the Disorders of the Spine and Peripheral Nerve (DSPN). As president of the CNS, he was troubled by the disproportionate interest in intracranial surgery compared to spine. Recognizing need for neurosurgical advancement in spine surgery, he suggested the formation of a joint section to Charles Drake, president of the AANS in 1978. The spine section gradually evolved under the leadership of Sanford Larson, Stewart Dunsker, and Edward Connolly. Initially, the section helped the AANS and CNS develop programs and courses in spinal sur-

https://doi.org/10.14245/ns.1938378.189

gery. Eventually, the first annual meeting of the DSPN was held in February 1985 in Central Florida. The mission of the DSPN is to advance spine and peripheral nerve care through a combination of education, advocacy, and research. The program chair was Barth Green and scientific program director was George Sypert.

As organized neurosurgery worked towards a spine specialty society, instrumented spine techniques ushered in a new era of spine surgery for orthopedic surgeons. In the 1970s, complex spine surgery was in its infancy and neurosurgeons did not commonly perform instrumentation. Most neurosurgeons were relegated to decompressions, tumor resections, and discectomies. Orthopedic societies were well organized and opposed to any foray in spinal instrumentation by neurosurgeons. Nevertheless, neurosurgical pioneers like Sanford Larson (Fig. 2) established a foothold in complex spine surgery with novel approaches to the thoracolumbar spine (e.g., lateral extracavitary approach), adoption of early spinal fixation techniques and the first neurosurgical complex spine fellowship.

In the 1980s, neurosurgeons performed instrumented surgery in the cervical spine, but thoracolumbar spinal instrumentation continued to be dominated by orthopedics. In his book "*Backbone,*" Volker Sonntag (Fig. 3) described the hostile turf war between the 2 specialties that took place in the 1980s.[33] By 1987, the Spine Task Force was created by the AANS to expand spine surgery and resident education to include instrumentation of the entire spine. The American Board of Neurological Surgery and the Residency Review Committee placed renewed emphasis on spine surgery, fusion and instrumentation. These organizations established that neurosurgeons receive comparable training to orthopedic spine fellowships. Educational courses in spinal instrumentation and biomechanics for neurosurgeons already in practice became available, and were taught by neurosurgery pioneers such as Edward Benzel (Fig. 4) and Charles Stillerman.

While orthopedic surgery and neurosurgery had a contentious relationship, several societies took a more collegial approach. The Cervical Spine Research Society (CSRS), established in 1973 by J. William Fielding, is a multidisciplinary organization of re-

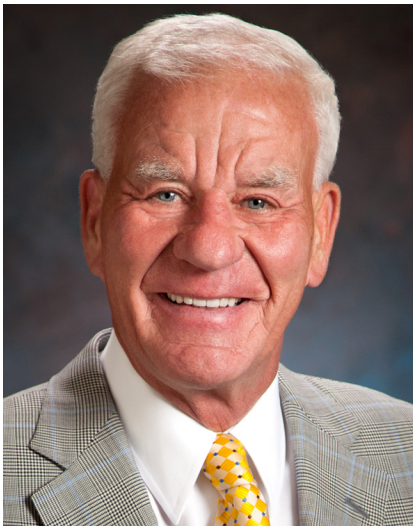

Fig. 3. Volker Sonntag.

Fig. 2. Sanford Larson (courtesy of the Medical College of Wisconsin).

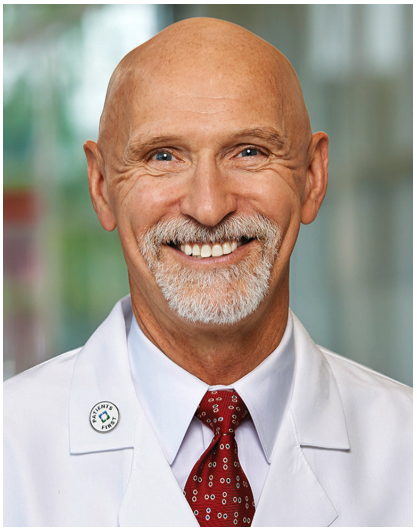

Fig. 4. Edward Benzel.

searchers, orthopedic surgeons, and neurosurgeons interested in the exchange and evolution of surgical techniques, diagnosis, and treatment of cervical spine pathology. Inspired by the CSRS, the Lumbar Spine Research Society was created in 2008, to address the need for an evidence-based, scientific approach to the lumbar spine. Similarly, the North American Spine Society (NASS) was established in 1985 and has been open to any healthcare provider that specializes in the treatment of spine pathology. Past presidents of NASS include both neurosurgeons and orthopedic surgeons.

Despite inroads made by collaborative national organizations like the CSRS and NASS, orthopedic surgery and neurosurgery continued to be at odds at the local level with respect to spine surgery practice. Then in 1994, class action litigation and investigative reports from the lay press sensationalized pedicle screw complications and medical device industry influence on the Food and Drug Administration.[34-37] With spine surgery under scrutiny, the 2 disciplines united and worked with industry to defend pedicle screw technology.[38-41] After the pedicle screw litigation ended, orthopedics and neurosurgery found renewed interest and motivation to collaborate with respect to research, innovation and healthcare policy. The Scoliosis Research Society, traditionally an orthopedic society founded in 1966 to advance the treatment of spinal deformity, accepted its first class of neurosurgeons in 2004.

As the pedicle screw controversy ended in 1999, collaboration among neurosurgeons, orthopedic surgeons, and the medical device industry enabled the rapid growth of 2 new areas in spine surgery: minimally invasive spine surgery (MISS) and artificial disc replacement. Rapid advancement in real-time intraoperative image guidance technology occurred in concert with MISS. Building on the anatomic foundation laid by Parviz Kambin and Leon Wiltse, Kevin Foley combined microsurgical principles, tubular retractors and emerging technologies in image guidance to perform minimally invasive lumbar discectomies. Richard Fessler expanded these techniques to perform percutaneous lumbar pedicle screws and cervical foraminotomies. As applications for MISS grew, so did the need for a new spine society. The Society for Minimally Invasive Spine Surgery, formed in 2007, after a group of orthopedic and neurological surgeons specializing in minimally invasive spine met at the University of California San Diego the year before.

As minimally invasive spine advanced so did the focus on motion sparing techniques. Artificial disc replacement was initially developed and implemented in Europe, with the first lumbar disc replacement approved for use in the United States in 2004.[42,43] Subsequently, the first cervical artificial disc replacement followed in 2007.[44-46] The Spine Arthroplasty Society formed in 2000 to address the interest and needs of surgeons and scientists focused on advancing motion preservation technology. Today, this society has since been rebranded as the International Society for Advancement of Spine Surgery, and has expanded its purview to include both arthroplasty and minimally invasive spine technology.

FUTURE OF SPINE SURGERY IN THE UNITED STATES

In his 2010 CNS presidential address, Gerald Rodts discussed how the pedicle screw litigation of the 1990s brought orthopedic surgery and neurological surgery together.[47] Today, the overlap between spinal neurosurgery and orthopedic spine surgery is much greater than the differences. The immaterial distinction between the 2 specialties has resulted in multidisciplinary academic spine societies, and numerous multidisciplinary spine centers. Shared interest in addressing health policy, payers and advancing patient care continue to drive the 2 specialties together.

Several academic institutions have merged orthopedic and neurosurgery spine as a unified spine division, with many spine fellowships integrating both specialties. Breaking down boundaries between academic departments and developing multidisciplinary systems that leverage unique strengths and different training backgrounds can create perspective to optimize care and value for spine patients. Certainly, the future of spine surgery in the United States will rely on demonstrating value and evidenced-based practices to patients, physicians, health systems, payers, and policy makers. This will likely require that organized neurosurgery continue to provide residency and fellowship training in spinal surgery, support research, and foster collaboration with our surgical and nonsurgical spine colleagues.

CONFLICT OF INTEREST

The authors have nothing to disclose.

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