Bulletin of the

University of Minnesota Hospitals
and
Minnesota Medical Foundation

Electroconvulsive Therapy: The Cardiac Risk

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BULLETIN OF THE
UNIVERSITY OF MINNESOTA HOSPITALS
and
MINNESOTA MEDICAL FOUNDATION

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INDEX

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GREETINGS

It is a privilege at the beginning of another academic year to greet the members of our Hospital and Medical School staffs. The interlude since our last staff meeting has, we hope, been a pleasant and refreshing one. Each spring we look forward to some summer vacation but as autumn approaches it is always heartening to have our pathways and interests converge again at the University Hospital and Medical School.

To the newcomers in our group, we extend a special welcome. Minnesota has been especially noted for the friendliness and cooperation which permeates all parts of the Medical School and Hospital. We hope that you will experience and participate in this friendliness and cooperation.

In the future when the history of this Medical School is written, the year 1949-50 will certainly be considered a significant one. This is the year that construction on the Mayo Memorial will be started and the Heart Hospital will be completed. All of this construction work will mean inconvenience and disturbance to the staff and the patients of the Hospital. However, the realization of what it will mean in the way of expanded and improved facilities will more than compensate for the inconveniences involved.

Until the new buildings are completed, we will continue to be handicapped by inadequate facilities. These need not, however, and I am sure will not, prevent continuing progress in teaching, in scientific research, and in the care of patients. So I am sure that we are justified in looking forward to another year of interesting and rewarding progress.

Harold S. Diehl, M.D.
Dean of the Medical Sciences

I. ELECTROCONVULSIVE THERAPY: THE CARDIAC RISK

Clarence J. Rowe
Burtrum C. Schiele

Introduction

Among the most colorful advances in recent psychiatric treatment has been the advent of Electroconvulsive Therapy (ECT). Since its introduction in Italy by Cerletti and Bini in 1938, its use has become world-wide; today it stands as one of the really effective agents in the treatment of certain psychiatric disorders. However, to those unfamiliar with its dangers and limitations it often appears as a panacea. Because of its somewhat spectacular nature and its occasional dramatic results it is frequently requested by patients or their relatives. The general physician who is frequently consulted as to the advisability of Electroconvulsive Therapy often lacks sufficient familiarity with the indications, contraindications and limitations. For these reasons we believe that the subject is of sufficient general interest to be presented to this group.

The Treatment Procedure

The technique is to apply sufficient electrical current to the frontal part of the head to induce a grand mal convulsion. Certain modifications have been made to lessen complications. Atropine (gr. 1/150) is given prior to treatment to reduce salivation and decrease the risk of aspiration. Musculoskeletal complications are lessened by hyperextension of the spine and curarization (d-Tubocurarine, 1 cc (20 units) / 40 lbs. body weight). Additional protection is afforded by having an attendant restrain the patient at the shoulders and hips. The apnea which follows the convulsion usually responds to a quick push on the chest wall. Oxygen, prostigmine, and an airway are used when indicated.

Preliminary investigation should routinely include an electro-cardiogram and chest X-ray in addition to the usual physical and neurological examinations. Other examinations and laboratory studies need be done only as indicated.

A series of such convulsions is necessary to produce the desired effect. The total number in the series depends upon the patient's response; between 8 and 12 treatments are needed in the average case. It is not uncommon for the patient to show decided improvement and then relapse a few weeks after treatment is terminated. Such cases usually respond to a few additional treatments. In more refractory cases, courses of 40 or more convulsions are not uncommon and are well tolerated. Reports in the literature indicate that several hundred have been administered to the same patient without untoward effects.

Indications, Limitations and Results:

There is no satisfactory theory as to the mode of action of ECT. About all we can say is that a series of these treatments alters the patient's cerebral function in such a manner as to foster the process of psychological readjustment. It is important to stress that the treatment is symptomatic. It relieves the patient of certain of his symptoms but does not alter his basic personality structure -- nor does it solve life's problems. It reduces most types of depression, agitation and excitement regardless of etiology. To illustrate this latter point, we might cite a case of general paresis, where ECT could be used to relieve the patient of excitement though, of course, he would still retain his neurological findings and intellectual deficit and would still require antiluetic therapy. (Actually, ECT is seldom used in the treatment of organic or toxic disorders.)

In general, ECT is most effective in the treatment of those patients considered to have a favorable prognosis without such therapy. In other words, the patient with a good personality background, adequate social and work adjustment, acute onset and a high proportion of affective symptoms (depression, elation, emotional tension, etc.) usually responds well to the treatment. On the other hand, a poor pre-psychotic personality, showing inade-

quate social and work adjustment, insidious onset and dissociation of affect suggests a less favorable prognosis.

If we look at diagnostic groupings, the clearest indications are the Agitated Depressions - particularly those in the Involutional Group. In Involutional Melancholia prior to the use of ECT, there was a recovery of about 40% and this only after 1½ to several years in the hospital. In contrast to this, such cases treated with ECT have a recovery rate of 85 to 95% and require only about 8 weeks of hospitalization. Involutional patients with paranoid or neurotic admixtures have less favorable prognoses. The recovery rate approximates 60%, but many others are benefitted to some extent. The results in Manic Depressive Psychoses are good but less gratifying. In general, it shortens the duration of elations and depressions but does not prevent recurrence. Good recoveries are occasionally obtained in acute schizophrenic and paranoid conditions although the long term results are often less satisfactory.

ECT has been extensively tried in the various neuroses and psychosomatic conditions. It has proven to be of value in many of the Reactive Depressions and occasionally in other chronic neuroses in which there is a large depressive element. As a general rule, however, it should be emphasized that with the exception of certain of the Reactive Depressions ECT is of no value in the majority of the neuroses - in fact, is usually contraindicated.

Complications and Contraindications

The incidence of complications is low if the cases are at all carefully selected. The most common complications are traumatic, and include dental trauma, joint dislocations and fractures. Of the last mentioned, compression fracture of the mid-dorsal spine is most frequently reported but is not severe and is usually asymptomatic. Cardiovascular complications are rare, though cardiac arrest and arrhythmias have been noted. The most important respiratory complication is the reactivation of latent pulmonary tuberculosis - although this danger seems to have been exaggerated. There has been considerable interest as to whether or not diffuse brain damage or other central nervous system lesions are caused by ECT. Spontaneous epilepsy, cerebral vascular accidents, parkinsonism and similar lesions have been reported, though rarely. The question as to whether or not a series of convulsions can result in significant amounts of permanent brain damage remains unsettled. While mental confusion and amnesia occur regularly and do give evidence of disturbed cerebral function, these phenomena are transient, clearing in a few weeks to months. Most workers feel that no appreciable amount of brain damage remains when ECT is given in the usual therapeutic doses.

Contraindications include any condition in which an epileptiform seizure is dangerous. Most of the conditions which have been listed as "contraindications" require special consideration but their presence does not imply routine elimination. Such obvious conditions as acute infections, fresh fractures, acute head injuries and generalized bone and joint disease are usually contraindications. Certain others, such as active pulmonary tuberculosis, malignancy, thyrotoxicosis, renal disease, pregnancy, and cardiovascular disease are regarded as relative contraindications.

Fatalities following ECT are rare. The exact death rate is difficult to determine since all cases may not have been reported, autopsy reports are not always available and the relationship of ECT to reported deaths in some cases is obscure. Kalinowsky[1] reported on more than 2000 cases without a fatality. Other reports[2,3] give death rates varying from 0.06% to 0.8%. In a review of 33 fatalities reported in the English and American Literature, Will, et al[4] found that 26 were apparently related to the treatment. Of these 12 were due to cardiac failure, 2 to respiratory failure and 2 others to respiratory or cardiac failure. Two others died in status epilepticus and 8 of complications initiated by the treatment.

Since cardiac failure is the most commonly reported cause of death and since co-existing cardiovascular disease is a

common problem in patients being considered for treatment we wish to discuss the cardiac risk in some detail.

The Cardiac Risk

In the past many cardiac patients who would have benefitted from the treatment have been denied its use because it was felt they would not withstand the strain of induced convulsions. At first glance it would appear that convulsions might aggravate cardiac damage, but it should be recalled that in epileptics this is rarely observed.

The literature concerning the cardiovascular system in relation to ECT is relatively scanty. The few articles[1,5,6,7,8] which have been written are summarized as follows: Transient disturbances in rate and rhythm are fairly common. Most authors believe that the increased vagotonia resulting from the convulsions causes such changes. Electrocardiographic studies have shown higher P waves and depression of S-T segments. These are apparently produced by transient dilation of the right auricle and overloading of the right ventricle. Consequent to the muscular straining which accompanies the seizure there is a marked transitory increase in peripheral venous pressure. This remains slightly elevated even after the convulsion has terminated. Most authors believe that slight myocardial changes may occur due to the apnea and anoxemia. Observations on the blood pressure reveal moderate elevations of the systolic but only slight rises in the diastolic pressure.

Cases of cardiovascular deaths following ECT have been reported in which the history, physical findings and ECG were not indicative of cardiac disease. On the other hand, patients with serious cardiac damage have tolerated the therapy well. The cardiac conditions which contraindicate ECT are not clearly defined because of incomplete data on the mechanism of fatalities and a lack of knowledge regarding methods of preventing untoward reactions. Most authorities agree that each case should be considered individually, weighing possible psychiatric recovery against possible aggravation of existing cardiac disease.

Kalinowsky and Hoch[1] in their treatise on this subject mention only aneurysm of the aorta as an absolute contraindication. They recognize myocardial disease, coronary artery disease and angina as only relative contraindications since many such patients have successfully tolerated treatment. Hypertension, rather than being a contraindication, they often consider to be an indication since the emotional disturbance is frequently a contributing factor in the elevated blood pressure. They conclude that acute cardiovascular embarrassment occasionally occurs during therapeutic convulsions but believe that there is no evidence that this can ever be predicted or that preexisting cardiac disorders have any bearing on such occurrences.

Most authors consider acute myocardial infarction and aortic aneurysms as absolute contraindications. However, Harris quoted by Hejtmancik et al[8], has successfully treated two patients with these conditions. Moore[9] treated 238 patients with cardiac disorders with only one fatality. Evans[10] reported treatment of 38 cardiac patients, five of whom had auricular fibrillation. Only one death occurred. Strauss[11] reported three cases, one with calcifying pericarditis, who developed no complications. More recently, Hejtmancik et al[8] have treated 26 patients with clinical or electrocardiographic evidence of heart disease without fatality. They used large doses of atropine (gr. 1/50 to 1/30) prior to each treatment to prevent cardiac arrhythmias and reduce severity of post convulsive apnea and cyanosis.

From the above discussion it is evident that the decision as to the advisability of treating the psychiatric patient who has cardiac disease will require cooperation between the Internist and the Psychiatrist. The Internist's role is to evaluate the severity of the cardiac disease, to estimate the risk and recommend safeguarding procedures. It is unfair to expect the Internist to make the decision as to whether or not ECT should be given. This is the Psychiatrist's responsibility. The Psychiatrist is more familiar with the probable course of the psychosis; he is in a better position for example, to weigh the risk of physical exhaustion

against possible aggravation of cardiac damage in a severely disturbed patient, or to balance the suicidal risk with the cardiac risk in a depressed patient. In brief, he is in a better position to weigh the various factors concerned.

Case Material

During the past two years the question of cardiac risk arose in seventeen cases treated with ECT at the University of Minnesota Hospitals. Seven of these cases are not reported since in four there was no clear evidence of cardiac disease after careful investigation and three others had only abnormal ECG findings. The remaining ten have been divided into two groups: (A) Three cases with Rheumatic Heart Disease, and (B) Seven cases with Hypertension a/o Hypertensive Heart Disease. The cases with cardiac findings and number of treatments are listed in Tables I and II. The diagnostic grouping is shown in Table III, and the number of treatments in Table IV. As to psychiatric results, all cases obtained mild to marked improvement and there were no fatalities nor untoward reactions except in one case which developed cardiac arrhythmia.

Table I

PATIENTS WITH RHEUMATIC HEART DISEASE

Patient	Clinical Findings	ECG	Chest Plate	ECT
#1 28, f.	Mitral Stenosis Aortic Insufficiency Auricular Fibrillation	Abn.	Cardiac Enlargement	10
#2 38, m.	Aortic Insufficiency ? Mitral Stenosis Auricular Fibrillation	Abn.	Cardiac Enlargement	5
#3 73, m.	Aortic Stenosis Aortic Regurgitation	Abn.	Cardiac Enlargement	11

Table II

PATIENTS WITH HYPERTENSION A/O HYPERTENSIVE HEART DISEASE

Patient	Clinical Findings	ECG	Chest Plate	ECT
#4 50, m.	L. vent. enlgmt. Diastolic above 95	Abn.	L. vent. Enlgmt.	13
#5 53, f.	L. vent. enlgmt. Diastolic above 100 Ankle edema	Norm.	L. vent. enlgmt.	6
#6 59, f.	Diastolic above 94	Abn.	L. vent. enlgmt. Inactive TBC.	7
#7 56, m.	L. vent. enlgmt. Diastolic above 100 Aortic Murmur	Norm.	L. vent. enlgmt. Aortic ectasia	4
#8 69, f.	L. vent. enlgmt. Apical systolic murmur Ankle edema	Abn.	L. vent. enlgmt. Aortic Dilation	6
#9 76, m.	Hypertension L. vent. enlgmt.	Abn.	Cardiac enlgmt.	8
#10 71, m.	Hist. of angina Labile B. P.	Norm.	L. vent. enlgmt. Aortic ectasia.	19

Table III

DIAGNOSTIC GROUPINGS

Involutional Depression	6
Neurotic Depression	2
Paranoid State	1
Catatonic Schizophrenia	1

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Table IV

NUMBER OF TREATMENTS

Total No. of Treatments	89
Total No. of Patients	10
Average No. of Treatments	8.9

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Case Reports

The following two cases illustrate the management of a moderately severe cardiac and a mild cardiac problem.

Case I.

This 28 year old female was suffering from Catatonic Schizophrenia complicated by Rheumatic Heart Disease. She had had Rheumatic Fever at 18 with several subsequent episodes of Cardiac Decomposition, three or four of which occurred during the preceding year. The psychosis had been present for seven months prior to admission. ECT had been refused elsewhere because of heart disease. Because of her Psychosis she was unable to cooperate in medical management. She refused digitoxin and did not follow the prescribed diet. Examination revealed the heart enlarged to the left with conus enlargement, apical diastolic thrill, systolic murmur heard best at apex, diastolic murmur heard best along left sternal border with diastolic rumble at apex and auricular fibrillation. The liver was enlarged two finger-breadths below the costal margin (to percussion). B. P. was 104/50, ECG reported auricular fibrillation; depression and sagging of ST segments in all limb leads, CF_2 and CF_4; Diphasic T waves in CF_2 and CF_4. X-ray and fluoroscopic examination revealed marked enlargement of the heart. Circulation time was five and one-half seconds and venous pressure was 11 cm.

Sedimentation rate was 28, urine was negative. Hemoglobin, 14.1; WBC, 15,400. Two weeks after admission she developed a fever which lasted four days. Subacute bacterial endocarditis was suspected but extensive laboratory investigation failed to reveal the cause.

The cardiologist made a diagnosis of Rheumatic Heart Disease with aortic regurgitation, mitral stenosis and regurgitation and auricular fibrillation. He considered her a "very poor risk" for Electroconvulsive Therapy. On the other hand, her psychosis interfered with cardiac management. Psychiatrically her prognosis without shock treatment was very poor and we felt she was the type of case who would benefit from the treatment. After careful discussion with the family consent was obtained for treatment. Certain precautions were taken: she was continued on digitoxin (parenterally when necessary) and given atropine and curare prior to each treatment. She received 10 seizures, all of which were tolerated well. There was no change in the auricular fibrillation and no marked variation in pulse rate. The post-convulsive cyanosis seemed somewhat more marked than usual and for this reason she was given oxygen after each treatment. Unfortunately, through an oversight no ECG was obtained at the completion of ECT. The psychiatric result was fair. She showed marked improvement in her behavior and cooperated in cardiac management. The family was delighted with the result and took her home where she has remained (11 months) though some paranoid trends have been retained.

Case 8

This is a case of Involutional Melancholia with asymptomatic Hypertensive Heart Disease. The patient was a 69 year old female who was admitted with a second attack of violent agitation. She was unable to remain still for more than brief periods and continuously slapped her head and chest in a somewhat rhythmical manner. She had been hospitalized nine months previously for a similar episode and had responded to conservative management. There was no history of previous cardiac symptoms. Examination revealed the heart enlarged to the left, Grade ii apical systolic murmur and 1 plus edema of lower extremities. B.P. was 165/85. An ECG was reported as normal (abnormal on two occasions during first admission). Chest X-ray showed moderate left ventricular enlargement and localized dilation of the ascending aorta. Laboratory studies were negative except for a trace of albumin in the urine. Cardiac Impression was: Arteriosclerotic - Hypertensive Heart Disease. The cardiologist felt that she was "not a good risk" for shock therapy. Since she did not respond to conservative treatment and since this type of illness clears promptly with ECT, it was decided to use it in her treatment. She was placed on digitoxin (0.1 mg. daily) and received 6 convulsions, all of which were well-tolerated. No adverse cardiac effects were noted. Her psychosis responded rapidly and she was able to return home four weeks after treatment was started.

Summary

1. ECT is of particular value in the Depressive Psychoses and in many acute psychotic reactions. It is helpful in only a very few of the psychoneuroses.

2. The treatment is a symptomatic one and its mode of action is unknown. It relieves the patient of certain of his symptoms but does not alter his basic personality structure. It is not a panacea but is a valuable adjunct to the total treatment program.

3. There are definite dangers incident to its use. Fractures, dislocations and dental trauma occasionally occur despite all precautions. Certain co-existing diseases, such as tuberculosis and cardiovascular diseases may be aggravated by its use.

4. The fatality rate is low (less than 1%). Of the reported fatalities the most common cause of death is cardiac failure. In a number the mechanism of death is not known and the role of ECT is obscure.

5. Most patients with cardiac disease can be treated with ECT. There is a certain risk to persons with normal

hearts and this risk is increased in patients with abnormal hearts.

(a) This increased risk must be balanced against the psychiatric dangers.

(b) Preliminary evaluation of the patient should include physical and neurological examinations, chest X-ray, ECG and such laboratory studies as seem indicated.

(c) The other decision as to whether or not a patient should receive ECT should rest with the Psychiatrist after the cardiac status has been determined by the Internist.

6. While some physicians have refused to treat patients with clinical or ECG evidence of mild cardiac involvement further experience indicates that even patients with moderately severe cardiac disease can tolerate the therapy.

7. In our recent experience we have treated 10 cases with mild to moderately severe cardiac disease without serious untoward effects.

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II. MEDICAL SCHOOL NEWS

Minnesota Medical Foundation Scholarships

The new program of scholarships for undergraduate medical students was announced by the Minnesota Medical Foundation in July, 1949. The Foundation at that time set aside a total of $2500 to be awarded during the academic year 1949-50. The scholarships were set up in an effort to help outstanding students who were forced because of financial need to take part-time jobs during their Medical School activities.

The committee appointed by the Minnesota Medical Foundation to recommend students to receive the awards consisted of Doctors Wesley W. Spink, Chairman; Howard L. Horns, and George N. Aagaard. At a meeting of the Board of Trustees of the Foundation on September 26, the following students were announced as recipients of $500 scholarship awards for the present academic year:

Alan R. Hopeman
Norman A. Nelson
Mildred L. Schaffer
John W. Anderson
Edward G. Huppler

* * * *

O. H. Wangensteen -- New Foundation President

The Board of Trustees of the Minnesota Medical Foundation at its July meeting elected Dr. O. H. Wangensteen, Professor and Head of the Department of Surgery, as its President. Dr. Wangensteen succeeded Dr. Erling S. Platou who had served as President since the organization of the Foundation in 1939. Dr. George N. Aagaard, Director of Postgraduate Medical Education, was elected Secretary-Treasurer of the Foundation to fill the vacancy made by the resignation of Dr. Maurice B. Visscher.

Courses for Physicians

Dr. Louis Weinstein, Haynes Memorial Hospital, Boston, Massachusetts, will participate in a continuation course in Infectious Diseases to be held at the Center for Continuation Study on October 3-5. Dr. Weinstein will discuss "The Pneumonias" and "Current Concepts of the Common Cold and Influenza."

A continuation course in Diseases of the Chest will be presented at the Center for Continuation Study on October 20-22. The course is sponsored by the Minnesota Chapter of the American College of Chest Physicians and is intended for general physicians. Dr. O. A. Sander of Milwaukee will participate as a visiting faculty member.

* * *

New Minn. Medical Foundation Members

William B.A.J. Bauer, M.D., Ladysmith, Wisconsin
Frederick H. Lott, M.D., St. Paul
E.L. Posey, Jr., M.D., Rochester
H.J. Kurtin, M.D., Blooming Prairie
Leonard A. Titrud, M.D., Minneapolis
Milton M. Hurwitz, M.D., St. Paul
J. Roger Nickerson, M.D., Heron Lake
Richard H. Beiswanger, M.D., Minneapolis
Edward Schons, M.D., St. Paul
J.A. Cosgriff, M.D., Olivia
A.H. Borgerson, Long Prairie
Henry W. Quist, M.D., Minneapolis
Bruce Boynton, M.D., Ada
R.R. Hendrickson, Lake Park
William M. Balfour, M.D., Rochester
E.B. Cohen, M.D., Minneapolis
R.A. MacDonald, M.D., Littlefork
K.R. Fawcett, M.D., Duluth
J. Jacob Kaplan, M.D., Minneapolis
Gordon Riegel, Taylors Falls
W.E. Macklin, Jr., M.D., Mankato
Kano Ikeda, M.D., St. Paul
M.L. Whalen, M.D., Bruce, Wisconsin

III. UNIVERSITY OF MINNESOTA MEDICAL SCHOOL
CALENDAR OF EVENTS

October 2 - October 8, 1949

No. 260

Sunday, October 2

9:00 - 10:00 Surgery Grand Rounds; Station 22, U. H.

Monday, October 3

8:00 - Fracture Rounds; A. A. Zierold and Staff; Ward A, Minneapolis General Hospital.

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; M-109, U. H.

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

11:00 - 11:50 Physical Medicine Seminar; Movies on Vocal Cord Study; E-101, U. H.

11:00 - 11:50 Roentgenology-Medicine Conference; Veterans Hospital.

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

12:00 - 1:00 Physiology Seminar; Pulmonary Ventilation Studies with the Mass Spectrometer; Fletcher Miller; 214 M. H.

12:15 - 1:20 Obstetrics and Gynecology Journal Club; Staff Dining Room, U. H.

12:30 - 1:20 Pathology Seminar; Fat Embolism; L. D. Peltier; 104 I.A.

12:30 - 1:30 Surgery Problem Case Conference; A. A. Zierold, C. Dennis and Staff; Small Classroom, Minneapolis General Hospital.

1:30 - 2:30 Surgery Grand Rounds; A. A. Zierold, C. Dennis and Staff; Minneapolis General Hospital.

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

4:00 - Public Health Seminar; 113 Medical Sciences.

4:00 - Pediatric Seminar; Factors Controlling the Development and Progress of Diabetes; E. G. Bauer; 6th Fl. W., Child Psychiatry, U. H.

5:00 - 5:50 Clinical Medical Pathologic Conference; Todd Amphitheater, U. H.

5:00 - 6:00 Urology-Roentgenology Conference; D. Creevy, H. M. Stauffer, and Staffs; M-109, U. H.

Tuesday, October 4

8:00 - 9:00 Fracture Conference; Auditorium, Ancker Hospital.

8:30 - 10:20 Surgery Seminar; Small Conference Room, Bldg. I, Veterans Hospital.

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

10:30 - 11:50 Surgical Pathological Conference; Lyle Hay and Robert Hebbel; Veterans Hospital.

12:30 - Pediatric-Surgery Rounds; Sta. I, Minneapolis General Hospital; Drs. Wyatt, Chisholm, McNelson and Dennis.

12:30 - 1:20 Pathology Conference; Autopsies; Pathology Staff; 102 I. A.

1:00 - 2:30 X-ray Surgery Conference; Auditorium, Ancker Hospital.

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

3:15 - 4:20 Gynecology Chart Conference; J. L. McKelvey and Staff; Station 54, U. H.

3:30 - 4:20 Clinical Pathological Conference; Staff; Veterans Hospital.

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

4:00 - 5:00 Physiology-Surgery Conference; Gastric Phase of Gastric Secretion with Studies on Site of Original and Production of Gastrin; D. W. Ferguson and N. Lifson; Eustis Amphitheater, U. H.

5:00 - 6:00 X-ray Conference; Presentation of Cases by Ancker Hospital Staff; Drs. Aurelius, Peterson and Gordon; Todd Amphitheater, U. H.

Wednesday, October 5

8:00 - 8:50 Surgery Journal Club; O. H. Wangensteen and Staff; M-515, U. H.

8:30 - 9:30 Clinico-Pathological Conference; Auditorium, Ancker Hospital.

8:30 - 10:00 Orthopedic-Roentgenologic Conerence; Edward T. Evans, Room 1AW, Veterans Hospital.

8:30 - 12:00 Neurology Rehabilitation and Case Conference; A. B. Baker and Joe R. Brown; Veterans Hospital.

11:00 - 12:00 Pathology-Medicine-Surgery Conference; Surgery Case; O. H. Wangensteen, C. J. Watson, and Staffs; Todd Amphitheater, U. H.

11:00 - 12:00 Electrocardiography Lecture; Action Potentials -- Muscle, Heart; Ruben Berman; Main Conference Rm., VA Hospital.

12:00 - 1:00 Radio-Isotope Seminar; The Form, Availability, Characteristics of Useable Radio-Isotopes -- Part III; J. Freidman; Rm. 206, Hospital Court, Temp. Bldg.

Wednesday, October 5 (Continued)

3:30 - 4:30 Journal Club; Surgery Office, Ancker Hospital.

4:00 - 5:00 Infectious Disease Rounds; Conference Rm., Bldg. I, Veterans Hospital.

5:00 - 5:50 Urology-Pathological Conference; C. D. Creevy and Staff; E-101, U. H.

Thursday, October 6

8:15 - 9:00 Roentgenology-Surgical-Pathology Conference; Craig Freeman and H. M. Stauffer; M-109, U. H.

8:30 - 10:20 Surgery Grand Rounds; Lyle Hay and Staff; Veterans Hospital.

9:00 - 9:50 Medicine Case Presentation; C. J. Watson and Staff; M-109, U. H.

10:00 - 11:50 Medicine Ward Rounds; C. J. Watson and Staff; E-221, U. H.

10:30 - 11:50 Surgery-Radiology Conference; Daniel Fink and Lyle Hay; Veterans Hospital.

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

11:30 - 12:30 Clinical Pathology Conference; Steven Barron, C. Dennis, George Fahr, A. V. Stoesser and Staffs; Large Classroom, Minneapolis General Hospital.

12:00 - 1:00 Physiological Chemistry Seminar; Biosynthesis of Urea; Mr. William Cohen; 214 M. H.

1:00 - 1:50 Fracture Conference; A. A. Zierold and Staff; Minneapolis General Hospital.

2:00 - 3:00 Errors Conference; A. A. Zierold, C. Dennis and Staff; Large Classroom, Minneapolis General Hospital.

4:00 - 5:00 Bacteriology and Immunology Seminar; The Effect of Gastric Mucin on Dog Plasma; B. Waisbren; 214 M. H.

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

Friday, October 7

8:30 - 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.

10:00 - 11:50 Medicine Ward Rounds; C. J. Watson and Staff; E-221, U. H.

10:30 - 11:20 Medicine Grand Rounds; Veterans Hospital.

10:30 - 11:50 Otolaryngology Case Studies; L. R. Boies and Staff; Out-Patient Department, U. H.

11:00 - 12:00 Surgery-Pediatric Conference; C. Dennis, O. S. Wyatt, A. V. Stoesser and Staffs; Minneapolis General Hospital.

Friday, October 7 (Continued)

11:30 - 12:50 University of Minnesota Hospitals General Staff Meeting; Hospitals Report, 1948-49; Ray Amberg; Powell Hall Amphitheater.

12:00 - 1:00 Surgery Clinical Pathological Conference; Clarence Dennis and Staff; Large Classroom, Minneapolis General Hospital.

1:00 - 1:50 Dermatology and Syphilology; Presentation of Selected Cases of the Week; H. E. Michelson and Staff; W-312, U. H.

1:00 - 3:00 Pathology-Surgery Conference; Auditorium, Ancker Hospital.

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

4:00 - 5:00 Electrocardiographic Conference; George N. Aagaard; 106 Temp. Bldg., Hospital Court, U. H.

5:00 - 6:00 Otolaryngology Seminar; Review of Current Literature; Dr. Wheeler; Todd Memorial Room, U. H.

Saturday, October 8

7:45 - 8:50 Orthopedics Conference; Wallace H. Cole and Staff; Station 20, U. H.

8:00 - 9:00 Pediatric Psychiatric Rounds; Reynold Jensen; 6th Floor, West Wing, U. H.

8:00 - 9:00 Surgery Literature Conference; Clarence Dennis and Staff; Small Classroom, Minneapolis General Hospital.

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

9:00 - 9:50 Medicine Case Presentation; C. J. Watson and Staff; E-221, U. H.

9:00 - 10:30 Pediatric Grand Rounds; I. McQuarrie and Staff; Eustis Amph., U. H.

9:00 - 11:30 Surgery-Roentgenology Conference; Presentation of Interesting Chest Cases; Surgery Staff; Todd Amphitheater, U. H.

9:00 - 12:00 Neuropsychiatry Case Conference; VA Hospital Annex, Fort Snelling.

10:00 - 11:50 Medicine Ward Rounds; C. J. Watson and Staff; E-221, U. H.

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

11:00 - 12:00 Anatomy Seminar; The Relationship of Gonodal Secretion to the Development of Adrenocortical Adenomas of Mice; Arthur Kirschbaum; 226 I. A.