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and
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Hemolysis During Trans-Urethral Resection

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INDEX

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I. HEMOLYSIS DURING TRANS-URETHRAL RESECTION; ITS INFLUENCE ON OPERATIVE MORTALITY

C. D. Creevy
Robert N. Evert

The prostate gland has long presented a challenge to surgeons. Its role in interfering with urination in old men was apparently first understood by Ulassa in the sixteenth century, but it was not the subject of a deliberate surgical removal for over 300 years. In the interim, many attempts were made to cut, tear, or tunnel through it with blind urethral instruments, with most unfortunate results. During this same period many lithotomists undoubtedly tore or cut off portions of the gland which interfered with the extraction of stones, but the first deliberate operations aimed solely at the removal of parts of the prostate were probably those of Amussat who, in 1832, excised a median lobe suprapubically, and of Ferguson who, in 1848, removed part of a prostatic cancer perineally. The mortality of such incomplete operations as these was high and their success was indifferent because of persistence of obstruction from remaining abnormal tissue.

Goodfellow in 1891 seems to have been the first to grasp the idea of enucleating the enlarged or hypertrophied portion of the gland while leaving the compressed normal part (surgical capsule) behind, thus relieving the obstruction completely; but he inserted a finger into the prostatic urethra through an incision in the bulb, enucleated the hypertrophy, and pulled it out through the external sphincter, to the great and lasting detriment of that muscle. By 1895, Fuller had discovered how to enucleate the prostate suprapubically, an operation subsequently popularized as his own by Freyer. Postoperative control of urination was better, but mortality was terribly high. Young shortly therafter improved the perineal operation, which had a low mortality (3.2 per cent in a thousand cases) in his hands, but as late as 1936 Barney[2] reported a series of 816 prostatectomies, both suprapubic and perineal, done in the Massachusetts General Hospital between 1911 and 1936, with an overall mortality of 14.2 per cent, the suprapubic being about one third more dangerous than the perineal. The death rate in less expert hands ranged between 25 and 30 per cent. However, the mortality in an unoperated series of over 200 cases, covering the same period, was estimated by Barney at well over 30 per cent. Hunt and Walters[11] in 1938 reported a mortality of 5.4 per cent in 1000 suprapubic prostatectomies. Millin[15] has recently made a great point of the superiority of retropubic enucleation over all other methods, but his mortality, reported in 1949, was 4.5 per cent in 757 cases. This is the first sizeable series to be reported since the widespread use of antibiotics.

It was the great risk of open operation in most hands which stimulated a series of pioneers to evolve the transurethral operation. Wishard developed the first instrument permitting such an operation under vision (through a perineal urethrotomy) in 1892, but soon abandoned it in favor of suprapubic enucleation. Subsequently Young (1909), Braasch (1918), and Caulk (1920) devised instruments which permitted excision of part of the prostate under direct vision, but hemostasis remained a serious problem until Bumpus (1926) utilized electrocoagulation (previously used by Beer for the destruction of vesical papillomata) for hemostasis in connection with a modified Braasch prostatic excisor. This subsequently led to the development of the Thompson punch now used at the Mayo Clinic. Electrocoagulation has continued to be the principal means of controlling bleeding during transurethral operations, although it needs to be supplemented at times by the local injection of vasoconstrictors as suggested by Emmett, or by the inflati n of a Foley balloon catheter in the prostatic fossa, with or without traction.

In the meantime, M. Stern, T. M. Davis, and J. F. McCarthy all contributed to the development of an instrument which cuts and coagulates with a wire loop energized by high frequency electrical currents.

There are several variants of this type of instrument now in use, although the model known as the Stern-McCarthy is most popular. Nesbit made an important contribution to the successful resection of larger glands when he devised an instrument which could be operated with one hand, the forefinger of the other being used to push prostatic tissue into the path of the cutting loop, and to judge the thickness of the remaining prostatic tissue. Asepsis is maintained by using the O'Connor sheath in the rectum.

It was soon found that an expert could remove all but the largest obstructing prostates transurethrally with a risk far below that obtainable in large series by open operations of any type, and that the completeness of removal could be made practically to equal that of enucleation. Thus, Thompson[19] has reported a mortality of 1 per cent in 1800 cases with his cold punch, while Nesbit[17] had a mortality of 1.81 per cent in 2425 cases with his modification of the Stern-McCarthy instrument. Although many urologists have stated, rather petulantly, that equally low mortalities can be achieved by open operation, these claims have never been substantiated by the publication of any large series of cases, although it is obvious that a substantial reduction in the death rate has resulted from the more frequent use of transfusions and particularly from the employment of the more effective antibiotics.

However, Creevy and others who endeavored to remove all of the obstructing tissue by the transurethral route were plagued by an unexplained postoperative reaction which seemed to account for a high proportion of morbidity and mortality. It was particularly likely to follow protracted, bloody operations, and manifested itself with most or all of the following symptoms: cyanosis during operation, nausea with or without vomiting, oliguria, uremia, a low grade, non-obstructive jaundice, and an anemia out of proportion to the blood actually lost; hypertension sometimes occurred late. Study permitted exclusion of such causes as surgical shock, transfusion with incompatible blood, intoxication with sulfonamides, and sepsis. Autopsies were not helpful.

In 1946 both Emmett and Foley suggested verbally that these reactions might be due to the entrance of irrigating water into the circulation, with the resultant hemolysis accounting for all of the manifestations listed above and leading to a renal lesion analogous to that which follows a transfusion with incompatible blood. Subsequent investigations made here and published elsewhere[5] demonstrated that the level of free hemoglobin in the plasma after transurethral resection with distilled water as the irrigating agent averaged 15 times that before operation. Control studies showed that open surgical operations, neurosurgical procedures involving surgical diathermy, and the intravenous injection of the isotonic solutions in common use did not cause elevation of the free hemoglobin of the plasma.

When four per cent glucose was used for irrigation during transurethral resection instead of distilled water, the pre- and postoperative plasma hemoglobins remained the same, but the blood sugar rose to almost twice the preoperative average, reaching 1079 milligrams per cent in one instance. (The blood sugar did not change during transurethral resection when water was used for irrigation).

Dr. E. T. Bell then kindly reviewed sections of the kidneys of 6 patients who died after transurethral resection at the University Hospital between 1940 and 1946; pigmented casts and degenerative lesions of the tubules were found in two, suggesting strongly that a hemolytic reaction had occurred.

Important evidence was also secured from studies made clinically and at autopsy in a patient whose death after transurethral resection initiated the investigation summarized above. He became cyanotic during resection, and that evening his plasma was a deep mahogany red (facilities for measuring it quantitatively were not available in that hospital at the

time). Thereafter he became oliguric, uremic, and jaundiced. The intensity of the uremia was reduced by peritoneal lavage, but he died of pulmonary edema on the 12th postoperative day. Autopsy disclosed a typical hemoglobinuric nephrosis.

Another convincing piece of evidence that irrigating fluid enters the circulation is found in an observation made by Wear[21] and verified by Creevy. The bladder is distended at the end of a thorough transurethral resection with Neo-Iopax or Diodrast, and a film is exposed to make sure that regurgitation up the ureters does not occur. The bladder is kept distended for 15 minutes, emptied, and another film is exposed. The contrast agent is found in the kidneys, showing that it must have been absorbed and excreted, since the mucous membrane of the bladder is impermeable to the contrast agents, and since reflux did not occur. Thus, the prostatic veins must have taken up the agent. Moreover, 45 per cent of 350 consecutive patients had positive blood cultures at the end of resection, indicating that particulate matter does enter the circulation.[6]

It was concluded from the above mentioned data and from clinical experience that, when the prostate is resected down to the capsule so that large veins are opened, blood hemolyzed by the distilled water enters the circulation, where more hemolysis doubtless occurs. If the patient is robust, has entirely normal kidneys, and suffers no serious drop in blood pressure, nothing happens. If, on the other hand, he has kidneys which have already been damaged by arteriosclerosis, hydronephrosis, or pyelonephritis, hemoglobinuric nephrosis is likely to occur. Its intensity appears to depend both upon the level of free hemoglobin in the plasma and upon the presence of other factors which impair the renal circulation.

The entrance of free hemoglobin into the renal circulation has been shown by Levy[12], by Mason and Mann[14], and by Hesse and Filatov[10] to produce a sudden and pronounced shrinkage of the kidney, presumably due to vasoconstriction. Flink[8] has demonstrated experimentally the resultant changes in the kidney and its function. Both appear to be identical with those resulting from the transfusion of incompatible blood, from blackwater fever, from the hemoglobinemia of severe burns, from crush injuries (myoglobin), etc.

While Baker and Dodds[1] have claimed that the renal damage is due to plugging of the renal tubules by pigmented casts resulting when the hemoglobin comes in contact with acid urine, most investigators feel that this is not so, and Flink has demonstrated, in the dog, the futility of alkalinizing the urine as a preventive measure.

Maegraith, Havard, and Parsons[13] have attributed the renal damage to tubular anoxia from vasospasm. It has been shown pretty conclusively that renal vasospasm sufficient to damage the kidney may also result from trauma other than crush injuries (by Trueta[20]); from prolonged hypotension due to shock (by Van Slyke and others[9]); and from the rapid loss of blood even though the blood pressure is maintained above shock levels by intravenous infusions of fluids (Corcoran and Page[3,4]).

Since all of these factors may be operative to some extent during a transurethral resection, and since many of prostatic patients have damaged kidneys as already noted, it is not surprising to find that the addition of hemoglobinemia to these other factors may be the proverbial straw that breaks the camel's back and leads to severe or even fatal renal failure. The role of bacteremia (which, as already noted, has been found at the end of operation in 45 per cent of the cases[6]) in damaging the kidney remains to be studied.

Inasmuch as there is no known means, other than the use of isotonic irrigating fluids, of preventing hemolysis, and since the treatment of hemolysis is ineffectual, it seems mandatory to use an isotonic solution for irrigation during and after transurethral prostatic resec-

tion.

Since the original observations concerning hemolysis during transurethral resection were published in "Surgery" for January 1947[7], fifteen or twenty papers by various authors have dealt with the subject. Most have agreed that hemolysis is important as a factor in postoperative morbidity and mortality but some have, naturally enough, raised objections.

It has been argued that distilled water can be injected into the human and that, despite the ensuing hemoglobinuria the kidneys are not damaged. This may be true of the normal person, but it is not true of the patient with damaged kidneys, particularly when we consider that he gets, during transurethral resection, not pure distilled water, but distilled water containing blood hemolyzed in the bladder. A patient of a former resident in urology here recently received between 300 and 350 cubic centimeters of distilled water intravenously through inadvertence shortly after a transurethral resection. He had had a blood urea nitrogen of 85 milligrams per cent on admission, but this had fallen to 25 with drainage by inlying catheter; urography had then demonstrated hydronephrosis and pyelonephritis. During the injection of the distilled water the patient had a chill, became cyanotic, and suffered a transitory fall in blood pressure. His plasma hemoglobin at the end of the attack was 290 milligrams per cent. His blood urea nitrogen rose to 33, and his serum bilirubin reached 0.8 milligrams next day. This points up the importance of pre-existing renal damage in these reactions.

Similarly, it has been argued that no free hemoglobin high enough per se to cause severe renal damage has been observed after transurethral resection. This is true, since the literature indicates that a level of three to four thousand milligrams per cent is necessary to injure the normal kidney seriously, while the highest postoperative level to come to our attention was 510. Here again the question of pre-existing renal damage is important.

The best proof or disproof of an hypotheses like this is to be found in clinical experience rather than in the laboratory. Since this work was begun, or rather, as soon as a sufficient number of resections had been done with distilled water to permit the gathering of data on plasma hemoglobin, isotonic irrigating solution has been used in all resections done in this hospital and in all those performed by Drs. E. A. Webb and B. A. Smith, Jr. Both 4 per cent glucose and 1.1 per cent glycine (Nesbit[16]) have been used. No hemolytic reactions (oliguria, anemia, uremia, jaundice) have occurred, although 13 of 109 cases done with water during the study became uremic, and three of these became jaundiced. Drs. Creevy, Webb and Smith have operated upon 986 patients using isotonic solutions, with 6 deaths, an operative mortality of 0.6 per cent in a series large enough to minimize the operations of luck and chance. This compares with a mortality of slightly more than 3 per cent before the isotonic solutions were adopted.

During this same time the residents of this hospital have performed transurethral resection on 560 patients, many of them exceedingly poor risks, with 14 deaths, a percentage of 2.5. The two series combined add up to 1546 cases with 20 deaths, or 1.3 per cent. In other words urological residents learning the operation on poor risks have had a lower mortality than has been achieved by the most experienced surgeons with open operations.

It must be admitted that this study takes no account of the role of antibiotics in reducing the mortality of the operation. We have been in the process of evaluating the relative merits of the sulfonamides, penicillin, streptomycin, aureomycin, and currently, chloramphenicol (what's wrong with calling it chloromycetin?) in reducing bacteremia and other postoperative complications. As soon as the study on chloromycetin has been completed, it is intended to accumulate a series without antiobiotics.

In any case, transurethral resection of the prostate gland has become a pretty safe operation in patients who, by and large, are not very good risks.

A survey of the last 100 cases from the clinic service receiving transurethral prostatic resection has revealed some interesting facts.

SURVEY OF LAST 100 TRANSURETHRAL RESECTIONS ON CLINIC SERVICE (to 12/31/49)

No. of patients		100
Age	avg.	74
	max.	93
	min.	26
No. of operations		132
% of operations repeated (2 or more stages)		26%
Weight of tissue removed	avg.	33.4 Gm.
	Max.	112
	Min.	5
Blood loss during surgery	avg.	253 cc.
	max.	700
Transfusions or ward		40
No. cases returned for control of bleeding		7
No. carcinoma		14
No. benign		86
Avg. preoperative stay		4.3 days
Avg. postoperative stay		10.4 days

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The average age of the patients was 74. Many of them had delayed the seeking of medical help for many years. The renal function was so impaired in 7 cases that a period of preliminary cystostomy drainage was needed to prepare them for prostatic surgery. It is a credit to cystostomy drainage using the Kreutzmann trocar that there were no deaths from uremia nor from the cystostomy itself in this series. Drainage of the bladder by suprapubic cystostomy has proven superior to drainage by urethral catheter. The troublesome complications of urethritis, epididymitis, or pyelonephritis are seldom encountered. Since the patient can be sent home with the cystostomy tube in place, the average period of hospitalization before surgery has been kept to four days, a feature greatly appreciated.

Twenty-six per cent of the transurethral resections needed to be repeated. It has been our policy to do a second resection on all of the larger glands, depending somewhat on the experience of the surgeon during the first resection. This is to ensure complete removal of the obstructing tissue, with resultant diminished postoperative morbidity and better late results. Practically all glands larger than 50 grams were subjected to a second resection. The cases

that proved most troublesome and required the greatest number of repeated resections were those who had large, atonic bladders. These patients often did not void well after removal of the catheter, and carried large volumes of residual urine. If parasympathomimetic drugs such as pilocarpine were not effective enough to lower the volume of the residual urine to below 100 c.c., another resection was performed. Other indications for performing a second stage resection were continued bleeding following removal of the catheter, or troublesome incontinence. Often a small amount of prostatic tissue left near the external sphincter impairs urinary control. Poor risk patients who could not withstand a prolonged resection were subjected to a second stage resection purposefully. In spite of the frequency of performance of a second resection, the average postoperative period of hospitalization was but 10.4 days.

It should be understood that the hundred cases now being discussed were operated upon by residents in the process of learning the operation. The need for repeated operation diminishes with increasing experience.

COMPLICATIONS

Postoperative hemorrhage, immediate, requiring cystoscopic examination for control	3
Postoperative hemorrhage, delayed, requiring cystoscopic examination for control	4
Perforation of capsule with extravasation of irrigating fluid	
Treated with suprapubic cystostomy	1
Treated with drainage of prevesical space	2
Periurethritis with subsequent stricture	1
" without " "	2
Epididymitis	3
Incontinence, temporary (up to 3 mo.)	15
" , permanent (7 mo.)	1
Cerebrovascular accident	1
Pulmonary infarction	1

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An examination of the list of complications is probably of most merit to us since it shows where improvements can be made. Three patients needed to be returned for cystoscopic control of profuse hemorrhage in the immediate postoperative period. Delayed hemorrhage, occurring after the removal of the catheter and often after the patient had left the hospital, proved severe enough in four instances to require cystoscopic evacuation of clots and fulguration of the bleeding areas.

The three cases of periurethritis could have been avoided by preliminary perineal urethrotomy. The bilateral vasectomy done before all resections did not prevent epididymitis in three cases, probably because they had all been catheterized prior to the performance of the vasectomy.

Incontinence has not been troublesome. Although 16 patients had varying degrees of incontinence at the time of discharge from the hospital, all but one of them

had complete control by the end of three months. The patient who remains incontinent at the end of 7 months required prolonged cystostomy drainage before his prostatic resection. His bladder contracted, and still has a capacity of but 100 cc., a feature which is doubtless responsible for his tardiness in regaining urinary control.

Summary

Transurethral resection of the prostate has become a relatively safe operation. In a series of 1546 cases performed by surgeons of varying experience, the mortality rate has been 1.3%.

The use of an isotonic irrigating fluid has contributed materially to the safety of this procedure.

Antibiotics have doubtless also helped reduce morbidity and mortality, but their exact role needs further study.

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II. MEDICAL SCHOOL NEWS

Coming Events

February 9 - Dean Harold S. Diehl; "A Report on British Medical Education Under the National Health Act"; 3:00 p.m., Medical Science Amphitheater; sponsored by the Minnesota Medical Foundation.

February 16 - E. Starr Judd Lecture - "Growth in the Field of Anesthesia" - Dr. Henry K. Beecher, Harvard University Medical School; Museum of Natural Science Auditorium, 8:15 p.m.

February 16-18 - Continuation course in Cancer for General Physicians.

March 6-8 - Continuation course in Gastro-Intestinal Diseases for General Physicians.

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Faculty News

Dr. Cecil J. Watson, Professor and Head of the Department of Medicine, delivered the third Rudolph Matas lecture at Tulane University, New Orleans, on January 27. The subject of Dr. Watson's address was "Modern Concepts of Liver Function and Their Alternation in Disease".

This annual lecture, established at Tulane University to honor Dr. Matas, well-known New Orleans surgeon and Emeritus Professor of Surgery at Tulane, is sponsored by the Nu Sigma Nu medical fraternity. It is designed to bring outstanding speakers in the various fields of medicine and surgery to New Orleans each year.

* * *

Clinical Research Club Elects Officers

Officers elected to posts in the Clinical Research Club for 1950 are Dr. Forrest Adams of the Department of Pediatrics, President, and Dr. Lyle A. French of the Division of Neurological Surgery, Secretary. Drs. Jack Friedman, Bernard Zimmermann, and Craig Borden were elected to the Program Committee.

Membership in the Clinical Research Club is open to any clinical or full-time members of the medical profession and medical school faculty below the rank of assistant professor. Membership is limited to interns, fellows, and instructors in order to encourage an interest in clinical research among the younger members of the medical profession and allied scientists.

The officers of the Clinical Research Club are interested in receiving titles of possible presentations for their regular meetings. It is not necessary to be a member to submit a title and present a paper before the society. Anyone interested is cordially invited to attend the meetings which are held on the first Monday of each month in Eustis Amphitheater.

III. UNIVERSITY OF MINNESOTA MEDICAL SCHOOL
CALENDAR OF EVENTS

February 5 - February 11, 1950

No. 276

Sunday, February 5

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

10:30 - 11:00 Surgical Conference; Venography in Periferal Vascular Disease; Dr. Bratnie; Rm. M-109, U. H.

Monday, February 6

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 - Pediatric Rounds; Erling Platou; Sta. I, General Hospital.

11:00 - 11:50 Physical Medicine Seminar; 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; Effect of Light on Porphrin Metabolism; Robert Pimenta de Mello; 214 M. H.

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

12:30 - 1:20 Pathology Seminar; Experimental Megaloblastic Anemia; C. D. May; 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 - Medical-Surgical Conference; Deep Phlebitis; C. V. Kusz; Bldg. I, Main Conference Rm., Veterans Hospital.

4:00 - Public Health Seminar; Subject to be announced; 113 Medical Sciences.

Monday, February 6 (Cont.)

4:00 - Pediatric Seminar; Mumps Encephalitis; W. Anderson; 6th Floor West, Child Psychiatry, University Hospitals.

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

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

Tuesday, February 7

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

8:15 - 9:00 Roentgenology-Surgical-Pathological Conference; Craig Freeman and L. G. Rigler; M-109, M. H.

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

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

10:30 - 11:50 Surgical Pathological Conference; Lyle Hay and E. T. Bell; Veterans Hospital.

11:00 - Contagion Rounds; Forrest Adams; Sta. I, General Hospital.

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

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

1:30 - 2:30 Pediatric Psychiatry Conference; R. A. Jensen and Staff; 6th Floor, West Wing, U. H.

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 Physiology-Surgery Conference; Physiological Aspects of Eosinophile Response to Stress; Bob Halberg and B. Zimmerman; Eustis Amphitheater.

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

5:00 - 6:00 Porphyrin Seminar; C. J. Watson, Samuel Schwartz, et al; Powell Hall Amphitheater.

5:00 - 6:00 X-ray Conference; Presentation of Cases by General Hospital Staff; Todd Amphitheater; Doctors Lipschultz and Mosser.

Wednesday, February 8

8:00 - 8:50 Surgery Journal Club; O. H. Wangensteen and Staff; M-109, U. H.

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

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

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

11:00 - Pediatric Rounds; Erling Platou; Sta. I, General Hospital.

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

12:00 - 1:00 Radio-Isotope Seminar; Radiation Dosage from Internally Administered Radio-Isotopes; James F. Marvin; 113 Medical Sciences.

12:15 - Staff Meeting; Main Classroom, General Hospital.

3:00 - Pediatric Rounds; E. J. Huenekens; Sta. I, General Hospital.

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

4:00 - 5:00 Infectious Disease Rounds; General Hospital, Basement Amphitheater.

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

Thursday, February 9

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 - Pathology Conference Clinic; Main Classroom; General Hospital.

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; Amino Acid Separation by Starch Column Chromatography; Verna Rausch; 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.

Thursday, February 9 (Cont.)

4:15 - 5:00 Bacteriology and Immunology Seminar; The Nature and Incidence of Variant Pullorum Disease in Minnesota; J. E. Williams; 214 M. H.

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

5:00 - 6:00 X-ray Seminar; Use of X-ray Absorption in Histo-Chemistry; David Glick; Todd Amphitheater, U. H.

7:30 - 9:30 Pediatrics Cardiology Conference and Journal Club; Review of Current Literature 1st hour and Review of Patients 2nd hour; 206 Temporary West Hospital.

Friday, February 10

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 - Pediatric Rounds; Erling Platou; Sta. I, General Hospital.

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

11:45 - 12:50 University of Minnesota Hospitals General Staff Meeting; Pulmonary Pulsations in the Diagnosis of Congenital Heart Disease; Joseph Jorgens; 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 Conference; 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.

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

3:00 - 6:00 Demonstrations in Cardiovascular Physiology; M. B. Visscher, et al; 301 M. H.

4:00 - 5:00 Clinical Pathological Conference; A. B. Baker; Todd Amphitheater, U. H.

Friday, February 10 (Cont.)

4:15 - 5:15 Electrocardiographic Conference; Rhythm and Arrhythmias; Reuben Berman; 106 Temp. Bldg., Hospital Court, U. H.

5:00 - 6:00 Otolaryngology Seminar; Todd Memorial Room, U. H.

Saturday, February 11

7:45 - 8:50 Orthopedics Conference; Wallace H. Cole and Staff; M-109, 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 - 11:30 Neurology Conference; Extrapyramidal System Degenerative Diseases; Powell Hall Amphitheater, U. H.

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 Amphitheater, U. H.

9:00 - 11:30 Surgery-Roentgenology Conference; Todd Amphitheater, U. H.

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 - Contagion Rounds; Forrest Adams; Sta. L, General Hospital.

11:00 - 12:00 Anatomy Seminar; Megaloblastic Anemia; R. Dorothy Sundberg; The Effects of Splenic Tissue and Extracts on Malignant Growths; Albina A. Yakaitis; 226 I. A.