

SpineSection

NEWSLETTER

AANS/CNS Joint Section on Disorders of the Spine and Peripheral Nerves

Greetings!

We are pleased to present you with the latest Newsletter of the Joint Section on Disorders of the Spine and Peripheral Nerves of the American Association of Neurological Surgeons and Congress of Neurological Surgeons.

In this issue, we present interviews with Vince Traynelis and John McGillicuddy, who will be the Meritorious Award recipients for Neurosurgery and Peripheral Nerve, respectively, at the upcoming Spine Summit Meeting in Orlando in March 2018. Also, Mike Wang gives us a look into The Future of Outpatient Lumbar Fusion. In our Peripheral Nerve learning corner, we explore the nuances of the motor examination of the

hand that can aid immensely in diagnosing spinal versus peripheral nerve disorders. Finally, we have an update from the Payor Policy Committee.

Please save the date for the Spine Summit Meeting in Orlando, March 14-17, 2018!

John O'Toole, MD john_otoole@rush.edu



American Association of Neurological Surgeons
and the American Association of Neurosurgeons



An Interview with the upcoming Meritorious Award recipient for Neurosurgery Vince Traynelis

by Cheerag Upadhyaya, MD

What were your initial thoughts regarding this recognition?

Two things came to mind. First, that it is a great honor. Second, am I really that old?

What do you see as the significant near term challenges to spine surgery?

It is clear that many gains have been made in recent years in understanding spinal alignment and balance. The challenge we now have is to understand what we do with this understanding. Does

everyone need a T4 to Pelvis operation? In which patients is it safer to proceed with a more limited operation? There is much to sort out in this space. We do not want to do too much or too little. In this regard, questions of cost effectiveness must be answered as if payers elect to not pay for these procedures, then what will we do? This is not only an economic, but also a moral dilemma.

I am also a little concerned about the rise of outpatient surgery. Specifically, I am worried that advancements that are good for some patients are then being generalized to all patients. For example, the

Interview with Vince Traynelis

■ Continued from page 1

fact that perhaps a 30 year old may safely undergo an outpatient surgery does not translate to a 90 year old being treated as an outpatient.

One other thing comes to mind; we must begin to influence payers on the costs of non-operative therapies. We are constantly being challenged on operative interventions. We must challenge payers and our peers in other specialties for data on the cost effectiveness of non-operative interventions.

Who were your mentors in neurosurgery & spine surgery?

The person that inspired me to become a neurosurgeon passed away recently – George Robert Nugent, MD. Dr. Nugent was Chair of the Department of Neurosurgery at West Virginia University School of Medicine when I was a medical student. He was a charismatic, superb clinician and surgeon. He taught me much of what I consider the foundation of medicine – go see the patient, examine the patient, look at the patient, look at the wound. These principles would always serve me well.

I spent 20 years at the University of Iowa, where Dr. Arnold H Menezes and Dr. John VanGilder were important mentors. I did both spine and cranial surgery, mostly vascular and skull base. I would show Dr. Menezes every case to solicit his advice and he was spectacular. I would scrub with him on some transoral cases and overall he was a superb mentor and teacher. Dr. VanGilder gave me my first job. He was a complex person who pushed people do their best. He was a great bedside clinician (like Dr. Nugent) and taught me a great deal and introduced me to many leaders in neurosurgery.

Dr. Volker Sonntag was very influential. Spinal instrumentation had just appeared and the AANS was interested in training neurosurgeons in spinal instrumentation. Myself and other neurosurgeons began to teach instrumentation and that is how I met Dr. Sonntag. He was very senior and internationally known. He was very congenial and respectful. I remember being shocked that he would ask my opinion on cases.

There were many others. Ed Benzel is a dear friend. We taught the biomechanics course at every single meeting. Richard L Saunders,



Chair of Neurosurgery at Dartmouth, a senior neurosurgeon of great integrity. My peers, specifically Regis Haid and Iain Kalfas. Reg and I went to medical school together and residency together and have known each other since 1979. And so many others, a list that would be exhaustive.

What advice would you give someone who wants to become more involved in organized neurosurgery and the spine section?

Make that interest known to the proper people in the section. Volunteer and be a great volunteer.

Start with the most menial jobs. You show up and do a good job. Then get a better job. It's not for everyone. Some people enjoy the work. Some people don't really enjoy it, but think they do. There is a lot of work that the leadership needs to get done. There is a perception that it is an "old boys club", but it is mostly a meritocracy. Excel at your task and you will be promoted.

What is needed to improve our outcomes in spine surgery?

We need more data. Registries are a good effort and ultimately are probably better and more generalizable than randomized controlled trials. Guidelines, while requiring tremendous effort, have also made huge changes in practice.

Also, I'm a big fan of meetings. I hope that meetings do not go away and we just all participate in webinars. You learn something from hearing a speaker and the give and take with the questions. You are able to make a judgment as to their thought process and may walk away and more carefully read their publications. It is at meetings that we see the speaker and make a personal assessment. That influences how one interprets their articles going forward.

What are your thoughts on the future development in technology and advancements in care?

There have been huge advances in the course of my career. Certainly, not everything that was thought to be promising worked out. However, we have learned from our efforts. For example, as we learned more about cylindrical interbody cages. After initial enthusiasm, there

was a pushback. But this endeavor focused our attention on the inter-vertebral disc space and innovation continued. What started out as a failure was actually the beginning of technological advancement. We have to be careful that something is truly an advancement and not just simply a way for a company to make money.

The space where we have to be careful is biologics. This is a huge growth area, but if one really looks closely at the data, you realize that maybe 90% of what's out there does not really have a solid scientific basis. There is some evidence that fusion isn't inhibited; but not great evidence that these biologics enhance fusion. Given the costs of biologics, there is the potential that a great deal of money could be spent for nothing.

One more thing, many innovative products have come out of small companies. As hospitals seek to limit vendors, we must be careful that this does not limit innovation.

What are your thoughts regarding the relationships between spine surgeons & industry?

I've worked with industry for many, many years; which gives me a certain perspective. Initially, I would seek funding from multiple companies to support research but never got paid personally for this effort. I learned a lot as I got to know the engineers. After a decade or so, I was approached and received a small consulting agreement with Medtronic. Gradually, I accrued some patents and there is no question that it was financially rewarding.

Now that I've done it for so long, I have come to believe that collaboration is vital. Engineers are bright people and are problem solvers. However, they frequently do not know the clinical problem. Engineers do not understand how helpful or how dangerous something will be. Without surgeon input, I do not see advancements.

Companies' need surgeons that have been in practice to help in cadaver labs and as beta testers. ADR is a good example. Who qualifies? What are the red flags?

Transparency is important. Everything is now disclosed and rules that prevent one from collecting royalties on products if utilized in your hospital are good.

More dangerous is the surgeon who starts their own pedicle screw company and begins placing those screws in their surgery center. This is not innovation.

Spine surgery often seems to have a negative stigma in the media, with a number of articles questioning the value of spine surgery. What can organized medicine / spine surgeons do to counteract this?

My understanding is that spine surgery is about 10% of the total cost of spine care. We have all seen patients having hundreds of visits for non-operative care. There is a lot of money being lost due to ineffective non-operative care. The societies have to stand up and demand evidence that non-operative care (epidural injections, etc) is also effective.

Our organizations have helped in reining in unscrupulous behavior. Orthopedic groups have admired neurosurgery's stand on improper testimony. Neurosurgery has changed the oral board exam in a manner similar to that of our orthopedic colleagues. Neurosurgeons now submit their own cases and so the ABNS is able to evaluate indications and accuracy of coding.

What advice would you give to a young neurosurgeon and spine surgeon?

Work hard, be ethical every day, and keep up with your field. Keeping up with the literature is critical; the journals are our newspapers. Be nice to your patients. Be congenial to everyone in your health system. See your patients everyday. Don't blow anyone off. Understand your limits. Realize that you can't do everything and have enough confidence to tell a patient that there is someone else across town that does a lot of the required procedure which may be in their best interest. People will respect you for this and it is far worse to have a bad outcome. Live by the thought that you want what your patient wants. You both want the best possible result. That mantra will never do you wrong.

What advice would you give to young spine surgeons who aspire to develop a successful research career?

You have to do research and publish. To be successful, you have to try and push the field a little bit. Early in your career, you will not be able to draw upon your experience. Consequently, focus on basic research, biomechanical studies, and participate in clinical trials. Try and become involved in the societies. You have to want to do this as it is extra work and your practice doesn't just stop. However, it is very rewarding if you are genuinely engaged.

The Future of Outpatient Lumbar Fusion Surgery

■ **Michael Y. Wang MD, FACS**

■ **Karthik Madhavan, MD**

Department of Neurological Surgery
University of Miami Miller School of Medicine
Miami, Florida, U.S.A.

Corresponding author:

Michael Y. Wang MD, FACS

Lois Pope Life Center

Department of Neurological Surgery

1095 NW 14th Terrace, Miami, FL 33136

Tel.: (305) 243-3294

Fax: (305) 243-3337

Email: MWang2@med.miami.edu



physician behavior. While many policy changes have been placed under the unassailable banner of "improvement in quality," it is clear to most surgeons that a major driver has simply been to control and reduce costs. Spinal surgery has been front and center in these processes given the ubiquitous nature of spinal disease, a unique environment with competing medical (and non-medical) specialists, variable philosophies of proper care, and the enormity of both the direct and indirect economic burden on society.

The past two decades has also seen a rapid expansion in outpatient surgical procedures. The impetus for this has come from three major groups: 1) physician

reduced inpatient costs from nursing care, pharmacy, therapy, and room and board. Furthermore, the reduction of complications related to a hospitalization can also be seen.

Relevance to spinal surgery

Given the substantial hospital margins in spinal surgery there has been significant effort directed at performing these operations in the outpatient setting. Currently, it is quite common for procedures such as a microdiscectomy and anterior cervical fusion to be performed in an ambulatory center. In fact, many insurance companies now mandate that these procedures be performed or billed as such.

A more interesting target has been single or multi-level spinal fusion procedures. Many of the more aggressive or advanced outpatient surgery centers have already been performing such procedures. This is not surprising due to the high financial margins that can be seen. The recent approval of lumbar spinal fusion in the outpatient setting by Medicare has been an additional driver. Several strategies have been utilized to allow for such a morbid procedure to be done with a short hospital stay. Some of these include: patient education, housing patients in a secondary facility or home with 24 hour nursing care, use of unilateral fixation, pre- and post-dosing with pharmacologics, and epidural/spinal analgesia, to name a few. Many of these approaches are also consid-

The American health care system is changing rapidly as a result of economic, political, and social forces which are not under the control of physicians and surgeons. It is anticipated that during this era there will be a major restructuring of how spinal care is bought and paid for. Evidence for this change has been abundant, including reduced physician reimbursements, onerous pre-authorization processes, and implementation of electronic medical records to monitor and control

ownerships of facilities to capture income outside of professional fees, 2) the formation of private business entities capitalized in the investment and professional management of these facilities, and 3) the understanding that costs of care can be lowered with outpatient surgery. While governmental and payor policies can have immediate and substantial impacts on the first two drivers, the third is a clear economic advantage. This is due to smaller scales of operations with reduced overhead and administration, as well as

ered to be “proprietary” given the substantial economic incentives. Nonetheless, even with the best approaches there are limitations on what types of surgery can be done as an outpatient. For example, it is probably not reasonable for spinal deformity surgery or staged operations to be done in a single setting as an outpatient.

The ERAS® approach at the University of Miami

The Enhancing Recovery After Surgery (ERAS®) movement began in Denmark as a practice concept integrating multidisciplinary, perioperative care programs. Previously known as “fast-track surgery” or “enhanced recovery programs,” ERAS® became popularized in the 1990’s, aiming to reduce the length of stay after elective surgery through integrated approaches.¹⁻³ ERAS® principles have included: 1) a focus on the patient and the patient experience; 2) a multi-disciplinary team approach; 3) efforts to reduce pain, morbidity, and recovery time; and 4) a data-driven iterative improvement process.⁴⁻⁶ The success of ERAS® has been obvious and well-demonstrated by the proliferation of programs both geographically and by specialty. To date there have been no peer-reviewed publications regarding spine ERAS® programs that have actually been implemented. Given that spinal fusion surgeries can be painful, morbid, and costly, the implementation of a spine ERAS® program would be most welcome. Over the last four years we have been developing a lumbar spinal fusion program incorporating the principles of ERAS® in an effort to improve patient outcomes and reduce complications.⁷

Our ERAS® protocol began with six technological components: surgery under sedation, endoscopic access, percutaneous screws, expandable interbody cages, osteobiologic adjuvants, and the use of long-acting local anesthetics.⁷ This allowed us to perform one and two level fusions were through a modified MIS TLIF approach that allowed for direct nerve visualization and decompression, interbody height restoration, interbody fusion, and bilateral pedicle screw

fixation. A consecutive case series of the first 38 patients treated with the ERAS® MIS TLIF was compared to a series of the 15 consecutive MIS TLIF patients who were treated prior to ERAS® implementation. Both procedures had identical instrumentation and implants, and all patients underwent fusion for the treatment of degenerative spondylolisthesis, or severe focal spondylosis and stenosis

In the ERAS® group there were 4 two-level cases, and all cases were single level for the comparators. Patients in both groups were similar with regard to medical co-morbidities, BMI, and age. Both groups of patients had excellent clinical results with an improvement of 23% and 24% on the final ODI of the ERAS® and comparator groups, respectively. The mean operative time was 96 vs. 132 minutes for the ERAS® and comparators, respectively ($P=0.003$). Blood loss was less (68 vs. 231 cc, $P<0.001$). Length of stay was also less with ERAS® surgery at a mean of 1.23 vs. 3.9 days ($P=0.009$). All ERAS® patients were discharged to home, compared with a 14% rate of discharge to an inpatient facility with standard MIS TLIF. Complications were less common with the ERAS® patients (12% vs. 21%). However, one patient required a revision of hardware. By comparison, the ERAS® had one case of early cage displacement which was treated with a revision operation via the anterior approach. Two patients early in the series developed an infection of the interbody graft treated with an incision and drainage followed by intravenous antibiotic therapy. None of the 53 patients in this small series with short follow-up exhibited clinical or radiographic evidence of pseudarthrosis. This data indicates that an outpatient one or two level lumbar fusion is quite possible with comparable clinical and radiographic results in properly selected patients.

Is this a “cherry picking” model?

While our efforts have been directed at performing lumbar fusion in way that allows older and sicker patients to receive less expensive care (in a future rationed environment), one must be cognizant that most efforts at triaging patients to outpatient

surgery simply pick the youngest, healthiest, and profitable patients to an outpatient center. That approach can save healthcare dollars as an aggregate population but the reader can draw his/her own conclusions as to where that might head in the future.

References

1. Kehlet H. Multimodal approach to control postoperative pathophysiology and rehabilitation. *Br J Anaesth*. May 1997;78(5):606-617.
2. Kehlet H, Wilmore DW. Multimodal strategies to improve surgical outcome. *Am J Surg*. Jun 2002;183(6):630-641.
3. Kahokehr A, Sammour T, Zargar-Shoshtari K, Thompson L, Hill AG. Implementation of ERAS and how to overcome the barriers. *Int J Surg*. Feb 2009;7(1):16-19.
4. Ljungqvist O. ERAS—enhanced recovery after surgery: moving evidence-based perioperative care to practice. *JPEN J Parenter Enteral Nutr*. Jul 2014;38(5):559-566.
5. Lassen K, Soop M, Nygren J, et al. Consensus review of optimal perioperative care in colorectal surgery: Enhanced Recovery After Surgery (ERAS) Group recommendations. *Arch Surg*. Oct 2009;144(10):961-969.
6. Hoffmann H, Kettelhack C. Fast-track surgery—conditions and challenges in postsurgical treatment: a review of elements of translational research in enhanced recovery after surgery. *Eur Surg Res*. 2012;49(1):24-34.
7. Wang M, Grossman J. Endoscopic minimally invasive transforaminal interbody fusion without general anesthesia: initial clinical experience with 1-year follow-up. *Neurosurg Focus*. 2016;40(2):1-5.

Key words: Minimally invasive, Cost, Economic, Spine, QALY, Anesthesia, Pedicle screw, Percutaneous, ERAS



Payor Policy Response Committee Update

Charles A. Sansur, Luis M. Tumialan and Khoi D. Than

It has been a busy time for the Payor Policy Response Committee. Please find below highlights on what the committee has been doing to advocate for spine surgeons and their patients.

1. Sacroiliac joint fusions.

This has been a hot topic for the committee. The following work has recently been done:

- Evidence Street response for SI joint fusions: The committee's recommendation was to keep the reimbursement at a Level 4, for

now. The committee supports the diagnosis of SI joint dysfunction, and SI fusion is a beneficial surgical solution. However, only 1 year follow-up data is available at this time. Eventually, as more follow-up is available from the ongoing clinical trials, the committee will be able to more reliably support SI joint fusion and perhaps increase its reimbursement category.

- Response to lack of coverage by Official Disability Guidelines for MIS SI joint fusions: The ODG

currently do not support SI joint dysfunction as a disability. The committee's response was that SI joint dysfunction is a real problem, often presents as an adjacent segment issue, and can certainly be work-related. The committee encouraged the ODG to recognize SI joint dysfunction as a disability.

- Lastly, the SI joint fusion codes currently listed are undervalued. There is a request to increase the wRVU from ~6 to 14. The committee is actively working on this.

2. Category III to Category I conversion for cervical arthroplasty revision.

- The utilization of cervical arthroplasty is increasing nationwide. A small percentage of cervical arthroplasty devices fail and require revision or removal. The committee is trying to make billing for removal of arthroplasty devices and conversion to fusions more reliable and uniform. Category III procedures have variable compensation, while Category I procedures are consistently compensated by insurance companies.

3. Maintaining Category III status for lumbar arthroplasty revision.

- Lumbar arthroplasty procedures are still being performed throughout the country, and are an active area of investigation in regard to optimal patient selection, surgical technique, and postoperative outcomes. The committee is trying to preserve possible reimbursement for these procedures, as long as they continue being utilized.

4. Evidence Street response for Neuromonitoring in the setting of ACDF.

- Insurance companies including Blue Cross Blue Shield and Highmark asked the committee for input regarding whether intraoperative neuromonitoring of the vocal cords during ACDF is reasonable. The committee's response was that such monitoring is indeed appropriate and should be reimbursed, especially for revision cases, patients with complex histories, and at the discretion of the surgeon.

5. NASS Guidelines.

- NASS frequently reaches out to the committee for input on various topics, including the following:
- Allograft and Demineralized Bone Matrix for Spinal Fusion: The committee added references but withheld a formal response. Rationale: Any allograft product literature will tend to be sparse as human tissue is not regulated by the Food and Drug Administration like synthetics (Class II with special

controls) or Bone Morphogenetic Protein (Class III) are. Allograft can be sold without a need for clinical studies showing efficacy, contrary to drugs or devices, which limits data.

- Spinal Cord Stimulation: This was reviewed by the Rapid Response Team. No coverage issues were identified on a very generic document, and there were no foreseen barriers to coverage. No formal response was submitted.

6. ICER Scoping Document on Certain Non-pharmacologic Interventions for Chronic Low Back and Neck Pain.

- The committee reviewed and supported these conservative management guidelines, which outlined the non-operative treatment modalities that should be implemented prior to spinal surgery.

AMA Opioid Task Force



Help save lives: Co-prescribe naloxone to patients at risk of overdose

Naloxone saves lives

The nation's opioid epidemic claimed more than 33,000 lives in 2015, but that figure would have been even higher if it wasn't for the life-saving opioid overdose antidote naloxone. For more than 40 years, naloxone has been used to reverse the effects of opioid overdose. Timely administration of naloxone has saved thousands of lives:

- From 1996 through June 2014, organizations that provide community-based overdose prevention services, including provision of naloxone to laypersons, recorded more than 26,000 opioid overdose reversals in the United

Co-Rx naloxone when clinically appropriate

The [AMA Opioid Task Force](#) encourages physicians to consider co-prescribing naloxone when it is clinically appropriate to do so. This is a decision to be made primarily between the patient and physician.⁵ Factors that may be helpful in determining whether to co-prescribe naloxone to a patient, or to a family member or close friend of the patient, include:

- Does the patient history or prescription drug monitoring program (PDMP) show that my patient is on a high opioid dose?
- Is my patient also on a concomitant benzodiazepine prescription?

An Interview with the upcoming Meritorious Award recipient for Peripheral Nerve, John McGillicuddy

by Line Jacques, MD

Dr. McGillicuddy, you will receive the First Meritorious Member Award at the Spine and Peripheral Nerve Section Annual 2018 meeting in recognition of your significant contribution to the field on March 16th 2018.

What were your initial thoughts regarding this recognition?

McGillicuddy: Rather embarrassed, but honored to be thought of as “meritorious”. Many others have contributed more to the field of Peripheral Nerve than I have. I was fortunate to be around in the very early days of the “re-establishment” of Peripheral nerve surgery in neurosurgery, which was brought about by Drs. David Kline and Alan Hudson.

In 1978 I received a brochure for a meeting on “Peripheral Nerves of the Upper Extremity” to be held at Duke to be sponsored by the American Society for Surgery of the Hand (ASSH). It was a revolutionary meeting of the giants of the U.S. nerve surgery and exposed me to the work of Drs. Narakas and Millesi, who presented their work on direct brachial plexus surgery and nerve grafting. That was controversial at that time.

Later, attended the first Cook County Peripheral Nerve Dissection Course directed



by Dave and Alan. At this point I really became interested in Peripheral Nerve. In 1987 I was asked to teach in the course, and continued until 1992.

In 1997 I heard Dr. Bart Sloof of Heerlen from the Netherlands give a talk on his results with surgery of neonatal Brachial Plexus palsy, which had exceptional recovery outcomes. I had been very conservative prior to this meeting. I spent some time in Heerlen and with van Ouwkerk in Amsterdam and Malessy in Leiden and then tried to replicate their work –greatly aided in starting this program by Dr. Lynda Yang, who continues the program with exceptional skill.

I was clearly very fortunate to have a large number of very willing and helpful mentors and hope that I have continued in this tradition.

What are the key qualities needed in order to be able to contribute in spine and the peripheral nerve fields?

McGillicuddy: Key qualities are enthusiasm, strong work ethic, curiosity, a willingness to imagine new ways to approach problems, and a multidisciplinary attitude. Orthopedics, plastic surgery, and rehabilitation physicians, including physical and occupational therapy, play important roles in the care of nerve anomalies. Progress can be made by working “across the aisle” with these specialties. Working in collaboration with radiology (MRI, ultrasound), neurology, and the basic neurosciences are necessary. Avoid “silo” thinking. Studies on outcomes and an appreciation of statistical analysis and application is critical.

You have seen the evolution of the peripheral nerve field throughout your career, what are the next steps to advance the quality of care in our field?

McGillicuddy: In the area of advancement, we must find the best uses of the available technology and our “practical” research – nerve guidance mechanisms, accelerating neuronal growth and basic neurophysiological work with gene therapy, either directly to nerves or to modify interposed grafts.

Secondly, we need to find and verify tests of evaluating outcomes in terms of useable and used functions, not just in terms of range of motion (ROM) and strength of isolated muscles.

What steps do we need to take to increase exposure to our subspecialty and attract talented new surgeons?

McGillicuddy: We need to show medical students and post graduates how rapidly nerve is evolving. The use of ultrasound and nerve transfers has revolutionized nerve surgery. We are approaching a breakthrough similar to spine surgery, with image guidance. In addition, diagnosis of nerve problems still requires a good amount of clinical detective work to determine the site and severity, and often the cause of the lesion. Thorough examination and clinical acumen is rewarded.

There is a need to increase the reimbursement for peripheral nerve work, to recognize the micro surgical techniques associated with these procedures. Also to recognize the effort involved in selecting the appropriate candidate for surgery, this often requires multiple patient visits and encompasses multi-diagnostic procedures and physical examinations.

You have been recognized by your former students as being and outstanding mentor. How can you translate your formula for success to others in our field striving to be excellent mentors?

McGillicuddy: I am not sure how to be a mentor, never mind a successful one. I think it begins with caring about the people you are mentoring. When someone approaches you for help, try to determine what they want or need. It is not about how they can help you but how you can help/direct them. It is wise to set standards and expectations.

Be willing to search out other possible mentors who may also be able to help. At times, it may be most helpful to release the mentee to one of them. One thing to avoid is to think of your mentee as someone to help you in your career; it is all about them, not you.

Great leadership is achieved by setting a good example, listening, doing what you say you will do, and leading from the front. It is much easier to pull a string across a table than to push it.

You have also served our country, seen spine and peripheral nerve war inflicted wounds; what are your thoughts on what should be done in that particular field to provide better access and outcomes?

McGillicuddy: I cannot be of much help here. I had no real experience with wounds of peripheral nerves. There is no place for treatment of these injuries in the acutely wounded. We are/I was involved in treating the loss of limbs, loss of blood, and shock. Most nerve injuries are discovered after the patient is stabilized. It is, of course, very important to examine the patient for any possible nerve injury once this is possible outside of the acute area of care. Most wounds are contaminated when seen and closure usually is secondary and done in a "hospital" setting. Microsurgical repair of lacerated nerves is not advisable acutely and will be done elsewhere. The most important issue then is the determination that there is a peripheral nerve injury at the earliest possible time to ensure that it does not go unrecognized.

Dr. McGillicuddy you were chosen among your peers as the Kline's Lecturer for the annual AANS meeting in 2011 and delivered an outstanding talk; how did you prepare for that particular talk?

McGillicuddy: I was as surprised to be chosen as a Kline Lecturer as I am for this honor. Looking at the line of illustrious predecessors, I was unsure of what I could provide of equal quality. (Oberlin 2007, Birch 2008, Richter 2009, Hudson 2010, McGillicuddy, 2011) .I had no exciting research to talk about and had not discovered any new nerve transfers. So I fell back on teaching. I liked to pull things together to make a practical path to a decision. So why not discuss the evaluation of a severe Upper Extremity nerve injury- the things to think about, the critical questions, the importance of the history, the practical examination, some diagnostic pearls, how to proceed after the diagnosis is made. I assumed that this had been done before but thought it would be useful to repeat. I am surprised it was considered "outstanding" but I did feel that I had made a presentation that would be useful.

Anything else you would like to add?

McGillicuddy: I don't know what else to say, but saving a few thoughts for my talk.

Peripheral Nerve Learning Corner

The Motor Hand Exam: Another Tool in the Toolbox

By Thomas J. Wilson, MD and Wilson (Zack) Ray, MD

While most of us feel confident in the diagnosis of common entrapment neuropathies (e.g., carpal tunnel syndrome), peripheral nerve entrapments can also masquerade as cervical radiculopathies. Both peripheral entrapments and cervical radiculopathies are lower motor neuron lesions and will present with weakness and hyporeflexia. A thorough and skilled motor hand exam is an important tool for the neurosurgeon to have in his or her toolbox. The motor hand exam can help in differentiating peripheral neuropathies from radiculopathies, guiding the surgeon towards the appropriate surgical intervention to address the ails of the patient.

A thorough motor hand examination should include examination of ulnar-, median-, anterior interosseous-, radial, and posterior interosseous-innervated musculature. While it is important to examine the entire upper extremity, we will focus on examination of the hand and wrist here. We begin by asking the patient to flex the wrist with ulnar deviation, testing the flexor carpi ulnaris, innervated by the ulnar nerve. We next ask the patient to flex the wrist with radial deviation, testing the flexor carpi radialis, innervated by the median nerve. We then ask the patient to flex the distal tip of the thumb at the distal interphalangeal (DIP) joint, testing the flexor pollicis longus, innervated by the anterior interosseous nerve. We then move across the hand testing flexion at the DIP joint of digits 2-5 individually, assessing the flexor digitorum profundus (FDP). The radial half of the FDP going to digits 2 and 3 is innervated by the anterior interosseous nerve, while the ulnar half going to digits 4 and 5 is innervated by the ulnar nerve. We next test flexion at the proximal interphalangeal (PIP) joints of digits 2-5, testing the flexor digitorum superficialis, innervated by the median nerve. Next, we have the patient spread/abduct the fingers, testing the dorsal interossei, innervated by the ulnar nerve. The palmar interossei, also innervated by the ulnar nerve, are then tested by having the patient adduct the fingers. When a wrist drop is present, be careful to test the function of the interossei with the wrist in a neutral position. If the interossei are tested with the wrist flexed, the interossei will appear weak due to mechanical disadvantage rather than true weakness. The patient is then asked to abduct the thumb (move the thumb perpendicular to the plane of the palm), while the

abductor pollicis brevis is palpated, innervated by the median nerve. The thumb is then extended, testing the extensor pollicis longus and brevis, innervated by the posterior interosseous nerve. The thumb is then adducted, testing the adductor pollicis, innervated by the ulnar nerve. Finally for the thumb, the thumb is opposed to the fifth digit, testing the opponens pollicis, innervated by the median nerve. Note that testing of the thumb alone can test the ulnar, median, anterior interosseous, and posterior interosseous nerves. After examining the thumb, the patient is asked to extend the fingers at the metacarpophalangeal joints, testing the extensor digitorum (primarily), innervated by the posterior interosseous nerve. Note that the DIP and PIP joints are extended by the lumbricals, which are innervated by the median and ulnar nerves, not the posterior interosseous nerve. The patient is then asked to extend the wrist with radial deviation, testing the extensor carpi radialis longus and brevis, innervated by the radial nerve. Lastly, the patient is asked to extend the wrist with ulnar deviation, testing the extensor carpi ulnaris, innervated by the posterior interosseous nerve. Assessing each of the muscles in the hand and wrist exam is aided by palpating the muscle or tendon during resisted movement.

The following are some examples of how the motor hand exam can help differentiate peripheral neuropathies from radiculopathies, especially when combined with the rest of the upper extremity motor examination:

Ulnar neuropathy vs. C8 radiculopathy: In both ulnar neuropathy and C8 radiculopathy, many of the hand intrinsics may be weak. The extensor pollicis longus is an important muscle that will be weak in C8 radiculopathy (its primary segmental innervation), but will not be weak in ulnar neuropathy (innervated by the posterior interosseous nerve). In addition, the median-innervated LOAF muscles may be weak in C8 radiculopathy, but are spared with ulnar neuropathy.

Radial neuropathy vs. C7 radiculopathy: Both provide innervation to the finger and wrist extensors, yet a C7 radiculopathy would also have some involvement of the wrist flexors and pronators (median-innervated). Similarly, the brachioradialis (pure radial nerve innervation, with mostly C6 segmental innervation) would not be involved in a C7 radiculopathy, but will be involved with a proximal radial neuropathy.

Carpal tunnel (median neuropathy) vs. C6 radiculopathy:

Though the distribution of sensory/pain symptoms may be similar, the motor patterns differ significantly. The median-innervated hand intrinsic (LOAF muscles) may be weak with carpal tunnel syndrome, but are supplied by C8 and T1, so will not be weak with a C6 radiculopathy. The biceps (musculocutaneous-innervated) and brachioradialis (radial-innervated) may be weak with a C6 radiculopathy but will not be weak in carpal tunnel syndrome.

Other entrapments or inflammatory neuropathies that may be detected using the motor hand exam include the following:

Anterior interosseous syndrome: The exam will show pure motor weakness of the flexor pollicis longus and flexor digitorum profundus to digits 2 and 3. The LOAF muscles will be spared, since they are innervated by the median nerve. When asked to make an "O" with the thumb and first digit tip to tip, the patient will make a duck bill instead.

Posterior interosseous syndrome: The typical description is a finger drop, without a wrist drop. The finger drop is due to the inability to extend the fingers at the MCP joints. Though a complete wrist drop is not present, there is radial deviation with wrist extension due to preservation of the extensor carpi radialis longus and brevis (radial-innervated), with weakness of the extensor carpi ulnaris (posterior interosseous-innervated).

Peripheral Nerve Updates for DSPN Members

Line Jacques, MD

1. The peripheral nerve business dinner during the 2017 CNS annual meeting will be held on Sunday, October 8th 2017 at 7:30PM Cinquecento Roman Trattoria 500 Harrison avenue Boston, MA 02118 (617)338-9500

2. The 2017 Kline lecture will be presented by Dr. Eric Zager (University of Pennsylvania) on Tuesday May 1st 2018 during the AANS meeting in New Orleans, Louisiana. The lecture title: TBD

3. The Kline Research Award will be offered again this year to support either basic or clinical research related to peripheral nerves with funding in the amount of \$10,000. The research award provides means of peer review for clinical projects, and therefore, to enhance competitiveness for potential National Institutes of Health (NIH) funding.

Dr. Sudheesh Ramachandra (Dr. Midha, University of Calgary) will present a talk entitled: Neuroanatomical analysis of distal surcharge end-to-side nerve repair for in-continuity nerve injury in rodents on Tuesday, May 1st 2018 during the AANS annual meeting in New Orleans.

4. Winner of the 2018 Kline Research Award will be announced at the 2018 DSPN meeting in Orlando, Florida

Kline Abstract Award, PN Abstract Award and the top PN Kuntz Abstract Award will be offered at the DSPN meeting and the abstracts will be podium presentations.

5. Kline NREF Fund "Honor your mentor" is on the NREF website. If you would like to contribute to the fund please visit Kline NREF Fund website: <http://www.nref.org/donate>

Note that the Peripheral Nerve Division leadership controls the use of the NREF PN funds (including the Kline fund) for research or education, within the guidelines of the NREF.

6. Upcoming meetings

WFNS 2nd Theoretical, Practical & Hands-on International Course in Peripheral Nerve & Brachial Plexus Surgery October 31st to November 3rd 2017
Belgrade, Serbia

<http://www.wfns.org/events/16/wfns-committee-events/81/2nd-theoretical-practical-hands-on-international-course-in-peripheral-nerve>

ASPEN annual meeting, January 12-14th 2018, Puerto Rico
<http://www.peripheralnerve.org/meeting>

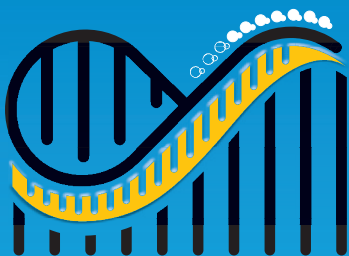
Sunderland Society meeting March 3-6th, 2018 in Palo Alto, CA, USA

21st Narakas meeting, Leiden, Netherlands; May 16-18th 2018

Toronto Obstetric Brachial Plexus Workshop-Hospital for Sick Children in Toronto, Canada; May 25-26th 2018

7. The 4th annual Peripheral Nerve Dissection Course: "The Kline Legacy" in New Orleans, Louisiana will take place on January 27-28th 2018.

**REGISTRATION
IS OPEN!**



THE ANNUAL MEETING OF THE AANS/CNS SECTION ON DISORDERS
OF THE SPINE AND PERIPHERAL NERVES

SPINE SUMMIT 2018

RESTORING ALIGNMENT IN AN ERA OF GLOBAL CHANGE

March 14-17, 2018

ORLANDO

Loews Royal Pacific Resort at Universal Orlando®

Spine Summit 2018 is bigger and more thrilling than ever.

Buckle up for an electrifying scientific program with hundreds of leading surgeons and industry leaders to explore innovations in spine and peripheral nerve surgery in the era of rapid, global change. Highlights include:

- Seven Special Courses covering MIS/ Navigation, optimizing surgical outcomes, peripheral pain, Brazilian spine symposium, and more
- Special guest presentation by Jerome Bettis (*Pittsburgh Steelers, NFL Hall of Fame*)
- Hands-on cadaver course
- Top abstract presentations, Kuntz Scholar awards, plus the J.A.N.E. and Mayfield Awards
- Special Seminar for APRNs & PAs
- Head-to-head debates and Happy Hour battles
- Cahill Controversies series



VINCENT TRAYNELIS

.....
Meritorius Award,
Neurosurgery



RICK SASSO

.....
Meritorius Award,
Orthopedic Surgery



JOHN MCGILLICUDDY

.....
Meritorius Member
Award



PAUL MCCORMICK

.....
Meritorius Member
Award

Register for Spine Summit 2018 at

cns.org/spine

**Advance Registration Deadline:
February 16, 2018**



Congress of
Neurological
Surgeons



American
Association of
Neurological
Surgeons

SPINE SUMMIT 2018 IS JOINTLY PROVIDED BY THE CONGRESS OF NEUROLOGICAL SURGEONS
AND THE AANS/CNS SECTION ON DISORDERS OF THE SPINE AND PERIPHERAL NERVES.