

HAND SURGERY

QUARTERLY



FROM THE PRESIDENT

The AAHS in Great Shape



ROBERT T.
BUCHANAN, MD

The Board of directors just concluded its yearly summer meeting. What we learned was that the organization is in excellent shape. In spite of the stock market collapse over the last year, we did better than most investors, even using our old investment strategy. We now have a new investment policy in place that should provide greater financial strength for the AAHS. Because of this, we are able to offer even more for less at the upcoming annual meeting in January. Watch for further information.

The program for the January 2002 meeting was finalized at the Board meeting. The theme this year is "Controversies in Hand Surgery and Therapy." The first day will deal with various problems where there are markedly different approaches to therapy or care. The controversy theme will continue throughout the rest of the meeting in the panels and instructional courses. International guests with new and innovative ideas will add to the program throughout. Guest speakers will

discuss hand transplantation and the Mayan culture that thrived around Cancun, and whose ruins can still be seen. Drs. Bob Acland and Russell Shatford will also present a 3-D Anatomic Video demonstration. We have expanded the instructional courses and increased the number of free papers, giving everyone more opportunities to learn about the subjects of interest to him. Many of the papers are presented in concurrent sessions but organized so that most participants will not have

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to miss anything that interests them. At the same time, we have made sure that everyone has ample time to enjoy the beautiful area and the many activities in and around Cancun.

Our committees have all been active. Thanks to the

**Time to make plans
to attend the 32nd
Annual Meeting. For
a first look at the
programs for the
AAHS, as well as the
ASRM and ASPN
meetings, turn to
page 4.**

Internet and Education Committees we have new content on the Web Site for both members and the public. The public information is designed to attract people to the site because of the quality of the information, and, then, allow them to find a member as a means of referral. Other changes will make the site more user friendly and helpful. Communication among members, staff, and the Board is being improved thanks to the work of several other committees. The By-laws and

continued on page 13

AAHS: Making the World a Better Place

As we end another bounteous summer in America, it is appropriate to take stock of our blessings, and our responsibilities. We live in an increasingly networked

world. John Donne's famous poem, "No Man is an Island" has never been more literally true. So, where are we, and where is AAHS, on the world stage? How are we doing, and can we do more?

The IFSSH held its 8th triennial meeting in Istanbul this past June. AAHS was represented as usual on the IFSSH Council. The main topic of discussion for the Council was the selection of the 10th triennial meeting location. After considerable discussion of the merits of the three contenders, Korea, Argentina/Brazil, and Australia, Sydney, Australia was chosen as the site for the 2007 meeting. The selection was based primarily on the factors of location (a continent that has not yet hosted an IFSSH Congress), cost (many were concerned about the high registration fees in Istanbul, which may have depressed attendance), and the possibility of enhanced cooperation with IFSSH, which unfortunately was suboptimal in Turkey due to the newness of the Turkish Hand Therapy society.

The IFSSH continues to serve its purpose of uniting world hand surgeons. Meeting their needs is a tricky balancing act. The poorer regions of the world hold most of the people, few of the doctors, and even less of the medical resources. These regions need access to basic

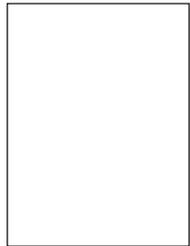
hand care and education. One of the frequently expressed concerns in Istanbul was that the high cost of the meeting is a barrier to participation by surgeons from poorer countries. The more developed regions hold less people but do have the lion's share of hand resources, and the surgeons there express a need to access high technology solutions for sophisticated hand problems, and updates on the latest research. Meeting the needs of both groups is no simple task, and it is not clear that a single triennial IFSSH Congress is the right solution.

Integration of hand surgeons and hand therapists at international congresses continues to be problematic as well. Both in Vancouver and in Istanbul, 'separate but equal' IFSSH and IFSSH meetings were held, with completely separate programs and registration processes for surgeons and therapists. Hand surgery and hand therapy may be integrated in the clinic, but full integration has yet to reach the international congress hall. Coordination of the combined half day IFSSH-IFSSH meetings in Istanbul was less than ideal, with changes being made to the schedule up to a few weeks before the meeting.

We can all be proud of AAHS's approach to the issues that confront IFSSH. AAHS remains unique in its tight integration of hand surgeon and hand therapist in all activities. AAHS also has a unique outreach program, funded by the Vargas award, which provides clinical and educational support to underserved regions of the world. The Vargas award is named for the late IFSSH Secretary General and AAHS member, Miguel Vargas-Busquets, who worked tirelessly to keep the needs of the underdeveloped regions of our planet squarely in the sights of the international hand surgery community. We should not forget, however, that AAHS past President Bob Demuth was also a key figure. He

kept the concept of educational outreach alive at the AAHS Board for many years before the Vargas program began. The untimely death of Mickey Vargas was the final catalyst to put the program in place, and it has grown to be a major expression of the educational mission of AAHS, one that allows our member surgeons and therapists to give something back to a world that has been so generous in showering resources on our fortunate land. We can also be proud of all those AAHS surgeons and therapists who have participated in these annual occasions for giving of time and talent, which have taken AAHS beyond North America, not only to Europe and Asia, but also to two continents that IFSSH has yet to visit: Africa and South America.

In 2002, AAHS will have an opportunity to reach out again within our own continent to our neighbor to the south, Mexico. A



PETER C. AMADIO, MD

HAND SURGERY QUARTERLY

President

Robert T. Buchanan, MD

Editor

Peter C. Amadio, MD

Executive Director

Laura Downes Leeper, CAE

Managing Editor

Anne B. Behrens

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bilingual program is planned for our annual meeting, with special provisions for hand surgeons and therapist whose means may be modest, but whose appetite for learning knows no bounds. These AAHS programs are unique not only in the time and talent AAHS members devote to outreach, but also in the generous support which our society provides to them, with an eye not to the financial bottom line but to a bottom line far more profound: doing what is right to fulfill our mission as surgeons, as therapists, and as humans who share a planet with many people less fortunate than ourselves.

Yet we can do more. Especially with our neighbors in Latin America, AAHS has a special opportunity to provide even more educational opportunities for young hand surgeons and therapists. President-elect Alan Freeland, like his predecessor Bob Demuth, is a true internationalist, and has forged ties with many hand surgeons in Latin America. Closer ties between AAHS and our Latin American neighbors can only benefit both groups. We, American hand surgeons and hand therapists, can expand our horizons and perform services of immense value to people with limited or no access to hand care which we take for granted. I do hope that all AAHS members will join Alan in volunteering their time and talent when called upon, to share their gifts of knowledge and opportunity to improve the lot of the many citizens of our planet who suffer from hand injury, deformity, or disease. And may each of you have a healthy and happy Labor Day holiday. **H**

"Bridging the Hemispheres"

32ND ANNUAL MEETING

It's never too early to start thinking about next year's annual meeting. The association will hold its 32nd Annual Meeting January 9-12 at the Hilton Beach and Golf Resort in sunny Cancún, Mexico. The Program Committee has developed a preliminary schedule of events that will allow for a combination of education and warm weather recreation.



Cancún offers a wealth of Mayan cultural legacies, including Tulum, Xel-Há, Xcaret, Chichen Itza, and other appealing places like Cozumel and Isla Mujeres just an hour or less away.

HOTEL INFORMATION

The 31st Annual Meeting will be held at the Hilton Cancun Beach and Golf Resort. Situated at the tip of the Yucatán Peninsula, the resort covers 233 acres in the heart of Cancún's Zona Hotelera. Angled to take in panoramic views, all guest rooms and suite feature terraces or balconies for outdoor relaxation. The hotel adds an extra level of

pampering at its Beach Club, 80 rooms housed in low-rise villas. The resort's seven cascading pools form a dazzling aquatic complex, highlighted by two whirlpools and a swim up bar. Other facilities include a full service fitness center, two lighted tennis courts, a scenic golf course and a water sports center.

Rates: \$220.00 for the Ocean View Room; \$270.00 for the Royal Beach Club Room. Reservations can be made by calling Mary Jo Harrold at the AAHS Central Office (312) 236-3307. Please be sure to mention you are attending the AAHS Annual Meeting. Members are encouraged to make their reservations early.

In addition to the Hilton, rooms have been reserved at the Ritz-Carlton Cancún. Standing on over seven acres of the Yucatán Peninsula, this luxurious ocean-front property is finely decorated in marble, antiques and chandeliers. All rooms have private balconies providing guests a magnificent view of the ocean. The hotel's amenities provide comfort, entertainment and fine dining in addition to lighted tennis courts, fitness center and spa. The Ritz is located in close proximity to the Hilton.

*Rates: \$285.00 for the Deluxe Ocean View Room. Reservations can be made by calling the Ritz Carlton directly 011 52 98 81 0808. Please be sure to mention you are attending the AAHS Annual Meeting. **H***

AAHS 32nd Annual Meeting

January 9-12, 2002
Hilton Cancún Beach & Golf Resort
Cancún, Mexico

Program at a Glance

AAHS

Wednesday, January 9, 2002

6:00 am–4:00 pm	Speaker Ready Room
6:00 am–2:30 pm	Registration
6:00 am–7:30 am	Continental Breakfast
6:20 am–2:15 pm	Concomitant Spanish Session
7:35 am–7:40 am	President's Welcome <i>Robert Buchanan, MD</i>
7:40 am–7:45 am	Program Chair Welcome <i>Miguel Saldana, MD</i>
7:45 am–8:00 am	Hand Therapy Introductions <i>Paul LaStayo, PhD, PT, CHT</i>
8:00 am–9:00 am	Panel: Pain
9:10 am–10:20 am	Panel: Fractures/Instabilities
10:20 am–10:40 am	Coffee Break
10:45 am–11:45 am	Panel: Tendon
11:45 am–12:15 pm	Boxed Lunch
12:20 pm–1:20 pm	Panel: Nerve
1:25 pm–1:58 pm	"Hooked on Evidence": Evidence-Based Practice
1:58 pm–2:00 pm	Hand Therapy Closing remarks
2:00 pm	AAHS Adjourns
2:15 pm–5:15 pm	AAHS Board Meeting
1:00 pm–5:00 pm	Poster Set Up
6:30 pm–7:30 pm	AAHS Welcome Reception

AAHS

Thursday, January 10, 2002

6:00 am–4:00 pm	Speaker Ready Room
6:00 am–2:30 pm	AAHS Registration
6:00 am–7:00 am	Coffee
6:15 am–7:10 am	Instructional Courses 101-104
7:00 am–5:00 pm	Posters Open
7:15 am–7:30 am	Report from the 2001 Vargas Award Winner <i>Gail Groth, OTR, CHT</i>
7:30 am–8:38 am	Scientific Paper Session A
8:38 am–8:53 am	Continental Breakfast
8:53 am–10:35 am	Concurrent Scientific Paper Session B-1
8:53 am–10:35 am	Concurrent Scientific Paper Session B-2

10:35 am–10:50 am	Break
10:50 am–11:35 am	International Panel I: Vascularized Bone Grafts
11:40 am–12:40 am	Working Lunch Instructional Courses 105-108
12:40 pm–1:10 pm	AAHS Keynote Speaker <i>Linda Cendales, MD</i>
1:15 pm–2:00 pm	Scientific Paper Session B-3
2:00 pm	Adjourn
6:30 pm–9:00 pm	Dine-Around

AAHS

Friday, January 11, 2002

6:00 am–4:00 pm	Speaker Ready Room
6:00 am–12:00 pm	AAHS Registration
6:00 am–7:00 am	Continental Breakfast
6:15 am–7:15 am	Instructional Courses 109-112
7:00 am–5:00 pm	Posters Open
7:20 am–8:28 am	Scientific Paper Session C
8:30 am–1:00 pm	Exhibits Hall Open
8:30 am–9:00 am	Refreshment/Exhibits Break
9:00 am–10:08 am	Concurrent Scientific Paper Session D-1
9:00 am–10:08 am	Concurrent Scientific Paper Session D-2
10:10 am–11:20 am	Concurrent Scientific Paper Session F-1
10:10 am–11:20 am	Concurrent Scientific Paper Session F-2
11:21 am–11:36 am	Break
11:37 am–11:42 am	ASSH President <i>Marybeth Ezaki, MD</i>
11:43 am–12:28 pm	Presidential Speaker <i>Mayan Lecture</i>
12:29 pm–12:44 pm	Presidential Address <i>Robert Buchanan, MD</i>
12:45 pm–1:30 pm	AAHS Business Meeting
1:30 pm	Adjourn
1:45 pm–2:30 pm	AAHS Board Meeting
2:45 pm–6:15 pm	ASRM Council Meeting
5:00 pm–9:00 pm	ASPEN Poster Set Up
6:30 pm–9:30 pm	ASPEN Council Meeting

AAHS/ASPEN/ASRM

Joint Day Program

Saturday, January 12, 2002

6:30 am–5:00 pm	Speaker Ready Room
6:30 am–7:00 am	Coffee
6:30 am–4:30 pm	AAHS/ASRM/ASPEN Registration
7:00 am–8:00 am	Instructional Courses 201-204
7:00 am–5:00 pm	Posters Open
8:00 am–8:15 am	Presidents' Welcome <i>Robert Buchanan, MD, AAHS President</i> <i>Randy Sherman, MD, ASRM President</i> <i>Nancy McKee, MD, ASPEN President</i>
8:15 am–9:45 am	Joint Panel: Nerve Entrapment Controversies

- 8:00 am–1:00 pm Exhibit Hall Open
- 9:45 am–10:30 am Presidents' Lecturer
Bob Acland, MD and Russell Shatford, MD
- 10:30 am–11:15 am Coffee/Exhibits Break
- 11:15 am–12:15 pm Joint Outstanding Nerve Paper Presentations
- 12:15 pm AAHS and ASRM Adjourn
- 12:15 pm ASPN Breaks
- 12:45 pm Golf Tournament - Hotel Departure
- 12:00 pm– 5:00 pm AAHS Poster Tear Down
ASRM Poster Set Up
- 1:00 pm–6:00 pm ASRM Resident/Fellows Symposium
- 1:00 pm–5:00 pm ASPN Scientific Session
- 1:00 pm–2:00 pm Guest Speaker
Freda Miller
- 2:00 pm–3:30 pm Scientific Session E
- 3:30 pm–4:00 pm Coffee Break
- 4:00 pm–5:00 pm Guest Speaker
Bruce Gold
- 7:00 pm–10:00 pm AAHS/ASRM/ASPN Dinner Reception

ASPN Sunday, January 13, 2002

- 6:30 am–2:00 pm ASPN Registration
- 6:30 am–7:00 am Coffee
- 7:00 am–8:00 am Instructional Courses 401-403
- 7:00 am–5:00 pm Posters Open
- 8:00 am–8:15 am Welcome
*Nancy McKee, MD, President
Rajiv Midha, MD, Program Chair*
- 8:15 am–9:00 am Guest Speakers
Susan Lederman
- 9:00 am–10:30 am Scientific Session F
- 9:00 am–2:00 pm Exhibit Hall Open
- 10:30 am–11:00 am Coffee Break/Exhibits
- 11:00 pm–12:00 pm ASRM/ASPN Nerve Panel: Survey and Perspectives On Recent and Novel Nerve Repair Methods and Technologies
- 12:00 pm–1:15 pm Scientific Session G
- 1:15 pm–2:15 pm Mayan Speaker Lunch
- 2:15 pm–3:45 pm Panel: Innovations in Peripheral Nerve Surgery
- 3:45 pm–5:15 pm Scientific Session H
- 5:15 pm–6:00 pm ASPN Business Meeting

ASRM Sunday, January 13, 2002

- 6:30 am–5:00 pm Speaker Ready Room
- 6:30 am–7:00 am Continental Breakfast
- 6:30 am–2:00 pm ASRM Registration
- 7:00 am–5:00 pm Posters Open
- 7:00 am–7:08 am President's Welcome
Randy Sherman, MD

- 7:08 am–7:15 am Program Chair's Welcome
Lawrence Colen, MD
- 7:15 am–8:15 am Panel I: Microsurgical Applications to Genitourinary Reconstruction
- 8:16 am–10:15 am Scientific Paper Session A
- 9:00 am–2:00 pm Exhibit Hall Open
- 10:15 am– 11:00 am Coffee/Exhibits Break
- 11:00 am–12:00 pm ASRM/ASPN Nerve Panel: Survey and Perspectives on Recent and Novel Nerve Repair Methods and Technologies
- 12:01 pm–1:45 pm Scientific Paper Session B
- 1:45 pm Adjourn
- 6:30 pm –9:00 pm Dine Around

ASRM Monday, January 15, 2002

- 6:30 am–5:00 pm Speaker Ready Room
- 6:30 am–2:30 pm ASRM Registration
- 6:30 am–7:00 am Continental Breakfast
- 7:00 am–8:00 am ASPN Incoming Council Meeting
- 7:00 am–8:00 am Instructional Courses 301 - 304
- 7:00 am–1:00 pm Posters Open
- 8:00 am–9:00 am Panel II: "Past Presidents" Panel
- 8:30 am–1:30 pm Exhibits
- 9:00 am–9:45 am Godina Lecture
William Zamboni, MD
- 9:45 am–10:30 am Coffee/Exhibits Break
- 10:30 am–12:45 pm Concurrent Scientific Paper Session C-1
- 10:30 am–12:45 pm Concurrent Scientific Paper Session C-2
- 12:45 pm–1:15 pm Boxed Lunch in Exhibit Hall
- 1:00 pm–5:00 pm Audio Visual Theater
- 1:15 pm–2:15 pm Panel III: Aesthetic Applications of Microsurgery
- 2:15 pm–2:45 pm Founders' Lecture
Robert Russell, MD
- 2:45 pm–3:30 pm ASRM Business Meeting

ASRM Tuesday, January 16, 2002

- 6:30 am–7:00 am Continental Breakfast
- 6:30 am–12:00 pm ASRM Registration
- 7:00 am–8:00 am Instructional Courses 305 - 308
- 7:00 am–12:30 pm Posters Open
- 8:00 am–9:00 am Panel IV: What to Do When the Free Flap Fails
- 8:00 am–12:30 pm Audio Visual Theater
- 9:00 am–1:00 pm Concurrent Scientific Session D-1
- 9:00 am–1:00 pm Concurrent Scientific Session D-2/3-Minute Presentations
- 1:00 pm Adjourn
- 1:15 pm–3:45 pm ASRM Council Meeting

Paradigm Shifts in Hand Therapy/Surgery: Challenge to Sacred Cows

AAHS Annual Meeting, Wednesday, January 9, 2002

6:00 am–7:30 am	Continental Breakfast		
6:20 am–2:00 pm	Concomitant Spanish Session		
7:35 am–7:40 am	President's Welcome <i>Robert Buchanan, MD</i>		
7:40 am–7:45 am	Program Chair Welcome <i>Miguel Saldana, MD</i>		
7:45 am–2:00 pm	Paradigm Shifts in Hand Therapy/Surgery: Challenge to Sacred Cows		
7:45 am–8:00 am	Hand Therapy Introduction <i>Paul LaStayo, PhD, PT, CHT and Richard Brown, MD</i>		
8:00 am–9:00 am	Panel: Pain <i>Moderator: Paul LaStayo, PhD, PT, CHT</i> Should we and can we assess? <i>Maureen Hardy, PT, MS, CHT</i> Modalities: Voodoo or valid? <i>Sue Michlovitz, PhD, PT</i> Go ahead, just denervate! <i>Richard Berger, MD</i> RSI: The ongoing controversy <i>Christine Novak, PT, MS</i>		
9:10 am–10:20 am	Panel: Fractures/Instabilities <i>Moderator: Georgiann Laseter, OTR, FAOTA, CHT</i> Anatomic reduction: Is it needed in elderly? <i>Marc Cohen, MD</i> Limited carpal fusions ... limited role? <i>A. Lee Osterman, MD</i> ORIF vs External fixator Cancun Style <i>Georgiann Laseter, OTR, FAOTA, CHT</i> Break it, then make it <i>Maureen Hardy, PT, MS, CHT</i>		
10:20 am–10:40 am	Break		
10:45 am–11:45 am	Panel: Tendon <i>Moderator: Scott Kozin, MD</i> Tendonitis vs. Tendinosis <i>Sue Michlovitz, PhD, PT</i> Tennis elbow: Can we treat arthroscopically? <i>Marc Cohen, MD</i> Controversies in Tendon Surgery <i>A. Lee Osterman, MD</i> Tendon rehab, Lags rule <i>Paul LaStayo, PhD, PT, CHT</i>		
		11:45 am–12:15 pm	Boxed Lunch "Lets Talk": How therapists and surgeons communicate <i>Starring Scott Kozin, MD vs Sue Michlovitz, PhD, PT with Ken Flowers, PT moderating</i>
		12:20 pm–1:20 pm	Panel: Nerve <i>Moderator: A. Lee Dellon, MD</i> The what, where and why of sensory re-ed <i>Christine Novak, PT, MS</i> Entubation-type repairs <i>Richard Brown, MD</i> PT for CTS, what's the deal with that? <i>Ken Flowers, PT</i> EMG/NCV vs sensory testing <i>A. Lee Dellon, MD</i>
		1:25 pm–1:58 pm	"Hooked on evidence": Evidence-based practice <i>Moderator: Sue Michlovitz, PhD, PT</i> Surgical Solutions <i>Scott Kozin, MD</i> TERT or not, that is the question (hierarchy of splints) <i>Ken Flowers, PT</i> So how am I doing so far? A therapist's perspective <i>Georgiann Laseter, OTR, FAOTA, CHT</i>
		1:58 pm–2:00 pm	Closing <i>Paul LaStayo, PhD, PT, CHT and Richard Brown, MD</i>

Faculty

Surgeons:

Richard Berger, MD
Richard Brown, MD
Marc Cohen, MD
A. Lee Dellon, MD
Scott Kozin, MD
A. Lee Osterman, MD

Therapists:

Ken Flowers, PT
Maureen Hardy, PT, MS, CHT
Georgiann Laseter, OTR, FAOTA, CHT
Paul LaStayo, PhD, PT, CHT
Sue Michlovitz, PhD, PT
Christine Novak, PT

Hand Therapy and CRPS (RSD)

Keith A. Bengston, MD

I was recently reading an article in the *Journal of Hand Therapy* regarding Complex Regional Pain Syndrome (CRPS) a.k.a. Reflex Sympathetic Dystrophy (RSD).^{*} This article took me through a brilliant description of the terminology controversy in CRPS, the proposed pathophysiology of the syndrome, and the use of various injections for treating the pain symptoms. As I was reading this cogent review, I kept thinking, "When are they going to talk about hand therapy?" Of course, the author, being an anesthesiologist, stuck to his area of expertise and did a nice job within his realm. Nonetheless, this was the "Journal of Hand Therapy" and I was hoping to read more about physical therapeutic measures.

This is symptomatic of the underlying problem in the way we treat CRPS patients. It seems more interesting to discuss aggressive interventions which produce dramatic results (albeit short-lived) than to study the pain-staking, incremental results seen in hand therapy. In reality, the most important person treating CRPS is the hand therapist. Certainly, a well-timed and well-placed injection or two may help move a recalcitrant case toward recovery or speed the rehabilitation process. However, 95% of the cure comes directly from the work of the hand therapist with the patient. Unfortunately, 95% of the medical literature is written by

anesthesiologists, neurologists, or hand surgeons. Only a handful of articles have been contributed by hand therapists. Something is wrong with this picture.

Here are some of the topics that hand therapists could delve into. First of all there are pain-relieving modalities. In CRPS many patients present with pain as their primary complaint. How successful are we in treating this symptom? Sure, there were some studies done 30 years ago on TENS and causalgia, but what about contrast baths,

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HAND THERAPY.

Fluido-therapy, desensitization techniques, or other forms of electrical stimulation? How do physical modalities compare with pain medications or injections?

Next there are anti-edema techniques. The amount of edema is easy to quantify with volumetric measurements, so it is relatively simple to follow our progress in this regard. How aggressive should we be with compression garments

or even with compressive pumps? Should compressive sleeves be worn in the daytime only or 24 hours per day?

Then there are range-of-motion and strengthening exercises. How much is too much? Should we be using ultrasound with our range-of-motion exercises or does this exacerbate the problems of pain and edema?

Finally, is it necessary to keep the patient pain-free during their rehabilitation process or is it better to be aggressive with therapy before stiffness and abnormal engrams set in? On the horizon are the new techniques of constraint-induced motion therapy and other neuromuscular re-education techniques. Do these have a role to play in treating CRPS?

The point is that hand therapists hold the key in the treatment of CRPS and they should act like it. Hand therapists need to increase their visibility in this area. They should be doing studies, publishing articles, and giving talks. Everyone should know that the hand therapist is the first person to call when one sees a patient with CRPS. **H**

^{*}Manning DC: Reflex sympathetic dystrophy, sympathetically maintained pain, and complex regional pain syndrome: Diagnoses of inclusion, exclusion, or confusion. *J Hand Ther* 13(4):260-268.

Lorraine Jensen, PT, CHT

Personal: I grew up in Rochester, New York, on the Lake Ontario shore, but came to another Rochester in Minnesota in 1964 to attend PT school and have lived here since. I have been married 35 years and have a grown son and daughter. My husband is retired. I enjoy golfing, bicycling, gardening and taking trips.

Education: I received a BS degree from Bowling Green State University in Ohio and in 1966, graduated from The Mayo School of Physical Therapy. I became a Certified Hand Therapist in 1992.

Employer: I have been associated with the Mayo Clinic for 35 years. I've worked in an acute care hospital, rehab, and general outpatient settings. I became especially interested in hand patients almost 20 years ago and since then have worked as a hand therapist. I work with 7 hand surgeons, 6 hand physiatrists and about a dozen hand therapists. Our therapy practice is large (about 150 PTs and OTs combined) and draws patients who are diverse, both in population and in types of diagnosis.



LORRAINE JENSEN, PT, CHT

AAHS Involvement: I have been a member for over 10 years. I submitted a poster in 1995 at the annual meeting in Marco Island. This year I have contributed to the AAHS web page and as a member of the Educational Committee reviewed abstracts submitted for this year's meeting.

Best Part of My Job: Of course, working with patients and helping them improve their function and "get their life back" is why we are all here and *that* is the best part of my job. I have a variety of patients, from those with tendonitis to those with complex tendon injuries, fractures and brachial plexus reconstructions. I am also very fortunate to work with excellent physicians and a group of therapists who are smart, talented, dedicated and fun to work with.

Major Accomplishments: I am an assistant supervisor for the Physical Medicine and Rehabilitation Outpatient Department. This requires administrative tasks every day such as staffing, doing committee work and keeping the department running efficiently. Meeting these requirements of my job and continuing to provide optimal care to my patients as a clinician has been a major accomplishment for me.

Clinical Specialties: I enjoy working with patients diagnosed with Complex Regional Pain Syndrome. I think hand therapists have much to offer these patients. I've learned there is no "quick fix" for this condition, but that understanding the condition, using gentle therapy techniques and being patient ourselves will help our patients recover.

Greatest Challenge: We as therapists are constantly being asked to do more. Reimbursement issues and documentation requirements continue to add to the duties of our workday. Meeting these requirements without taking valuable time away from our patients is a growing challenge.

Three Words That Describe Me: Conscientious, competent and caring. **H**

Brachial Plexus

In this roundtable, we will discuss all aspects of brachial plexus injury and its management. It is our hope that the AAHS membership will find the information provided to be useful in managing these challenging problems. Our moderator is **Allen T. Bishop, MD**, Professor of Orthopedic Surgery, Mayo Medical School and Chair, Division of Hand Surgery, Department of Orthopedic Surgery, Mayo Clinic. The members of the panel include **Scott Kozin, MD**, Associate Professor of Orthopaedic Surgery, Temple University, and Hand Surgeon, Shriners Hospital for Surgery, Philadelphia, PA; **Julia Terzis MD, PhD, FRCS (C)**, Professor of Surgery, Division of Plastic and Reconstructive Surgery, Eastern Virginia Medical School, Norfolk, VA; **Scott W. Wolfe, MD**, Attending Surgeon, Hospital for Special Surgery and Weill-Cornell Medical College, New York, NY; and **Denise Kinlaw, PT**, Assistant Professor of Physical Therapy, Mayo School of Health-Related Sciences – Program in Physical Therapy, and Hand Therapist, Mayo Clinic Hand Center, Rochester, MN.

Dr. Bishop: Dr. Wolfe, would you please summarize the types of injuries encountered in adult brachial plexus trauma?

Dr. Wolfe: Brachial plexus injuries are usually divided into either supraclavicular or infraclavicular lesions. Generally in the adult population these injuries are high energy or multisystem trauma, and present as a complete plexus palsy with a flail and insensate arm. As a rule the supraclavicular injuries involve avulsion of some or all of the major roots from the spinal cord, with complete avulsion being the most common type. The roots that aren't avulsed are frequently ruptured at a very high trunk level.

In contrast, lower energy injuries, such as those occurring when skiing or kayaking, are generally infraclavicular lesions. We see these often with glenohumeral joint trauma. These generally have a better prognosis than supraclavicular injuries. Finally, terminal branch injuries, such as isolated injuries to the axillary or the musculocutaneous nerve, can also occur with proximal humeral trauma or glenohumeral dislocations and have a good prognosis for recovery. Isolated palsies of one or more terminal nerve branches, which occur in the absence of trau-

ma, are frequently referred to as Parsonage-Turner syndrome or Parsonage-Turner neuritis.

Dr. Bishop: Dr. Terzis, what are the most common mechanisms of injury in your experience?

Dr. Terzis: My experience was published in the *Journal of Plastic and Reconstructive Surgery* on October 1999. This study presented the outcomes of microsurgical reconstruction in 263 patients operated for brachial plexus injuries. Evaluation of the outcome was done in 204 patients who had a follow-up of two years or longer. High velocity motor vehicle accidents were the most common cause of injury—speeds at which the accidents occurred ranged from 25 to 120 mph (mean 54.5 ± 25 mph). A total of 73 patients (36 percent) had motorcycle accidents, 46 (23 percent) were traumatized in car accidents (drivers or passengers), and 10 patients were hit by a vehicle (pedestrians). Twenty patients were paralyzed secondary to gunshot wounds, whereas in 55 patients (27 percent) the causal factor was an accident at work or other type of injury.

Dr. Bishop: Not infrequently, I encounter cases with supraclavicular injury in whom I have found these root or trunk injury injuries

combined with terminal branch pathology. Is this also your experience, Dr. Wolfe?

Dr. Wolfe: Absolutely. There are tethers of several of the terminal branches at different levels that may be responsible for a segmental injury to a terminal branch. In the example you cited, the musculocutaneous nerve is tethered at the coracobrachialis, the axillary nerve as it winds below the neck of the humerus, and the suprascapula nerve at the spinoglenoid and suprascapular notches. Therefore, the same traction injury that results in avulsion at the cord level can result in a secondary injury at the distal level as well.

Dr. Bishop: Unfortunately, in many cases the patient will sustain polytrauma due to the high energy nature of the injury. Dr. Terzis, please comment on the associated injuries one may encounter.

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ONE OF THE
ADVANTAGES OF
INTERCOSTAL DIRECT
NERVE CROSSING
IS THAT ONE CAN
PLACE THE POINT OF
NERVE REGENERATION
VERY CLOSE TO THE
MOTOR END PLATE
OF THE BICEPS
MUSCLE.

ALLEN T. BISHOP, MD

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Dr. Terzis: Coexistent fractures and/or dislocations of the upper extremity and vascular injuries correlated with extended multi-level lesions of the brachial plexus components. A total of 117 patients (57 percent) had some type of fracture in the involved extremity, and seven patients had

shoulder dislocation. Fifty-seven patients (28 percent) presented with an associated vascular injury. The majority of these vascular lesions involved the subclavian or the axillary vessels (69 percent).

The majority of the patients had multiple trauma, which in some cases was life threatening. In cases of thoracic injury, further investigation with x-rays was done to rule out rib fractures; preoperative needle electromyograms were performed to determine whether the intercostal nerves neighboring fractured ribs were good candidates as donors for neurotization. Eighty-six patients (42 percent) experienced a loss of consciousness.

Finally, 137 patients had involvement of other organ systems, including 73 percent with head trauma, 25 percent with abdominal injury, and 39 percent with thoracic injury.

Dr. Bishop: So it is very important to recognize, first of all, the need for basic resuscitation and assessment of the entire body, and to be mindful of the very high frequency of vascular trauma.

Dr. Wolfe: The converse of that is that frequently in the face of severe systemic injuries the plexus is overlooked until later.

Dr. Kozin: It is also very difficult when a brachial plexus injury is combined with tetraplegia or a spinal cord injury. Then the differential diagnosis is sometimes hard to make despite multitudes of tests because they may be partially paralyzed and partially spastic.

Dr. Bishop: Ms. Kinlaw, what is the role of hand therapy following traumatic plexus injury in the period of time before they have had reconstructive surgery?

Ms. Kinlaw: Shoulder support is the first emphasis, via sling or other orthotic support that prevents attenuated capsule and subluxed shoulder. Second, maintain range of motion in all of the joints, with the possible exception of the shoulder. If, for example, there has been an incomplete avulsion of C5, C6, then we don't want to do stretching above the level of about 100 or 120 degrees or we may cause further injury. Care needs to be taken to avoid also overstretching the scapulothoracic joint when exercising the gleno-humeral joint.

Range of motion to the elbow, wrist and hand, again, depending upon the level, must be done passively if the muscles are completely denervated, active assistively if partially denervated or actively if the innervation is spared. Active exercises are encouraged to make sure that the muscles that are left innervated are exercised and maintain their strength as much as possible.

For the person who is completely flaccid, splinting may be necessary to maintain the hand and the wrist in a position of function so that unnecessary contractures don't develop. This is especially important if they are going to have some surgeries in the future where tendon transfers may augment the hand and wrist function or neurotized free muscle transfers may be

done to help to restore some upper extremity function in the patient with a complete brachial plexus avulsion.

Dr. Bishop: Thank you, Ms. Kinlaw. Dr. Kozin, what are the causes and risk factors associated with birth-related or obstetric brachial plexus trauma? What kind of injury patterns do you encounter?

Dr. Kozin: Most obstetrical palsies are secondary to traction, similar to adult injuries, just traction applied in a different method. Traction often occurs during shoulder dystocia and passage through the birth canal. However, we have seen plexus injury following Cesarean section and vaginal delivery. The typical child is of large birth weight and the child's mother may have had gestational diabetes, and the delivery is often difficult and vacuum extraction or some kind of forceps may have been used.

Dr. Bishop: What is meant by "Erbs palsy"?

Dr. Kozin: Erbs palsy classically describes a lesion involving C5 and C6 or the upper trunk. "Extended Erbs" implies inclusion of C7. "Duchenne" means a C8 and T1, although that is very uncommon. Lastly, "global" implies involvement of the entire plexus and a severe injury with a combination of ruptures and avulsions.

Dr. Terzis: Have you ever seen an isolated C8-T1 (Klumpke) lesion?

Dr. Kozin: In obstetrical palsy, a lower trunk injury of C8 and T1 has been described during a breech delivery with the arm abducted above its head or a child being delivered by C-section and pulled out by the arms. These positions place preferential strain across the lower plexus.



FOR UPPER TRUNK
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SCOTT KOZIN, MD

Dr. Bishop: Ms. Kinlaw, what kind of problems might be seen in a child with the typical upper trunk or Erbs type palsy after an obstetrical injury? What are the most important aspects of therapy for those children?

Ms. Kinlaw: For those children, we usually observe that the shoulder is internally rotated and the arm is at the side. There is the absence of shoulder motion because of the involvement of the upper trunks. So the patient is unable to flex, abduct and externally rotate the shoulder. But because there is sparing of the muscles of shoulder internal rotation, such as the latissimus dorsi, the shoulder rests in an internally rotated position. The forearm rests in pronation because the segment involved in pronation is C7, which is spared in Erb's palsy. The patient is unable to flex the elbow because C5-C6 nerve roots innervate the elbow flexors.

My practice is to try and maintain range of motion in the extremity, especially if there was a stretch injury and it is expected that the patient will get some return of function. Passive range of motion is done to prevent contractures. Stretching is done if contractures have already formed. In the infant, I try to stimulate the activation of the muscles that are still innervated, the C7, C8 and T1 innervated muscles working on getting flexion and extension of the thumb, fingers and the wrist.

Dr. Kozin: We have learned in obstetrical palsy that when you stretch the shoulder into external rotation, you must stabilize the scapula. And a lot of exercise that were recommended, like hanging from the monkey bars or pull-ups, were just moving the scapulothoracic joint and not the glenohumeral joint. In addition, MRI imaging has demonstrated changes in the glenohumeral joint begin prior to six months of age. Therefore, we must stress to the caretaker that early range of

motion with the scapula stabilized is critical. This therapy will hopefully maintain the joint integrity.

We do not use early splinting but rely on frequent and proper range of motion. We delay splinting as the infant creates considerable difficulty in splint fabrication and wearing.

Dr. Terzis: There is a dramatic difference between global obstetrical brachial plexus palsy and Erbs palsy, in that one very rarely sees contractures in global paralysis as most of the musculature of the upper limb is denervated. . But in the Erbs palsy you always see contractures, especially in the shoulder and elbow.

Dr. Kozin: Also, the contractures can get worse as the child is recovering, particularly in a child whose C5-C6 is out and not coming back. Their subscapular muscles begin to come back; their pectoralis muscles start firing. All of the internal rotators come in but their external rotators and abductors do not.

Dr. Bishop: Dr. Wolfe, what are some of the important features of the physical exam in traumatic brachial plexus injury?

Dr. Wolfe: I stress the importance of a thorough neurologic exam in the emergency room and repetition of the exam over the next several days. Certainly a vascular examination is paramount. Documentation of the neurologic exam is really critical to the future treatment plan. Abrasions and ecchymosis in the supraclavicular area and a head tilt away from the injury indicates a high level injury and is a poor prognostic finding. Assuming a person has a vascularized limb and does not warrant immediate exploration, one needs to begin to figure out the level of the lesion. I look for motor findings that will enable me better to pinpoint the level of the injury. Among the most important signs is the classic Horner's syndrome,

which is characterized by ptosis, meiosis, and anhydrosis; and is due to interruption of the sympathetic afferents from the C8-T1 level. That finding indicates a gloomy prognosis, because it indicates avulsion of the inferior rootlets. If an avulsion has occurred at one level, it is highly suspicious to have occurred at more proximal levels.

In terms of motor findings, we look specifically for loss of rhomboid and serratus anterior function. The nerve to the rhomboid comes off C4-5, just off the rootlet, and the long thoracic comes off C-5, 6 and 7, again very proximally. So, the presence of paralysis of either indicates a very proximal lesion and probably a root avulsion. As one travels down the plexus distally, one can map the level of injury based on the presence or absence of motor function.

Dr. Bishop: Dr. Wolfe, do you look for a Tinel sign in the neck at all? And if so, what benefit does that have?

Dr. Wolfe: Yes and no. I think it is difficult in the immediate injury period, but certainly later on it can help to try to define upper versus lower, or supraclavicular versus infraclavicular, injuries.

Dr. Bishop: Dr. Terzis, when should one first perform electrophysiologic testing after a traumatic injury?

Dr. Terzis: I usually do a baseline needle EMG and nerve conduction studies at three weeks and then at six weeks. If there are still fibrilla-



THERE IS A REASONABLE PERIOD OF TIME AFTER WHICH AN ATTEMPT TO RECONSTRUCT THE PLEXUS IS PROBABLY NOT GOING TO PRODUCE A GOOD FUNCTIONAL OUTCOME; MY LIMIT IN AN ADULT IS NINE MONTHS.

SCOTT W. WOLFE, MD

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tions at six weeks, then you would want to plan for an immediate exploration. If the patient has total anesthesia in the upper extremity and if the conduction velocities are normal in the median and ulnar nerves, this is highly indicative of avulsion injury. Another test in adults that I have been

using is the lamina test. This is executed while the patient is awake. A spinal needle is inserted percutaneously and small volleys of electrical stimulation are delivered at every root level by the electromyographer. If the patient has a global avulsion he or she will localize the stimulus in the neck, but if there is any connectivity of the roots with the spinal cord, even if there is distal rupture of that root, he or she would localize the stimulus to the territory served by that root. This is quite a powerful test, but it can be done safely only in adult patients and is not applicable to

children as there needs to be cooperation between the subject and the examiner.

In addition to the lamina test, the elicitation of the Tinel's sign is very important. If there is no Tinel's sign present in the neck, its mere absence implies avulsion.

Dr. Bishop: The lamina test gives you information about each individual nerve root, which is difficult to come by otherwise. Is there a role for myelography and/or CT myelography?

Dr. Terzis: Yes. With the use of CT myelography and the lamina test, one can have at least 85 percent accuracy. MRI tends to be more useful for localization of tumors distal to the transverse foramina.

Dr. Wolfe: Dr. Bishop, we also insist on CT myelograms for each of our patients. Many patients will come in with an MRI scan done early in the post-injury period, but in the first five or seven days an MRI gives me almost no information. It demonstrates a lot of hematoma artifact and I don't think it visualizes the nerve roots well. A CT myelography done in one millimeter cuts through each of the foramina really gives you unparalleled resolution and you can track the rootlets right back to the cord and very precisely indicate which are avulsed and which aren't. We reported on our operative confirmation of our CT myelographic findings and demonstrated upwards of 90 percent accuracy.

Dr. Bishop: Dr. Kozin, what is your current preoperative assessment for obstetrical palsy?

Dr. Kozin: We have gotten away from the CT myelography and MRI as a routine preoperative examination. CT myelography tends to overestimate the number of avulsions and MRI tends to underestimate. If push comes to shove, we are still using CT myelography in difficult or unclear cases, but primarily we use our clinical judgement and surgical findings to base definitive treatment.

Dr. Bishop: Can you comment on the use of EMGs in babies for obstetrical injuries?

Dr. Kozin: The problem with electromyography is the test is they are not quantitative. Early in our experience, we were using EMG to assess recovery because EMG signs of recovery will precede clinical changes. However, Peter Waters has made the analogy to a

light bulb to EMG evidence of recovery. You don't know whether EMG evidence of recovery represents a 10 watt or 100 watts bulb. Therefore, we are relying more on serial physical examinations prior to surgery and intraoperative findings at the time of surgery.

Dr. Bishop: In your estimation, is it the physical exam and its evolution with time that are the main determinant for operative decision-making?

Dr. Kozin: Yes. This can be extremely difficult when the child is evaluated for the first time at five to six months of age. You must obtain the birth history and the extent of the recovery. All parents initially claim complete lack of motion, but careful questioning about initial positioning and finger motion can provide evidence of upper, middle, or lower trunk function. Subsequently, the onset of recovery and details about recuperation are important details to attain. This information provides valuable insight about the natural history and prognosis for recovery.

Dr. Bishop: When should a child have a surgery for an obstetrical palsy?

Dr. Kozin: We've changed our advice to parents. For upper trunk lesion or Erb's palsy, we now tell them that if the biceps returns by two months of age, the child will probably have a fairly normal, if not normal limb. However, if the biceps recovery is delayed more than two months, somewhere between two months and six months, the main limitation will involve the shoulder and the elbow. After six months if there has been no recovery of biceps, our current recommendation is to consider either nerve grafting or nerve transfers. The prognosis for complete or global lesions is poor with or without surgical intervention.

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WHEN WORKING WITH PATIENTS FOLLOWING PLEXUS SURGERY, THE GOAL IS TO RE-EDUCATE THE MUSCLE TO A FUNCTIONAL LEVEL.

DENISE KINLAW, PT

FROM THE PRESIDENT

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Membership Committees have been busy, and will report to the membership in the next Newsletter.

The most significant thing we learned from the meeting was how well the AAHS has been running. This seems in part due to the new Committee structure and method of charges put in place over the last few years. We reviewed the Strategic Plan and Plan of Work developed in 1999. Most of the Short Term Goals and many of the Long Term Goals had been met, or were well under way. Therefore, we spent our time outlining the future direction of the organization. We concentrated on how to make the AAHS more relevant in the changing environment of our modern world and more beneficial to the members. We believe we have arrived at a plan that will accomplish those goals. The new organizational structure will allow us to implement these plans and accomplish them more efficiently.

Watch for more in the coming months as your dedicated staff and committee members continue to improve your organization for you. **H**

2002 Application for Research Grants

The AAHS Research Grant Awards were established to further the purpose of the Association as stated in its Bylaws and to foster creativity and innovation in basic and/or clinical research in all areas pertinent to hand surgery.

Awards and Eligibility

Grants will be made for a one year period to up to three investigators. Grants are available to all AAHS members. One of the investigators must be an **active** or **affiliate** member of the association.

Grant Application

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American Association for Hand Surgery
20 N. Michigan Avenue, Suite 700
Chicago, Illinois 60602

Applications (**an original plus seven copies**) must be received by the committee chair no later than **Thursday, November 1, 2001**, in order for the judging to be completed in time and the recipients to be announced at the Annual Meeting.

The AAHS and the Research Committee are required by the IRS to document disbursement of grant funds. Award recipients will be required to sign a letter of acceptance and submit a progress report once each year. The AAHS must be acknowledged as the source of funding in any presentation or publication. A final report must be submitted at the completion of the study. It is expected that the results of the funded research be submitted for presentation at an Annual Meeting within two years of the receipt of the award.

Funds must be returned to the AAHS if the study is not undertaken within twelve months of the receipt of the award.

Failure to follow these guidelines will disqualify the recipient from any further grant opportunities and from presenting any papers at the AAHS Annual Meeting for a period of three years following such default.

Mail Grant Proposals to

Saleh M. Shenaq, MD
Baylor College of Medicine
6560 Fannin Street, Suite 800
Houston, TX 77030



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Dr. Bishop: Dr. Wolfe, what is the appropriate timing for surgery for a traumatic brachial plexus injury?

Dr. Wolfe: This is a somewhat controversial topic. There are many surgeons in Europe and in Australia who feel that the plexus should be explored early, and especially when avulsion injuries are suspected. I think if you have a patient with suspected or proven C5 through T1 avulsions there is no reason to delay. Similarly, if you have a patient with an open injury, you can deal with the plexus injury at the time of vascular repair. But in the vast middle ground, I prefer to wait for at least three months, since these are frequently mixed injuries and partial nerve injuries require some time to recover. If for instance, you operate early and the involved nerve is

demonstrated to be in continuity, but the muscles that it innervates are not working, one doesn't know whether that nerve is going to recover or not. And there is very little you can do in the operating room to make that decision. If, however, you have waited for three months and there has been no clinical or electrodiagnostic evidence of recovery, I think you can excise the neuroma-in-continuity with confidence and perform primary nerve grafting. I repeat my electrodiagnostic studies at six and at twelve weeks, and repeat my clinical examination at those times. Between the CT-myelogram, the clinical exam and the electrodiagnostic studies, I feel I have a pretty good indication of what I am going to find at surgery.

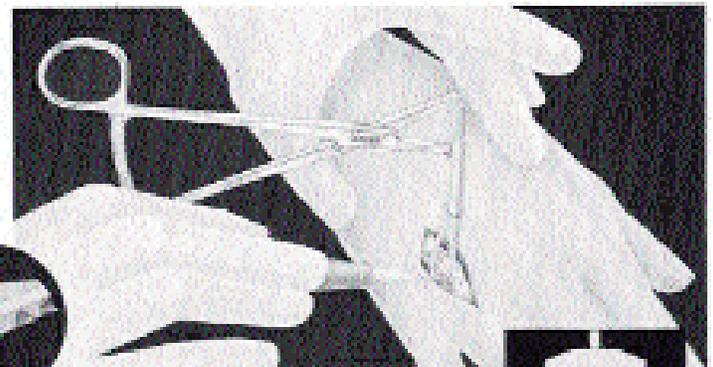
Dr. Bishop: Dr. Terzis, do your criteria differ at all from those of Dr. Wolfe?

Dr. Terzis: As far as the obstetrical paralysis is concerned, I agree

with Dr. Kozin. But if the biceps does not come back by three months, I operate. If the paralysis is global, I have operated as early as six weeks. I have always used CT myelography in conjunction with needle EMG's and Nerve Conduction studies as baseline preoperative studies. The results of electromyography and of nerve conduction, as Dr. Kozin said, are not as clear cut. There is a silent period very early on after the injury, but after six weeks you can get very useful information. Again, in the case of global paralysis on physical examination, the presence of a Horner's sign, and a positive CT myelogram, will lead me to explore the lesion early because I can salvage the hand.

As far as the Erb's type of paralysis, if there is no evidence of biceps and deltoid reinnervation by six weeks, I will definitely plan for surgery by three months. So I will not wait past three months.

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Dr. Bishop: What are the specific surgical goals, having reached the operating room?

Dr. Terzis: For adult posttraumatic plexopathies, I will always try to stabilize the shoulder, aiming for repair of the suprascapular and axillary nerves. Second, contrary to other people, I strongly believe that elbow extension is important. Although restoration of the biceps is of higher priority than the triceps, I will also always reconstruct the triceps. I don't use triceps as a transfer for biceps restoration because today we have many other options

Thus I usually set priorities for target reconstruction, going from proximal to distal muscles. If the patient is compliant, I will even attempt reanimation of the hand.

Dr. Wolfe: I agree with Dr. Terzis. I just wanted to point out a useful transfer taught to me by Mr. Rolf Birch in England. I now reinnervate the long thoracic nerve as a scapula stabilizer in all cases of complete plexus palsy. With a single T2 intercostal nerve, it is a very easy transfer to the long thoracic. And I think the stabilization that you attain of the scapula really helps strengthen the results from the suprascapula and axillary nerve transfers.

Dr. Terzis: That is a very good idea. I also neurotize routinely the thoracodorsal nerve with one or two intercostal nerves because it is right there and I can subsequently use the ipsilateral latissimus for other functions. Thus, I will dedicate if possible intercostals for the thoracodorsal and the long thoracic as the nerves are right there and it takes little time to do these transfers.

Dr. Bishop: When should a patient not have nerve surgery for traumatic plexus injury?

Dr. Wolfe: I think we have to put an end point to nerve reconstruction. There is a reasonable period

of time after which an attempt to reconstruct the plexus is probably not going to produce a good functional outcome; my limit in an adult is nine months. In the very young, you can probably extend that a little longer. In the older patient, the time limit may be substantially shorter than nine months.

Once you have made the decision to reconstruct the plexus you have to have the capability of approaching it from several different ways. At the bottom of the reconstructive ladder is a simple neurolysis. This is indicated for the intact nerve that has dense perineural scarring but is electrodiagnostically intact. Primary nerve repair in trunk injuries with a well defined zone of injury is done on occasion, but I find more frequently that the zone of injury is fairly wide and that primary repair at three to six months is not usually possible. Then we have at our disposal any number of nerve grafts, beginning with the sural nerve graft, the ipsilateral antebrachial cutaneous and brachial cutaneous nerves, and even the radial sensory nerve of the ipsilateral arm. There is little morbidity from the donor site. The next step after nerve grafting would be nerve transfer, or so-called "neurotization" using either the most inferior branch of the spino-accessory nerve, or the intercostal nerves. If we are dealing with a predominantly upper level injury and C7, 8 and T1 are intact, the medial pectoral nerve can be used, either all or a portion of it, to transfer out to some various denervated terminal nerves.

And then, finally, at the highest level of the reconstructive ladder is the functioning free muscle transfer, and we will get into that a little bit later, I think.

Dr. Terzis: I know many people recently are doing these peripheral mini transfers using the pectoral nerve. However, none of my patients likes to have a concavity on their anterior torso. If the pec-

toralis major is present, they usually won't give it up since there is an aesthetic component involved in addition to the functional needs it serves. Many times, if it is not a global avulsion, I will reconstruct the lateral and medial pectoral nerves because they want restoration of that contour on their anterior chest.

Dr. Wolfe: I agree that loss of a functioning pectoral muscle is a deficit both functionally and cosmetically. But it has been shown that the pectoralis is a multiply innervated muscle, and I try to use only one or two healthy branches of it and leave the remainder intact to preserve function of the sterno-costal portion of the muscle.

Dr. Bishop: Dr. Terzis, please comment on the selection of extraplexal nerves for neurotization.

Dr. Terzis: Routinely, I preserve the distal accessory for direct neurotization of the suprascapular nerve. In my hands, that transfer has been very successful, with 75 percent good and excellent results. That is not the case for the infraspinatus. In the global community, the uniform finding is that we can get very easily supraspinatus back, but not infraspinatus. Can anybody comment on that?

Dr. Wolfe: I concur.

Dr. Bishop: I believe it may be due to the possibility of some suprascapula nerve injury at the level of the spinoglenoid notch.



IN OBSTETRICAL PARALYSIS, IF THE BICEPS DOES NOT COME BACK BY THREE MONTHS, I OPERATE. IF THE PARALYSIS IS GLOBAL, I HAVE OPERATED AS EARLY AS SIX WEEKS.

JULIA K. TERZIS, MD

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Dr. Kozin: Also axonal dropout occurs during nerve regeneration or transfer. The infraspinal is quite a distance down the road and is left with few axons for reinnervation. This helps explain why the shoulder consistently loses external rotation after upper trunk injuries.

Dr. Terzis: I heavily use intercostals. Again, I will neurotize the long thoracic, the thoracodorsal, as well as the musculocutaneous nerve. However, if you plan to resuscitate elbow flexion with intercostals you cannot neurotize the triceps from the same donors. So if there are any intraplexus donors, I will use those for the musculocutaneous and then use intercostals for axillary and triceps. But you cannot use intercostals for both biceps and triceps, especially in adults. In the children, the plasticity is much higher and you might get away with it, although I had one case that the child had severe cocontraction from that type of neurotization.

So other than intraplexus donors, I have used cervical plexus sensory and motor donors. However, the cervical plexus motors have the same power as the contralateral C7. That means they are pretty weak donors. The most powerful extraplexus donor is the distal accessory and then the intracostals, because both of these transfers are used directly without an interposition nerve graft. I will not sacrifice a functioning phrenic if I am going to take ten intercostals from that side, but in these cases I have used phrenic in an end-to-side fashion. That means I have created an epineurial and perineurial window and have with a diamond knife caused some local injury at that site. Subsequently, I attach the nerve graft to this window and have got graft reinnervation without paralyzing the diaphragm. I

have also used the ipsilateral hypoglossal. I have been using the hypoglossal nerve since 1984 for the babysitter procedure for facial paralysis and it works beautifully there. But my results with the use of partial hypoglossal for traumatic plexopathies using an end-to-side coaptation and always an interposition nerve graft have not yielded satisfactory results. Thus, the use of the partial hypoglossal for extraplexus neurotizations is lower in the list of priorities as I have never been able to get an M4 from the use of the hypoglossal, but I have never used the entire hypoglossal as a donor. I will be interested to hear what is the experience of the rest of the panel with this donor.

Dr. Kozin: I have not used end to side nerve transfers as a routine part of brachial plexus reconstruction. I am still not convinced that the data uniformly supports this technique

Dr. Terzis: Dr. Kozin, are you talking about the use of end-to-side in obstetrical paralysis?

Dr. Kozin: I am just particularly talking about brachial plexus reconstruction and the use of end to side transfers involving the phrenic nerve. This is especially pertinent when you are utilizing the intercostal nerves as donors.

Dr. Terzis: Well, in the case of the intercostals, most of the time these are used in an end-to-end manner.

Dr. Kozin: After harvesting the intercostals and then performing an end to side with the phrenic nerve risks pulmonary problems. This is especially true in children as they are developing their pulmonary cavity.

Dr. Wolfe: The experience out of Thailand indicates that you can indeed take phrenic and intercostal nerves for use. I have not personally done it, but I know Dr.

Panupan Songcharoen has done that quite successfully in over 100 cases. In only one did he report a significant pulmonary compromise and resultant pneumonia.

Dr. Terzis: And I know David Chuang's work in Taipei, who trained with me. He takes the entire phrenic nerve plus the ipsilateral intercostals. I have not had the nerve so far to take both in a child, but many times in severe lesions the distal phrenic may be completely gone. Because I routinely use preoperative fluoroscopy of the diaphragm I know before I go in the operating room if I have a functioning diaphragm. If the diaphragm is not functioning then I will distally explore the phrenic and if it is gone, then I will use the entire proximal phrenic as a strong motor donor. Otherwise I will try to maintain continuity of the phrenic nerve and just provoke additional neurotization through a nerve graft applied by end-to-side technique to the phrenic nerve. I have used this approach quite extensively since '83 without pulmonary complications.

Dr. Bishop: Perhaps we could also just talk briefly about functioning free muscle transfers and their role.

Dr. Wolfe: Dr. Bishop, before we leave the topic of neurotization, I'd like to point out one further technique that has proven itself very useful, using one or two fascicles of the ulnar nerve, as first described by Oberlin. In injuries where C8-T1 is still functioning, this is a very powerful transfer, and one that results in virtually no donor deficit.

Dr. Bishop: One of the advantages of intercostal direct nerve crossing is that one can place the point of nerve regeneration very close to the motor end plate of the biceps muscle. And of course, the fact that the ulnar nerve is a mixed

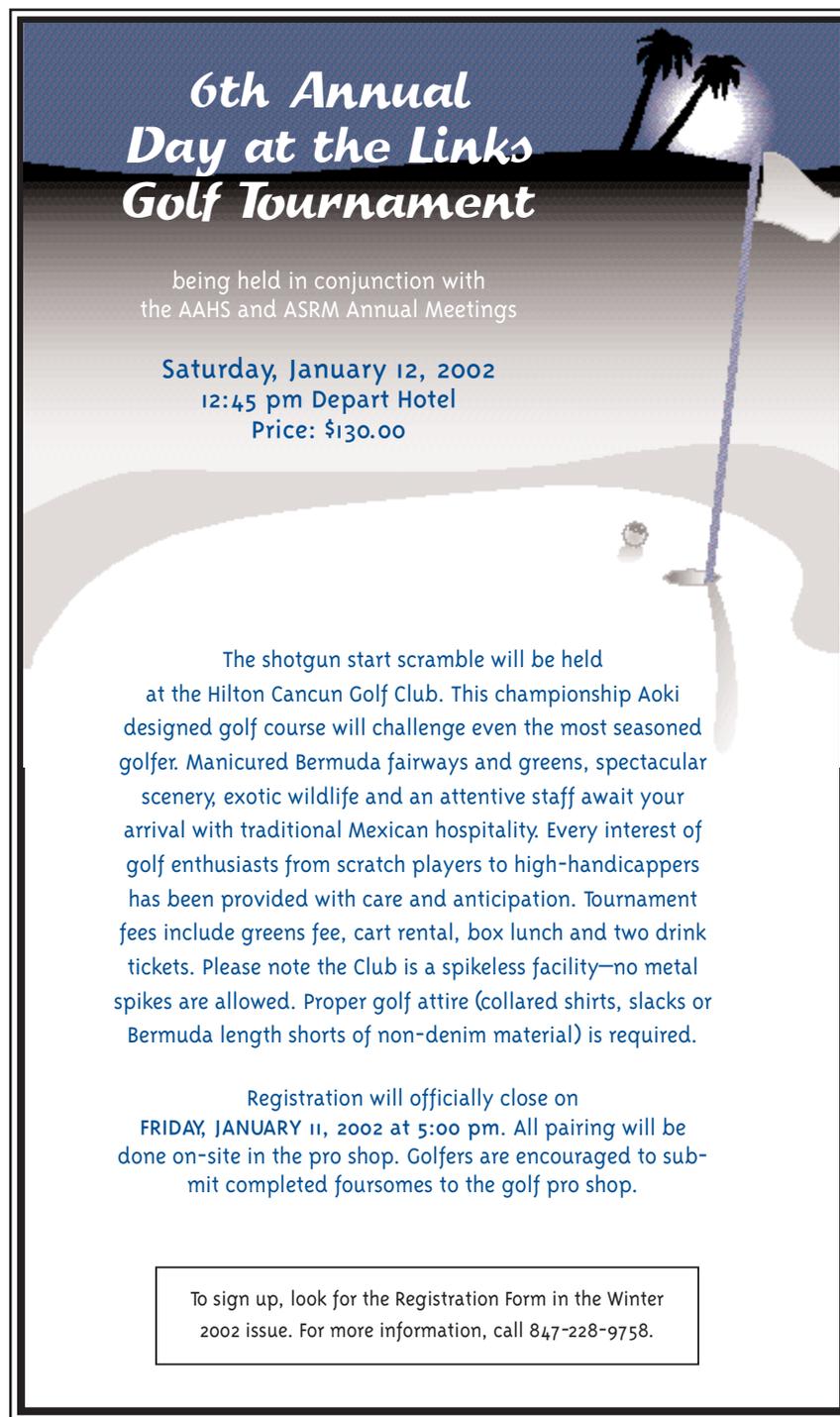
nerve at that level means that there in general is little, if any, effect on ulnar nerve function.

What about functioning three-muscle transfers? We tend to use them here for cases of neglected injury. The most common operation in more than 20 cases has been a free muscle transfer for elbow flexion alone. In a few other cases we have also used a second gracilis for finger flexion. David Chuang in Taipei is using this transfer after a contralateral C7 neurotization of the median nerve and then doing a delayed free muscle transfer for finger flexion. One may also use the double free muscle method of Kazuteru Doi from Yamaguchi University. This technique allows patients with complete plexus avulsions to regain elbow flexion/extension, as well as grasp and release function with two functioning free muscle transfers.

Dr. Wolfe, do you want to comment on your experience with free muscle transfers?

Dr. Wolfe: Our use of functioning free muscle transfers for brachial plexus palsy is generally limited to the patient who presents for treatment well after the acute reconstructive period has passed. If a patient is more than nine months from injury, I usually will offer him a combination of a shoulder fusion and a free functioning muscle transfer for biceps function. It is important to do the free functioning muscle transfer first; otherwise your position of shoulder fusion will make it very difficult to do the transfer later. I usually do these procedures in two stages. I have seen several of Dr. Doi's double free muscle transfer patients, and he has salvaged very functional upper extremities from completely palsied limbs. It involves a very intensive and prolonged rehabilitation course with biofeedback and other modalities. But I think it is a very viable technique.

Dr. Terzis: I have never done a shoulder fusion so I want to ask



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Dr. Wolfe why does he do that instead of reanimating the shoulder, by repairing the suprascapular and the axillary nerves? But I have done many wrist fusions when I proceed to reanimate the hand. To answer your question on functioning muscle transfers, I have given up using gracilis for elbow flexion or elbow extension.

So for elbow animation I will use the contralateral latissimus or a rectus femoris muscle. Because in Caucasians, at least in my patients, I can't get enough function back with the gracilis for animation of the proximal extremity. But for finger flexion and extension, I will use the gracilis free muscle routinely for finger flexion and finger

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extension.

Now, even in very early lesions, that means even at three months, it is rare to get an M4 muscle grading for finger flexion or extension through a plexus reconstruction. I usually get an M3, so I will always bank some nerve grafts for future free muscle transfers especially with supraclavicular lesions. Thus, I try to have an option for carrying out future free muscles which invariably will strengthen whatever function is restored from the initial brachial plexus reconstruction.

Dr. Bishop: Can you comment on the strategies and methods that you find most effective in surgical treatment of obstetrical palsy?

Dr. Kozin: The initial decision regarding surgery is based upon personal bias and return of biceps. We use lack of return of biceps to a grade 3 by six months as an indicator for surgery. Earlier exploration can be considered in global lesions. At the time of surgery, intraoperative finding and adjuvant SSEP's are used to differentiate a rupture from an avulsion. Ruptures are treated by resection of the neuroma and sural nerve grafting. Avulsions require viable axons from another source, such as a ruptures at a different level or nerve transfer. Nerve transfer options are similar in children and adults and have been discussed previously. Tendon transfers are used for incomplete spontaneous recovery or persistent impairment despite neurosurgical reconstruction. Most commonly, tendon transfers are performed about the shoulder to restore external rotation. The latissimus dorsi and teres major muscle are transferred to the supraspinatus and infraspinatus. Lastly, free muscle transfers are used when there inadequate

available motors to restore critical function. Our most common free muscle transfer is gracilis for biceps with intercostal nerve transfer.

Dr. Bishop: Ms. Kinlaw, perhaps you could comment about re-education and therapy on the recovery muscles following plexus surgery?

Ms. Kinlaw: When working with patients following plexus surgery, the goal is to re-educate the muscle to a functional level. First of all, electrical stimulation is done to the muscle. I have a direct current unit that has the ability to change the pulse duration so that the muscle can be stimulated directly. I can stimulate early on before the reinnervation has taken place so that the contractility of the muscle is maintained. The patient is supplied with a home unit and stimulates the muscle as it is reinnervating. For the patient who has had spinal accessory neurotization, they are taught scapular elevation. This will be the activation technique when there is return of function to the muscle. If the intercostals are used for neurotization, the patient tries to activate the muscles using deep breathing, coughing or Valsalva maneuvers. When there is return of some active contraction of the muscle, electrical stimulation continues to be used as a reeducation tool and a strengthening tool for the muscles. At some point during the reinnervation the patient may be able to respond to a neuromuscular electrical stimulation unit. This provides a more physiologic contraction of the muscle and assists the patient to try and gradually increase the amount of contraction that they are getting.

Electrical stimulation and the use of biofeedback have been important tools to try and at least give the patient some idea of the level of contraction that they are producing. So when we are working with the

patient who has had intercostal neurotization, we have them work on coughing, deep breathing exercises or Valsalva maneuvers as an activation technique. Shoulder shrugs activate muscle neurotized by the spinal accessory nerve. As the healing and reinnervation take place, eventually the muscle will contract, usually, in my experience, quite suddenly. One day there is no response and the next day there is a small amount of contraction that is finally seen by doing the particular maneuver.

Eventually it gets to the point where the patient no longer has to activate the old function, i.e. elevation. They will be able to transfer that knowledge right to the muscle. They get, so to speak, the mind/body connection so they no longer have to use the activation techniques. The patient will work in gravity eliminated positions at first and then progress to anti-gravity positions. I use the powder board and skateboard. Once the patient is able to move the limb gravity-eliminated, weights may be added to the system. Anti-gravity trials are done to check the patient's progress. When the patient is able to get a fair muscle grade consistently, the gravity-eliminated positions are no longer used.

Dr. Bishop: I thank all of the panelists for their attention and for sharing your knowledge with the American Association for Hand Surgery membership. **H**

CPT Coding for Brachial Plexus Surgery

Stiles T. Jewett, Jr., MD, FACS

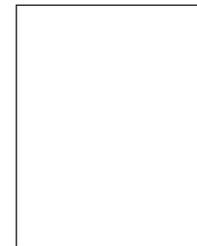
There are only two CPT codes that apply directly to surgery of the brachial plexus. **64713** describes neuroplasty which includes exploration, neurolysis or nerve decompression. **64861** is used for neurorraphy where actual suture repair is performed. For completeness sake **64415** describes injection of anesthetic into the brachial plexus.

The challenging part of brachial plexus coding, as for most of the peripheral nervous system, is proper use of add-on codes to further specify what was done in the procedure. **64713** Neuroplasty is the decompression or freeing of intact nerve from scar tissue, including external neurolysis and/or transposition. If internal neurolysis, requiring use of the operating microscope, is performed, **+64727** is used as an add-on. Note, this only applies to actual use of an operating microscope. Loupes do not count. Also, do not report 69990 use of the operating microscope in addition to **+64727** as its use is already included in the latter code.

64861 describes suture repair of the brachial plexus. If done on a secondary or delayed basis use **+64872** as an add-on to describe the extra work required. If extensive mobilization or transposition is required, report **+64874**. If the

64415	Introduction/Injection of Anesthetic Agent (Nerve Block), Diagnostic or Therapeutic, brachial plexus
64713	Neuroplasty (Exploration, Neurolysis, or Nerve Decompression, brachial plexus)
64861	Suture of; brachial plexus
+64872	Suture of nerve requiring secondary or delayed suture (List separately in addition to code for primary neurorraphy)
+64874	requiring extensive mobilization, or transposition of nerve (List separately in addition to code for nerve suture)

953.4	Injury to Brachial Plexus
880	Open wound of shoulder and upper arm The following fifth-digit subclassification is for use with category 880: 0 shoulder region 1 scapular region 2 axillary region 3 upper arm 9 multiple sites
880.0	Without mention of complication
880.1	Complicated
880.2	With tendon involvement.



STILES T. JEWETT, JR., MD, FACS

operating microscope is utilized, it is appropriate to use **69990** in addition to the primary code(s).

ICD-9-CM code **953.4** describes injury to the brachial plexus. Open wounds of the shoulder and upper arm are classified to a fifth digit specification which indicates both severity and exact location. **880.0** open wound of shoulder and upper arm without mention of complication. **880.1** complicated. Complicated is defined as "with major infection, delayed treatment or healing, tissue loss or with foreign body." **880.2** with tendon involvement. The ICD-9-CM classification defines this to mean "injury to the fibrous cords that secure muscles." The fifth digit specifies exact location: 0 = shoulder,

1 = scapular region, 2 = axillary region, 3 = upper arm, and 9 = multiple sites.

Example:

Repair of a clean open wound of the brachial plexus at the shoulder utilizing the operating microscope.

64861 Suture of Brachial Plexus
69990 Use of operating microscope
ICD-9-CM 880.00



American Association for Hand Surgery Calendar

2002

January 9-12, 2002
32nd Annual Meeting
Hilton Cancun Beach & Golf
Resort
Cancun, Mexico

July 12-14, 2002
Mid Year Board of Directors
Meeting
Ritz Carlton Hotel
Chicago, IL

2003

January 8-11, 2003
33rd Annual Meeting
Hyatt Regency Kauai
Koloa, Kauai, Hawaii

April 17-19

Post Traumatic Reconstruction
of the Upper Extremity
Hotel Inter-Continental
Chicago, IL

2004

January 14-17, 2004
34th Annual Meeting
Westin Mission Hills
Palm Springs, California

2005

January 12-15, 2005
35th Annual Meeting
Sanibel Harbor Resort
Sanibel Island, Florida

2006

January 11-14, 2006
36th Annual Meeting
Loews Ventana Canyon Resort
Tucson, Arizona

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