Bulletin of the

University of Minnesota Hospitals
and
Minnesota Medical Foundation

Hemispherectomy In Seizures

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BULLETIN OF THE
UNIVERSITY OF MINNESOTA HOSPITALS
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I. CEREBRAL HEMISPHERECTOMY FOR INTRACTABLE SEIZURES

David R. Johnson, M.D.
Lyle A. French, M.D.
William T. Peyton, M.D.

Introduction

In February, 1950, a left cerebral hemispherectomy was performed at the University Hospital in an attempt to control severe and persistent convulsive seizures in a 38-year-old man. Twelve years previously the man had undergone removal of a left-sided cerebral glioma. It was felt that his seizures were due to extensive scarring secondary to this operative procedure. Prior to surgery in 1950 he had been in status epilepticus intermittently for a period of six weeks. Following removal of the entire left cerebral hemisphere, he has had no seizures. He does have a persistant right hemiparesis but is able to be up and around and is gainfully occupied. Subsequently seven more patients have been subjected to a similar procedure. All have been severe epileptics who had an associated hemiparesis. The purpose of this report is to present the results of this procedure on these eight patients. The discussion will be limited primarily to its effects on the convulsive seizures, the neurological and the mental status.

Review of Literature

Total unilateral cerbral hemispherectomy was reported by Dandy[1] in 1928. His five cases were all done in an attempt to cure cerebral gliomas. Others[2, 3, 4, 5, 6, 7, 8, 9] have reported on hemispherectomy for attempted cure of glioma. In November, 1950, Krynauw[10, 11] reported a series of twelve patients in which he had done cerebral hemispherectomy. These patients all had infantile hemiplegias associated with intractable convulsions. Prior to this paper, Williams and Scott[12] reported that McKenzie in 1938 had done a complete cerebral hemispherectomy to obtain relief from convulsive seizures but for some reason this did not lead to additional operations of this type. Since Krynauw's original paper, several other authors[13, 14, 15, 16, 17, 18] have reported a limited experience with cerebral hemispherectomy in the treatment of intractable seizures.

Selection of Cases and Preoperative Studies

Encouraged by the report of Krynauw and others a program of investigation in this problem has been pursued at this hospital. Seven more patients suffering from an infantile type of hemiplegia associated with uncontrollable seizures have been subjected to excision of an entire cerebral hemisphere. All these patients have been institutionalized epileptics from the state school and hospital at Cambridge, Minnesota. The patients have been selected on the basis of having a hemiparesis present from infancy or early childhood, associated now with a large number of grand mal seizures. All have responded very poorly to what is generally considered adequate doses of anticonvulsant medication. Hemiparesis alone has not been considered an indication for operation. Krynauw[10, 11] however, operated on several cases who had no seizures but who were infantile hemiplegics and had severe behavior disturbances which prevented the patients from living a normal life in society. So far no patients in this category have been operated upon here. The age of the group of patients done at U. of M. varied from 13 to 38 years, and at the time of operation they had been at the Cambridge State Hospital for periods varying from six to seventeen years. Neither the age of the patient nor the length of time hospitalized prior to surgery has seemed to have any effect on the post-operative control of seizures. The length of time these patients have been institutionalized is, however, of considerable significance for it makes available the number of observed seizures over each 24 hour period for many years. Also available were the kinds and quantities of anti-convulsant drugs given during these periods. This type of information is not commonly available in a study of seizures because these data are usually obtained from the patient, a relative, or friend. This usually represents a rough approximation of what actually

exists and at times is grossly misleading. All patients were carefully examined to ascertain their pre-operative neurological status. Other preoperative studies done in all patients were EEG's, pneumoencephalograms, carotid angiograms, and a complete battery of psychological tests. As part of the operative procedure, electrocorticograms were done prior to excision of the hemisphere and following excision electrical recordings were taken from the thalamus and remaining parts of the basal ganglia. The extent of the hemispherectomy varied slightly from case to case but in general the entire cerebral cortex including the insula, hippocampal gyrus and inferior medial orbital gyri were removed.

The depth of the cut was across the internal capsule and included the greater part of the basal ganglia. In the later cases the caudate nucleus was also removed. The thalamus and structures below this were spared.

Preoperatively there was evidence of gross pathology of the affected hemisphere as manifested not only by the hemiparesis and seizures but also by the above mentioned studies. Air encephalograms and carotid artery angiograms usually showed either a dilated ventricle on the affected side indicating an atrophic process or in several cases a gross malformation of the large cerebral vessels. Several patients also had large porencephalic cysts as seen on pneumoencephalography. The gross pathology seen at operation was very extensive in all cases and included such diverse pathology as severe lepto-meningeal scarring, subarachnoid cysts that had replaced large areas of the brain, and extensive vascular malformations such as in a Sturge-Weber's syndrome. None of the hemispheres removed were normal on gross and microscopic examinations.

In general the preoperative EEG's showed a severe, diffuse dysrythmia usually more pronounced on the effected side. Postoperatively there generally was a marked improvement with the remaining hemisphere showing a normal or borderline normal pattern. Interestingly enough, the side of the head from which the hemisphere was removed revealed a pattern similar to the normal (opposite) side except for a decreased voltage in the waves.

Representative Case History

, was born 6 October, 1917. At the time of birth a left hemiparesis was noted. Otherwise she developed fairly well until the age of two years when she fell off a couch striking her head. Immediately thereafter she began to have grand mal seizures. She continued to have grand mal seizures throughout infancy and childhood. In 1939 at the age of twenty her seizures greatly increased in frequency and severity. Because of the grand mal attacks and a severe personality disturbance, it became increasingly difficult to care for the patient at home. She was studied at the University Hospital in 1947 and committment to the State School and Hospital at Cambridge was advised. She entered there several months later. Following admission to Cambridge she complained of numerous psychosomatic symptoms and her seizures continued. The seizures have been of two types: (1) minor spells--described by the patient as "blackout spells." These attacks are preceded by a feeling of pressure in the back of the head, dizziness, and a gripping sensation in her abdomen. These spells last from a few seconds to five minutes and occur five to ten times per day. (2) Over a period of years they have been followed about once weekly by a typical grand mal seizure, severe in type and duration.

Anticonvulsant medication did not particularly affect the attacks. Because of the hemiparesis and uncontrolled seizures, she was considered as a candidate for cerebral hemispherectomy. She is the oldest patient in the series. Preoperative neurologic examinations revealed an obese 36-year-old woman who was reasonably alert and who was fully oriented and co-operative. A Wechsler-Bellevue I.Q. on March 10, 1953, showed a verbal scale of 78. A Stanford-Binet Form L was 70. There was a bilateral optic atrophy, a left homonomous hemianopsia, a left sixth nerve palsy, and a bilateral horizontal nystagmus with a slight rotary component.

There was a marked left hyperreflexia with a positive Babinski sign and a moderately severe spastic hemiparesis with the arm being most involved. The left hand was useless. She walked with a typical left hemiparetic gait. Her entire left side was atrophied, the upper extremity more than the lower. There was a severe loss of all sensory modalities on the left side. Routine skull x-rays revealed a slight asymmetry--the right side being somewhat underdeveloped. A pneumoencephalogram revealed the right ventricle to be greatly dilated and the entire ventricular system was displaced to the right. A carotid angiogram showed filling only of the right external carotid artery. Preoperative EEG showed random slow waves bilaterally without a definite basic frequency. The voltages over the left side were higher than on the right.

On March 23, 1953, the entire right cerebral hemisphere was removed. This included the insula, the hippocampal gyrus and part of the caudate nucleus. One half hour after completion of the operation she was alert and rational. She could move both her left arm and leg as well as preoperatively and she could feel pain and light touch as well as before. The left arm and leg were flaccid. There was a marked left hyperreflexia and a positive Babinski sign. Her postoperative course was completely uneventful and when seen at the Anoka State Hospital one month later, whe was walking as she did preoperatively. She had had no convulsions of any type. She received no anticonvulsant medications. An EEG at that time revealed an amplitude asymmetry with less activity over the posterior half of the right hemisphere--that is the removed side. The activity from the left parietooccipital area was normal alpha activity. She was last seen ten months following hemispherectomy. She still had had no seizures of any type. She was taking no medications. Her gait and reflexes were the same as prior to surgery. She had some finger movement in her left hand, at least as good as the preoperative level. The nystagmus present prior to surgery was gone. Her Wechsler-Bellevue verbal scale was 82 and the Stanford-Binet Form was 74--both slightly higher than preoperatively. The patient and her mother were more than satisfied with the result of her operation.

The Effect on Seizures

All patients except the previously mentioned man who had a glioma had had seizures since infancy. With the exception of this man, all the patients had uncontrollable seizures that had necessitated institutionalization. The postoperative followup now ranges from two to forty-seven months. Of the eight patients, it is felt that seven have had excellent results so far. Four patients have had no seizures of any kind and are on no medication. Two others have had one seizure each in the first few months postoperatively and none since. One patient had five seizures immediately postoperatively but none in the last fifteen months. She takes no medication. One case is classified as a poor result although her reduction in seizures has been almost 90 per cent. In retrospect this last case was probably poorly chosen as a definite microcephaly was present and in addition the patient had a definite history of severe meningo-encephalitis at the age of five weeks. She had averaged 700-800 grand mal seizures per year for a period of 17 years of institutional custody. She has been followed fourteen months now and has had approximately eighty seizures. The following table is a summary of the patients:

Patient	Diagnosis	Followup in months	Preop. seizures per year	Post-op. seizures	Post-op. medication
	Glioma	47	Status epil	0	yes
	Birth Injury	15	165 GM	0	none
	Sturge-Weber	19	300-500 GM	1	yes
	Meningo-encephalitis Microcephaly	19	300-500 GM	5	none
	Meningo-encephalitis	14	700-800 GM	75-80	yes
	Birth Injury	11	1,800-3,600 PM 50 GM	0	none
	Birth Injury	9	50-100 GM	1	none
	Birth Injury	2	65-160 GM	0	none

The Effects on the Motor System

Seven of the eight patients in this series had become hemiplegic in infancy or childhood and while able to walk, all had moderate to severe spastic deformities most marked in the upper extremity. For the most part their arms were useless except for gross movements of the shoulder and elbow. In some patients movements of these joints were very strong. There was a moderate to severe atrophy of the affected side in all patients. The deep tendon reflexes were extremely hyperactive and clonus was usually present at the knee and ankle. The toe signs were positive. Within a half hour to several hours following completion of the operation, the patients became sufficiently responsive to carry out adequate testing. In most of the patients at this time, movement was present in the arm and leg. The extremities previously spastic were flaccid but the reflexes and Babinski signs were the same as preoperatively. Within one week two patients could walk unassisted and the other six did so within two to four weeks. When examined several months later all patients except one had regained their preoperative walking status and in one, the exception, this ability was considerably improved. Ability to use the affected arm also returned to the preoperative level but this returned somewhat more slowly. Interestingly enough, finger function is not abolished by hemispherectomy. Whatever finger movement was present prior to surgery was regained. One patient stated he could now use his hand and arm without purposely thinking about it such as was necessary preoperatively. One patient with Sturge-Weber's syndrome, in addition to a severe spastic hemiparesis, had marked athetoid movements of the involved arm and almost continuous bobbing of the head. Both these signs completely disappeared following hemispherectomy. In two patients, orthopedic deformities became more apparent. With lessening of the spasticity of the extremities, unstable joints have increased movement and in these two patients, this instability will probably require arthrodesis. The effect of removal of the entire cerebral cortex as well as most of the basal ganglia might be expected to exaggerate a pre-existing hemiplegia. In no case did this happen. Krynauw[10] believed that the integrity of the caudate nucleus on the side opposite the hemiplegia was necessary for the maintenance of preoperative motor function. This appears not to be true as four of our cases have had the caudate nucleus almost completely removed and they recovered motor function to a degree equal to the others. It is believed that the rapid return of motor function to the preoperative level is due to the contralateral hemisphere having assumed many years previously the function of the pathologic side. It is considered that the pathologic hemisphere offers only a restraining effect on the normal side.

It has also long been believed that

abdominal reflexes were abolished by lesions of the pre-motor cortex. This is not necessarily true because the last patient in our series has perfectly normal, brisk abdominal reflexes bilaterally following hemispherectomy.

The Effects on the Sensory System

It must be appreciated that the various modalities of sensation are extremely difficult to evaluate in a group of patients such as this. Seven of these eight patients were institutionalized epileptics and were mentally deficient in varying degrees preoperatively. Intelligent co-operation in sensory testing was not always present. Another factor operating is that in most of the patients there was some preoperative evidence of sensory loss in all modalities. From post-operative testing the following generalizations can be made: neither superficial nor deep sensation is abolished by hemispherectomy but a quantitative change is apparent. It is thought that this is due to a loss of the finer discriminative powers and not to the loss of either gross superficial or deep sensation. The most adequate testing that could be carried out was done on a 20-year-old boy with a Wechsler-Bellevue I.Q. of 86. Prior to surgery he was grossly normal in all modalities of sensation. In the first few days postoperatively all modalities were still present but were now less well delineated than preoperatively. When seen two months later there was no sensory difference between his two sides. He could accurately identify small objects placed in his hand, his ability to perceive finger writing on his skin was normal, and position and vibration sense were intact. It previously has been considered that stereognostic sensation was appreciated only in the contralateral parietal cortex. That this is not entirely true is shown by this patient's ability to identify deep sensation without his contralateral parietal cortex. It must be assumed that either the parietal cortex is bilaterally represented or that the thalamus also can act in the appreciation of this type of sensation.

The Effects on Speech

Five of the eight patients were left hemiplegics and for practical purposes had used only their right arms for many years. None of these patients had any loss of speech and all could talk as soon as they recovered from the anesthesia. Of the three patients who had right hemiplegia, one had had a severe motor aphasia following operation for a brain tumor twelve years previously. Following hemispherectomy he regained some useful speech function. The other two patients had normal speech preoperatively and this was unchanged by the surgery. It is felt that the hemisphere removed is always the nondominant one since these patients suffered their loss of function many years previously. It is apparent that handedness in infantile hemiplegics has no relation to speech function or that handedness was transferred to the opposite side following the onset of paralysis. This, of course, well agrees with previous concepts because it has long been observed that transference of speech function is the rule rather than the exception in children up to the age of about fifteen years.

The Effects on Intellect and Personality

Pre- and post-operative psychological tests were given to seven of the eight patients. The full results will be reported elsewhere. No loss of intellectural function as measured by the various testing procedures was found. In fact, several of the patients scored slightly higher postoperatively. It is felt that this improvement might well be caused by the relief from large doses of sedative anti-convulsants. The other factor may be that the relatively normal side is released from the abnormal driving of the pathologic hemisphere. The clinical impression expressed by a group of physicians and psychiatric aides, as well as the clinical psychologist's findings, indicate that the patients as a whole are a happier, better adjusted group than they were preoperatively. Striking general improvement was noted in a girl thirteen years old who preoperatively could not feed herself, was not bladder or bowel trained, and who sat around the

institution with a dull and lifeless look on her face. She was also a very difficult behavior problem. This child is now feeding herself, taking care of her toilet needs, is no longer subject to violent temper tantrums and is accomplishing minor tasks in the field of rehabilitation. Her change in appearance could hardly be more complete. As stated previously, Krynauw[10] in his report operated on several patients strictly on the basis of severe behavior disturbance associated with infantile hemiplegias. These patients had no seizures. While we have operated on no patients for behavior disturbance per se, several were markedly benefited in this aspect of personality adjustment. Another patient particularly had been very difficult to manage prior to surgery. It was frequently necessary for her to be placed in seclusion because of her violent behavior during which times she had attacked other patients and aides. Postoperatively she is reported to be more cheerful and co-operative and the previously violent flareups have not been manifest. Inasmuch as such behavior disturbance itself is even more incapacitating socially than are seizures, it is felt that severely disturbed patients with infantile hemiplegias and with only a few or no seizures might well be considered candidates for cerebral hemispherectomy.

Summary

There have been no deaths in this series. It is felt that the results in these eight cases of cerebral hemispherectomy for intractable seizures have been very satisfactory. Seven of the eight patients have been for practical purposes completely relieved of their seizures for periods of two to forty-seven months. The eighth case has had a reduction of almost 90 per cent of the seizures. Most of the patients are now taking no anti-convulsant drugs. The pre-existing neurologic deficits have not been aggravated and in at least one there has been a definite improvement. Intellectually no patient has gone below the preoperative level and several have shown a definite improvement in their personality adjustment within the institution. The patients and the relatives are gratified by the results and it is felt that this study should be continued.

Acknowledgement

This study has been made possible through the co-operation of Dr. Ralph Rossen, Supt. of the Hastings State Hospital, Dr. Raymond Gully, Supt. of the Cambridge State Hospital, and Dr. John Reitman, Supt. of the Anoka State Hospital. Dr. Zondal Miller, Consultant in Neurology to the Anoka State Hospital has examined all the patients preoperatively and in addition had done the encephalograms and angiograms. Dr. Albert Uecker, clinical psychologist of the Cambridge State Hospital, has examined all patients pre-and post-operatively from a mental point of view. We also wish to thank Mr. Jarle Leirfallom, Director of Public Institutions, State of Minnesota, in making available funds so that these patients could be transferred for treatment.

The above study is to be continued under the auspicies of the U. S. Public Health Service, Council on Neurological Diseases and Blindness.

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References:

1. Dandy, W.
Removal of the Right Cerebral Hemisphere for Certain Tumors with Hemiplegia
J.A.M.A. 90:823, 1928

2. O'Brien, J. D.
Further Report on a Case of Removal of the Right Cerebral Hemisphere
J.A.M.A. 107:657, 1936

3. Gardner, W. J.
Removal of the Right Cerebral Hemisphere for Infiltrating Glioma
J.A.M.A. 101:823, 1933

4. Zollinger, R.
Removal of Left Cerebral Hemisphere: Report of a Case
Arch. Neurol. and Psychiat. 34:1055, 1935

5. Dandy, W.
Physiological Studies Following Extirpation of the Right Cerbral Hemisphere
John Hopk. Hosp. Bull. 53:31, 1933

6. O'Brien, J. D.
Removal of the Right Cerebral Hemisphere
Ohio St. Med. Jr. 28:644, 1932

7. Rowe, J.
Cerebral Hemispherectomy
Am. Journal Psychiat. 94:605, 1937

8. Karnosh, L. J.
Cerebral Hemispherectomy
Journ. Neurosurgery 6:285, 1949

9. Crockett, H. G. and Estridge, N. M.
Cerebral Hemispherectomy
Bull. Los Angeles Neurol. Soc. 16: 71, 1951

10. Krynauw, R. A.
Infantile Hemiplegia Treated by Removing One Cerebral Hemisphere
J. Neurol., Neurosurg., and Psychiat. 13:243, 1950

11. Krynauw, R. A.
Cerebral Hemispherectomy in Infantile Hemiplegia
Sem. Des. Hop. de Paris 27:1091, 1951

12. Williams, D. J. and Scott, J. W.
The Functional Response of the Sympathetic Nervous System of Man Following Hemidecortication
Journ. of Neurol. and Psychiat. Vol. 2:313, 1939

13. Marshall, C. and Walker, E.
The EEG after Hemispherectomy in Man
EEG and Clin. Neurophysiol. 2:147, 1950

14. Obrador, S. and Taromendi, M. H.
Some Observations on the Brain Rhythms after Surgical Removal of a Cerebral Hemisphere
EEG and Clin. Neurophysiol. 2:143, 1950

15. Cairns, H. and Davidson, M. A.
Hemispherectomy in Infantile Hemiplegia
Lancet (London) 2:411, 1951

16. Obrador, S.
About the Surgical Technique for Hemispherectomy in Cases of Cerebral Hemiatrophy
Acta Neurochirurg. 3:55, 1952

17. MacKay, H. J.
Hemispherectomy in Hemispastics
Northwest Med. 51:363, 1952

18. Powell, T. P. S.
Residual Neurons in the Human Thalamus Following Hemidecortication
Brain 52:571, 1952

II. MEDICAL SCHOOL NEWS

Coming Events

February 1-5	Continuation Course in Child Psychiatry for General Physicians and Specialists
February 10-11	Continuation Course in Cancer Detection for General Physicians
February 11	Dedication of the Elias P. Lyon Laboratories
February 15-17	Continuation Course in Fundamental Advances in Internal Medicine for Internists
February 16	Journal-Lancet Lecture; "The Biosynthesis of Heme;" Dr. David Shemin, Columbia University, New York City; Owre Amphitheater; 8:00 p.m.
February 18-20	Conference on Sterility and Associated Problems of Reproduction for Physicians
March 4-6	Continuation Course in Clinical Dietetics for Dietitians
March 5-6	Parenteral Alimentation Symposium (Sponsored by Hennepin County Medical Society); Radisson Hotel, Minneapolis
March 8-10	Conference on Coroners' Problems
March 22-24	Continuation Course in Cardiovascular Diseases for General Physicians.

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Continuation Course

The University of Minnesota announces a continuation course in Fundamental Advances in Internal Medicine for Internists for February 15 to 17, 1954. Basic concepts in the fields of infectious disease, gastroenterology, and hematology will be discussed. The faculty will include Dr. Walter Lincoln Palmer, Professor, Department of Medicine, University of Chicago School of Medicine; Dr. David Shemin, Associate Professor, Department of Biochemistry, Columbia University College of Physicians and Surgeons, New York City; and Dr. Claude-Starr Wright, Associate Professor, Department of Medicine, The Ohio State University, Columbus, Ohio. Dr. Shemin will also present the annual Journal-Lancet Lecture on February 16. The course will be presented under the direction of Dr. Cecil J. Watson, Professor and Head, Department of Medicine, and the remainder of the faculty will be made up of members of the Faculty of the University of Minnesota Medical School.

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Dr. Mosser Receives ACS Fellowship

Dr. Donn G. Mosser, Instructor, Department of Radiology, has been awarded one of three American Cancer Society fellowships in clinical radiation therapy for study in cancer centers in Great Britain, France, and the Scandinavian countries. He and his family will leave late in August and will be gone for more than a year. He will spend eight months at the Christie Hospital and Holt Radium Institute in Manchester, England, under Dr. Ralston Paterson. He will also spend varying periods at the Royal Infirmary in Edinburgh, the Royal Cancer and Middlesex Hospitals in London, the Radium Institute of the University of Paris, the Radium Center in Copenhagen and Radiumhemmet in Stockholm. The faculty joins in congratulating Dr. Mosser on receiving this fellowship.

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III. UNIVERSITY OF MINNESOTA MEDICAL SCHOOL
WEEKLY CALENDAR OF EVENTS

Physicians Welcome

February 1 - 6, 1954

Monday, February 1

Medical School and University Hospitals

9:00 - 9:50 Roentgenology-Medicine Conference, L. G. Rigler, C. J. Watson and Staff; Todd Amphitheater, U. H.

9:00 - 10:50 Obstetrics and Gynecology Conference; J. L. McKelvey and Staff; W-612, U. H.

10:00 - 12:00 Neurology Rounds; A. B. Baker and Staff; Station 50, U. H.

11:30 - Tumor Conference; Doctors Hitchcock, Moore, and Stenstrom; Todd Amphitheater, U. H.

11:30 - 12:30 Physical Medicine Seminar; Frozen Shoulder; J. P. Engel; Heart Hospital Auditorium.

12:15 - Obstetrics and Gynecology Journal Club; Staff Dining Room, U. H.

12:30 - 1:30 Physiology Seminar; Anomalous Osmosis in Model Systems of Physiological Significance; Eugene Grim; 214 Millard Hall.

1:30 - 2:30 Pediatric-Neurological Rounds; R. Jensen, A. B. Baker and Staff; U. H.

1:30 - 3:30 Dermatology Hospital Rounds; H. E. Michelson and Staff; Dermatology Histopathology Room, M-434, U. H.

4:30 - Infectious Disease Rounds; Sta. 43, U. H.

4:30 - Public Health Seminar; 15 Owre Hall.

5:00 - 6:00 Physiology-Surgery Conference; Todd Amphitheater, U. H.

5:00 - 6:00 Urology-Roentgenology Conference; C. D. Creevy, O. J. Baggenstoss, and Staff; Eustis Amphitheater.

Ancker Hospital

8:30 - 10:00 Tuberculosis and Chest Conference; Auditorium.

2:00 - 3:00 Surgery Journal Club; Classroom.

Minneapolis General Hospital

9:30 - Pediatric Rounds; Eldon Berglund; Newborn Nursery, Station C.

10:30 - 12:00 Medicine Rounds; Thomas Lowry; Sta. F.

11:00 - Orthopedic and Fracture Rounds; Drs. John Moe and Arthur Zierold; Sta. A.

11:00 - Pediatric Rounds; Erling Platou; Station K.

12:30 - Surgery Grand Rounds; Dr. Zierold; Sta. E.

1:30 - 2:30 Tuberculosis Conference; J. A. Myers; Sta. M.

2:00 - Pediatric Rounds; Stations I and J.

Veterans Administration Hospital

1:30 - Cardiac Conference; Drs. Berman, Weisbart, and Smith, Rounds Immediately following conference.

Tuesday, February 2

Medical School and University Hospitals

9:00 - 9:50 Roentgenology-Pediatric Conference; L. G. Rigler, I. McQuarrie and Staff; Eustis Amphitheater, U. H.

12:30 - 1:30 Physiology 114C -- Respiration; E. B. Brown; 129 Millard Hall.

12:30 - Bacteriology Seminar; 214 Millard Hall.

12:30 - 1:20 Pathology Conference; Autopsies; J. R. Dawson and Staff; 102 I. A.

3:30 - General Physiology-Biophysics Seminar; 323 Zoology Building.

4:00 - 5:00 Pediatric Rounds on Wards; I. McQuarrie and Staff; U. H.

4:30 - 5:30 Clinical-Medical-Pathological Conference; Todd Amphitheater, U. H.

5:00 - 6:00 X-ray Conference; Presentation of Cases from Ancker Hospital; Drs. Aurelius, Peterson, and Engels; Eustis Amphitheater, U. H.

Ancker Hospital

8:00 - 9:00 Fracture Conference; Auditorium.

9:00 - 10:00 Medical X-ray Conference; Auditorium.

Minneapolis General Hospital

10:00 - Psychiatry Grand Rounds; R. W. Anderson; Station H.

10:00 - Pediatric Rounds; Spencer F. Brown; Stations I and J.

11:00 - 12:00 Medicine-Surgery Conference; Classroom, Station M.

12:30 - 2:30 Dermatology Rounds on Clinic; Carl W. Laymon and Staff.

12:30 - ECG Conference; Boyd Thomes and Staff; 302 Harrington Hall.

1:00 - Tumor Clinic; Drs. Eder, Coe, and Lipschultz; Classroom.

Veterans Administration Hospital

7:30 - Anesthesiology Conference; Conference Room, Bldg. I.

8:30 - Surgery Staff Seminar; Medical Conference Room, Bldg. I.

9:30 - Infectious Disease Rounds; Drs. Hall, Zinneman, Lubin, and Sherman.

9:30 - Surgery-Pathology Conference; Conference Room, Bldg. I.

10:30 - Surgery-Tumor Conference; L. J. Hay, J. Jorgens and Donn Mosser; Conference Room, Bldg. I.

1:00 - Review of Pathology, Pulmonary Tuberculosis; Conference Room, Bldg. I.

1:30 - Combined Medical-Surgical Chest Conference; Conference Room, Bldg. I.

2:00 - 2:50 Dermatology and Syphilology Conference; H. E. Michelson and Staff; Bldg. III.

4:00 - Thoracic Surgery Problems; Conference Room, Bldg. I.

Wednesday, February 3

Medical School and University Hospitals

8:00 - 9:00 Roentgenology Surgical-Pathological Conference; Paul Lober and L. G. Rigler; Todd Amphitheater, U. H.

11:00 - 12:00 Pathology-Medicine-Surgery-Pediatrics Conference; Todd Amphitheater, U. H.

12:30 - 1:30 Physiology 114B -- Transport Seminar; Nathan Lifson and M. B. Visscher; 214 Millard Hall.

12:30 - 1:20 Radioisotope Seminar; Underground Cobalt Unit, U. H.

1:00 - 2:00 Dermatology Clinical Seminar; F. W. Lynch; 300 North Clinic.

1:30 - 3:00 Pediatric Allergy Clinic; Albert V. Stoesser and Lloyd Nelson; W-211, U. H.

3:30 - 4:30 Dermatology Pharmacology Seminar; J. D. Krafchuk; 3rd Floor Conference Room, Heart Hospital.

4:30 - 5:50 Dermatology Infectious Disease Seminar; J. D. Krafchuk; 3rd Floor Conference Room, Heart Hospital.

5:00 - 5:50 Urology-Pathological Conference; C. D. Creevy and Staff; Eustis Amphitheater, U. H.

5:00 - 6:00 Residents' Lecture; Small Bowel; Jack Freidman; Todd Amphitheater, U.H.

5:30 - 7:30 Dermatology Journal Club and Discussion Group; Hospital Dining Room.

7:30 - 9:30 Dermatology Pathology Seminar; Review of Interesting Slides of the Week; Robert W. Goltz; Todd Amphitheater, U. H.

Ancker Hospital

8:30 - 9:30 Clinico-Pathological Conference; Auditorium.

12:30 - 1:30 Medical Journal Club; Library.

Minneapolis General Hospital

9:30 - Pediatric Rounds; Max Seham; Stations I and J.

10:30 - 12:00 Medicine Rounds; Thomas Lowry and Staff; Station D.

11:00 - Pediatric Seminar; Arnold Anderson; Classroom, Station I.

11:00 - Pediatric Rounds; Erling S. Platou; Station K.

12:00 - Surgery Seminar; Arthur Zierold; Classroom.

12:15 - Pediatric Staff Meeting; Classroom, Station I.

1:30 - Visiting Pediatric Staff Case Presentation; Classroom, Station I.

2:00 - 5:00 Infectious Disease Rounds and Conference; Wesley W. Spink; Station 100.

Veterans Administration Hospital

8:30 - 10:00 Orthopedic X-ray Conference; E. T. Evans and Staff; Surgical Conference Room, Bldg. 43.

8:30 - 12:00 Neurology Rehabilitation and Case Conference; A. B. Baker.

9:00 - Gastro-Intestinal Rounds; Drs. Wilson, Zieve, Hay, Brakel, Nesbitt and O'Leary.

12:30 - Medical Journal Club; Doctors' Dining Room.

12:30 - X-ray Conference; J. Jorgens; Conference Room, Bldg. I.

Wednesday, February 3 (Cont.)

Veterans Administration Hospital (Cont.)

1:30 - 3:00 Metabolic Disease Conference; Drs. Flink, Schultz and Brown.

4:00 - Combined Medical Surgical Conference; Drs. Flink and Hay; Conference Room, Bldg. I.

7:00 p.m. Lectures in Basic Science of Orthopedics, Conference Room, Bldg. I.

Thursday, February 4

Medical School and University Hospitals

9:00 - 11:50 Medicine Ward Rounds; C. J. Watson and Staff; E-221, U. H.

11:00 - 12:00 Cancer Clinic; K. Stenstrom, A. Kremen and B. Zimmermann; Todd Amphitheater, U. H.

12:00 - 1:00 Medical Journal Club; Caesarian Section; G. Hottinger; 116 Millard Hall.

12:30 - 1:30 Electrocardiography Conference; Ernst Simonson; Staff Room, Cardiac Clinic, Heart Hospital.

12:30 - Physiological Chemistry Seminar; White vs. Brown Flour in Nutrition; N. Mizuno; 214 Millard Hall.

1:30 - 4:00 Cardiology X-ray Conference; Heart Hospital Theatre.

5:00 - 6:00 Radiology Seminar; Electrokymography; Joseph Jorgens; Eustis Amphitheater, U. H.

Ancker Hospital

8:00 - 10:00 Medical Grand Rounds; Auditorium.

Minneapolis General Hospital

9:30 - Neurology Rounds; Heinz Bruhl; Station I.

10:00 - Pediatric Rounds; Spencer F. Brown; Station K.

10:00 - Psychiatry Grand Rounds; J. C. Michael and Staff; Sta. H.

11:30 - 12:30 Clinical Pathological Conference; John I. Coe; Classroom.

12:30 - 2:30 Dermatology Rounds and Clinic; Carl W. Laymon and Staff.

1:00 - Fracture - X-ray Conference; Drs. Zierold and Moe; Classroom.

1:00 - House Staff Conference; Station I.

Veterans Administration Hospital

8:00 - Surgery Grand Rounds; Conference Room, Bldg. I.

8:00 - Surgery Ward Rounds; Lyle Hay and Staff; Ward 11.

11:00 - Surgery-Roentgen Conference; J. Jorgens; Conference Room, Bldg. I.

1:00 - 3:00 Bacteriology Conference; Streptococcus; Richard Smith; Conference Room, Bldg. I.

1:30 - 4:30 Infectious Diseases Conference and Rounds; Drs. Spink and Hall; Conference Room, Bldg. 1.

Friday, February 5

Medical School and University Hospitals

8:00 - 10:00 Neurology Grand Rounds; A. B. Baker and Staff; Station 50, U. H.

9:00 - 9:50 Medicine Grand Rounds; C. J. Watson and Staff; Todd Amphitheater, U. H.

10:30 - 11:50 Medicine Rounds; C. J. Watson and Staff; Todd Amphitheater, U. H.

10:30 - 1:50 Otolaryngology Case Studies; L. R. Boies and Staff; Out-Patient Department, U. H.

11:00 - 12:00 Vascular Rounds; Davitt Felder and Staff Members from the Departments of Medicine, Surgery, Physical Medicine, and Dermatology; Out-Patient Department, Heart Hospital.

11:45 - 12:50 University of Minnesota Hospitals Staff Meeting; Femoral Head Prosthesis: A Preliminary Report; Frank J. Iwersen; Powell Hall Amphitheater.

1:00 - 2:50 Neurosurgery-Roentgenology Conference; W. T. Peyton, Harold O. Peterson and Staff; Todd Amphitheater, U. H.

1:30 - 2:30 Dermatology Grand Rounds; Presentation of Cases from Grouped Hospitals (University, Ancker, General and Veterans) and Private Offices; H. E. Michelson and Staff; Eustis Amphitheater, U. H.

2:30 - 4:00 Dermatology Hospital Rounds; H. E. Michelson and Staff; Begin at Dermatology Histopathology Room, M-434, U. H.

3:00 - 4:00 Neuropathological Conference; F. Tichy; Todd Amphitheater, U. H.

3:30 - 4:30 Dermatology-Physiology Seminar; J. D. Krafchuk; 3rd Floor Conference Room, Heart Hospital.

4:00 - 5:00 124 Advanced Neurophysiology Lecture; Werner Koella and Ernst Gellhorn; 111 Owre Hall.

4:30 - 5:20 Ophthalmology Ward Rounds; Erling W. Hansen and Staff; E-534, U. H.

5:00 - Urology Seminar and X-ray Conference; Eustis Amphitheater, U. H.

Ancker Hospital

1:00 - 3:00 Pathology-Surgery Conference; Auditorium.

Minneapolis General Hospital

9:30 - Pediatric Rounds; Wallace Lueck; Station J.

10:30 - Pediatric Surgery Conference; Oswald Wyatt; Tague Chisholm; Station I, Classroom.

12:00 - Surgery-Pathology Conference; Dr. Zierold, Dr. Coe; Classroom.

1:00 - 3:00 Clinical Medical Conference; Thomas Lowry; Classroom, Station M.

1:15 - Pediatric X-ray Conference; Oscar Lipschultz; Classroom, Main Bldg.

2:00 - Pediatric Rounds; Stations I and J.

Veterans Administration Hospital

10:30 - 11:20 Medicine Grand Rounds; Conference Room, Bldg. I.

1:00 - Pathology Slide Conference; E. T. Bell; Conference Room, Bldg. I.

2:00 - Autopsy Conference; E. T. Bell; Conference Room, Bldg. I.

Saturday, February 6

Medical School and University Hospitals

7:45 - 8:50 Orthopedic X-ray Conference; W. H. Cole and Staff; M-109, U. H.

9:00 - 10:00 Infertility Conference; Louis L. Friedman, David I. Seibel, and Obstetrics Staff; Eustis Amphitheater, U. H.

9:00 - 11:50 Medicine Ward Rounds; C. J. Watson and Staff; Heart Hospital Amphitheater.

9:15 - 10:00 Surgery-Roentgenology Conference; L. G. Rigler, J. Friedman, Owen H. Wangensteen and Staff; Todd Amphitheater, U. H.

10:00 - 11:30 Surgery Conference; Todd Amphitheater, U. H.

10:00 - 12:50 Obstetrics and Gynecology Grand Rounds; J. L. McKelvey and Staff; Station 44, U. H.

11:30 - Anatomy Seminar; A Review of Studies on the Ground Substance of Connective Tissue; Joseph Wethington; 226 Institute of Anatomy.

Ancker Hospital

8:30 - 9:30 Surgery Conference; Auditorium.

Minneapolis General Hospital

8:00 - Urology Staff Conference; T. H. Sweetser; Main Classroom.

9:00 - Psychiatry Grand Rounds; R. W. Anderson; Sta. H.

11:00 - 12:00 Medical - X-ray Conference; O. Lipschultz, Thomas Lowry and Staff; Main Classroom.

Veterans Administration Hospital

8:00 - Proctology Rounds; W. C. Bernstein and Staff; Bldg. III.

8:30 - 11:15 Hematology Rounds; Drs. Hagen, Fifer, and J. Anderson.

11:15 - 12:00 Morphology . . . . Dr. Aufderheide; Conference Room.