THE WESTERN NEUROSURGICAL SOCIETY

1988

THE RITZ-CARLTON
LAGUNA NIGUEL

THE WESTERN NEUROSURGICAL SOCIETY

1988

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SCIENTIFIC PROGRAM

This Continuing Medical Education activity is acceptable for eleven credit hours in Category I for the Physician's Recognition Award of the American Medical Association.

CALENDAR OF EVENTS

SUNDAY
September 11, 1988

9.00 a.m. - 12.00 noon	EXECUTIVE COMMITTEE	Colonnade
2.00 a.m. - 5.30 p.m.	REGISTRATION	Conference Level
6.30 p.m. - 8.30 p.m.	WELCOMING PARTY	Ballroom 1-3

MONDAY
September 12, 1988

7.00 a.m. - 7.55 a.m.	*BREAKFAST BUSINESS MEETING	Pavilion 2-4
8.00 a.m. - 12.00 noon	REGISTRATION	Conference Level
8.00 a.m. - 12.00 noon	SCIENTIFIC SESSION	Ballroom 1-3
12.30 noon	GOLF, TENNIS	
7.00 p.m. - 10.00 p.m.	"A Night at La Scala"	Monarch Bay Pool

TUESDAY
September 13, 1988

7.00 a.m. - 7.55 a.m.	*BREAKFAST BUSINESS MEETING	Pavilion 3-5
8.00 a.m. - 12.00 noon	REGISTRATION	Conference Level
8.00 a.m. - 12.00 noon	SCIENTIFIC SESSION	Ballroom 1-3
12.30 noon	GOLF, TENNIS	
7.00 p.m. - 8.00 p.m.	RECEPTION	Monarch Bay Courtyard
8.00 p.m. - Midnight	SOCIETY DINNER/DANCE	Ballroom 1-3

WEDNESDAY
September 14, 1988

8.00 a.m. - 12.00 noon	SCIENTIFIC SESSION	Ballroom 1-3
12.00 noon	ADJOURNMENT	

*Members of Western Neurosurgical Society only.

34th ANNUAL MEETING

OF THE

WESTERN NEUROSURGICAL SOCIETY

SCIENTIFIC PROGRAM

Monday, September 12, 1988

08.00

WELCOME - Gordon B. Thompson, MD - President

SESSION I

08.15 - 09.00

1. Cortical Blood Flow Measurement and AVM Surgery
   Kenichiro Sugita, MD - Nagoya, Japan

09.15

2. Transcranial Doppler Studies After Aneurysm Rupture
   Bryce K. Weir, MD and K. Hutchinson, MD - Edmonton, Alta

09.30

3. Transcranial Doppler: Neurosurgical Applications
   R. Lamond, MD and J. Alksne, MD - San Diego, CA

09.45

4. Preoperative and Intraoperative Localization of Eloquent Cortex Adjacent to Arteriovenous Malformations
   Neil Martin, MD, Sheldon Jordan, MD et al - Los Angeles, CA

10.00 - 10.15
Coffee Break

SESSION II

Moderator: George Ablin, MD

10.15

5. Postoperative Cerebral Blood Flow for Evaluation of Vasospasm
L. Philip Carter, MD, T. Graham, MD and R. Spetzler, MD
Phoenix, AZ

10.30

6. Vertebral Artery Aneurysms: Different Strategies for Different Lesions
Michael B. Pritz, MD - Orange, CA

10.45

7. Management of Giant Arteriovenous Malformations
Robert F. Spetzler, MD - Phoenix, AZ

11.00

8. Hypervolemic Hemodilution in the Treatment of Acute Stroke: Results of the Pentastarch Study
Joseph M. Zabramski, MD, R. F. Spetzler, MD et al - Phoenix,AZ

11.15

9. The Use of the Macroflange in the Treatment of Complex Vertebral Aneurysms
Wolff M. Kirsch, MD, W. Orrison, MD and Viraf Cooper, MD
Albuquerque, NM

11.30

10. The First Neurosurgical Golfing Death - 1626
William Caton, MD - Pasadena, CA

Monday, September 12, 1988

11.45 - 12.15

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PRESIDENTIAL ADDRESS

Gordon B. Thompson, MD

Introduction by George Ablin, MD

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SESSION III

Moderator: John Kusske, MD

08.00 - 08.45

12. Surgery of Posterior Fossa Meningiomas
Kenichiro Sugita, MD - Nagoya, Japan

09.00

13. Brainstem Auditory Evoked Potentials and Magnetic Resonance Imaging in the Spina Bifida Aperta Syndrome and Arnold-Chiari Malformation Type II
Barry N. French, MD and Andrew J. Gabor, MD - Sacramento, CA

09.15

14. Fractured Odontoid: The Management of Delayed Neurological Manifestations
David J. Fairholm, MD - Vancouver, BC

09.30

15. Experience with Percutaneous Lumbar Nuclectomy
W. M. Hammon, MD - Honolulu, HI

09.45

16. Alternatives of Cervical Disc Surgery
David Pitkethly, MD, J. A. Maxwell, MD and Jeffrey Pearce, MD
Bellevue, WA

10.00 - 10.15
Coffee Break

SESSION IV

Moderator: Robert Rand, MD

10.15

17. The Difficult Craniopharyngioma: Management and Prognosis
Donald P. Becker, MD, Keith Black, MD et al - Los Angeles, CA

10.30

18. Utility of Peripheral Benzodiasenines as a Specific Ligand for Brain Tumours
Keith L. Black, MD, K. Ikezaki, MD and D. P. Becker, MD
Los Angeles, CA

10.45

19. Chromosomal Alterations in Human Brain Tumours
Ronald F. Young, MD, Michael Chapparo, MD et al - Irvine, CA

11.00

20. Intrasellar Meningeal Sarcoma Presenting as Pituitary Apoplexy
M. E. MacRae, MD, B. Bayliss, MD et al - Calgary, Alberta

11.15

21. Hydatid Cyst of Brain - Unusual Presentation
Peter Dyck, MD and Viesturs Petersons, MD - Los Angeles, CA

11.30

22. Biographical Tribute to Henry M. Cuneo
Frank Anderson, MD - Los Angeles, CA

SESSION V
Moderator: Ian M. Turnbull, MD

08.00

23. Coronal Craniosynostosis: Forehead Release versus Forehead Advancement
S. T. Myles, MD - Calgary, Alberta

08.15

24. Hydrocephalus: A New Adjustable Zero Pressure Shunt System
Eldon L. Foltz, MD - Orange, CA

08.30

25. Shunt Infection: An Epidemiological Analysis
Michael H. Sukoff, MD, Hector V. Berezowski, MD and Vicki Czaykowski, RN - Santa Ana, CA

08.45

26. Surgery for Epilepsy in Childhood: Investigations, Selection and Results
Warwick J. Peacock, MD, Harry T. Chugani, MD et al - Los Angeles, CA

SESSION V
(continued)
Moderator: Ian M. Turnbull, MD

09.00

27. Treatment of Syringomyelia by Cervical-Medullary Decompression
Ulrich Batzdorf, MD - Los Angeles, CA

09.15

28. Cervical-Brachial Plexus Bridge Graft Anastomosis for Cervical Nerve Root Avulsions
Shokei Yamada, MD and G. Peterson, MD - Loma Linda, CA

09.30

29. Carotid Endarterectomy in a Community Hospital
Michael Kendrick, MD - Bend, OR

09.45

30. Anterior Cervical Discectomy with and without Fusion: Factors Affecting Long Term Results
John Grollmus, MD, H. Gerber, MD et al - Spokane, WA

10.00 - 10.15
Coffee Break

Wednesday, September 14, 1988

SESSION VI

Moderator: Frank LeBlanc, MD

10.15

31. Steffee Plating
John Oakley, MD and Allan Jackson, MD - Edmonds, WA

10.30

32. Distraction Rod Instrumentation for Spinal Disorders
Alan T. Hunstock, MD, Douglas B. Kirkpatrick, MD
and Lynn M. Gaugin, MD - Santa Rosa, CA

10.45

33. Therapeutic Models of Low Back Care
W. Bradford DeLong, MD - San Francisco, CA

11.00

34. Ten Years of CT Scanning and the Surgery of Spinal Stenosis
DeWitt B. Gifford, MD - Oakland, CA

11.15

35. Acute Surgical Syndromes Following Spinal Manipulation
Marc Morin, MD and John Kusske, MD - Laguna Hills, CA

11.30

36. Surgical Treatment of Spondylotic Lumbar Hypermobility
T. G. Obenchain, MD and L. M. McKinley, MD - Escondido, CA

11.45

37. Reserve Paper

ADJOURNMENT

SCIENTIFIC PROGRAM

MONDAY

SESSION I

Moderator: Gordon Thompson, MD

08.15 - 09.00

Guest of the Society

PROFESSOR KENICHIRO SUGITA

Nagoya, Japan

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1. CORTICAL BLOOD FLOW MEASUREMENT AND AVM SURGERY

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09.00 - 09.15 DISCUSSION

09.15

2. Transcranial Doppler Studies after Aneurysm Rupture

Bryce K. A. Weir, MD and K. J. Hutchinson, MD
Edmonton, Alberta

Intracerebral arterial velocities were recorded daily from thirty-six patients with subarachnoid hemorrhage (SAH) secondary to ruptured intracranial aneurysm and eight patients who were admitted for elective aneurysmal surgery while in neurosurgical intensive care. While recordings were made from anterior, middle and posterior cerebral, intra and extracranial internal carotid arteries bilaterally and, in appropriate cases, from the basilar artery, the highest velocities and greatest change in velocity occurred in the middle cerebral artery (MCA) on one side. In non-midline aneurysms this was the side of the ruptured aneurysm. The time averaged MCA velocity remained below 100 cm/sec in seven of the elective patients, the MCA velocity of the other elective patient rose to a maxium of 132 cm/sec. Of the patients admitted following SAH, in seven, MCA velocity remained below 100 cm/sec and showed no suggestion of vasospasm by either clinical or radiological indicators. In thirteen, MCA velocities reached maxima greater than 155 cm/sec and had clinical or radiological evidence of vasospasm. In sixteen, maximum MCA velocities were in the 100 to 154/cm/sec range, these patients were fairly evenly split between those with and without evidence of vasospasm. The suggestion that an MCA velocity greater than 155/cm/sec is a definite indicator of vasospasm is in agreement with other recent reports. Parameters other than mean velocity may be helpful in determining the presence of vasospasm in the equivocal mean MCA velocity range. In one patient with prolonged vasospasm the waveform pulsatility increased dramatically eight hours before death. Highly pulsatile velocity waveforms are typical of high vascular resistance associated with extensive brain infarction. The recording of these velocities is technically demanding but the equipment is relatively inexpensive. Some reduction in the frequency of angiography may result from the use of this technique.

09.30

3. Transcranial Doppler: Neurosurgical Applications

R. Lamond, MD and J. Alksne, MD, San Diego, CA

09.45

4. Preoperative and Intraoperative Localization of Eloquent Cortex Adjacent to Arteriovenous Malformations

Neil Martin, MD, Sheldon Jordan, MD, Fernando Vinuela, MD
Marc Nuwer, MD, Jack Beatty, MD, Jacques Dion, MD and
Donald Becker, MD, Los Angeles, CA

The risk of neurological deficit following resection of arteriovenous malformations depends on the precise topographical relationship of the lesion to critically functional cortical and subcortical regions. The definition, preoperatively and intraoperatively, of the relationship of the vascular malformation to eloquent cortical areas permits accurate estimation of the risk of neurologic deficit following resection, and allows planning of the surgical approach so as to avoid the functional regions. Methods: Preoperative techniques for functional localization include somatosensory recording using a tight array of scalp electrodes, and magnetoencephalography. Intraoperative functional localization has been accomplished by cortical stimulation studies in awake patients, and cortical mapping of somatosensory evoked potentials. Results: Nine patients have had preoperative or intraoperative procedures for motor cortex localization. In 3 cases surgery was deferred because of involvement of motor cortex by unruptured AVMs. In two of six operated cases permanent neurologic deficit ensued after resection of AVMs that were found to include regions of the motor cortex. In four cases resection of AVMs adjacent to but not within motor cortex caused no permanent neurological deficit. One patient had preoperative localization of language cortex by magnetoencephalography carried out while the patient performed a language task. This test suggested that the AVM was adjacent to but not within eloquent cortex, and intraoperative stimulation studies done under local anesthesia confirmed this. Resection of this AVM caused transient mild aphasia with no permanent sequelae. Conclusion: Preoperative and intraoperative functional localization techniques hold the promise of improving patient selection for surgery, and for reducing the incidence of neurological deficit when AVMs adjacent to eloquent cortex are treated.

MONDAY **SESSION II**

Moderator: George Ablin, MD

10.00 - 10.15 COFFEE BREAK

10.15

5. Postoperative Cerebral Blood Flow for Evaluation of Vasospasm

L. Philip Carter, MD, Thomas Graham, MD and
Robert F. Spetzler, MD, Phoenix, AZ

Cerebral vasospasm has been shown to decrease cerebral blood flow (CBF) in patients with subarachnoid hemorrhage. This may become so severe that infarction occurs. Several new methods of evaluating cerebral perfusion have been used in an attempt to evaluate vasospasm. These include measurement of CBF with xenon 133, stable xenon, assessment of flow velocity with transcranial Doppler, and more recently by continuous thermal technique of measuring CBF. Continuous thermal techiques have the advantage of following CBF on a real time continuous basis, immediate changes can be seen and the effects of therapy are readily apparent.
We are using a Flowtronics Saber System CBF and ICP Monitor which gives a continuous recording of cortical blood flow at the site of monitoring. The probe is left on the cortex following craniotomy in the area avoiding major vascular channels. Continuous monitoring can be carried out for several days following the craniotomy. To date we have monitored 40 patients, of these 18 have been aneurysm patients. The correlation with stable xenon has been carried out 9 times. In two patients declared brain dead, the flows were known to be zero at the time of organ harvesting. With these 11 points a correlation between thermal flow and stable xenon of 0.82 was found. We had one patient who developed a meningitis and ventriculitis. No other major complications have occurred using this technique. Changes in CBF follwing subarachnoid hemorrhage and aneurysm clipping have been followed and the general trend to reduce CBF with the development of vasospasm has been observed. These results are similar to that reported by Takemae et al, in which they observed decrease in CBF with vasospasm with thermal techniques. This technique gives us the opoportunity to observe the effects of treatment of vasospasm.

10.30

6. Vertebral Artery Aneurysms: Different Strategies for Different Lesions.

Michael B. Pritz, MD, Orange, CA

Since the vascular anatomy of the posterior circulation differs from that of the anterior circulation, it is not surprising that approaches tailored to individual aneurysms of the vertebral artery and its branches may be necessary. To illustrate the management of such problems four different types of aneurysms are presented to demonstrate strategies individualized to each of these lesions.

One was a ruptured fusiform vertebral artery aneurysm that was treated by trapping. Preoperative angiography was unable to identify with certainty the location of the posterior inferior cerebellar artery (PICA). A second was a giant vertebral-PICA aneurysm that presented as a brainstem mass. This aneurysm was treated by temporary clipping followed by internal decompression and clot removal and then clip ligation of the neck. The third example was a ruptured vertebral-PICA aneurysm that pointed medially into the brainstem. This was treated by clip ligation in conjunction with intraoperative angiography. The fourth case was a ruptured fusiform vertebral artery aneurysm in which the origin of the PICA could be identified with certainty. This was treated by proximal occlusion with a detachable balloon. Radiologic features and management strategies specific to each of these different types of pathology will be discussed.

10.45

7. Management of Giant Arteriovenous Malformations
Robert F. Spetzler, MD, Phoenix, AZ

11.00

8. Hypervolemic Hemodilution in the Treatment of Acute Stroke: Results of the Pentastarch Study

Joseph M. Zabramski, MD, Robert F. Spetzler, MD and members of the Hemodilution in Stroke Study Group, Phoenix, AZ

A multicenter, randomized, controlled trial was conducted to evaluate the efficacy of hypervolemic-hemodilution using pentastarch, a 10% hydroxyethyl starch solution, in the management of patients with acute stroke. A total of 88 patients (45 pentastarch, and 43 controls) were enrolled in the study protocol within 24 hours of the onset of stroke in the carotid artery distribution. Patients in the treatment group underwent hypervolemic-hemodilution (H&H) using pentastarch solution for 72 hours. Patients in the control group received standard medical therapy. Graded neurologic exams (GNE) were performed by a blinded observer at the time of admission to the study protocol, at the end of therapy (72 hours), at 1 and 2 weeks, and at 1, 2, and 3 months. Barthel disability index scores were calculated at each of the follow-up evaluations beginning one week after enrollment. There were no sigificant differences in group demographics or GNE scores at baseline. GNE scores improved 7 points in those patients in the pentastarch group (controls - 1 point) from baseline to end of therapy at 72 hours, and a total of 24 points at the end of 3 months (controls - 16 points; P=0.11). Patients in the pentastarch group reached an average Barthel disability rating of 85 at 3 months (fully independent 100), while control patients scored 70 (P=0.08). Deaths associated with progresive cerebral edema occurred in 5 patients with severe stroke; 4 in the pentastarch group vs. 1 in the controls (P=0.36). Because of this apparent trend for increased mortality in the treatment group, the protocol was terminated early. Although there was a clear trend for improved neurologic outcome in stroke patients treated with pentastarch (H&H) therapy, this beneficial effect was offset by the increased risk of malignant intracranial edema. The results of the study protocol will be reviewed and plans for the development of a new plasma expander specifically tailored for H&H therapy will be discussed.

11.15

9. The Use of the Macroflange in the Treatment of Complex Vertebral Aneurysms

Wolff M. Kirsch, MD, William Orrison, MD and
Viraf R. Cooper, MD, Albuquerque, NM

Two cases of complex vertebral aneurysms are presented that offered unique challenges.

A large, partially thrombosed, left vertebral artery aneurysm caused severe brain stem and upper medullary compression with quadriparesis and episodic apnea. The patient was operated on by an oblique suboccipital approach. The aneurysm was opened and debulking initiated. The intra-arterial placement and inflation of balloons did not stop back bleeding through the open vertebral aneurysm. Hemostasis was secured by affixing a patch of Shiley pericardium with macroflanges. The patient did not fare well after surgery. He remained quadriplegic for approximately three months, eventually dying in a nursing home.

A 31 year old right-handed male bled within a 6 week period three times from a dissecting right vertebral artery aneurysm. The aneurysm was approached in an oblique retromastoid direction and treated by plicating the point of aneurysm dissection with macroflanges and Shiley pericardium. The patient has done well with evidence of control of the aneurysmal dilatation and is currently asymptomatic. This form of therapy may be an alternative to segmental isolation and trapping of this artery. The operative procedures will be illustrated with a video tape.

11.30

10. The First Neurosurgical Golfing Death - 1626

William Caton, MD, Pasadena, CA

PRESIDENTIAL ADDRESS

Gordon B. Thompson, MD

Introduction by George Ablin, MD

TUESDAY

SESSION III

Moderator: John Kusske, MD

08.15 - 09.00

Guest of the Society

PROFESSOR KENICHIRO SUGITA

Nagoya, Japan

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12. SURGERY OF POSTERIOR FOSSA MENINGIOMAS

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08.45 - 09.00 DISCUSSION

09.00

13. Brainstem Auditory Evoked Potentials and Magnetic Resonance Imaging in the Spina Bifida Aperta Syndrome and Arnold-Chiari Malformation Type II

Barry N. French, MD and Andrew J. Gabor, MD, Sacramento, CA

The spina bifida aperta syndrome (SBAS) consists of myelomeningocele; the Arnold-Chiari malformation (ACM), type II; hydrocephalus; hydrosyringomyelia; and the tethered cord syndrome. This study evaluates whether relationships exist among brainstem auditory evoked responses (BAER); MRI scanning; the embryological diversity of the ACM; the apnea-bilateral abductor vocal cord paralysis syndrome; the foramen magnum compression syndrome; hydrosyringomyelia.

An unselected group of 65 patients with SBAS was studied. Fifty-four patients had BAER performed with an abnormal BAER in one or more parameters in 77% and normal in 23%. Abnormalities were distributed throughout the brainstem. Absolute latencies were prolonged for wave III in 36%, wave V in 53%; the interwave latencies were prolonged for I-III in 52%, III-V in 64% and I-V in 65% (95% tolerance limit).

An unselected group of 26 patients had MRI or CSF-contrast enhanced CT scanning of the craniospinal axis: 92% treated hydrocephalus; 92% Arnold-Chiari malformation; 50% syringomyelia to some degree, and 85% "tethered" spinal cord. Fifteen patients also had at least one BAER to correlate with the MRI scan findings and the clinical picture.

An Arnold-Chiari malformation to the C1/C2 level may be associated with either a normal or abnormal BAER. However, any malformation at C2 or lower was always associated with a prolonged BAER. The BAER was always prolonged in symptomatic Arnold-Chiari malformation, whether in the apnea/abductor vocal cord palsy syndrome or the foramen magnum compression syndrome.

Deterioration in the BAER was documented in one patient on serial studies with improvement after decompression; two other patients had improved BAER parameters after decompression. No relationship was found between the level of motor function of the myelomeningocoele and the degree of Arnold-Chiari malformation or between the degree of Arnold-Chiari malformation and the presence or absence or extent of hydrosyringomyelia.

It is recommended that patients with SBAS have baseline BAER and MRI studies. Serial studies may be of value in those patients with one or a combination of: an initially abnormal BAER; compression of the subarachnoid space in the foramen magnum/posterior fossa on MRI scan; presence of hydrosyringomyelia on MRI scan.

09.15

14. Fractured Odontoid: The Management of Delayed Neurological Manifestations

David J. Fairholm, MD, Vancouver, BC

Odontoid fractures are a common injury but seldom associated with serious neurologic injury. A high index of suspicion, sophisticated radiologic investigation, and prompt effective treatment usually results in satisfactory healing. When the injury is unrecognised, delayed neurologic symptoms due to C1-2 dislocation is a probable outcome.

The clinical picture is usually one of progressing neurologic dysfunction. Early symptoms are often unilateral sensory changes. The condition may progress over a variable rate involving sensory and motor systems and eventually leading to tetraplegia with respiratory failure. The onset of symptoms may be as early as a few months or as late as many years following injury. Radiologic investigation consisting of simple plain x-rays, flexion-extension films with tomograms are usually sufficient for diagnosis.

Treatment is carried out according to a plan determined by the reducibility of the dislocation. Those which reduced in extension or traction undergo simple posterior C1-2 fusion. Those which are fixed in dislocation or remain unreduced in 14 days of traction, require anterior trans-oral decompresion. Posterior fusion is then usually required for stabilization. External orthosis utilizing either Halo vest or brace is maintained until radiologic fusion is achieved. A series of cases encountered in a society where this injury is commonly unrecognised will be presented.

09.30

15. Experience with Percutaneous Lumbar Nuclectomy
W. M. Hammon, MD, Honolulu, HI

09.45

16. Alternatives of Cervical Disc Surgery

David Pitkethly, MD, John A. Maxwell, MD, Jeffrey Pearce, MD
Bellevue, WA

We reviewed the charts and mailed questionaires to 306 consecutive patients operated upon for cervical radiculopathy from 1973 through 1987. We divided our patients into those with soft herniated disc (148), and osteophytic spurs (158) as the primary pathology. We looked at the operations performed: anterior cervical fusion (Cloward technique) 220, anterior microscopic discectomy without fusion 71, and posterior microscopic foraminotomy (only for soft herniated disc) 15. Postoperative complications and reoperations were tabulated. The 306 total patients included 193 men and 113 women. The average age for soft disc herniation was 40 and osteophytic spur 49. Fifty-two patients had two-level surgery. Reoperation at a later date for an adjacent disc space radiculopathy was performed in nine patients (4%) with anterior cervical fusion and two patients (3%) with anterior cervical discectomies. Four patients (2%) with anterior cervical fusions had non-unions. Of the 57 patients undergoing anterior cervical discectomy for soft herniated disc, 25% had moderate to severe postoperative interscapular or sternal pain; whereas the remaining patients in all categories had a combined incidence of 12%. We also had three patients (4%) require anterior cervical fusion at the site of anterior discectomy because of severe postoperative neck and radicular arm pain. Good to excellent patient satisfaction as tabulated by the 176 questionaires returned was as follows: soft disc herniations with anterior cervical fusion 87% (39 replies), soft disc herniations with anterior microscopic discectomy 100% (37 replies), soft disc herniations with posterior microscopic foraminotomy 100% (10 replies), osteophytic spur with anterior cervical fusion 88% (83 replies) and osteophytic spur with anterior microscopic discectomy 71% (7 replies). Our current practice is to operate on patients with cervical radiculopathy secondary to osteophytic spurs by anterior cervical fusion. Those patients with soft disc herniations are treated by posterior microscopic foraminotomy with removal of the extruded fragment.

TUESDAY SESSION IV

Moderator: Robert Rand, MD

10.00 - 10.15 COFFEE BREAK

10.15

17. The Difficult Craniopharyngioma: Management and Prognosis

Donald Becker, MD, Keith Black, MD, Neil Martin, MD and Warwick Peacock, MD, Los Angeles, CA

In 1976, S. Kramer stated: "Craniopharyngioma: the best treatment is conservative surgery and post-operative radiation therapy". In 1988, our thesis is "The best treatment is radical surgery directed to complete as possible tumor removal". Post-operative radiation is to be given when exquisite imaging studies document non-resectable tumor recurrence. New techniques in skull base surgery enhance excisional opportunities.

The complex adherent craniopharyngioma presents a special challenge. The tumor is benign; total excision results in cure. Tumor left behind usually subjects the patient to delayed neurological deficit involving vision, memory, vegetative functions and weight control. Further invasive procedures and radiation therapy are often required. The goal of complete tumor removal must be balanced with the danger of surgical neurological injury. The tumor location often requires unusual, tailored, and multidirectional approaches. Bone and dura at the skull base should be sacrificed as extensively as necessary to allow adequate exposure.

Recent cases will be presented to define the following points: 1. MRI and CT scanning are complementary; both should be obtained and this provides the basis for diagnosis and planning of the operation. 2. Careful preoperative planning is critical to provide adequate circumferential exposure: (a) to allow for multidirectional approaches in a single sitting or staged procedures; (b) to allow for adequate section or resection of skull and base bone; (c) to minimize operative injury to pituitary stalk and gland, optic pathway and hypothalamus. 3. Endocrine testing aids in directing the surgical approach. Hormone replacement is limited to only that which is necessary and required. 4. Cyst drainage and internal and external radiation therapy are effective adjunctive treatments. Rarely should they be a primary modality. This approach promises to improve prognosis in both children and adults.

10.30

18. Utility of Peripheral Benzodiasenines as a Specific Ligand for Brain Tumors

K. L. Black, MD, K. Ikezaki, MD and D. P. Becker, MD
Los Angeles, CA

10.45

19. Chromosomal Alterations in Human Brain Tumors

Ronald F. Young, MD, Michael Chapparo, MD, Violet Shen, MD, Jacob Katz, MD and Moyra Smith, PhD, Irvine, CA

Cytogenetic studies were carried out on 30 human brain tumors; 13 gliomas, 7 meningiomas and 10 miscellaneous types including PNET, medulloblastoma, schwannoma etc. Karyotyping was carried out on cells grown briefly in tissue culture. DNA and RNA analysis was accomplished using the southern blot technique with a variety of gene probes. In glial tumors, the most prominent abnormality was the presence of so-called "double minutes". Double minutes have been shown to represent extra gene copies and to be responsible for gene amplification. The commonest gene amplification in glial tumors was an increase in the expresion of the epidermal growth factor receptor (EGFR). EGFR is located on the glial cell membrane and plays a role in regulation of cell division. Increased EGFR expression may be one factor in an increased rate of cell division leading to oncogenesis. Activation of other oncogenes has also been seen in glial tumors but a consistent pattern has so far not been identified. We confirmed the loss of chromosome 22, which has been described by others in meningiomas. We have also noted heterozygosity at the D22S1 locus on chromosome 22 in meningiomas with a normal karyotype. A number of karyotypic and nucleic acid changes have also been seen in the miscellaneous group of tumors.

A consistent chromosomal abnormality has not been noted to account conclusively for oncogenesis in any tumor. As more gene probes become available to study smaller chromosomal regions, more careful analysis of changes in DNA and RNA in tumors will be possible. We believe such studies may be valuable for tumor classification, prediction of prognosis and possibly for the development of chemotherapeutic agents or to genetic engineering methods to treat brain tumors.

11.00

20. Intrasellar Meningeal Sarcoma Presenting as Pituitary Apoplexy

M. E. MacRae, MD, B. Bayliss, MD, B. Corenblum, MD and B. Curry, MD, Calgary, Alberta

CNS sarcomas occurring only within the sella turcica are extremely rare. The majority of these have been fibrosarcomas following radiation treatment for pre-existing pituitary adenomas. This is the first reporting of an intrasellar meningeal sarcoma. A 53 year old nursing supervisor was admitted with headache, blurred vision and emesis. An invasive intrasellar mass was found on coronal CT. Menarche occurred at age 43, with normal menstrual cycles until age 52. A "triple bolus" assessment of her anterior pituitary function was considered normal. Prior to surgery, she developed signs and symptoms compatible with a diagnosis of pituitary apoplexy. At emergency surgery haemorrhagic tumor was identified. Tumor histology, based on immunohistochemistry and electron microscopy, was compatible with meningeal sarcoma. Postoperatively, she received thyroid and steroid hormone replacement and radiation therapy. Eleven and 17 months postoperatively, she has developed nodules in her lung and liver respectively. Right lower lobectomy confirmed the presence of metastatic meningeal sarcoma. She is presently receiving Adriamycin and DTK chemotherapy.

11.15

21. Hydatid Cyst of Brain - Unusual Presentation

Peter Dyck, MD and Viesturs Petersons, MD, Los Angeles,CA

Although echinococcosis caused by the hydatid stage of the dog tapeworm Taenia echinococcus has been recognized since antiquity, hydatid cysts of the brain remain an enigmatic problem even today. The operative mortality remains high.

We describe the case of 38 year old man, whose dominant hemisphere multilobulated hydatid cyst could not be "delivered" in toto because of pericystic reaction, which we suspected was prompted by head trauma. Although the patient was a Central North American native, he had a long stay in the United States.

Surgical eradication of the lesion was not possible by evagination of the lesion in toto. Hence it was removed piecemeal after cyst aspiration and irrigation with hypertonic saline and 1% iodine. The patient has survived the event and has recovered with a mild ptosis in one eye and extreme gaze diplopia.

This offers an alternative management of hydatid cysts of the brain to the conventionally promulgated notion that all hydatid cysts can be enucleated by pericystic irrigation.

It appears likely that hypertonic saline, and particularly 1% iodine, is a pertinent adjunct to surgical therapy therapy of a difficult intracranial hydatid disease of the brain.

11.30 - 12.00

22. Biographical Tribute to Henry M. Cuneo MD

Frank Anderson, MD, Los Angeles, CA

SESSION V

Moderator: Ian Turnbull, MD

08.00

23. Coronal Craniosynostosis: Forehead Release versus Forehead Advancement

S. T. Myles, MD, Calgary, Alberta

A number of different operative techniques have been suggested for treatmnet of coronal craniosynostosis, whether unilateral or bilateral.

In the past 10 years, I have tried the lateral canthal advancement procedure, as well as tongue-in-groove advancement of the supra-orbital bar, in 11 children with unilateral or bilateral coronal craniosynostosis. While the initial cosmetic result has been satisfactory, excesive vertical growth of the frontal bones has occurred subsequently in several children, causing relative turricephaly.

In 7 children with unilateral or bilateral coronal synostosis, the supra-orbital bar and reshaped frontal bones have been replaced as free grafts without advancement. The cosmetic results have been excellent, provided the operative procedure was carried out at 2 to 3 months of age. This procedure, which I have termed "forehead release", requires less operative time, and reduced blood loss, compared to forehead advancement.

08.15

24 Hydrocephalus: A New, Adjustable Zero Pressure Shunt System

Eldon L. Foltz, MD, Orange, CA

A percentage of patients shunted for hydrocephalus are disabled by low intracranial pressure (ICP) several years after shunt placement. These patients show a dramatic fall in ICP when in the upright position, whereas normal ICP is present in the supine position. This ICP decrease (to as much as -350 mm CSF when upright) correlates with disabling symptoms.

Current shunt valves are relative pressure valves which operate on a pressure gradient basis for opening pressure. This design favors overshunting and the resulting low ICP syndrome. To avoid such low ICP, our zero pressure shunt system functions on a closing CSF pressure device which allows ICP to fall only to zero on the upstream side of this device. The system is an absolute pressure system and includes a one-way valve.

This shunt system is designed on the concept that ventricular shunts must absolutely control the siphoning process inherent in such shunts. These hydraulic parameters vary in relation to body position, supine and upright. Therefore, placement of this device in the subgaleal space has two vertical coordinates: 1. the distance from vertex when upright; 2. the distance from frontal tip when supine. At those specific points, the intra-luminal shunt pressure cannot go below zero. At reference points of vertex (when upright) and frontal tip (when supine) the ICP can fall only to a negative value equal to the vertical distance of the zero presure device (siphon control) from that reference point for that body position.

This system has been effective in 22 patients suffering from disabling low ICP syndrome. All had ICP records pre and postoperatively. Twelve has brain map EEGs to assess effect of ICP change by body position. Twenty patients were markedly improved clinically. Two patients demonstrated impaired ability to function at "normal" ICP levels, requiring a graduated return to such levels. The need for such a system in the initial treatment of hydrocephalus will be obvious in the specific review of the characteristics of this system, and the results in the 22 cases in which the system now functions.

08.30

25. Shunt Infection - An Epidemiological Analysis

Michael H. Sukoff, MD, Hector V. Berezowki, MD and
Vicki Czaykowski, RN, Santa Ana, CA

The ubiquitous and serious nature of shunt infections is well known. Reported incidence has ranged from 2% to 39%, averaging approximately 15%. Infection rate increased with subsequent revisions. Mortalities of 10% to 15% have been reported. Adherence to meticulous technique and the utilization of prophylactic antibiotics has apparently decreased the incidence of shunt infection in many series. There is a large volume of publications dealing with the pros and cons of perioperative antibiotics (with variable conclusions), operative techniques, the surgeon's experience and the effect of some premorbid conditions, particularly myelomeningocoeles, on shunt infection. There is, however, a paucity of reports analyzing other premorbid conditions and none regarding home or extended care facility (ECF) origin of the patients.

We present a 14 year analysis, 220 patients and 327 procedures (ventriculo-peritoneal, lumbar peritoneal and ventriculo-atrial). We have broken down our patients as to years (1974 through June 1984; July 1984 through July 1988), age, and one premorbid condition; whether the patient was living at home or in an ECF. Preoperative antibiotics (Methicillin), or in patients who have had previous shunt procedures or originated in an ECF (Vancomycin) was used consistently during the last 4 years of the study. Methicillin alone was utilized perioperatively during the first 10 years. Over 90% of the infections were caused by staphylococcus species. The procedures were all carried out by one neurosurgeon. There were ten different pediatric or general surgeons performing the peritoneal portions of the procedures or assisting in the ventricular portions or in the atrial ones. The overall incidence of infection was 7%. Broken down into years, 1974 through June 1984 was 6.6%, and July 1984 through July 1988 was 8.1%.

When considering only ECF patients, the infection rate was 10.2% (8.7% 1979-1984; 14.7% 1984-1988). In patients living at home, the shunt infection rate was 4.7% (19.8% and 3.8%).

Considering ages, ECF patients from 5 mths to 17 years had the highest rate of infection, 13.6%. The same breakdown in home patients showed the highest rate in the neonatal to 4 mths age group and was 16.9%. Infection rate in older patients was considerably less in both groups.

Our statistics reflect a higher shunt infection rate in patients living in an ECF as compared to those at home, except in the neonatal group. Age also was a factor, shunt infection being considerably lower in the older age groups. The use of perioperative Vancomycin in higher risk groups did not appear to reduce the incidence of infection.

We conclude that an additional variable to consider in the epidemiology of shunt infections is the premorbid habitat of the patient. ECF patients have a higher overall shunt infection rate than home-living ones. Additionally, infections were considerably more common in the younger age groups. Explanations for this are offered and discussed. Vancomycin did not appear to decrease shunt infection when used in ECF patients.

08.45

26. Surgery for Epilepsy in Childhood: Investigations, Selection Results

W. J. Peacock, MD, H. T. Chugani, MD, D. A. Shewmon, MD, and W. D. Shields, MD, Los Angeles, CA

Since February 1986, we have performed 5 hemispherectomies, 4 temporal lobectomies, 4 focal resections and 2 corpus callosotomies on children suffering from intractable epilepsy. Apart from standard electroencephalographic (EEG) using scalp electrodes, EEG telemetry for up to 7 days was performed on all patients. Functional evaluation also included intracarotid sodium amytal testing (WADA test) and barbiturate narcosis to activate interictal EEG spike activity. Positron emission tomography (PET) was done on all patients to complete the functional assessment. CT and MRI scans were the structural investigations.

Patients with partial seizures and a single resectable focus underwent focal excision including temporal lobectomy. Those with partial or generalized seizures and a hemiplegia who had evidence of diffuse epileptogenic foci and damage in the hemisphere contralateral to the hemiplegia while the opposite hemisphere was normal on all structural and functional tests underwent hemispherectomy. Those children with secondary generalized bilateral synchrony and no hemiplegia were considered for corpus collostomy. Three of the 5 hemispherectomy patients are seizure-free while 2 have each had a brief recurrence which has been easily controlled with medication. Three of the four children who had temporal lobectomies do not require medication and are seizure-free while one receiving medication still has occasional seizures. Of the 4 children who underwent a focal resection, one died due to an anesthesia complication and the other 3 are seizure-free. One child is seizure-free and the other has had a significant reduction in seizures following corpus callosum section.

In carefully selected children with medically refractory seizures, surgical removal of the epileptogenic area has been successful in completely eliminating seizures or significantly reducing their frequency.

09.00

27. Treatment of Syringomyelia by Cervical-Medullary Decompression

Ulrich Batzdorf, MD, Los Angeles, CA

With the wider use of magnetic resonance imaging (MRI), the diagnosis of syringomyelia is being made with increasing frequency. Twelve (12) patients with syringomyelia, eleven (11) with associated Chiari I malformation and one (1) with a membranous obstruction of the fourth ventricle, have been treated by suboccipital craniectomy, resection of the posterior arch of C1, establishment of improved outflow of CSF from the fourth ventricle and duraplasty. All patients have shown at least partial reduction in the size of the syrinx cavity, and in many the progressive collapse of the intramedullary cavity, as judged by MR imaging, has been quite dramatic. To date, none of these patients have required direct shunting of the syrinx cavity; all have shown some level of clinical improvement, dysesthetic pain proving to be the most intractable symptoms. The principle underlying this form of treatment is the elimination of the craniospinal pressure gradient by opening up the subarachnoid space at the cranio-cervical junction. Intradural maneuvers used to accomplish this vary with the type of surgical pathology encountered.

09.15

28. Cervical-Brachial Plexus Bridge Graft Anastomosis For Cervical Nerve Root Avulsions

Shokei Yamada, MD and Gordon Peterson, MD, Loma Linda, CA

It is generally believed that avulsions of the nerve roots from the spinal cord are surgically irreparable. The outcome is permanent paralysis of the muscles innervated by these roots.

The authors report the results of bridge graft anastomoses from the cervical plexus to the brachial plexus which were performed on four patients with cervical nerve root avulsions. These include two cases with complete avulsions of C5 and C6; one case with those of C8 and T1 and partial C7; and one case with total loss of C5 through T1 roots.

Two and a half years after the anastomosis from the cervical plexus to the upper trunk (brachial plexus), the first two patients regained normal or nearly normal functions of shoulder girdle muscles and biceps, which had been completely paralyzed before surgery. The third patient underwent anastomosis for the cervical plexus to the branch of the lateral cord proximal to the formation of the median nerve. He regained nearly normal functions of flexor carpi radialis and pronator teres. The fourth patient, now eight months after cervical plexus-upper trunk anastomosis, shows flicker contraction of the deltoid and pectoralis major, as the first two patients did at the same postoperative interval. EMG studies have indicated voluntary muscle activities return two months before visible contractions.

The cervical-brachial plexus bypass anastomosis is an effective means to restore the functions of muscle gorups which otherwise will be permanently paralyzed after nerve root avulsions. Considering the rate of nerve regeneration, the perfect indication of this surgical procedure is for avulsions of C5 and C6 roots.

09.30

29. Carotid Endarterectomy in a Community Hospital

Michael M. Kendrick, MD, Bend, Oregon

A review is made of 419 carotid endarterectomies done over a 7 year period from 1980 through 1987 in a community hospital by two surgeons. Nearly all operated patients were evaluated pre and postoperatively by Doppler ultrasound, and all patients had arch and carotid angiography. Nearly universal correlation was noted between the two modalities. Indications for surgery were transient ischemic attacks, recovered stroke, and asymptomatic carotid bifurcation stenosis greater than 75%. All surgeries were done as independent procedures rather than a prelude to coronary artery surgery, major vascular surgery etc. Intraoperative technique included heparinization, shunting of virtually all patients, and reversal of heparinization at the conclusion of the procedure. Only patients with recurrent stenosis had patch grafting using woven grafts. All other arteries were closed primarily with 6-0 suture. Postoperative management included blood pressure maintenance near normal levels using pressors or antihypertensives. Pressor agents were usually required as intravenous drips for 12 to 24 hours. Perioperative mortality (within 90 days of surgery) was 1.9% (8 patients). Causes included postoperative myocardial infarction (1 patient), pulmonary embolus (1 patient), hemorrhage (1 patient), and postoperative cerebral infarction (5 patients). An additional postoperative stroke rate of 1% ws noted (5 patients). Of these patients, 3 made excellent recoveries, leaving an overall rate of 2.4% for death or poor result. Most of the postoperative strokes were secondary to postoperative occlusion, and only one case of intraoperative infaraction was noted. It is our opinion that the overall good results of the series are at least in part due to the stability of our operative technique. Both operating surgeons use virtually identical techique, leading to a well-practised team effort both intra and postoperatively.

09.45

30. Anterior Cervical Discectomy with and without Fusion: Factors Affecting Long Term Results

J. Grollmus, MD, H. Gerber, MD, R. Vincent, MD and J. Demakas, MD, Spokane WA

Cervical spondylosis and disc disease is a common cause of pain and disability. These patients have been the source of a great expenditure of time and a fairly high percentage of operative interventions by contemporary neurosurgeons. 700 patients operated on over a ten year period are evaluated. Three neurosurgeons have treated these patients in a slightly divergent fashion. All have had an anterior discectomy. One surgeon has fused all patients, another surgeon has fused none, and a third surgeon has fused some but not all.

In light of these slightly divergent methods we have evaluated the patients return to work and ability to persist in their occupations. We have reviewed the recurrences and operative complications. We have tried to answer whether or not insurance or litigation plays a part in the operative event or in the persistence of late symptoms. These answers help create a more realistic discussion with future patients in the preoperative state and perhaps allow the patient to have a more informed consent.

10.00 - 10.15 COFFEE BREAK

WEDNESDAY **SESSION VI**

Moderator: Frank LeBlanc, MD

10.15

31. Steffee Plating
John Oakley, MD and Allan Jackson, MD, Edmonds, WA

10.30

32. Distraction Rod Instrumentation for Spinal Disorders
Alan T. Hunstock, MD, Douglas B. Kirkpatrick, MD and Lynn M. Gaugin, MD, Santa Rosa, CA

10.45

33. Therapeutic Models of Low Back Care

W. Bradford DeLong, MD, San Francisco, CA

The results of spinal surgery can be enhanced if the surgeon becomes aware of a variety of therapeutic models and uses what each has to offer.

The clinical picture of low back pain falls into four broad groups: radiculopathy and/or sciatica; ligamentous inflammation and/or instability; synovial joint pathology; and myofascial disorders. Patients with chronic low back pain usually fall into all four groups.

The treatment of radiculopathy/sciatica includes the use of physical therapy emphasizing therapeutic exercises and training in stabilization of the lumbosacral spine and pelvis, along with epidural injections and selective nerve root blocks as needed. If surgery becomes necessary, preoperative discography can help define the pain-generating levels.

Syndromes of ligamentous origin occur when chronic inflammatory changes develop in injured ligaments. Goldie has analyzed these changes in tennis elbow. In the low back and pelvis, these changes probably occur primarily at the fibro-periosteal junction, and may improve if the ligaments are strengthened with a proliferative medication. This was pioneered in the USA by Hackett and further developed by Cyriax and others. Ongley and his colleagues have recently demonstrated the efficacy of proliferative therapy for the treatment of chronic low back pain in a prospective, randomized, controlled, double blind study, in which 87.5% of a 40 patient treated group improved 50% or more in six months, as opposed to the same degree of improvement in 39% of the 41 patient placebo group ($p=0.001$).

Disorders of the facets and sacroiliac joints can result in the loss of accessory joint play, with the development of a pathophysiological barrier to joint motion. Osteopathic principles can be useful in analyzing and treating these somatic dysfunctions. Of particular interest to spinal surgeons are dysfunctions resulting in bilateral sacral extension or superior innominate shear, since these problems are frequently unrecognized preoperatively and may be responsible for severe persistent postoperative pain. Muscle energy and direct thrust techniques are generally used to treat somatic dysfunctions, accompanied by muscle balancing to prevent recurrence.

Most low back syndromes are accompanied by myofascial trigger points, a concept developed by Travell and Simons, and by myofascial restrictions. The trigger points can be treated by spray and stretch techniques, though at times injection with a solution of 0.5% procaine is also required. Myofascial restrictions can be treated by osteopathic techniques of myofascial release.

Best results can be achieved if the surgeon does not lock the patient into a single etiological category and does not lock himself or herself into a single therapeutic model.

11.00

34. Ten Years of CT Scanning and the Surgery of Spinal Stenosis

DeWitt B. Gifford, MD, Oakland, CA

At this time, ten years have elapsed since the introduction of lumbar CT scanning in our community. This revolution in the diagnosis of lumbar stenotic conditions has vastly increased the volume of surgery performed, but has also refined the precision with which microsurgical technique may be applied. A personal series of 107 cases is reviewed; categorized by central, lateral, and foraminal stenosis due to spondylitic disease and degenerative spondylolisthesis; but also including patients with synovial cysts of the facet joint, congenital and developmental abnormalities such as achondroplastic dwarfism and late (ten years or more) spurring or hypertrophy developing at the site of previous surgery. All but the last group had excellent results from surgical decompression. Complications included an 8% incidence of intraoperative dural tears requiring repair, one postoperative hematoma with a previous cauda equina syndrome, two cases of continued slippage in spondylolisthetics and a single late postoperative death from myocardial infarction. Use of myelography declined from 100% in the first three years to zero in the last two. A discussion of MRI is included which at present still appears inferior for surgical guidance in these conditions.

11.15

35. Acute Surgical Syndromes Following Spinal Manipulation
Marc Morin, MD and John Kusske, MD, Laguna Hills, CA

11.30

36. Surgical Treatment of Spondylotic Lumbar Hypermobility

Theodore G. Obenchain, MD and L. Mercer McKinley, MD, Escondido, CA

Twenty-eight patients experienced chronic disabling low back pain radiating into one or both lower extremities. In each case, the pain was intractable to all forms of conservative treatment. Examination was unremarkable except for local joint and ligamentous pain. Neurological examination was normal in all cases. Imaging studies were normal in two patinets and revealed minor abnormalities of disc degeneration (bulges) in twenty-six. Discography was abnormal in twenty-four patients. Diagnostic facet blocks produced temporary pain relief in twenty-two patients. In each case, operative evaluation of mobility, laminectomy and inspection of disc space(s) was performed. Twelve patients had no discs removed, whereas sixteen underwent discectomy. Fusion with spinal instrumentation was performed in all patients because of hypermobility found at the time of operation. Results were graded by four different scale criteria. Twenty patients had excellent and seven had good results. One result was fair. Patients may experience primary arthritic lumbar facet pain. Hypermobility of a lumbar motion segment, more commonly, causes secondary facet pain due to early degeneration of the disc. Evaluation with discography and/or facet blocks is reasonable to better define the levels and etiology of the pain. Spinal stabilization is effective for long-term pain relief in this group of patients.

1988

GUESTS

THE WESTERN NEUROSURGICAL SOCIETY

Guest	Host
Sugita, Professor Kenichiro	Guest of the Society
Abou-Samra, Moustapha	Melvin Cheatham
Amyes, Edwin	George Ablin
Black, Keith	Donald Becker
Blue, James	Ralph Kamm
Capanna, Albert	Franco Erculei
Carver, Christopher	John Phillips
Chapparo, Michael	Ronald Young
Cobb, Cully, Jr	Cully Cobb,III
Cohn, William	Michael Sukoff
Dobkin, William	Steven Giannotta
Erickson, LaVerne	George Ablin
Fairholm, David	Gordon Thompson
Grollmus, John	Edward Reifel
Hill, Norman	Peter Allen
Hunstock, Alan	Ronald Young
Kendrick, Michael	George Koenig
Lamond, Roderick	John Alksne
MacRae, Elizabeth	Francis LeBlanc
Martin, Neil	Ulrich Batzdorf
Morgan, DAvid	Ronald Young
Morin, Marc	John Kusske
Myles, S. Terence	Francis LeBlanc
Oakley, John	Philip Weinstein
Obenchain, Ted	Randall Smith
Peacock, Warwick	Ulrich Batzdorf
Penka, Christopher	Wolff Kirsch
Pitkethly, David	William Kelly
Seelig, John	Randall Smith
Shuer, Lawrence	Gerald Silverberg
Sonntag, Volker	Robert Spetzler
Vinuela, Fernando	Ulrich Batzdorf
Wagner, Franklin	Lyman Maass
Wohns, Richard	Ben Blackett
Zabramski, Joseph	Robert Spetzler

ORGANIZATIONAL COMMITTEE

Frank M. Anderson
Edwin B. Boldrey
Howard A. Brown
Herbert G. Crockett
John Raaf
Rupert B. Raney
David L. Reeves
C. Hunter Sheldon

FOUNDING FATHERS

Robert B. Aird
Frank M. Anderson
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Howard A. Brown
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Herbert G. Crockett
Henry M. Cuneo
Edward W. Davis
Robert S. Dow
John D. French
Hale A. Haven
O. W. Jones, Jr
Edward K. Kloos
Lester B. Lawrence
Kenneth E. Livingston
Frank W. Lusignan
Ernest W. Mack
Theodore Magoun
Edmund J. Morrissey
Henry W. Newman
Nathan C. Norcross
Robert H. Pudenz
John Raaf
Robert W. Rand
Aidan Raney
Rupert B. Raney
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Augustus S. Rose
C. Hunter Sheldon
W. Eugene Stern
Frank Turnbull
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Arthur A. Ward
Delbert Werden
Ward W. Woods

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David L. Reeves (deceased)	1955
John Raaf	1956
Frank Turnbull	1957
Howard A. Brown	1958
Rupert R. Raney (deceased)	1959
Edmund J. Morrissey	1960
C. Hunter Shelden	1961
Ernest W. Mack	1962
Hale A. Haven (deceased)	1963
Frank M. Anderson	1964
Edwin B. Boldrey	1965
John R. Green	1966
Arthur A. Ward, Jr	1967
Lester B. Lawrence (deceased)	1968
John D. French	1969
Chester B. Powell	1970
Robert W. Porter	1971
Henry M. Cuneo	1972
Edward K. Kloos	1973
W. Eugene Stern	1974
Ralph B. Cloward	1975
James R. St.John	1976
Eldon L. Foltz	1977
John Tytus	1978
Donald B. Freshwater	1979
William A. Kelly	1980
Byron C. Pevehouse	1981
Robert W. Rand	1982
Theodore S. Roberts	1983
Thomas K. Craigmile	1984
Ulrich Batzdorf	1985
Gale C. Clark	1986
Lyman Maass	1987

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John Raaf	1955
Frank Turnbull	1956
Howard A. Brown	1957
Rupert B. Raney (deceased)	1958
Edmund J. Morrissey	1959
C. Hunter Sheldon	1960
Ernest W. Mack	1961
Hale A. Haven (deceased)	1962
Frank M. Anderson	1963
Edwin B. Boldrey	1964
Herbert C. Crockett (deceased)	1965
Karl O.Von Hagen	1966
Samuel W. Weaver	1967
Chester B. Powell	1968
Peter O. Lehman	1969
Charles W. Elkins (deceased)	1970
Nathan C. Norcross	1971
James R. St.John	1972
Edward K. Kloos	1973
Ralph B. Cloward	1974
Thomas K. Craigmile	1975
Lyman Maass	1976
Gale C. Clark	1977
William A. Kelly	1978
Byron C. Pevehouse	1979
Robert W. Rand	1980
Theodore S. Roberts	1981
Ulrich Batzdorf	1982
George Ablin	1983
George A. Ojemann	1984
Gale C. Clark	1985
Robert Weyand	1986
Robert Florin	1987

PAST SECRETARY-TREASURERS

Herbert C. Crockett (deceased)	1955, 1956, 1957
Ernest W. Mack	1958, 1959, 1960
Samuel W. Weaver	1961, 1962, 1963
James R. St.John	1964, 1965, 1966
Robert W. Porter	1967, 1968, 1969
William A. Kelly	1970, 1971, 1972
John S. Tytus	1973, 1974, 1975
Theodore S. Roberts	1976, 1977, 1978
Ulrich Batzdorf	1979, 1980, 1981
John A. Kusske	1982, 1983, 1984
W. Ben Blackett	1985, 1986, 1987

PAST HISTORIANS

Henry M. Cuneo	1962-1966
Ernest W. Mack	1967-1971
Donald B. Freshwater	1972-1976
George Ablin	1977-1982
Gale C. Clark	1982-1984

PAST MEETINGS OF THE SOCIETY

1.	Biltmore Hotel, Santa Barbara, CA	Nov 25-26, 1955
2.	Timberline Lodge, Oregon	Dec 9-11, 1956
3.	Holiday Hotel, Reno, Nevada	Sept 29-Oct 1, 1957
4.	Del Monte Lodge, Pebble Beach, CA	Oct 19-22, 1958
5.	La Valencia Hotel, La Jolla, CA	Sept 27-30, 1959
6.	Del Monte Lodge, Pebble Beach, CA	Oct 23-26, 1960
7.	Bayshore Inn, Vancouver, BC	Oct 29-Nov 1, 1961
8.	Camelback Inn, Phoenix, AZ	Oct 28-31, 1962
9.	El Mirador Hotel, Palm Springs, CA	Oct 20-23, 1963
10.	Fairmont Hotel, San Francisco, CA	Oct 18-21, 1964
11.	Olympic Hotel, Seattle, WA	Oct 3-6, 1965
12.	Hotel Utah, Salt Lake City, UT	Nov 6-9, 1966
13.	Kona Kai Club, San Diego, CA	Oct 15-18, 1967
14.	Mauna Kea Beach Hotel, Kamuela, HI	Nov 16-19, 1968
15.	Del Monte Lodge, Pebble Beach, CA	Oct 15-18, 1969
16.	Bayshore Inn, Vancouver, BC	Oct 4-7, 1970
17.	The Broadmoor, Colorado Springs, CO	Oct 31-Nov 3, 1971
18.	The Skyline Country Club, Tucson, AZ	Oct 29-Nov 1, 1972
19.	Airport Marina Hotel, Albuquerque, NM	Sept 16-19, 1973
20.	Santa Barbara Biltmore Hotel, CA	Oct 27-30, 1974
21.	Mauna Kea Beach Hotel, Kamuela	Sept 28-Oct 1, 1975
22.	Harrah's Hotel, Reno, NV	Sept 26-29, 1976
23.	La Costa Resort Hotel, Carlsbad, CA	Sept 18-21, 1977
24.	The Lodge, Pebble Beach, CA	Oct 8-11, 1978
25.	Camelback Inn, Scottsdale, AZ	Sept 23-26, 1979
26.	Mauna Kea Beach Hotel, Kamuela, HI	Sept 21-24, 1980
27.	The Empress Hotel, Victoria, BC	Sept 20-23, 1981
28.	Jackson Lake Lodge, Jackson Hole, Wyoming	Sept 12-15, 1982
29.	Hotel del Coronado, Coronado, CA	Oct 2-5, 1983
30.	The Broadmoor, Colorado Springs, CO	Sept 9-12, 1984
31.	Silverado Country Club & Resort, Napa, CA	Sept 22-25, 1985
32.	Maui Intercontinental, Wailea, Maui, HI	Sept 28-Oct 1 1986
33.	Banff Springs Hotel, Banff, Alta	Sept 6-9, 1987

FUTURE MEETINGS OF THE SOCIETY

Sun Valley Lodge, Sun Valley, Idaho	Sept 10-13, 1989
Mauna Lani Bay Hotel, Kawaihae, HI	Sept 9-12, 1990

THE WESTERN NEUROSURGICAL SOCIETY

MEMBERSHIP ROSTER

1988

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