Gray Matters

Newsletter of the National Capital Neurosurgery Program • Walter Reed Army Medical Center • Washington, DC 20307-5001

Winter-Spring 2000

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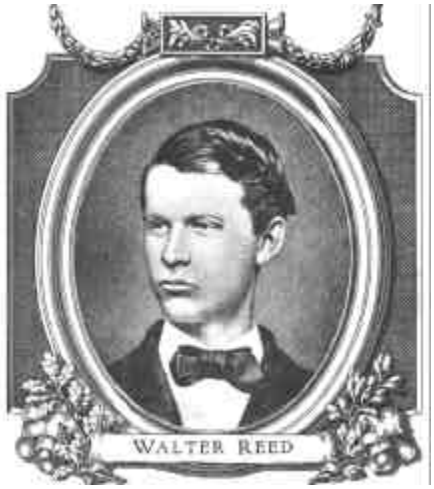

Walter Reed took his medical degree from Bellevue Hospital in New York at age 21. The following year the Brooklyn Board of Health appointed him assistant sanitary officer. Unfortunately, dismal medical and economic conditions in the city keenly disillusioned him, and Reed got into a fist fight with a German immigrant. While feeling sorry for himself, the self-proclaimed "hot-headed Virginian" began to write a series of love letters to Emilie Lawrence. In an early letter to her he mentioned his plan to enter the Army Medical Corps for the first time, but being young and unsponsored put him at a disadvantage in competing for one of the thirty vacancies for medical officers.

Military Contributions to Peripheral Nerve Injuries

Military conflicts produce a number of peripheral nerve injuries unlikely ever to be matched by any civilian setting. Peripheral nerve injuries occur in approximately ten percent of survivors of all non-lethal combat injuries. It is not surprising then that wartime experience with such injuries has greatly influenced modern clinical management of peripheral nerve injury. The following brief review highlights some of the major contributions made by military surgeons to the understanding and therapy of peripheral nerve injuries.

Before the late 1800's there were few reports of attempts at repair mechanical injuries of nerves. The reluctance to undertake surgical intervention in part arose from the erroneous impression that spontaneous recovery following nerve division was the rule. The clinical observation that recovery of pain sensation after nerve section performed for neuralgias bolstered this belief. Weir Mitchell helped debunk the misconception that divided nerves spontaneously recover. From his experience in the War Between the States, Mitchell concluded that the apparent functional recovery of a limb following interruption of a nerve was due to (1) the overlap of the sensory distribution of adjacent nerves and (2) the compensatory action of uninvolved muscles. Mitchell also gave a detailed account of the scope and outcomes of peripheral nerve injuries in his treatise *Gunshot Wounds and Other Injuries of Nerves,* but he is best remembered for the earliest, sound description of causalgia.

Dr. S. Weir Mitchell

During World War I there were over 3500 nerve injuries among the American wounded. An exceedingly effective and organized response to these casualties was directed by Carl Huber who established multiple clinical and experimental peripheral nerve centers at military and civilian hospitals. The ongoing research at these facilities was disseminated to army surgeons before they left for Europe at the Neuro-Surgical School of New York for Medical Officers of the U.S. Army.

Continued on page 3

Gaining Confidence in Your Doctor

Evidence-Based Therapy

Neuro-oncologist: I am prescribing a new drug for your brain tumor. Clinical studies say it will improve your chances of survival.

Patient: How can you be so sure?

Neuro-oncologist: According to the studies, nine out of ten who take this drug die. My first nine patients have already died, and you're the tenth one to take it. Consequently, you will live.

A Costly Anesthetic

Tired of being pestered by spine patients always asking how much his services cost, a surly anesthesiologist came up with a ready reply:

"Oh, about $1000—$10 to put you to sleep and $990 to wake you up. Most patients buy the whole package."

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Historical Note

John Martin, M.D.

First Program Director of Neurosurgery Residency

John Martin was born on December 18, 1904, in Keithsburg, Illinois, a small town on the Mississippi River. The son of John C. and Nora B. Martin, he attended high school in Peoria and worked for five years before moving to Chicago, where he enrolled at Lewis Institute, a small college later incorporated into the University of Chicago. He received a baccalaureate degree in 1930.

Dr. John Martin, M.D.
(1904-1996)

Despite lack of financial resources in the early years of the Great Depression, Dr. Martin had the "temerity" [his word] to apply to Northwestern University Medical School, where he was accepted for the class entering in the fall of 1930. He received a master's degree in 1934 and his M.D. the following year. He served an internship and residency at the Passavant Memorial Hospital from 1934 through 1940, the last four years in neurological surgery under the tutelage of Loyal Davis. He spent late 1939 in Cushing's laboratory in New Haven, Connecticut, where he worked with Louise Eisenhardt. In 1940 he began his practice as chief of neurosurgey at Wesley Memorial Hospital in Chicago.

In 1942 he received a Ph.D. in neurophysiology and in February of that year he was called to active duty. He was appointed chief of neurosurgery for the 12th U.S. General Hospital that was mobilized to Algeria in December, 1942, in support of the Mediterranean Theater of Operations. He received a bronze star in July, 1945, and was discharged in the rank of lieutenant colonel in 1946. He returned to Chicago, but relations with Loyal Davis allegedly became increasingly strained, and Dr. Martin left in Chicago in 1952.

In the meantime Surgeon General George Armstrong had advanced the idea of establishing a neurosurgery residency at Walter Reed General Hospital. The selection of the first program director fell to Silas Hayes and Major General Streif, who chose the newly available John Martin as chief of the Neurosurgery Service. The first two residents to complete the program were Ludwig G. Kempe, who began in January, 1954, and Bert G. Leigh, who followed in July, 1954. However, Dr. Martin's tenure at Walter Reed was a troubled one, and he left the Army on a medical disability in 1955 following an inquiry into his professional performance.

After his departure from Walter Reed Dr. Martin took several extended vacation periods, and he ultimately re-established himself as a neurosurgical consultant in Clarinda, Iowa. From 1975 through 1992 he was Clinical Professor of Surgery at the University of Iowa. His most gratifying accomplishment of his professional life was collecting rare and historic medical books that were ultimately housed in the John Martin Rare Book Room at the Hardin Library of the Health Sciences, University of Iowa. Dr. Martin died in 1996.

Huber's colleagues and pupils included Charles Elsberg, Byron Stookey, Winfield Ney, Loyal Davis, and Howard Naffziger. These surgeons made lasting contributions to peripheral nerve repair. In contrast to the physiologically naive clinical reports on peripheral nerve repair before

Dr. Byron Stookey

WWI, reports after the Great War reflect a sophisticated understanding of peripheral nerve physiology which informed the technical refinements advanced during the Great War. These refinements included rejection of the physiologically implausible "nerve flap" operation, a histopathologically correct understanding of neuromas, and meticulous animal-model evaluation of nerve grafting strategies.

The WWI experience laid the foundation for major advancements in peripheral nerve injury. Byron Stookey's landmark monograph *Surgical and Mechanical Treatment of Peripheral Nerves* appeared in 1922, and it remained the definitive work on the subject for decades. Stookey's contemporary Charles Elsberg further expanded the understanding of peripheral nerve physiology. Elsberg and others recognized the deleterious effect of strong traction on nerves. He advocated cutting back the proximal segment of a divided nerve until "normal funiculi are reached," for "the ideal apposition of the ends of the nerve would be one in which the cut end of each funiculus is placed exactly opposite to its corresponding end." Elsberg recommended the use of perineurial and epineurial sutures for nerve repairs and cautioned that "when they are tied, care should be taken that the sutures just bring the funiculi into apposition. If the sutures are tied too tightly, the funiculi are bent at their ends with a resulting poor approximation." Thus, he cautioned, "[T]he approximation should always be made without tension." Thus, out of the work of Stookey and Elsberg the main tenets of modern direct nerve repair were derived: cutting back of nerve injuries to normal nerve, the correct apposition of corresponding fascicles, the preference for loosely tied epineurial sutures, and the primacy of tension-free neurorrhaphy.

In France, many peripheral nerve injuries suffered by soldiers of the Fourth Army Corps in World War I also served as

Dr. Charles Elsberg

the basis for important clinical observations. Army surgeon Henri Delageniere and neurologist Jules Tinel evaluated a series of repaired and unrepaired nerve injuries. Tinel demonstrated that regenerating nerves were easily stimulated by minimal mechanical irritation and this

Dr. Barnes Woodhall

response could be followed in serial examinations over the course of regeneration, the well known "Tinel's sign".

World War II initially overwhelmed military surgeons with a vast number of casualties with peripheral nerve injuries. By the end of the War over 25,000 peripheral-nerve injuries were tallied among American troops. Colonel Glen Spurling recruited neurosurgeons specifically for this purpose. In 1944 the Surgeon General ordered the establishment of a Peripheral Nerve Registry under the direction of Barnes Woodhall. Woodhall characterized the registry as "an instrument both to evaluate the influence of newly developed technical procedures upon the immediate results of peripheral nerve repair." In 1956 he published the monumental study *Peripheral Nerve Regeneration: A Follow-up Study of 3,156*

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World War II Injuries. Woodhall and Haymaker memorialized their unparallelled clinical knowledge of nerve injuries in the book *Peripheral Nerve Injuries* that has stood as a definitive text fifty years later.

British military medical officers were similarly inundated by many peripheral nerve casualties and set out to record their cases and report the outcomes. The British established the modern clinical system of grading muscle strength so common with nerve injuries. Herbert Seddon was frustrated by his inability to classify the wide variety of nerve injuries with the clinical nomenclature of the time. In 1943 he divided nerve trauma into three types according to severity as neurapraxia,

Dr. Herbert Seddon

anxontmesis, and neurotmesis. Seddon's schema represented a major improvement over the terminology prior to 1940, but it was not reliably predictive of spontaneous recovery. Sydney Sunderland, an Australian orthopædist, treated hundreds of nerve injuries and devised a more detailed five-degree classification that addresses deficiencies that he perceived in Seddon's system. It is a testament to both Seddon and Sunderland that their terminology has remained in active use.

Military conflicts in the latter half of

Dr. Sydney Sunderland

the Twentieth Century added further refinements to the management of nerve injuries. The Korean War led to consolidation of hand surgery specialization, and the Vietnam engagement prompted improvements in reconstructive techniques and prostheses. Despite many advancements in understanding of and surgery for traumatic injuries of peripheral nerves over the past 150 years, recent military campaigns in the Middle East and in the Balkans serve to remind neurosurgeons that injuries of peripheral nerves remain very common. However, the clinical knowledge of traumatic neuropathies gained from past wars benefits all modern casualties.

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—*Submitted by Dr. Neal Naff.*

Lawrence Lariar: *The Army Fun Book*. Crown, 1943, page 130.

Cerebrations—*Remarks From the Program Director*

James M. Ecklund, M.D., F.A.C.S.

Neurosurgery in the National Capital Region remains exciting and promising as we enter 2000. The generous donations of our alumni and supporters have enabled us to continue our popular Visiting Professor Program. Last year we were delighted by visits from Dr. Beverly Walters from Brown University in August and Dr. Henry Brem from Johns Hopkins in October. Dr. Walters, who is Chairman of the A.A.N.S. Practice Guidelines Committee, delivered a lecture entitled, ''Literature Review and the Guidelines Process.'' She later challenged us all by conducting an informative journal club. Dr. Brem delivered outstanding presentations on ''Surgical Neuro-oncology'' and the ''Development of a Neurosurgical Research Laboratory.'' This spring we welcomed Dr. David G. Piepgras, Chairman of Neurosurgery at Mayo Clinic, on 8 May, and we look forward to Dr. Dan Barrow, Chairman of Neurosurgery at Emory and current President of the C.N.S., as Visiting Professor on 26 June. We extend an open invitation to all alumni and friends of our program to attend future presentations.

Dr. James Ecklund

In just a few months two new faculty members will join our program. Dr. Leon Moores will be returning as Director of Pediatric Neurosurgery after completing a fellowship in pediatric neurosurgery. Dr. Lisa Mulligan, who recently completed an epilepsy fellowship at Yale, will remain on the faculty after her graduation to replace Dr. Kaveh Khajavi as Director of Epilepsy and Functional Neurosurgery. Dr. Khajavi has done an outstanding job building both of these programs to the great benefit of our patients and residents. Dr. Jeff Poffenbarger will be graduating this spring and will be assigned to Brooke Army Medical Center in San Antonio. Dr. Richard Gullick will succeed Jeff as Chief Resident. The remainder of the resident team this spring will be Drs. Mike Rosner, Jonathan Martin, and Carrie Antoine. New residents Drs. Patrick Cooper and Michael Rolli will enter the residency this summer.

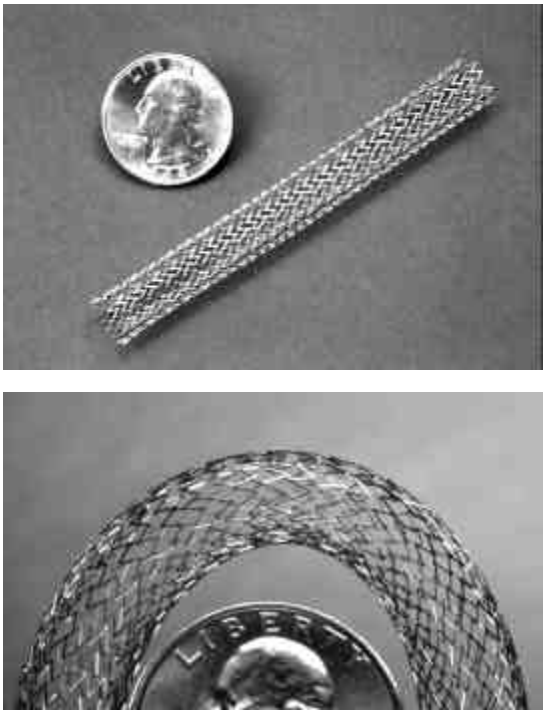
We also welcome Paula Rudy, a physician assistant, to the Neurosurgery Service. Paula has extensive neurosurgical experience, and her addition improves our clinic efficiency to better serve our patients. Paula also will assist Drs. Armonda, Naff, and Noonan in the neuro-interventional suite. This team is continuing to develop multidisciplinary, collaborative efforts for the management of cerebrovascular disease within the National Capital Area. The multidisciplinary cerebrovascular conference attended by Neurosurgery, Neurology, Vascular Surgery, Neuroradiology, and Cardiology is the last Monday each month and all interested individuals are encouraged to attend.

Dr. Eric Sipos and Dr. Geoff Ling organized our first annual research symposium last October which served to highlight the ongoing scholarly activity within our program. We encourage all interested individuals plan to attend our 2000 research symposium next fall. Our Twelfth Annual International Spine and Peripheral Nerve Workshop will be held this 4 through 13 June at the Uniformed Services University in Bethesda, Maryland. This outstanding hands-on workshop was founded by Dr. Peter Klara and continues today as a great resource for our residents and military neurosurgeons. We are also excited to host an alumni reception at the A.A.N.S. this spring as a follow up to our first alumni dinner at last years meeting.

Have a safe and healthy summer!

ENDOVASCULAR NEUROSURGERY: Role of the Stent

What began as "interventional neuroradiology" has been evolving into "endovascular neurosurgery" over the past 15 years or so. From the technique of balloon embolization perfected in the Soviet Union by Dr. Fedor A. Serbinenko, the armamentarium of endovascular procedures has expanded to include a variety of methods for managing craniocerebral lesions by way of their vascular channels. Besides detachable balloons the armamentarium includes a variety of other embolic materials (cyanoacrylate, polyvinyl or ethyl alcohol, silk and other microparticulates) and implantable devices such as platinum microcoils and stents.



The nitinol stent shows its flexibilty. This device was used in the case reported below to correct a carotid pseudoaneurysm.

Endovascular procedures often complement and do not necessarily replace conventional open approaches. Among craniocerebral diseases that lend themselves to endovascular methods can be counted intracranial aneurysms, vascular malformations, arteriovenous fistulæ, dissecting aneuryms, and atheromatous plaques. Super-selective catheterization permits injection of oncolytic drugs directly into neoplasms or devascularization of such tumors in preparation for resection. It is conceivable that micro-lasers may eventually find a role in treating intracranial lesions.

Many of the neuroradiologists affiliated with Walter Reed Army Medical Center and National Naval Medical Center are trained in interventional techniques described above. For the first time, two members of the Neurosurgery Staff are also qualified in endovascular procedures as well. The cooperation between Neuroradiology and Neurosurgery has led to a vibrant professional synergism in managing previously highly risky or inoperable conditions of the nervous system and its vasculature.

Below, Dr. Rocco Armonda presents a recent case that illustrates how placement of a stent in a carotid pseudoaneurysm is extending the therapeutic capabilities of neurosurgeons.

HISTORY: A 42-year-old man developed acute pain in the left face and mild droopiness of the left eyelid while exercising. He denied diplopia or any disturbance of speech. Computed tomography (CT) and magnetic resonance imaging (MRI) of the head were unremarkable. Subsequently, magnetic resonance angiography (MRA) of the head and neck showed bilateral dissections of the distal cervical segments of the internal carotid arteries. The left carotid dissection was associated with luminal stenosis (Figure 1), and the right carotid dissection had aneurysmal dilation. Digital subtraction cerebral angiography confirmed subintimal dissection of both prepetrous internal carotid arteries and a pseudoaneurysm on the left.

MANAGEMENT: Patient underwent three months of anticoagulation with Coumadin®. Follow-up MRA and cerebral angiography demonstrated a persistent left pseudoaneurysm and resolution of the right subintimal dissection. To lower the risk of thrombo-occlusive platelet aggregation and emboli during endovascular procedures he was premedicated with abciximab (ReApro®), a platelet receptor inhibitor. A temporary balloon occlusion test of the right internal carotid artery was performed without neurological deficits or asymmetry of the cerebral oxygenation index as monitored by a noninvasive, near-infrared cerebral oximeter. A soft-tipped, hydrophilic exchange wire was navigated passed the left pseudoaneurysm and a 6-mm by 20-mm, self-expanding, flexible, nickel-titanium stent (SmartStent®, Cordis, Johnson & Johnson) was deployed. The patient's activated clotting time was maintained at 25 to 30 seconds on heparin. After stent deployment, angiography showed delayed filling of the pseudoaneurysm. After 24 hours the abciximab and heparin were discontinued and the femoral sheath removed. Patient was discharged the following day without neurologic sequelæ. An angiogram at one month demonstrated complete obliteration of the pseudoaneurysm and no luminal stenosis (Figure 2). Patient remained on low-dose aspirin and Plavix® for three months after insertion of the stent.

DISCUSSION: Spontaneous craniocervical dissections are rare, and their bilateral occurrence should raise the suspicion for an arteriopathy such as fibromuscular dysplasia, Ehler-Danlos syndrome, Marfan syndrome, alpha-l-antitrypsin deficiency , type I collagen point mutations, and systemic lupus erythematosus. Cervicocerebral arterial dissections may follow minimal neck torsion or trauma associated with coughing, vigorous noseblowing, all varieties of sports activities, sexual activity, chiropractic manipulations, and administration of inhalational anesthet-

Figure 1. A pseudoaneurysm is present in the cervical segment of the left internal carotid artery at the base of the skull (large arrow).

ics. It is thought that extension and rotation of the neck compresses the internal carotid artery and leads to a dissection in the predisposed patient. The morbidity of carotid dissections in one study of 635 patients included 21% mild neurological deficits, 25% moderate-to-severe deficits, and 4% fatalities, while 50% of patients remained neurologically intact. Only 8% of carotid pseudoaneurysms healed on anticoagulant therapy, but cerebral infarction complicated 40% to 60% of cases not receiving anticoagulation. After six months of medical therapy recanalization occurred in 90% of cases presenting with arterial stenosis and 62% of those presenting with occlusion. According to these findings, stenting should be reserved for those patients who do not respond to medical therapy after a maximum of six months.

ROLE OF STENTING: Recent developments in endovascular stent technology now allow treatment of some arterial dissections while preserving the parent vessel. Open surgical repair including extracranial-intracranial bypass procedures is hazardous, for morbidity and mortality rates are reported as high as 53%. The application of newer metal alloys to stents has increased the safety of endovascular treatment of arterial dissections. Specifically, "nitinol", an alloy of nickel and titanium developed during the Vietnam war by the Naval Surface Warfare Center has the desirable properties of light weight, flexibility, and good diameter "memory", "crush-recoverability", and absence of fraying of the ends of stent during postdeployment dilatation. In experimental animals nitinol stents show minimal neo-intimal hyperplasia and inflammatory response. By combining stenting with the administration of gpIIb/IIIa platelet integrin receptor inhibitors, one can prevent the activation of platelets and thus the thrombotic and thromboembolic complications. Long-term benefits of these platelet inhibitors have also been observed in the cardiology literature where there was a decrease in mortality, recurrent myocardial infarction, and coronary restenosis. Follow-up of a series of seven patients who received carotid stents for large nonhealing pseudoaneurysms (four cases) and severe preocclusive stenosis (three cases). In six patients there was no evidence of restenosis after a mean of 20.2 months. One patient who underwent complete occlusion of the pseudoaneurysm with the use of a GoreTex®-covered stent had asymptomatic complete vessel occlusion at three months. Two of four patients with pseudoaneurysm had spontaneous occlusion of their pseudoaneurysm using stenting alone, one required GDC coiling, and one progressively thrombosed over 18 months.

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Figure 2 . A nitinol stent deployed in the right internal carotid artery has restored full patency of the lumen and obliterat ed the pseudoaneurysm.

How to contact the Neurosurgery Service:

Routine appointments
(888) 999-5195

Nurse Case Managers
(202) 782-8732
(202) 782-8756

Clinic Secretary
(202) 782-9800

Office of the Chief
(202) 782-9804

Facsimile (FAX)
(202) 782-0713 (office)
(202) 782-7622 (clinic)

Resident on Call & Emergencies
(202) 782-1000

Website
http://www.wramc.amedd.army.mil/departments/surgery/neuro

CALL FOR PHOTOGRAPHS

The Editor is collecting old photographs of the residents who trained at Walter Reed General Hospital. These pictures will be placed permanently in the residents' gallery of the Neurosurgery Service. A history of the neurosurgery residency at Walter Reed is planned in time for the fiftieth anniversary of the program.

Snapshots or portrait photos of the following individuals in uniform and contemporary with the time of residency are particularly desirable:

> *Wilbur G. Bingham, Jr.(1955-58), Marvin Richard Cressman (1961-65), Darwin John Ferry, Jr. (1965-69), Richard D. Hamilton (1956-60), William M. Hammon (1958-62), Wilbur F. Helmus, Jr. (1963-67), Severt Harold Jacobson (1970-74), James Scott Johnston (1973-76), Ludwig G. Kempe (1954-58), William Martin Klemme (1957-61), Bert G. Leigh (1954-58), Albert Nicholas Martins (1962-66), Harold C. Murphree (1955-59), Norwyn Robert Newby (1973-77), Archimedes Ramirez (1972-76), Donald Ray Smith (1966-70), Stanley Allen Shatsky (1974-78), John Courtney Slaughter (1967-71), George Michael Wiese (1969-73).*

The Editor also requests any group pictures of the WRGH Neurosurgery Service in the 1950's and 1960's and photographs of neurosurgeons who trained at National Naval Medical Center residents over the past thirty years.

Any original photographs or negatives sent to the Editor will be copied and returned promptly. The mailing address is Editor, *Gray Matters,* Neurosurgery Service, Walter Reed Army Medical Center, Washington, DC 20307-5001.

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