

Volker K. H. Sonntag, M.D.: Pioneer in Spinal Neurosurgery and Consummate Educator, Colleague, and Family Man

Adib A. Abila¹, Timothy Uschold¹, Shelley A. Kick², Timothy E. Link^{1,3}, Robert F. Spetzler¹

INTRODUCTION

With many accolades and friendships too numerous to recount fully, Volker K. H. Sonntag, M.D., retired from clinical practice at the Barrow Neurological Institute (BNI) in Phoenix, Arizona, in December 2009. We briefly present his life story, which epitomizes the American dream. Beginning from his humble roots in war-torn Germany, we celebrate the accomplishments, values, and visionary sense of direction that have defined his life and career. His roles as editor and reviewer of a host of scientific journals, as committee member and president of numerous national neurosurgical organizations, and as director of the neurosurgery training program at BNI have rightfully earned him renown among his peers as an advocate, leader, innovator, celebrated academician, and skilled practitioner. To the individuals who have been honored to train under his tutelage or to work with him, he is appreciated as a consummate educator, mentor, and role model.

EARLY LIFE

Volker Sonntag was born during World War II on November 23, 1944, in what later became known as East Germany. As the Russian forces advanced toward Berlin from the East during the spring of 1945, the Sonntag family joined countless other political refugees in a mass exodus to the West. His mother Gisela, then pregnant with his younger brother, settled her two boys in temporary quarters at Camp Lockstedter Lager in Schleswig-Holstein in West Germany. Volker's father joined them several months later. East German refugees were largely unwelcome and faced considerable hardships as they struggled to find work in the West. The living spaces in the refugee camp were arranged into fairly rudimentary barracks and huts.

On October 22, 1948, Volker's father, Heinz, moved the family to Bad Hersfeld in Hessen, West Germany, to begin a dental practice.

His mother assisted in the family enterprise (**Figure 1**). His father, initially experiencing symptoms of an upper respiratory infection, was later diagnosed with a brain mass presumed to be a glioma in October 1952. In a nearby town, he underwent a craniotomy that uncovered a temperoparietal abscess. His treatment was followed by a 6-month hospital and rehabilitative course before he was able to return to his family. He was left with hemianopsia and apraxic deficits, diagnosed by Dr. Sonntag years later after he recalled repeated side-collision car crashes involving his father. Efforts by Volker's mother to keep the practice running with substitute dentists were unsuccessful, and the family soon faced hard times again.

Unable to retain steady employment, the Sonntag family decided to seek better opportunities outside of West Germany. After many years of searching, the Lutheran Church found a sponsor for the family in Phoenix, Arizona. In 1955, Volker's mother came home and announced that the family would move to Arizona. For the 11-year-old German boy, finding Phoenix, Arizona, on a map of the United States was an exciting task. Over the next 2 years, the family prepared for the trip, selling many of their belongings and saving for the move. Their journey started on March 26, 1957. Volker was 12 years old at the time.

Their trip began on the U.S. General Langfitt, a troop transporter. The boys and their father slept separately from Gisela as the ship ferried 1160 Germans, Poles, and Czechoslovakians toward New York Harbor (Gisela Sonntag, unpublished diary, 1957). An excerpt from Gisela Sonntag's diary describing the early part of their journey follows:

On Tuesday, March 26, 1957, after some last minute formalities, we left our temporary home in Bremen-Lesum around 10 AM. We were given food for our journey and, in brilliant sunshine, boarded modern buses, which took us to the train in Bremen-Vegesack. Following a half-hour wait and an approximate one-hour clean and comfortable ride, we arrived in Bremerhaven, directly at the Columbus Pier where we were greeted with music

Key words

- History
- Neurosurgery
- Spine
- Spine instrumentation

Abbreviations and Acronyms

AANS: American Association of Neurological Surgeons

ACGME: Accreditation Council of Graduate Medical Education

BNI: Barrow Neurological Institute



From the ¹Division of Neurological Surgery and ²Neuroscience Publications, Barrow Neurological Institute, St. Joseph's Hospital and Medical Center, Phoenix, Arizona, USA; and ³Department of Neurological Surgery, Columbia University Medical Center, New York, New York, USA

To whom correspondence should be addressed: Robert F. Spetzler, M.D.
[E-mail: neuropub@chw.edu]

Citation: *World Neurosurg.* (2012) 78, 1/2:24-30.

DOI: 10.1016/j.wneu.2011.05.061

Journal homepage: www.WORLDNEUROSURGERY.org

Available online: www.sciencedirect.com

1878-8750/\$ - see front matter © 2012 Elsevier Inc. All rights reserved.



Figure 1. Volker Sonntag (middle) as a child in Germany in 1952 with his mother and brothers. (Courtesy of Volker K. H. Sonntag, M.D.)

and immediately went on board. Once on board, we immediately went to our sleeping cabins, men and women were housed separately, which meant that Heinz went off with his sons and I went off by myself. When I first entered the large dormitory style cabin, I became frightened because all I could see were beds next to each other and stacked on top of each other and women rummaging through their suitcases. I don't know exactly how many slept in our cabin, maybe 100 (Gisela Sonntag, unpublished diary, 1957).

The family occupied countless hours on the ship attempting to find each other and to navigate the corridors of the immense vessel, which had been poorly retrofitted to accommodate civilian passenger travel. Volker slept on a hanging bed with five people above him and one below him, only able to slide into this space sideways with about 1 foot of space between beds. While on board, they dined on American fare and attended English lessons (although Dr. Sonntag frequently credits the Mickey Mouse Club and American cartoons for much of his English grammar). Volker and his brother Gunther were particularly prone to seasickness, and Volker spent most of the voyage in the sick bay with an intravenous line. They wore life jackets for much of the trip. Their primary entertainments were movies, which were played nightly. On April 6, 1957, 12 days after boarding, they sailed past Ellis Island and the Statue of Liberty and made landfall outside New York Harbor. Gisela Sonntag wrote the following:

We got up around 4 AM! Around 5:30 AM we passed Long Island. We were very happy to see land again, America! Soon we are greeted by the Statute of Liberty and this cosmopolitan city awoke before our eyes in a veil of mist and rain. The sight of the sprawling buildings, the enormous harbor and the wide roads was overwhelming (Gisela Sonntag, unpublished diary, 1957).

Once through immigration and customs, the family boarded buses from Manhattan to the train station in New Jersey. From there, they traveled through Philadelphia, Baltimore, and Chicago and on the Sante Fe Sky Chief through Oklahoma, Texas, and New Mexico en route to Phoenix. Two weeks after the start of their journey on April 9, they arrived. Volker, who had only ever had oranges as a special treat at

Christmas, was amazed to discover that the fruit grew on trees (3). Mrs. Sonntag's described their arrival in Arizona as follows:

Around midnight we boarded the train again and spent our third night on the train. This morning we saw Arizona in the rising sunlight. The landscape is about the same as yesterday, but the earth must get a bit more water. We saw cacti, green trees and a lot of unknown. . . (Gisela Sonntag, unpublished diary, 1957).

Over the years, the Sonntags integrated into American society. Initially, however, work was difficult to find. First Heinz and the boys worked at a trailer park doing manual labor. His mother attended school to learn English. She later became a secretary and soon afterward a dental assistant again. His father was unable to return to work as a dentist because of health and licensure issues, but he worked several jobs. Over the next 4 years, the family repaid loans in full to the Lutheran Refugee Service despite tight finances. Volker contributed to the family by working at a chicken farm for 5 years. Throughout the latter years of high school and all of college, he worked as a short-order cook at a fast-food establishment (**Figure 2**). He became a U.S. citizen in 1966.

COLLEGE, MEDICAL SCHOOL, AND EARLY NEUROSURGICAL YEARS

Dr. Sonntag completed his undergraduate degree and thesis, earning summa cum laude honors, from Arizona State University in 1967 with a Bachelor of Arts in chemistry. He entered the first medical school class at the then newly opened University of Arizona School of Medicine in Tucson and served as the Class President. He obtained his medical degree in 1971 and completed his rotating internship there as well in 1972. He traveled to Boston for his neurosurgery residency from 1972-1977 at Tufts New England Medical Center as one of the first trainees under Dr. Bennett Stein.

He dated Lynne Twohig seriously during 1972, but they parted as he moved to Boston and she continued studying to complete her BS in Nursing at the University of Arizona. They reunited at a social event in Phoenix around the Easter holiday of 1974 after more than a year apart and were married 5 days later in Phoenix. Following completion of his training, Dr. Sonntag worked for a year in Youngstown, Ohio, doing a wide variety of cases before returning to Phoenix in 1978. The couple welcomed their first child, Alissa, in 1978 in Youngstown.

The early years in Phoenix were full of potential discouragements. Writing



Figure 2. Volker Sonntag at the time of his graduation from high school in 1963. (Courtesy of Volker K. H. Sonntag, M.D.)

to a prominent Valley neurosurgeon (and later colleague) to inquire about employment prospects, the candid reply he received simply stated, "If you move to Phoenix, you will starve." Nonetheless, the pull of both families and familiar surroundings brought them back. Dr. Sonntag recounts stories of his days traveling between hospitals to perform cases with sets of neurosurgical instruments in the back of his car, engraved with his initials to ensure their return after the completion of each case. Other days were spent alone in his office waiting for the phone to ring. Nonetheless, working at five area hospitals (including St. Joseph's and BNI) over the next 5 years, he reports that he soon built one of the highest neurosurgical case volumes in the Valley (Sonntag VKH, personal communication, 2011). The Sonntags' second child, Christopher, was born during this period in 1981.

During these early years, Dr. Sonntag's interest and expertise in spinal neurosurgery largely developed from necessity. Eager to attract cases and referrals, he sought out cervical fractures and traumatic injuries, which were considered less attractive cases by local colleagues and by both faculty and residents at BNI. His early experience in the cervical spine led to a review of the management of bilateral locked facets (10), which generated interest among the cranial-dominated neurosurgical literature. His local reputation for excellence in spinal surgery followed.

BARROW NEUROLOGICAL INSTITUTE YEARS

Fortunes changed for Dr. Sonntag in 1983 with the arrival of a new BNI chairman of neurosurgery, Dr. Robert F. Spetzler. The two quickly developed a unique friendship based on a common life story, mutual admiration, and a unique vision. Based on Dr. Stein's recommendation, Dr. Spetzler invited Dr. Sonntag, along with others, to form an academic neurosurgical practice, the Barrow Neurosurgical Associates. Dr. Sonntag, who by this time had already acquired a favored reputation among BNI residents, chose to subspecialize in the spine. It was a calculated decision that undoubtedly recognized the potential for advancement in the field, but he could scarcely have anticipated what this commitment would entail. In 1984, Dr. Sonntag assumed the position of Vice-Chairman of the Division of Neurological Surgery and Director of Spinal Neurosurgery at the BNI (Figure 3).

Despite a tradition of excellence in spinal surgery that began with Horsley, Cushing, and Mixer, in 1984, neurosurgical involvement with the spine, beyond decompressive procedures, was the exception. With the exclusion of Dr. Sanford Larson at the University of Wisconsin and early innovators such as Dr. Ralph Cloward, spinal instrumentation was beyond the scope of both neurosurgical training and practice. At the time, the state-of-the-art techniques, which were primarily performed by orthopedists, consisted of posterior wiring techniques, various interlaminar devices, and Harrington rods.

Dr. Sonntag, along with others, recognized that neurosurgery could not be left behind. He states that it all started in 1990 with a course on spinal instrumentation taught by Sandy Larson in Milwaukee, Wisconsin, a neurosurgeon who performed these procedures that until that time were mainly managed by orthopedic surgeons. Dr. Sonntag's contributions in the areas of standardized resident training, as liaison to the orthopedic community, in clinical research, and in the politico-legal arena during the contentious debate over instrumentation cemented his place as a champion for the neurosurgical community.

In 1989, the Accreditation Council of Graduate Medical Education (ACGME) began formal consideration of spine fellowship training under the sole auspices of orthopedic surgery. The exclusion of neurosurgery represented a significant challenge to its future legitimacy to treat spine cases. In a letter drafted by Orthopedic Residency Review Committee to the ACGME, the opinion was offered that ". . . 'treatment by spinal fusion or instrumentation,' we concur are integral disciplines in orthopedic surgery and not neurosurgery The addition of spine instrumentation to a neurosurgical residency would not provide adequate training and would adversely impact on patient care."

Taking exception to the above statements, the American Board of Neurological Surgeons formed the Spine Task Force in October 1991, chaired by Dr. David Kelly. Dr. Sonntag served as Assistant Chairman. This committee produced the guidelines for neurosurgery resident training in spine and protocols for the development of a spine service. Perhaps most insightfully, the committee recommended that neurosurgical expertise should be extended to include the thoracic and lumbar spine in addition to the cervical region (11). These guidelines, which were adopted and approved by the American Association of Neurological Surgeons (AANS) and Congress of Neurological Surgeons in 1993, have helped shape neurosurgical training since that time. Dr. Sonntag continues to serve and influence residential education on a national level as a member of the ACGME Neurosurgery Resident Review Committee.

Obtaining privileges to place spinal instrumentation and to perform new spine techniques independently of orthopedists required new layers of oversight and approval for most neurosurgeons. Locally in Phoenix, the controversy was no different. Orthopedists at St. Joseph's hospital confronted Dr. Spetzler during an executive meeting with allegations of malpractice of Dr. Sonntag's instrumentation cases (9, 11). Dr. Spetzler countered with an offer to take the 12 cases from Dr. Sonntag and the last 12 cases performed by the orthopedic surgeons and to have them reviewed in a blinded fashion. Dr. Sonntag often relays the story of opening the results of the review with Dr. Spetzler in his home office in 1990. Dr. Sonntag's decision making and results were judged as superior, and the controversy was eliminated.

Although this seminal event helped to settle the controversy at BNI, neurosurgeons nationally faced considerable obstacles. To help settle the ongoing debate between the orthopedic and neurosurgical specialties, Dr. Julian T. Hoff, president of AANS, appointed Dr. Stewart Dunsker (Chairman), Dr. Sonntag, and Dr. Charlie Branch to a liaison committee. In August 1993, orthopedic and neurosurgical representatives met in Chicago to begin a dialogue about the future of spine surgery.

This new, more amiable relationship proved fruitful during the pedicle screw litigation. In the early 1990s, neurosurgeons found themselves united with orthopedic surgeons in opposition to an outcry against the use of pedicle screws, which were labeled as harmful and highlighted in a December 1993 episode of the TV news program *20/20*. The U.S. Food and Drug Administration (FDA) did not approve pedicle screws for use until the late 1990s and then only as class II evidence (9). Meanwhile, several large spine device companies were involved in class action litigation claiming wrongdoing on the part of the companies. One of Dr. Sonntag's early trainees, Curtis A. Dickman, M.D., was a coauthor of an article that was integral in obtaining Food and Drug Administration approval for the use of pedicle screws (9, 12).

Since that time, spine surgery has continued to evolve to become an equal component of neurosurgical practice. Technology continues to advance, and spine surgeons must continually adapt their practices as



Figure 3. Volker Sonntag, M.D., with other members of the Barrow Neurological Institute in 1987. Seated, left to right: Volker K. H. Sonntag, M.D., John Green, M.D., Edward Neuwelt, M.D., and Robert F. Spetzler, M.D. Standing, left to right: Daniele Rigamonti, M.D., Shih Sing Liu, M.D.,

Conrad Pappas, M.D., Daniel Nehls, M.D., Fred Williams, M.D., Mark Hadley, M.D., and Joseph Zabramski, M.D. (Used with permission from Barrow Neurological Institute.)

new techniques and new technologies become available. Dr. Sonntag recounts the many times over his career that he has performed a new spine operation for the first time, reflecting the explosive growth of the field, even in the last decade. Dr. Sonntag recalls that in 1988 spine workshops involved teaching participants how to braid wires for use in the spine and discussion of wiring techniques as primary methods of fixation.

Dr. Sonntag has also served as a North American Spine Society Board Member (1993-1995), Secretary (1995-1999), and President (2000-2001). He is unique among neurosurgeons, with only Dr. Charles Ray and Dr. Charlie Branch having occupied the last-mentioned office.

Dr. Sonntag was not involved politically only as an advocate for organized neurosurgery; he was equally ambitious with his clinical and academic practice. His most extensive areas of interest have included cervical spine instrumentation, treatment of the craniocervical junction, spinal biomechanics, and spinal trauma. In 1989, he introduced a novel C1-2 interspinous wiring technique that later came to be known as the "Sonntag C1-2 fusion" (5). Its biomechanical superiority to the older Gallie and Brooks/Jenkins constructs has been supported (2, 4). He expanded his area of expertise with novel descriptions of occipitoatlan-

tal fixation (1, 7), occipital and cervical fixation in the pediatric spine (6), and C2 fracture patterns (8). He holds five U.S. patents, four of which involve the Atlantis anterior cervical discectomy plating system (Medtronic, Minneapolis, Minnesota, USA) and its variations.

As of this writing, Dr. Sonntag's contributions to the literature include 190 peer-reviewed and 105 nonrefereed manuscripts. A list of his 21 most cited journal articles is provided in **Table 1**. He is a prolific speaker, having served as a visiting professor nationally and internationally to other neurosurgical programs on 73 different occasions throughout his career. He has made 914 presentations at scientific meetings and conferences. When relaying his scientific and clinical experiences, his tone is humble and modest. He has coedited five books, including *Kempe's Operative Neurosurgery*, *Surgery of the Craniovertebral Junction*, *Surgical Treatment of Discogenic Diseases of the Spine*, *Essentials of the Spine*, and *Principles of Spine Surgery*. He has also been a Section Editor for the spine volume of *Youman's Neurological Surgery* for the last two editions. He has coauthored 92 book chapters for other textbooks.

Throughout his tenure at BNI, Dr. Sonntag was instrumental in shaping the success of the institution and its reputation as a major

Table 1. Most Cited Articles of Volker Sonntag as of Spring 2011 Ranked by Number of Citations

Rank	Article	Number of Citations*
1	Bracken MB, Shepard MJ, Collins WF, Holford RT, Young W, Baskin DS, Eisenberg HM, Flamm E, Leo-Summers L, Maroon J, Marshall LF, Perot PL, Piepmeier J, Sonntag VKH, Wagner FC, Wilberger JE, Winn HR: A randomized, controlled trial of methylprednisolone or Naloxone in the treatment of acute spinal-cord injury: results of the second National Acute Spinal cord Injury Study. <i>N Engl J Med</i> 322:1405-1411, 1990	1473
2	Bracken MB, Shepard MJ, Holford RT, Leo-Summers L, Aldrich EF, Fazi M, Fehlings M, Herr DL, Hitchon PW, Marshall LF, Nockels RP, Pascale V, Perot PL, Piepmeier J, Sonntag VKH, Wagner F, Wilberger JE, Winn HR: Administration of methylprednisolone for 24 or 48 hours or tirilazad mesylate for 48 hours in the treatment of acute spinal cord injury: results of the third national acute spinal cord injury randomized controlled trial. <i>JAMA</i> 277:1597-1604, 1997	712
3	Bracken MB, Shepard MJ, Collins WF, Holford RT, Young W, Baskin DS, Eisenberg HM, Flamm E, Leo-Summers L, Maroon J, Marshall LF, Perot PL, Piepmeier J, Sonntag VKH, Wagner FC, Wilberger JE, Winn HR, Young W: Methylprednisolone or naloxone treatment after acute spinal cord injury: 1-year follow-up data: results of the second National Acute Spinal cord Injury Study. <i>J Neurosurg</i> 76:23-31, 1992	439
4	Lawton MT, Porter RW, Heiserman JE, Jacobowitz R, Sonntag VKH, Dickman CA: Surgical management of spinal epidural hematoma: relationship between surgical timing and neurological outcome. <i>J Neurosurg</i> 83:1-7, 1995	299
5	Bracken MB, Shepard MJ, Holford RT, Leo-Summers L, Aldrich EF, Fazi M, Fehlings M, Herr DL, Hitchon PW, Marshall LF, Nockels RP, Pascale V, Perot PL, Piepmeier J, Sonntag VKH, Wagner F, Wilberger JE, Winn HR, Young W: Methylprednisolone or tirilazad mesylate administration after acute spinal cord injury: 1-year follow up results of the third National Acute Spinal Cord Injury Randomized Controlled Trial. <i>J Neurosurg</i> 89:699-706, 1998	269
6	Paramore CG, Dickman CA, Sonntag VKH: The anatomical suitability of the C1-2 complex for transarticular screw fixation. <i>J Neurosurg</i> 85:221-224, 1996	196
7	Pappas CTE, Harrington E, Sonntag VKH: Outcome analysis in 654 surgically treated lumbar disc herniations. <i>Neurosurgery</i> 30:862-866, 1992	189
8	Dickman CA, Sonntag VKH: Posterior C1-2 transarticular screw fixation for atlantoaxial arthrodesis. <i>Neurosurgery</i> 43:275-280, 1998	169
9	Hadley MN, Sonntag VKH, Rekeate HL, Murphy A: The infant whiplash-shake injury syndrome: a clinical and pathological study. <i>Neurosurgery</i> 24:536-540, 1989	166
10	Hadley MN, Dickman CA, Browner CM, Sonntag VKH: Acute axis fractures: a review of 299 cases. <i>J Neurosurg</i> 71:642-647, 1989	166
11	Dickman CA, Sonntag VKH, Papadopoulos SM, Hadley MN: The interspinous method of posterior atlantoaxial arthrodesis. <i>J Neurosurg</i> 74:190-198, 1991	162
12	Hadley MN, Browner C, Sonntag VKH: Axis fractures: a comprehensive review of management and treatment in 107 cases. <i>Neurosurgery</i> 17:281-290, 1985	162
13	Naderi S, Crawford NR, Song GS, Sonntag VKH, Dickman CA: Biomechanical comparison of C1-2 posterior fixations: cable, graft, and screw combinations. <i>Spine (Phila Pa 1976)</i> 23:1946-1955, 1998	154
14	Herman JM, Sonntag VKH: Cervical corpectomy and plate fixation for postlaminectomy kyphosis. <i>J Neurosurg</i> 80:963-970, 1994	147
15	Green KA, Dickman CA, Marciano FF, Drabier JB, Hadley MN, Sonntag VKH: Acute axis fractures: analysis of management and outcome in 340 consecutive cases. <i>Spine (Phila Pa 1976)</i> 22:1843-1852, 1997	134
16	Levi AD, Dickman CA, Sonntag VKH: Management of postoperative infections after spinal instrumentation. <i>J Neurosurg</i> 86:975-980, 1997	131
17	Eleraky MA, Llanos C, Sonntag VKH: Cervical corpectomy: report of 185 cases and review of the literature. <i>J Neurosurg</i> 90(1 Suppl): 35-41, 1999	120
18	Marcotte P, Dickman CA, Sonntag VKH, Karahalios DG, Drabier J: Posterior atlantoaxial facet screw fixation. <i>J Neurosurg</i> 79:234-237, 1993	115
19	Baskin DS, Ryan P, Sonntag V, Westmark R, Widmayer MA: A prospective, randomized, controlled cervical fusion study using recombinant human bone morphogenetic protein-2 with the CORNERSTONE-SR allograft ring and the ATLANTIS anterior cervical plate. <i>Spine (Phila Pa 1976)</i> 28:1219-1224, 2003	106
20	Paramore CG, Dickman CA, Sonntag VKH: Radiographic and clinical follow-up review of Caspar plates in 49 patients. <i>J Neurosurg</i> 84:957-961, 1996	105
21	Dickman CA, Mamourian A, Sonntag VKH, Drayer BP: Magnetic resonance imaging of the transverse atlantal ligament for the evaluation of atlantoaxial instability. <i>J Neurosurg</i> 75:221-227, 1991	103

*As of 11/22/2010.

referral center for spinal procedures. Foreign dignitaries, professional athletes, and challenging cases from around the world were regulars in his clinic and operating room. Since 1988, he has served as Director of the Spine Fellowship Program. Dr. Ian Kalfas was his first fellow.

In 1995, Dr. Spetzler asked Dr. Sonntag to assume the role of Residency Program Director as well. Beyond its clinical reputation, BNI owes much of its esprit de corps to the example and leadership of Dr. Sonntag. Residents and staff have been greeted (as "Chiefy") by Dr. Sonntag in lederhosen at his annual Oktoberfest for many years; have indulged in friendly but spirited competition at the annual BNI Olympics since the late 1980s; and have enjoyed countless soccer matches, softball games, hikes, and events too numerous to count. The annual Sonntag Society event is a reunion of all previous residents and spine fellows, where Dr. Sonntag meets with his former trainees. Most recently, he served as head coach for the 2010 softball team that captured first place in the New York Charity Softball Tournament from a pool of 24 neurosurgical teams.

He is known by all for his love of the Blazing Craniotome (an annual resident roast of the attendings), stories and jokes told with great vigor and enthusiasm, interests and knowledge outside of medicine, and, most importantly, his devotion to his family. By tradition, visiting professor dinners always conclude with a joke from the Chiefy. He has balanced his clinical, committee, editorial board, research, and publication responsibilities with fitness and activity and with the most important aspect of his life to him: family. He stresses that balance involves working hard on a daily basis and getting the work done at a reasonable enough time to be home for dinner every night with his family. He states that he never missed a soccer practice when not at a professional commitment while coaching his children's soccer teams (Figure 4). He now looks forward to being an active grandfather to his

new grandson, Tucker Resh, who was born to Alissa and Tyler Resh on August 29, 2010.

ACCOLADES

In 1981, Dr. Sonntag was honored as an honorary Alpha Omega Alpha alumnus and again in 1987 as an Alumni Medal Winner by the University of Arizona. He has held memberships in >27 societies and professional associations (Table 2). Most notably, he has served as Congress of Neurological Surgeons Executive Committee Member 1985-1993, Chairman of the Joint Section on Spinal Disorders and Peripheral Nerve 1992-1993, AANS vice-president 2001-2002, American Academy President 2003-2004, and American Board of Neuro-



Figure 4. Volker Sonntag, M.D., with his son Chris in 1989. (Courtesy of Volker K. H. Sonntag, M.D.)

Table 2. Conservative Estimate of Peer-Review Manuscripts Reviewed by Volker Sonntag Since 1995*

Year	No.
1995	36
1996	11
1997	52
1998	187
1999	318
2000	314
2001	309
2002	338
2003	314
2004	533
2005	665
2006	309
2007	112
2008	112
2009	98
2010	85
Total	3793

*As tallied via the Barrow Neuroscience Publications Office.

logical Surgeons Director 1998-2004. In 1992, he was elected to the Society of Neurological Surgeons. In 2005, he became a member of the Resident Review Committee for Neurosurgery under the ACGME, and he became vice-chairman of the committee in 2009. Since 1982 he has served on 16 editorial boards. He continues to serve on nine, including Spine, Neurosurgery, Acta Neurochirurgica, The Spine Journal, and World Neurosurgery.

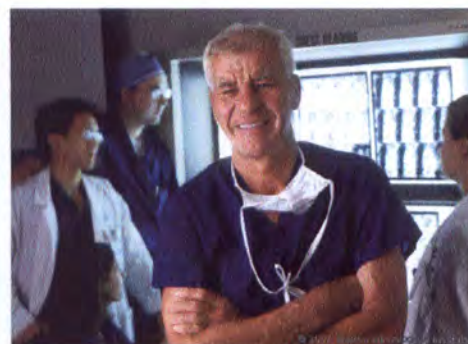


Figure 5. Volker Sonntag, M.D., at Barrow Neurological Institute in 2002, the year he was selected as Honored Guest of the Congress of Neurological Surgeons. (Used with permission from St. Joseph's Hospital and Medical Center.)

In 2000, Dr. Sonntag was chosen as the Honored Guest for Lifetime Leadership and Mentoring to Young Neurosurgeons by the AANS Young Neurosurgeons Committee. In 2002, he was selected as the Honored Guest of the Congress of Neurological Surgeons (Figure 5). Both North American Spine Society and the Joint Section of Disorders of the Spine and Peripheral Nerves have established named research funds in his honor.

At BNI, Dr. Sonntag served as Vice-Chairman of the Division of Neurological Surgery and Chairman of the Spine Section from 1984-2009 and was chosen by the residents as Teacher of the Year seven times. Dr. Sonntag was Director of the Spine Fellowship from 1988-2009 and the residency program from 1995-2009. He was appointed clinical associate professor and later clinical professor at the University of Arizona College of Medicine in 1985 and 1989. In 2000, he became the recipient of the endowed Alumni Chair for Spine Research. He remains at BNI as Vice-Chairman Emeritus. He also continues to serve on the Resident Review Committee and continues to make trips across the globe as a visiting professor and ambassador of neurosurgery in meetings with foreign dignitaries. Most recently, he enjoyed a private audience with the Vice-President of Taiwan. He has always been involved in humanitarian efforts, including prior trips to Vietnam with Cindy McCain and most recently to Tanzania.

In 2009, Dr. Sonntag's clinical practice concluded with a black-tie gala celebration at the Biltmore resort in Phoenix, Arizona. Residents, fellows, colleagues, and prominent neurosurgeons from around the world (including Dr. Stein) paid tribute to his remarkable career with stories, humor, and

much admiration. With typical humility, Dr. Sonntag honored his family and friends. The Sonntag Pavilion, a permanent center for resident and physician education on the BNI campus, to be scheduled for construction in 2012, was made possible largely from unsolicited funds donated in his honor that evening.

CONCLUSIONS

It is impossible to recount fully or measure the impact of Dr. Sonntag's career on the lives of patients, peers, and trainees. His legacy is evidenced by the 138 residents and fellows he has trained, many of whom now occupy academic positions throughout the world. Indirectly, Sonntag-mentored neurosurgeons carry his principles and values to trainees at many of the 101 neurosurgery residency programs in the United States. His influence to the wider neurosurgical community extends even further. Owing in significant part to Dr. Sonntag's clinical, scientific, and political leadership, the scope of spinal neurosurgery has reached unanticipated heights. It is with great respect and admiration that we congratulate Dr. Volker K. H. Sonntag on a truly inspiring and pioneering career.

ACKNOWLEDGMENTS

We thank the staff of the Neuroscience Publications Office at Barrow Neurological Institute for its assistance with this article.

REFERENCES

- Apostolides PJ, Dickman CA, Golfinos JG, Papadopoulos SM, Sonntag VK: Threaded Steinmann pin fusion of the craniovertebral junction. *Spine (Phila Pa 1976)* 21:1630-1637, 1996.
- Brooks AL, Jenkins EB: Atlanto-axial arthrodesis by the wedge compression method. *J Bone Joint Surg Am* 60:279-284, 1978.
- Congress of Neurological Surgeons Honored Guests. Congress of Neurological Surgeons Website 2002. <http://www.cns.org/about/history/honoredGuests/default.aspx?inID=2002>.
- Dickman CA, Crawford NR, Paramore CG: Biomechanical characteristics of C1-2 cable fixations. *J Neurosurg* 85:316-322, 1996.
- Dickman CA, Sonntag VK, Papadopoulos SM, Hadley MN: The interspinous method of posterior atlantoaxial arthrodesis. *J Neurosurg* 74:190-198, 1991.
- Eleraky MA, Theodore N, Adams M, Reigate HL, Sonntag VK: Pediatric cervical spine injuries: report of 102 cases and review of the literature. *J Neurosurg* 92:12-17, 2000.
- Gonzalez LF, Crawford NR, Chamberlain RH, Perez Garza LE, Preul MC, Sonntag VK, Dickman CA: Craniovertebral junction fixation with transarticular screws: biomechanical analysis of a novel technique. *J Neurosurg* 98:202-209, 2003.
- Greene KA, Dickman CA, Marciano FF, Drabier JB, Hadley MN, Sonntag VK: Acute axis fractures: analysis of management and outcome in 340 consecutive cases. *Spine (Phila Pa 1976)* 22:1843-1852, 1997.
- Lochhead RA, Abla AA, Mitha AP, Fusco D, Almefty K, Sanai N, Oppenlander ME, Albuquerque FC: A history of the Barrow Neurological Institute. *World Neurosurg* 74:71-80, 2010.
- Sonntag VK: Management of bilateral locked facets of the cervical spine. *Neurosurgery* 8:150-152, 1981.
- Sonntag VK: The development of spinal neurosurgery: a historical perspective. *Neurosurgery* 60:587-588, 2007.
- Yuan HA, Garfin SR, Dickman CA, Mardjetko SM: A historical cohort study of pedicle screw fixation in thoracic, lumbar, and sacral spinal fusions. *Spine (Phila Pa 1976)* 19:2279S-2296S, 1994.

Conflict of interest statement: The authors declare that the article content was composed in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Citation: World Neurosurg. (2012) 78, 1/2:24-30.

DOI: 10.1016/j.wneu.2011.05.061

Journal homepage: www.WORLDNEUROSURGERY.org

Available online: www.sciencedirect.com

1878-8750/\$ - see front matter © 2012 Elsevier Inc.

All rights reserved.

