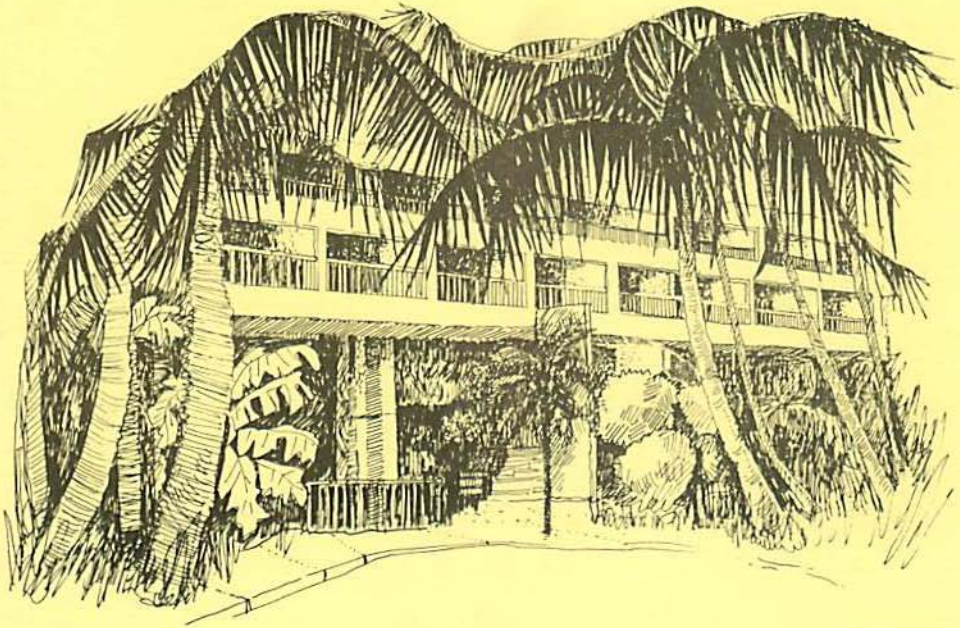
American Academy of Neurological Surgery

ANNUAL MEETING

Kamuela, Hawaii

November 2-5, 1977



ANNUAL MEETING 1977

Mauna Kea Beach Hotel

Kamuela, Hawaii

November 2 - 5, 1977

THE AMERICAN ACADEMY OF NEUROLOGICAL SURGERY

Officers 1977

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AMERICAN ACADEMY OF NEUROLOGICAL SURGERY

MAUNA KEA BEACH HOTEL

Registration for Meeting	LOBBY LOUNGE
Aloha Cocktail Party	NORTH GARDEN
Breakfast Business Meeting	GARDEN PAVILION
Scientific Session	AUDITORIUM
Coffee Break	GARDEN PAVILION
Evening Hawaiian Luau	NORTH POINTE
Banquet	BATIK ROOM

PROGRAM 1977

WEDNESDAY, NOVEMBER 2

4:00 - 7:00 P.M. . . . . Registration - Lobby Lounge
6:30 - 8:00 P.M. . . . . Aloha Cocktail Party - North Garden
(Dinner on your own - jackets required)

THURSDAY, NOVEMBER 3

7:30 A.M. . . Breakfast and Business Meeting - Garden Pavilion
Members Only
8:20 - 10:30 A.M. . . . . Scientific Session - Auditorium
10:30 - 10:50 A.M. . . . . Coffee Break - Garden Pavilion
10:50 - 12:10 P.M. . . . . Scientific Session - Auditorium
12:10 P.M. . . . . Lunch - on your own
1:30 - 3:00 P.M. . . . . Scientific Session - Auditorium
(Academy Award Winner Presenting at 1:30)
3:00 - 3:20 P.M. . . . . Coffee Break - Garden Pavilion
3:20 - 4:00 P.M. . . . . Scientific Session - Auditorium
6:30 P.M. . . . . Cocktails - North Pointe
8:00 P.M. . . . . Luau Hawaiian Feast - North Pointe
(Aloha attire - entertainment)

FRIDAY, NOVEMBER 4

7:30 A.M. . . Breakfast and Business Meeting - Garden Pavilion
Members Only
8:30 - 10:30 A.M. . . . . Scientific Session - Auditorium
10:30 - 10:50 A.M. . . . . Coffee Break - Garden Pavilion
10:50 - 12:00 Noon . . . . . Scientific Session - Auditorium
(Presidential Address at 11:30)
12:00 Noon . . . . . Lunch - on your own
1:00 P.M. . . . . Tennis and Golf
7:00 P.M. . . . . Cocktails - Batik Room
8:15 P.M. . . . . Banquet - Batik Room

SATURDAY, NOVEMBER 5

8:00 A.M. . . Breakfast and Business Meeting - Garden Pavilion
Members Only
9:00 - 10:40 A.M. . . . . Scientific Session - Auditorium
10:40 - 11:00 A.M. . . . . Coffee Break - Garden Pavilion
11:00 - 12:30 P.M. . . . . Scientific Session - Auditorium

LADIES PROGRAM

WEDNESDAY, NOVEMBER 2

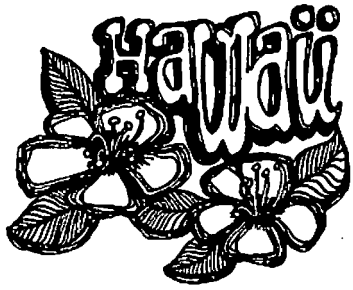
4:00 P.M. - 7:30 P.M. ..... Registration - Lobby Lounge
6:30 P.M. - 8:00 P.M. ..... "Aloha" cocktail party - North Garden

THURSDAY, NOVEMBER 3

10:00 A.M. - 12:00 Noon ..... Hawaiiana demonstration - North Pointe
6:30 P.M. - 8:00 P.M. ..... Cocktails - North Pointe
8:00 til ..... Luau - Hawaiian Feast - North Pointe and entertainment

FRIDAY, NOVEMBER 4

1:00 P.M. ..... Tennis & Golf
7:00 P.M. ..... Cocktails - Batik Room
8:15 P.M. til ..... Banquet - Batik Room



Scientific Program

THE AMERICAN ACADEMY OF NEUROLOGICAL SURGERY

Kameula, Hawaii
November 2 - 5, 1977

MODERATOR: William H. Sweet

THURSDAY, November 3
8:20 a.m.
Welcoming Remarks and Announcements

8:30 a.m.

1. Management and prognosis of intracranial germinomas -- Follow-up study of 69 cases --

Ryuichi Tanaka, Hiroshi Kameda
and Komei Ueki
Niigata, Japan

In a series of 103 pineal tumors including so-called "ectopic pinealomas" there were 69 germinomas, 13 teratomas, 6 mixed teratoma and germinomas, 3 tumors with origin of the pineal parenchyma, and others.

For diagnosis of germinomas, clinical and neuro radiological findings and tumor cell diagnosis in CSF were very useful. The adequacy of the diagnosis was confirmed in most cases retrospectively after radiotherapy to recognize tumor shrinkage.

Follow-up study of 47 germinomas treated with radiotherapy revealed that the 5 year and 10 year survival rates were 44.7% and 23.4% in the whole germinomas, and 61.5% and 38.5% in the germinomas of the pineal region. Seventeen out of 26 irradiated cases with germinoma in the pineal region are still surviving, leading useful lives, 4 cases more than 15 years, 5 cases 10 to 15 years, and 6 cases 5 to 10 years. In the series of the pineal region germinomas, the smaller tumors responded very well to radiotherapy, whereas the larger ones showed a tendency to recurrence.

Since results of radiotherapy are fairly good and even palliative operations can be a hazard, the most promising management of germinomas may be radiotherapy before any surgical treatment except shunting operation if necessary.

(Discussion)

5.

8:50 a.m.

2. Appearance and Evolution of Immuno-deficiency in Brain Tumor Bearing Rats

Hachiki Sobue, Keiichi Inoue, Makoto Minagawa,
Kenichi Tanimura, and Komei Ueki
Miigata, Japan

ENU-induced rat glioma cells were transplanted to allogeneic 93 WKA rats, 35 subcutaneously and 58 intracerebrally. Intracerebrally transplanted tumor cells ($1x10^6$) developed into large mass with high incidence of take (89.7%). Tumor increased in size most rapidly 20-30 days post-implant. Subcutaneously transplanted tumor cells ($1x10^6$) were rejected rapidly or regressed spontaneously 12-15 days post-implant with temporary growth.

Lymphocyte infiltration, developed by the transplantation immunity, appeared in and around the tumor at the brain, and was poor compared with that at the subcutaneous tissue. The loss of quantitative balance between the tumor cells and the lymphocytes mobilized to the lesion, seemed to be one of the most important factors for the take and growth of tumor.

Microcytotoxicity assay in vitro showed that peripheral lymphocytes in both subcutaneously and intracerebrally tumor bearing rats destroyed the tumor cells specially 7-15 days post-implant. In intracerebrally tumor bearing rats, this ability was gradually lost along with the tumor growth, especially in the final stage (30 days-).

In intracerebrally tumor bearing rats, blastogenesis of lymphocytes to PHA tended to fall from the beginning of tumor grow(7-10 days), although the tumors were not large enough to decline the physical conditions of the hosts.

The suppression of cytotoxicity and blastogenesis with tumor growth, seems to be another factor to destine the continuous proliferation of tumor cells in the brain.

(Discussion)

9:10 a.m.

3. Radioimmunoassay of astroprotein (an astrocyte-specific cerebroprotein) in cerebrospinal fluid

K. Morimoto, T. Mori , Y. Ushio, T. Hayakawa and H. Mogami
Osaka, Japan

8:50 a.m.

2. Appearance and Evolution of Immuno-deficiency in Brain Tumor Bearing Rats

Haruhiko Saitoh, Koichi Inoue, Makoto Minagawa,
Kenichi Tanimura, and Komei Ueki
Niigata, Japan

ENU-induced rat glioma cells were transplanted to allogeneic 93 WKA rats, 35 subcutaneously and 58 intracerebrally. Intracerebrally transplanted tumor cells (1×10^5) developed into large mass with high incidence of take (88.7%). Tumor increased in size most rapidly 20-30 days post-implant. Subcutaneously transplanted tumor cells (1×10^6) were rejected rapidly or regressed spontaneously 12-16 days post-implant with temporary growth.

Lymphocyte infiltration, developed by the transplantation immunity, appeared in and around the tumor at the brain, and was poor compared with that at the subcutaneous tissue. The loss of quantitative balance between the tumor cells and the lymphocytes mobilized to the lesion, seemed to be one of the most important factors for the take and growth of tumor.

Microcytotoxicity assay in vitro showed that peripheral lymphocytes in both subcutaneously and intracerebrally tumor bearing rats destroyed the tumor cells specially 7-15 days post-implant. In intracerebrally tumor bearing rats, this ability was gradually lost along with the tumor growth, especially in the final stage (30 days).

In intracerebrally tumor bearing rats, blastogenesis of lymphocytes to PHA tended to fall from the beginning of tumor growth (7-10 days), although the tumors were not large enough to decline the general conditions of the hosts.

The suppression of cytotoxicity and blastogenesis with tumor growth, seems to be another factor to decline the continuous proliferation of tumor cells in the brain.

(Discussion)

9:10 a.m.

3. Radioimmunoassay of astroprotein (an astrocyte-specific cerebroprotein) in cerebrospinal fluid

K. Morimoto, T. Mori, Y. Ushio, T. Hayakawa and H. Mogami
Osaka, Japan

An attempt was made to apply astroprotein (Benda et al 1970 and Mori 1970) to immunological diagnosis of central nervous system disorders.

Using radioimmunoassay, astroprotein concentration in cerebrospinal fluid (CSF) was measured in 81 patients with intracranial disease (60 brain tumors and 21 miscellaneous) and 4 patients without central nervous system disorders. Astroprotein concentration in CSF was below 25 ng/ml in all patients who were free from intracranial disorders. In 9 out of 14 patients (64%) with glioblastoma or astrocytoma, the level of astroprotein in CSF was more than 25 ng/ml. In 3 patients with glioblastoma, astroprotein level elevated more than 500 ng/ml. Of 46 patients with intracranial tumors other than glioblastoma or astrocytoma, 10 patients (22%) showed astroprotein level more than 25 ng/ml of CSF. Of 21 patients with central nervous system disorders other than tumors, 4 patients (19%) showed astroprotein level more than 25 ng/ml of CSF.

We conclude that measurement of astroprotein level in CSF might be useful not only as a screening test of brain tumors such as glioblastoma or astrocytoma, but also an indicator of the degree of brain damage.

(Discussion)

9:30 a.m.

4. A FOREFATHERS' TRAIL – BORON NEUTRON CAPTURE THERAPY

Hiroshi Hatanaka
Tokyo, Japan

Application of neutron capture reaction, of either Lithium-6 or Boron-10 which emits alpha particle as secondary radiation to cancer treatment was first proposed by Locher in 1936. Sweet, Javid, Zervas and others considered such a therapy will be suited to treat brain tumors specifically, because the brain tissue is not penetrated by the boron compounds that are easily taken up by tumor cells. After the earlier series at Brookhaven National Laboratory and MIT reactors between 1953 and 1961 conducted by Sweet and Farr, Hatanaka joined the project group in 1964 and back in Tokyo he and Sano resumed treatment with revised protocol by using mercaptoundecahydrododecaborate which was originally studied by Soloway, Hatanaka and Davis. His earlier series between 1968 and 1974 was mostly conducted at Hitachi Training Reactor with minimal yield of thermal neutron flux and only 15 patients were treated, mainly due to short supply of boron-10 isotope and lack of a medical radiation facility. The average survival for glioblastoma patients, most of whom had been treated elsewhere with conventional therapies has exceeded 28 months. Some patients are fully active in their occupation

even after several years. Since March 1977, Musashi Institute of Technology reactor specifically re-designed for this purpose has been employed, and at least twelve patients' treatment is expected before March 1978. Use of epithermal neutron for deep-seated tumors and development of simultaneous dose monitoring device are the new features of current studies. The Boron-10 enrichment and production of the compound by the Shionogi Research Laboratory will make it possible to treat two dozen patients in the coming year.

(Discussion)

9:50 a.m.

5. Short Course Irradiation of Glioblastoma Multiforme

Robert L. McLaurin, Vicharn Lorvidhaya,
and Bernard S. Aron
Cincinnati, Ohio

During the past two years, nine consecutive patients with glioblastoma multiforme have been treated with "short course irradiation" following biopsy for partial tumor removal. The purpose of this study was to determine whether there was justification for subjecting the patient to more prolonged irradiation in view of the limited survival time of such patients. A total of 2,500 or 2,700 rads were delivered in five daily treatments. Decadron was administered during irradiation.

The results in this group of patients were compared with previously treated patients in whom surgery alone or surgery plus prolonged irradiation had been used. The results indicate that the present group of patients showed a survival rate similar to those who had been treated with more prolonged radiation and distinctly better than those treated with surgery alone. It is concluded that short course irradiation is well tolerated, is equally as effective as more prolonged irradiation following surgery, but is less effective than other recently reported therapeutic regimens.

(Discussion)

10:10 a.m.

6. Excision of Craniopharyngioma: Surgical technique and operative morbidity

Russel H. Patterson, Jr. and
Alec Danylevich
New York, New York

During the past two years, 9 patients were subjected to a presumed total removel of a craniopharyngioma. Removal was accomplished with least trauma through a subfrontal approach behind the optic chiasm and between the optic tracts to free the tumor from the hypothalamus. Once freed from behind, large tumors were extracted between the optic nerves after removal of the tuberculum sellae.

The postoperative morbidity in this group was compared with 20 consecutive operations limited to partial excision, and the results are summarized below.

	Subtotal	Total
patients	16	9
operations	20	9
mortality	0	0
postoperative stay	16 days	23 days
acuity better	55%	11%
acuity worse	10%	22%
difficult water balance	0	22%
steroid dependent	88%	100%

Since our earlier reported experience demonstrated a recurrence rate after subtotal removal without radiation therapy of 72% at 5 years and 89% at 10 years, we believe that total removal should be attempted in all cases with the exception of children who are still growing.

(Discussion)

10:30 a.m.
Coffee Break

10:50 a.m.
7. Cushing's Disease Revisited

Charles B. Wilson and Blake Tyrrell
San Francisco, California

In 1932 Cushing delivered his classic paper on pituitary basophilism. Convincingly and with characteristic clarity he described the clinical and pathological findings in hypercortisolism caused by pituitary basophilic adenomas, and that form of Cushing's Syndrome has been designated Cushing's Disease.

The authors have evaluated 30 patients with Cushing's Disease, all of whom have undergone transsphenoidal exploration of the pituitary gland. The usual finding has been a 2-6 mm microadenoma, and in 85% of cases normal function of both pituitary and adrenal glands has been restored. Presented will be preoperative diagnostic testing, operative technique and results.

(Discussion)

11:10 a.m.

8. SYMPTOMATIC PITUITARY TUMOR ENLARGEMENT AFTER INDUCED PREGNANCY

P.B. Nelson, A.G. Robinson, D.F. Archer
and J.C. Maroon
Pittsburgh, Pa.

A case is presented and 11 cases are reviewed in which symptomatic pituitary tumor enlargement occurred during pregnancies which resulted from induced ovulation. This complication is being reported more commonly with the availability of gonadotropins and bromocriptine for induction. The syndrome is usually characterized by headache and visual disturbances with bitemporal field cuts, but may present with ocular muscle palsies. The cases are divided into two groups. One group had a shorter duration of amenorrhea, 3.8 years, developed symptoms before the 14th week of pregnancy, and were ausally treated by tumor removal. The second group had a longer period of amenorrhea, 10.1 years, and develped symptoms after the 24th week of pregnancy and were usually treated by delivery of the infant. Tumor removal or termination of the pregnancy both resulted in resolution of symptoms. All pregnancies resulted in normal infants. This series provides guidelines for management of future cases.

(Discussion)

11:30 a.m.

9. POSTERIOR FOSSA MENINGIOMAS, OUR EXPERIENCE WITH 31 CASES

John Cuff, Eben Alexander
Winston-Salem, North Carolina

Thirty-one patients operated on for posterior fossa meningiomas at North Carolina Baptist Hospital between 1949-1977 are reviewed. These include 12 lateral convexity tumors, 8 in the cerebello-pontine angle, 6

foramen magnum, 3 primarily involving the tentorium, and 2 clivus tumors.

The initial symptoms, all symptoms at the time of diagnosis, length of time between onset of symptoms and diagnosis, and physical signs are presented and discussed.

A review of the neuroradiological studies obtained is presented with a discussion of the role of computerized cranial tomography. 6 cases are presented which made use of this diagnostic tool. The impact on treatment and diagnosis of these patients, especially in terms of early diagnosis and surgery, is discussed.

Morbidity and mortality are discussed and correlation with tumor location and clinical presentation is made. Suggestions for anticipating the high risk patient and for decreasing the surgically related morbidity and mortality are presented.

Finally, a discussion of our long-term surgical experience is presented with respect to total or partial removal, location of tumor, and other clinical or surgical parameters.

(Discussion)

11:50 a.m.

10. Cerebral Metastatic Chorionic Carcinoma: A Unique Case

Robert G. Fisher, Scott Bennion,
Dan Daniel Frimmer, Robert L. Malatesta
Plainfield, New Jersey

This individual case report is most unique. The patient presented with having a typical course for this type of lesion -- bleeding into the subarachnoid space from a mass lesion readily diagnosed by neuroradiologic means. However, at no time was any demonstrable mass in either the pelvis or the lung found. The human gonadotrophic hormone was markedly elevated.

Combined surgical, cobalt irradiation, and chemotherapy has effected a cure.

The literature will be discussed and pertinent points learned both from the experience of others and the author will be pointed out.

(Discussion)

12:10 p.m.
Lunch

MODERATOR: Robert S. Knighton

1:30 p.m.

11. ACADEMY AWARD

Medial hypothalmic neurons and their connections:
A neural network regulating pituitary function.

Howard W. Blume
Montreal, Quebec, Canada

2:00 p.m.

12. On the occurrence of rupture of cerebral aneurysms during intracranial operation.

Yuji Miyazaki
Sapporo, Japan

Even today when remarkable advances have been achieved in intracranial direct operation techniques of cerebral aneurysm, there is always a possibility of rupture during the operation. Thus in attempt to cope with this insidious problem with the dual aim of finding preventive measures and procedure to be followed in the case of ruptures during operation, a study was made on cerebral aneurysm ruptured cases occurring during operations.

Up to 1976 I have conducted intracranial direct operation of 376 cerebral aneurysms (337 cases), out of which 48 aneurysms ruptured during operation (12.8%), and among these cases internal carotid aneurysms showed the highest incidence (20.0%).

It was found that no age level correlation was seen with rupture and cases with 3 previous ruptures showed the highest frequency of 25.0%. Cases within one month after the last rupture showed a high frequency of 21.0%.

The causal factor of rupture of cerebral aneurysm during operation in 44 cases (91.7%) was clearly attributable to operative procedures and these factors will be described in detail.

On the other hand, rupture of the cerebral aneurysm during operation without the aid of a surgical microscope showed a frequency of 21.0%, while in contrast the incidence of rupture under a surgical microscope was 11.9%, and I wish to emphasize that even in the latter the frequency of rupture during operation is far from low.

The state of the ruptured site of cerebral aneurysm will be described in detail. The value of intracranial interruption of cerebral blood flow under

hypothermia and artifical hypotention for prevention of rupture of cerebral aneurysm will be discussed.

(Discussion)

2:20 p.m.

13. SURGICAL MANAGEMENT OF INTRACRANIAL GIANT ANEURYSMS

Yoshio Hosobuchi
San Francisco, California

The introduction of microsurgical techniques has greatly improved the surgical management of intracranial aneurysms. However because of their size, direct surgical attack on giant aneurysms still presents a considerable challenge.

Obliteration of the aneurysmal cavity by a mass of coiled wire was achieved in a single case by Werner and colleagues in 1941. In 1971, J.F. Mullan reintroduced this technique for the electrometallic thrombosis of cerebral aneurysms. Its purpose is to induce ntramural thrombosis of the aneurysm by inserting fine (copper, copper-alloy, or stainless-steel) wires into the aneurysm and reinforcing the aneurysmal wall with large quantities of packed, fine wire.

During the past seven years, the author has operated on 40 cases of giant intracranial aneurysms, 21 of which were treated by the electrometallic thrombosis technique; the others were treated by clipping the neck of the aneurysm, entrapment, or carotid ligation. This report discusses the indications for the electrometallic thrombosis technique, and presents findings which indicate that it is the optimal management technique for giant aneurysms of the basilar artery and carotid bifurcation.

(Discussion)

2:40 p.m.

14. THE INFLUENCE OF NITROPRUSSIDE ON CEREBRAL AUTOREGULATION

Martin H. Weiss, John Spence and Theodore Kurze
Los Angeles, California

Ten cats were studied to assess the question of abolition of cerebral autoregulation attendant to the use of nitroprusside for hypotensive anesthesia. The animals were anesthetized with pentobarbital, 30 mg./kg., following which appropriate cannulas were placed enabling continuous

monitoring of arterial and central venous pressures. Animals were ventilated on a constant volume ventilator; end tidal CO_2 content was continuously monitored and maintained at 4%. Core temperature was maintained at 38 degrees centigrade. A cannula was stereotaxically placed in the lateral ventricle enabling continuous monitoring of intracranial pressure utilizing appropriate transducers and amplifying systems.

After the establishment of stable baseline parameters as described above, a continuous infusion of sodium nitroprusside was begun in a dose sufficient to maintain a mean systemic arterial pressure (SAP) of 65 mm. Hg. The infusion was continued for incremental periods of 30 seconds to 10 minutes, increasing the time of infusion by 30 seconds for each subsequent trial. At 10 seconds following the cessation of nitroprusside administration, intravenous dopamine was infused to raise the systemic arterial pressure to a mean of 100 mm. Hg., and the subsequent response in intracranial pressure was recorded in each instance.

In no animal was a loss of cerebral autoregulation noted when the nitroprusside infusion was maintained for 3 minutes or less. When the infusion was maintained for 4 minutes or longer, cerebral autoregulation was lost in each animal, and the length of time to return of cerebral autoregulation correlated with the duration of nitroprusside infurion. Infusions of duration of 3½ to 4 minutes evoked variable responses; in some, cerebral autoregulation was lost, in some, autoregulation persisted until infusions beyond 4 minutes in duration were established.

It is apparent that sodium nitroprusside disturbs the integrity of cerebral autoregulation and that the onset and extent of this disturbance is a dose-dependent phenomenon.

(Discussion)

3:00 p.m.
Coffee Break

3:20 p.m.

15. VASCULAR CHANGES IN ARTERIOVENOUS MALFORMATIONS OF THE BRAIN

Bennett M. Stein, and Samuel M. Wolpert
Boston, Massachusetts

A review of our experience with 48 arteriovenous malformations of the cerebral hemisphere will be presented. To be stressed are the aspects relating to the vascular changes accompanying therapeutic embolization and post operative vascular changes which are seen in a dynamic state by serial angiography.

The majority of the cases have had embolization and surgery as a form of treatment. We have observed dynamic vascular changes as a response to occlusion of feeding vessels and the interstices of these arteriovenous malformations. These vascular changes following either embolization or surgery are indicative of an evolving change in the circulation when a high flow arteriovenous shunt is partially or totally eliminated and the arterial supply associated with this shunt returns to its normal function.

The changes which are observed through frequent angiographic studies include the following:

1. Initial increase in caliber of the feeding arteries when occlusion of these vessels occurs followed by a very gradual decrease in the size of feeding arteries with apparent stasis and prolonged ectasia,
2. A variable course of events associated with the size of coincidental aneurysms on the feeding vessels when these vessels are eliminated from their role as contributors to an arteriovenous malformation,
3. Cerebral edema either short term or prolonged is assumed to be associated with neurological symptomatology appropriate for the changing arterial and venous patterns.

The paper will be illustrated by 35 mm slides, primarily of angiographic material.

(Discussion)

3:40 p.m.

16. Acquired and Congenital Vascular Malformations of the Middle Meningeal Artery

James T. Robertson, B. King Tipton, J.D.,
and James Langston
Memphis, Tennessee

Arteriovenous malformations of the middle meningeal artery are rare. The incidence and significance of such lesions have been debated. In recent years, with the advent of advanced neuroradiologic techniques, increasing numbers of these lesions have been reported. In this paper, the authors review the available literature and recount their own surgical experiences with nine cases of pseudoaneurysm and arteriovenous fistulae of the middle meningeal artery.

Dural vascular malformations can be associated with sudden or gradual neurological deterioration after head injury. Rarely, such lesions appear to be unassociated with craniocerebral trauma, i.e. of developmental origin. Emphasis has been placed on the variable natural

Resistance to this: 1 million spent to show anticoagulants no good (doses) - all neurologists continue to use them. ∴ NS will continue to do bypasses, no matter what.

Phase I degree of risk (small)
II efficacy (present study)
III controlled trial (being initiated as a group trial now).
IV general use.

Sundt: clinic neurologists believe it a very useful operation.

history of this disease, the need for proper radiologic technique allowing clearer delineation, and the value of careful followup allowing timely surgical intervention. A method of approaching middle meningeal artery arteriovenous fistulae and post-traumatic aneurysms is outlined.

(Discussion)

Friday, November 4
MODERATOR: Arthur A. Ward, Jr.

8:30 a.m.

17. CEREBRAL REVASCULARIZATION – PRESENT VALUE AND FUTURE TRENDS

James I. Ausman, Myoung C. Lee,
Shelley N. Chou, and Lyle A. French
Minneapolis, Minnesota

Fifty consecutive patients undergoing anterior and posterior circulation cerebral revascularization in the last three years have had detailed pre- and postoperative neurologic, neuropsychologic and angiographic assessment. In STA/OA-MCA anastomosis there has been no operative mortality, 4% postoperative morbidity, 2% long term mortality from MI and 2% from stroke. An independent neurologist found no patients with increased deficit after surgery, while 40% were improved objectively and 80% stated they were better subjectively in operations performed at least 3 months after ischemic infarction. Neuropsychologic evaluation six months or more after the procedure indicated several cases of significant documented improvement and none who were worse. In 100 pre- and postoperative cerebral angiograms there was no mortality and a 1% mild permanent morbidity. In 80% of patients with postoperative angiograms, 98% of the anastomoses were patent. Cerebral filling through the anastomoses evaluated by a new method of angiographic analysis correlated with the clinical result.

New approaches to posterior circulation ischemia including OA-PICA, STA-superior cerebellar artery and vertebral artery-PICA using a vascular graft will be shown. For patients with ipsilateral common and ICA occlusions, subclavian to external carotid followed by STA-MCA bypasses have been employed for intracranial revascularization.

(Discussion)

8:50 a.m.

18. The Effect of STA-MCA Anastomosis on rCBF Following Experimental MCA Occlusion.

Richard S. Kramer, and
W. Jerry Oakes
Durham, North Carolina

Eight of twelve mongrel dogs subjected to trans-orbital occlusion of the proximal left cerebral artery underwent left superficial temporal artery-middle cerebral artery (STA-MCA) anastomosis 5 to 38 days after occlusion. Instantaneous rCBF was determined in all animals prior to MCA occlusion ("control rCBF") by trans-femoral left ventricular (LV) injection of polystyrene microspheres labelled with Sr-85 under light general anesthesia. The effect of subsequent left MCA occlusion on the redistribution of rCBF was determined by LV injection of microspheres labelled with Sc-46 immediately prior to STA-MCA anastomosis.

The anastomoses were either evaluated acutely after 2 hours (3 dogs) or allowed to mature for 2 to 21 days (5 dogs) prior to final determination of rCBF by LV injection of microspheres labelled with Ce-141, again under controlled conditions of arterial blood pressure, pH, pO2, and pCO2; the patency of each anastomosis was elaluated angiographically prior to sacrifice. The diameter of the microspheres (15+ 3 microns) assured that each determination reflected nutrient, rather than non-nutrient (e.g. "A-V shunt"), flow to uniform volumes of cerebral tissue perfused by both left and right anterior cerebral (ACA), middle cerebral (MCA), and posterior cerebral (PCA) arteries in each dog. Every animal demonstrated persistent clinical evidence of left hemispheral ischemia (e.g. right hemiparesis, circling gait) after MCA occlusion. Following sacrifice and fixation, the cerebral hemispheres were dissected according to primary arterial perfusion patterns (ACA, MCA, and PCA) and analyzed for each of the three differentially-labelled microspheres, employing a 3-channel auto-gamma spectrometer; spectral "cross-talk" was corrected by computerized matrix analysis.

Regardless of the interval (5 to 38 days) following left MCA occlusion, nutrient CBF was redistributed so as to maintain control-level perfusion in the distribution of the occluded artery at the expense of the ipsilateral PCA and (to a lesser degree) ACA flow. This phenomenon has not heretofore been documented, and is considered to reflect the intensity and longevity of the local hyperemic, leptomeningeal collateral, and angioproliferative response to regional cerebral ischemia; in essence, this observation suggests that a patho-physiologic intra-cerebral "steal" routinely accompanies cerebro-vascular occlusion.

Left STA-MCA anastomosis was observed to exert a mildly deleterious effect on left hemispheral perfusion when measured acutely (2 hours after bypass), presumably as a consequence of operative vascular manipulation. Mature anastomoses (2 to 21 days) enhanced left hemispheral flow only in those animals in which MCA flow was significantly reduced following occlusion; in animals demonstrating successful maintenance of homeostatic left MCA flow after occlusion (by virtue of focal hyperemia, collateralization, etc.), STA-MCA anastomosis actually resulted in decreased rCBF in the MCA distribution.

Our experiments suggest that:

1. Following proximal MCA occlusion, canine rCBF is redistributed so as to maintain effective perfusion of the "ischemic" zone by re-directing flow from the ipsilateral PCA, and ACA, territories.
2. The STA-MCA bypass procedure cannot be usefully evaluated, either in metabolic or rheologic terms, during the first few hours after anastomosis.
3. The effectiveness, after "maturation", of an STA-MCA anastomosis is inversely related to flow in the MCA distribution pre-operatively; an innovative clinical method for determining regional MCA flow will be discussed.
4. While post-operative angiograms will define the patency of STA-MCA anastomosis they do not necessarily reflect the hemodynamic effects of this procedure.

(Discussion)

9:10 a.m.

19. Effect of Lasix on Experimental Traumatic Cerebral Edema

Robert L. McLaurin, Patricia Tornheim Brown and Raymond Sawaya
Cincinnati, Ohio

The present study was designed to evaluate the effect of Lasix on traumatic cerebral edema. Anesthetized cats received craniocerebral trauma delivered by the Remington Humane Stunner. Following injury the animals were given a fixed fluid and electrolyte intake.Nine animals received Lasix and compared with a control group of 9 animals given no medication. All animals were sacrificed at 48 hours and the heads immersed in liquid nitrogen. Only animals with unilateral cerebral contusion were used. The amount of edema in the contused and non-contused hemispheres was determined by a specific gravity technique employing a density gradient.

The results in these groups of animals were also compared with non-impacted controls and with impacted animals given ad lib fluid intake. The results indicate that despite some degree of systemic dehydration in the controlled-intake animals, the uncontused hemispheres of treated and untreated animals were similar in water content to the control non-impacted cats. The contused hemispheres of the treated animals had a significantly lower water content than those of untreated animals. In addition the pattern of edema distribution in treated animals was more restricted than in the untreated animals. It is concluded that Lasix appears to have a specific reducing effect on traumatic cerebral edema that does not depend simply on bodily dehydration.

(Discussion)

Why: ? reduced filtration pressure
or
? ischemic choroidal epithelium
transient changes

Dopamine peripherally mediated
↑ & ↓ specific for cardiac - not
peripheral vascular (like epinephrine
+ afford).

9:30 a.m.

20. MODULATION OF CSF PRODUCTION BY ALTERATIONS IN CEREBRAL PERFUSION PRESSURE

Martin H. Weiss, Nancy Wertman
and Theodore Kurze
Los Angeles, California

Forty-eight cats have been studied to assess the interrelationship between intracranial pressure (ICP) and systemic arterial pressure (SAP) with respect to CSF production. Adult cats were anesthetized with intraperitoneal pentobarbital, 30 mg./kg., and appropriate cannulas were placed to enable continuous monitoring of systemic arterial and central venous pressures. The animals were ventilated on a constant volume ventilator; end tidal CO_2 content was continuously monitored and maintained at 4%. Core temperature was maintained at 38 degrees. A ventriculocisternal perfusion was established according to the technique of Pappenheimer, et al., using warmed Elliott's B. solution containing $RISA^{125}$ as a nondiffusible indicator. Intracranial pressure was set at a predetermined level (2 or 20 mm. Hg.) by adjusting the height of the outflow cannula. Blood pressure was continuously monitored and maintained at means of 70 and 115 mm. Hg. Four groups were studied in which cerebral perfusion pressure (CPP) was set at 50, 70, 95, and 115 mm. Hg. Calculations of CSF production (CSF_p) were made according to the formulas derived by Pappenheimer, et al..

The mean rate of CSFp at CPP of 70 mm. Hg. or above averaged 20 µl./minute whereas reduction of CPP to 50 mm. Hg. (ICP 20 mm. Hg. and SAP 70 mm. Hg.) decreased CSFp by approximately 50%. Statistical analysis, using an analysis of variance, reveals these to be significantly different ($P<.001$). Recent evidence indicates that this level of CPP exceeds the capacity of cerebral autoregulation to maintain constant cerebral blood flow, therein resulting in oligohemic perfusion of choroid plexus. It is apparent that under conditions of stable SAP, CSF production may be significantly influenced by cerebral perfusion pressure.

(Discussion)

9:50 a.m.

21. CSF Antibiotic Levels During Treatment of Shunt Infections

Robert L. McLaurin and Steven L. Wald
Cincinnati, Ohio

manage 2/3 of injections without removing shunt.

uses intraventricular dose
1x in lumbar - for prophylaxis
(+ systemic [illegible] 3 days before).

Staph aureus
epidermidis
E. Coli
etc.

During the past decade the treatment of shunt infections has been influenced by the observation that in some instances removal of the shunt is not necessary but rather that the infection can be controlled by a combination of intraventricular and systemic antibiotic treatment. The intraventricular agent has been administered in arbitrary dosages and at arbitrary intervals but no systematic observations on the validity of the regimens have been made.

In the past year we have made serial observations on the CSF level of antibiotic achieved in 8 patients. Six patients have had Holter shunt systems in place while 2 have had ventriculitis without a shunt system. In 2 patients multiple courses of trestment using different antibiotics have been used. The antibiotics included in these observations are methicillin, cephalothin, and gentamycin. The concentrations of antibiotics have been compared with the minimal inhibitory concentration (MIC) in each instance.

The observations have demonstrated that with the dosages being currently used in our clinic it is probably not necessary to administer intraventricular therapy more often than every other day since adequate levels are maintained during that interval even with a functioning shunt. A corollary to this conclusion is that testing for efficacy of treatment requires that the CSF sample be taken not sooner than 72 hours after cessation of treatment. It is recommended also that if facilities are available antibiotic concentrations and MIC determinations should be done during the course of treatment of each patient.

(Discussion)

10:10 a.m.

22. THE MANAGEMENT OF ENCROACHMENT OF THE CERVICAL SPINE

Mitsuo Tsuru
New York, New York

In recent years, many factors have been blamed for the myelopathy of cervical spondylosis, with no general agreement as to their individual importance.

Some of these factors are mechanical, and include the sagittal diameter of the spinal cord, the size and attachments of the dentate ligaments, the presence of root-sleeve fibrosis and of intradural adhesions.

Vascular factors may also play a part. because the main blood supply of the cervical cord usually comes from two or three radicular arteries which may be involved by spondylitic spurs.

I think it is probable that more than one factor is operating in any individual patient. In this report, I would like to show the importance of

the predisposed narrow canal in the development of cervical myelopathy, in the cases of cervical spondylosis, ossification of the posterior longitudinal ligaments, and the atlanto-axial dislocation.

In the cases of atlanto-axial dislocation, I would like to also propose the definition and the indication of surgical treatment of the atlanto-axial dislocation, using the predisposed canal size and the so-called instability index.

(Discussion)

10:30
Coffee Break

10:50 a.m.

23. Disc Protrusions in Adolescents

Robert G. Fisher
Plainfield, New Jersey

Thirty cases of lumbar disc protrusions in patients 21 years or younger were operated with uniformly successful results initially. An initial follow-up period indicated that 10% of the cases required reoperation within three years.

Follow-up studies ranging up to 25 years are disclosing results that suggest long standing follow-up studies and attending are necessary.

The symptoms, signs, myelogram and operative findings are for the most part similar to those of the adult. Prompt recognition of disc protrusions in the first and second decades in the past has been lacking.

(Discussion)

11:10 a.m.

24. Anterior Cervical Discectomy and Interbody Fusion With a Synthetic Calcium-Phosphate

T. Shima, F.H. Mayfield,
and S.B. Dunsker
Cincinnati, Ohio

Anterior cervical discectomy with and without fusion has been reported upon repeatedly. One major objection to the interbody fusion is that it produces increased morbidity from pain at a site remote from the disease area.To avoid this increasedmorbidity heterologus substances such as bovine bone have been used with varying degrees of acceptance.

We have studied the use of an entirely new type of biomaterial: a resorbable ceramic. It is a purified from of tricalcium phosphate. This substance has the advantage that as osteocytes and other new tissue proliferate and calcify within the matrix, the matrix itself is absorbed. This material has been used successfully in some dental work and in plastic surgery.

Cervical discectomies and interbody fusions were performed in adult mongrel dogs. Comparisons were made between autogenous bone and the synthetic bone matrix, using fluorescent histologic techniques. These studies demonstrate the method of fusion in autogenous bone and these will be compared with the synthetic substance.

(Discussion)

11:30 a.m.

PRESIDENTIAL ADDRESS
NEW KNOWLEDGE IN NEUROSCIENCE: EXAMPLE, THE NEUROPEPTIDES

William H. Sweet

Saturday, November 5
Moderator: John J. Lowrey

9:00 a.m.

25. Intraspinal Neurenteric Cysts

Robert H. Wilkins
Durham, North Carolina

Intraspinal neurenteric cysts are unusual lesions resulting from abnormalities of embryonic development of the spinal cord, spine, and gut. Other related developmental anomalies, such as persistence of the neurenteric canal and neurenteric cysts in other locations, are also part of the split notochord syndrome. Forty-three previously reported cases and two personal cases of intraspinal neurenteric cysts have been reviewed: their clinical, radiographic, surgical and pathological features will be presented.

(Discussion)

9:20 a.m.

26. Epidemiological Studies on the Patients with Persistent Vegetative State.

Kenichiro Higashi, Yozo Sakata, Mitsunori Hatano,
Seisho Abiko, Kiyoshi Ihara, Sanao Katayama,
Yukio Wakuta, Tomomi Okamura,
Kiroyuki Ueda, Michihiko Zenke and Hideo Aoki
Ube, Japan

Vegetative patients resulting from severe brain damage were investigated epidemiologically with co-operation of 69 clinics in 16 prefectures of western Japan. After inquiring with doctors in this area, we examined 193 cases reported to us and selected 110 patients. The criteria for the selection were 1) defect of communication, 2) loss of expression of intention, 3) urinary and fecal incontinence, 4) complete loss of self-supportability, 5) continuation of above conditions beyond 3 months.

The causes of brain damage in this survey were varied. More than one-third of the cases were due to trauma, and more than one-fifth were from vascular accidents. Duration of the vegetative state varied from 3 months to 17 years. Three-year observation revealed that 65% of the patients died during this period. Mean survival time for dead patients was 38 months. Among survivors, only 3 patients recovered from vegetative state.

Reactivity, clinical signs, EEG findings, methods of management and results of various trials of treatment were investigated in connection with the patient's prognosis.

(Discussion)

9:40 a.m.

27. Mechanism of Tremor Generation

H. Narabayashi
Tokyo, Japan

Through experiences in human stereotaxic surgery on various extrapyramidal symptoms, one of the most important and established findings is the existence of unitary rhythmic burst discharges in the ventralis intermedius nucleus of the thalamus in cases with tremor.

These cellular activities in burst fashion can be divided in to three sub-groups; rhythmic tremor-locked one, rhythmic but not tremor-locked

one and the non-rhythmic one.

Either stimulation or lesion-making in the exact area of tremor-locked rhythmic bursts increases or abolishes tremor.

It seems almost definite this area is generating tremor. But the pattern of frequency (c/s) of tremor rhythm, i.e. its phenotype seems to depend on the peripheral factor as well. Tremor-locked bursts are the results of afferent projection of muscle sense, which might suggest a model of reverberating circuit producing a kind of resonance-effect.

(Discussion)

10:00 a.m.

28. EXPERIMENTALLY-BASED PROPOSAL FOR MODIFIED TEMPORAL LOBECTOMY IN TLE

E.C. Poletti, M. Sujatanond, M.A. Kinnard,
G.C. Creswell, F. Morrison, M. Kliot,
R.N. Kjellberg, N.T. Zervas, W.H. Sweet and
P.D. MacLean
Boston, Massachusetts

Approximately 80% of patients suffering from intractable temporal lobe epilepsy (TLE) have pathology limited to the anterior hippocampus (AH) and the uncus. The pathways by which sub-threshold stimulation and seizures spread from the AH have been investigated during the last nine years in five series of experiments.

First, 666 basal diencephalic (BD) units in the awake monkey were studied during shock stimulation and AH seizure activity. A total of 13% of hypothalamic (Hyp), 28% of preoptic (Pro), and 32% of basal forebrain (BF) units were responsive.

Second, the results of an anatomical fornix degeneration study showed direct projections to certain Hyp, Pro and BF structures. These structures were shown in the previous study to have unit responses driven at long latencies ($\geq$ 20 msec.) This suggested the possibility of a new pathway from AH to BD independent of the fornix system.

Accordingly, third, in awake monkeys with complete lesions of the fornix system, 619 BD units were tested to AH stimulation and seizure activity. A total of 12% of Hyp, 5% of Pro, and 18% of BF units were affected, establishing the postulated non-fornix pathway.

A current study of 519 amygdala units in awake monkeys has not found any short-latency driven units to AH stimulation or seizures. These results suggest that the non-fornix pathway from AH to BD does not pass through the amygdala, stria terminalis, or ventral amygdalofugal projections.

Most recently, a fifth study, using the radioactive 2-desoxyglucose technique in the rat, suggests that AH seizures are relayed to Hyp, Pro and BF structures via the subiculum and entorhinal cortex.

These combined results showing specific pathways for spread of sub-seizure and seizure activity from AH to BD raise the possibility of treating unilateral TLE with a more limited and less destructive operative procedure than temporal lobectomy. Based on our experimental data, two alternative operations are proposed. If either procedure should prove effective for unilateral TLE, it might also permit surgical therapy for the larger population of patients suffering from bilateral independent foci.

(Discussion)

10:20 a.m.

29. Investigation of Cortical and Thalamic Neural Activity in the Late Phases of Somatosensory Evoked Potentials

J.A. Kusske, J.W. Hutchison and M. Verzeano

Evidence for experimentally induced supraspinal neural phenomena that lasts for long periods of time has been derived from several different sources in the last few years. Several pathologic clinical states have been related to this abnormal central activity which is thought ro represent an alteration in firing patterns of neurons rather than a lesion. We have been interested in investigating neuronal networks which may underlie pathologic changes in neural activity. Recent investigations in our laboratory, both in humans and experimental animals, have demonstrated evoked oscillations that were time locked to a stimulus, and which extended as long as 3500 msec after the stimulus. These oscillations could be driven at certain frequencies of stimulation and contained components harmonically related to each other and to the frequency of the stimulus. In the cat these late oscillations were recorded not only in the somatosensory cortex, but in the specific and nonspecific thalamic nuclei as well. In the work reported here evoked potentials and associated neuronal activity, induced by repetitive stimulation of the sciatic nerve were recorded simultaneously from the somatosensory cortes, the ventro posterolateral and centre median nucleus in cats. Only the late compoenets of the response extending beyond the first 500 msec were studied under high amplification. Averaging and autocorrelation studies of the late part of the evoked potential and of the associated neuronal discharge, show that their highest amplitude of oscillation and their highest degree of periodicity are reached at specific frequencies of stimulation, in the cortex as well as the thalamus. Cross correlation studies of the relations between gross and neuronal activities within the cortex or within the thalamus, as well as studies of the relations between cortical and thalamic activities show that the highest degree of correlation occurs when the frequencies of stimulation are within the same range. This suggests that the development of the late oscillations of the evoked potential and of the associated

neuronal discharge is based on the activity of cortical, thalamic and cortico-thalamic loops which respond most effectively at frequencies of stimulations related to their resonance characteristics. These results will serve to further our work in chronic pain states, epilepsy and in behavioral studies where memory consolidation is involved.

(Discussion)

10:40 a.m.
Coffee Break

11:00 a.m.

30. Variability in The Localization Of One And Two Languages In Cerebral Cortex

George A. Ojemann and Harry Whittaker
Seattle, Washington

The extent of lateral language cortex has been identified by the technique of stimulation mapping during a naming task, at craniotomy under local anesthesia for the treatment of medically intractible epilepsy in patients known to be left hemisphere dominant for language by intracarotid Amytal testing. Stimulation was at a constant current, below the threshold of after discharge, for each patient. Three questions, not previously addressed with this technique, were considered: 1) Does language cortex in an individual patient cover the classical language cortex derived from pooled data? 2) How much variability is there between patients in the extent of language cortex? 3) Are multiple languages located in the same cortex?

In 3 patients the extent of lateral language cortex was mapped with a large number of sites (23-28/patient). The area involved in language in each patient was larger than that classically described. These cases were pooled with another 5 patients where language cortex had been sampled at fewer sites. The variability in the extent of language cortex between all these patients was large. Only a small area of inferior frontal lobe just anterior to motor strip, apparently involved in the motoric aspects of language, was common to all patients in whom it was sampled. No area of temporal or parietal lobe was invariably part of language cortex in all patients! With this degree of variation, some lesions in left posterior temporal or parietal lobes may be resected without risk of aphasia, if the pattern of language localization is known for that individual patient. One patient was bilingual in English and Dutch. The two languages were not localized to the same areas of cortex: periSylvian cortex was common to both languages, but surrounding this, both frontally and parietally, were areas with differential representation of the two languages.

(Discussion)

11:20 a.m.

31. Experience With Ultrasonic Aspiration In Neurosurgery

Eugene S. Flamm, Joseph Ransohoff
David Wuchinich and Alan Broadwin
New York, New York

Durjng the past two years, we have explored the possibility of using a new ultrasonic aspiration device for the removal in intracranial tumors. The instrument consists of a hand piece with a small bore tube that vibrates at rates sufficient to fragment tissue, which is then removed by the self-contained suction and irrigation system. The instrument has been used successfully in 24 cases to date, including 12 meningiomas, 4 acoustic neurinomas, and 6 gliomas. With this instrument, tumor mass can be readily reduced in size to facilitate removal without the use of cutting current. In some cases, the ultrasomic aspirator was effective when other modalities of tissue removal were not successful. The advantages of the instrument are the reduced risk of damaging major blood vessels which tend to resist fragmentation by the instrument, the tactile feedback that the surgeon has which is not present when cutting loop is used, and the absence of heating of surrounding tissue. The laboratory experience with this instrument, as well as the clinical applications, will be illustrated.

(Discussion)

11:40 a.m.

32.ENHANCED VISUALIZATION OF THE CT SCAN WITH ALTERNATE PLANAR VIEWS AND 3-D DISPLAY

Clark Watts
Columbia, Missouri

This is a preliminary report on one of several means of improving the visualization of CT data obtained from transverse overlapping scans. Techniques for the rapid generation of coronal and sagittal planar views from the basic data have been developed. These additional planes can be visualized in a 3 dimentional presentation with or without the use of stereoscopic pairs. These techniques of alternative visualization have been helpful to the neurosurgeon and the radiation therapist in more clearly defining the location and size of mass lesions.

(Discussion)

12:00 noon

33. "The Effect of Left Stellate Ganglionectomy Upon Certain Cardiac Arrhythmias

Wolff M. Krisch, Bruce Coyer, Ray Pryor,
Jay Law and Sol Penn
Denver, Colorado

There have been notable pharmacological advances in the management of life-threatening cardiac arrhythmias, primarily through the use of beta-blocking agents. A small but definite number of patients afflicted with unusual cardiac arrhythmias (recurrent ventricular tachycardia, "prolonged QT interval syndrome") have proven to be refractory to drug therapy or cardiac pacing procedures. This abstract reports our experience with left stellate ganglionectomy on two young men; one afflicted with the prolonged QT interval syndrome and the other with recurrent ventricular tachycardia. During the course of surgery on both of these patients, stimulation and recording of elecrical activity from the left phrenic nerve, left stellate ganglia and sympathetic chain, and heart was obtained. A correleation of electrical activity in the left phrenic and sympathetic chain has been detected and will be described. The patient with the prolonged QT interval syndrome has had reversion of his QT interval to normal and has been totally free of syncopal attacks for a follow-up period of seven months. The second patient is now only one month post-operative, too short an interval to ascertain the effect of ganglionectomy on this disorder. A discussion of neurosurgical implications for interruption of left sided cardiac sympathetic innervation will be presented.

(Discussion)

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DR. SPENCER BRADEN Cleveland, Ohio	(Active) 7/20/69	Founder
DR. F. KEITH BRADFORD Houston, Texas	(Active) 4/15/71	1938
DR. WINCHELL McK. CRAIG Rochester, Minnesota	(Honorary) 2/12/60	1942
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DR. HENRY L. HEYL Hanover, New Hampshire	(Senior) 3/01/75	1951
DR. OLAN R. HYNDMAN Iowa City, Iowa	(Senior) 6/23/66	1942
MR. KENNETH G. JAMIESON Brisbane, Australia	(Corresponding) 1/28/76	1970
SIR GEOFFREY JEFFERSON Manchester, England	(Honorary) 3/22/61	1951
DR. DONALD D. MATSON Boston, Massachusetts	(Active) 5/10/69	1950
DR. KENNETH G. McKENZIE Toronto, Ontario, Canada	(Honorary) 2/11/64	1960
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DR. RUPERT B. RANEY Los Angles, California	(Active) 11/28/59	1939
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DR. SAMUEL R. SNODGRASS Nashville, Indiana	(Senior) 8/08/75	1939
DR. C. WILLIAM STEWART Montreal, Quebec, Canada	(Corresponding)	1948
DR. GLEN SPURLING La Jolla, California	(Honorary) 2/07/68	1942
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AMERICAN ACADEMY OF NEUROLOGICAL SURGERY
1976 ANNUAL MEETING

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SCIENTIFIC PROGRAM

Thursday's Sessions Excellent _____ Good _____ Poor _____
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