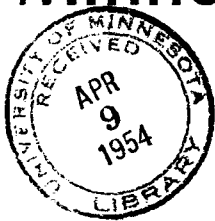


Bulletin of the
University of Minnesota Hospitals
 and
Minnesota Medical Foundation



Surgical Injuries
of the Ureters

BULLETIN OF THE
UNIVERSITY OF MINNESOTA HOSPITALS
and
MINNESOTA MEDICAL FOUNDATION

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I. SURGICAL INJURIES OF THE URETERS

C. D. Creevy, M.D.

Surgical injuries to the ureters occur most frequently during operations upon the female genitalia or the lower large intestine, usually in the presence of dense adhesions, large or infiltrating neoplasms, or of brisk bleeding which is hard to control. They also result from operations upon or through the pelvic floor. Deliberate cutting and reanastomosis or reimplantation during segmental resection of the bladder for cancer and during diverticulectomy cannot be classed as accidental injuries, although the principles governing their repair are the same.

TYPES OF INJURY AND DIAGNOSIS

Many types of injury may occur. The intact ureter may be occluded by a ligature or pinched off when sharply angulated by adjacent sutures or ligatures; it may be perforated by stick ties, or divided with or without ligature or removal of a segment; a piece may be snipped off laterally; or it may undergo rapid or gradual necrosis following crushing by a hemostat or destruction of its extrinsic blood supply by a too extensive stripping of its adventitia in an effort to remove all adjacent lymphatics in a radical operation for cancer.

The nature of the resulting findings and symptoms depends upon whether the lesion is unilateral or bilateral, whether occlusion is complete or incomplete, and whether the injury results in leakage of urine into the peritoneal cavity or to the outside.

Complete bilateral occlusion usually causes anuria without other manifestations until uremia develops. Fever appears if the ureter of an infected kidney is ligated or leaks into or behind the peritoneum. Unilateral complete occlusion is ordinarily silent except in the presence of antecedent infection, in which case chills, fever, renal pain, and toxemia develop, but these phenomena

are most likely to follow partial obstruction. The volume of the urinary output is not altered by unilateral injury.

If the damaged ureter leaks into the peritoneal cavity, signs of free peritoneal fluid with peritoneal irritation will be added to the phenomena already mentioned; uremia follows bilateral but not unilateral injury, because in the latter case the absorbed urine is excreted by the opposite kidney. Retroperitoneal extravasation may produce signs suggestive of a perirenal or psoas abscess. Escape of urine from the wound means an ureteral fistula. One may differentiate ureteral from vesical fistulae quite readily by distending the bladder with fluid stained with indigocarmine; if the fluid from the fistula is stained, leakage is from the bladder, unless there is ureteral reflux, an unusual event in the absence of previous chronic inflammatory disease of the bladder. If there is any reason to suspect such a contingency, the blue dye should be mixed with a contrast agent and a roentgenogram made after the bladder has been filled. This will delineate the reflux up the ureter as well as the extravasation and prevent error.

Cystoscopy should be done at once whenever injury of the ureter is suspected. Excretory urography is likely to be unsatisfactory in the immediate postoperative period, both because of the presence of excessive amounts of intestinal gas, because a freshly occluded kidney will not excrete contrast agent, and because the presence of an abdominal wound makes impracticable the use of the compression ordinarily essential for the making of a good urogram. After inspection of the bladder to make sure that it is intact, the ureters are catheterised. If catheters pass readily to both renal pelves and recover clear urine one has, for practical purposes, excluded any ureteral injury except a small perforation; if there is reason to suspect that one is present, it is wiser to leave the catheter in the affected ureter for a few days than to try to verify the presence of an ureteral fistula by ureterography lest it

then be impossible, because of spasm, to reinsert the catheter. If the inlying catheter is well placed with its eye in the renal pelvis, and is carefully secured in position, a fresh perforation will heal in a few days.

The same is true of an established ureterovaginal fistula if a catheter can be passed into the renal pelvis and properly secured. For obvious reasons, the opportunity to employ this method in the freshly injured ureter does not often occur, but postoperative ureterovaginal fistulae are not uncommon.

If there is evidence of leakage of urine into or behind the peritoneum, free surgical drainage must be supplied. If ureteral catheters pass full length but recover no urine, one suspects that the ureters have been divided and that the catheters have passed out of the ureters at the site of injury. This can be ascertained by injecting contrast agent into the catheters and exposing a film, which will show extravasation. Immediate repair is required, and will be discussed later. If normal renal pelvis are shown, ureterograms are made to exclude ureteral injury. Anuria with normal pyeloureterograms means, of course, that the patient has some form of "lower nephron nephrosis" and must be treated accordingly.

It is usually impossible to pass catheters beyond the site of injury, a finding which demands immediate operation if the lesion is bilateral. Unilateral injuries should be treated promptly, but are emergencies only if there is evidence of urinary leakage into or behind the peritoneum, because Hinman has shown that the kidney may recover after complete obstruction lasting as long as three weeks. However, the presence of active infection in the blocked kidney may destroy it in a comparatively short time if the obstruction is not corrected; the resulting toxemia may endanger the patient's life. Waiting too long in the hope that an occluding ligature will be absorbed may lead to so much inflammatory reaction and fib-

rosis at the site of injury that repair may become difficult or impossible. There is no great hurry if an ureterovaginal fistula is draining freely to the outside without renal pain, chills, or fever.

TREATMENT

The best course to follow in the presence of complete bilateral ureteral obstruction depends upon the general condition of the patient. If it is poor, it is safest to make a unilateral nephrostomy; as soon as the general condition permits (bearing in mind that the other kidney must not be left obstructed too long), the abdominal wound should be reopened, or a fresh abdominal incision made if the original one was vaginal. The ureters above the point of damage will be dilated, and can be followed easily to the site of obstruction. Ligatures and sutures about the ureter are removed until any kinks or constrictions disappear. Indigocarmine may then be injected into the ureter above the site of injury with a syringe and fine needle; if it appears in a catheter previously inserted into the bladder, patency of the ureter has been established. Leakage from the ureter will be seen. If the other side is also obstructed, it is well to inject phenolsulphonephthalein into the other ureter to avoid confusion. The blue dye already in the fluid in the bladder from the first side will disappear upon the addition of alkali, which will also bring out the red of the phenolsulphonephthalein. If this appears from the second side, the abdomen may be closed with drainage. If there is any leakage of the injected dye from a perforation, a catheter should be passed to the corresponding renal pelvis through a cystoscope, and left in situ for a few days.

A small lateral wound of the ureter without loss of tissue may be sutured with fine chromic catgut in the adventitia, and patency of the ureter verified with dye as noted above. If the ureter is lacerated or divided, a small catheter is passed down from the site of injury to

the bladder, and its presence therein proved by aspirating urine. It is then withdrawn, and a small perforation is made in the distal segment of the ureter. Through this one threads the largest Robinson (two eyed) rubber catheter that can be passed without causing blanching of the ureteral wall, inserting it past the injury through the upper segment into the renal pelvis. Pains must be taken to make sure that the eyes are within the pelvis by aspirating urine, and then by injecting fluid and drawing all of it back. The catheter is then secured to the ureteral adventitia with chromic catgut, and the flared end brought out through the operative wound.

If the distal segment of the ureter cannot be found, it may be replaced up to the iliac crossing with a tubular flap fashioned from the bladder. This will be discussed later. The type of repair to be employed if the ureter has been severed depends upon the condition of the ureter itself. If it has been crushed by a clamp, the crushed tissue is trimmed off. If it has been divided cleanly without crushing, and is larger than normal, a simple end to end anastomosis is made with four or five loosely tied sutures of 0000 or 00000 chromic catgut in the adventitia. If the lumen is small, a stricture is likely to follow this type of repair; the ends may be trimmed obliquely to increase circumference at the site of anastomosis, and the repair made as described above. If the lumen is unusually small, a terminolateral anastomosis is to be preferred because it makes the suture line as long as possible, so that maximal contraction of the ensuing scar is likely to leave an adequate lumen which will not require much postoperative dilatation. The sleeve type of anastomosis described in all the textbooks, in which the upper end of the ureter is pulled into the lower one is unsatisfactory because it leaves an intraureteral ledge which is likely to prevent subsequent instrumentation.

When a segment of ureter is missing, the location as well as the length of the defect becomes important. Short de-

fects (and long ones if the ureter is dilated and tortuous) may be overcome by mobilization above and below, taking pains to leave as much periureteral tissue as possible attached to the ureter in order to preserve the extrinsic blood supply and to minimize postoperative fibrosis. The ends are united as described above. The use of a tubular flap of bladder for long defects of the pelvic ureter has already been mentioned, but this is not feasible when the gap is above the pelvic brim. While McArthur successfully bridged a considerable ureteral defect by leaving a catheter in it, this has always seemed to me to be demanding too much of Mother Nature, particularly since he made no followup studies of the kidney on the affected side.

While Higgins, Moore and Parke Smith have successfully anastomosed the upper segment of a damaged ureter across the midline to the sound one, this should be reserved for those rare instances in which the sound ureter leads to a defective kidney, while the damaged one comes from a good one. In any other circumstances, one imperils a good kidney in an effort to preserve the other one, surely an unsound practice. A preferable method, but one not yet thoroughly tried out for a long defect above the pelvic ureter, consists in isolating a segment of ileum of suitable length and joining its distal end to the bladder and its proximal end to the upper portion of the ureter. This has been done successfully in the dog by Annis, by McLean and Fois, and by Davids and Lesnick, and in the human by Rack, by Hunter and Wells, and by Foret and Heusghem. Longuet used a U shaped loop of isolated ileum to replace both lower ureters damaged during radical hysterectomy.

When a short segment of the distal ureter is missing, the proximal segment may be mobilized and implanted into or anastomosed to the bladder. When this cannot be accomplished, the tubular vesical flap of Boari, used with success by Ockerblad and by Flocks, is quite satisfactory if carefully done. If the bladder is contracted, the ileal loop is obviously preferable.

GENERAL PRINCIPLES OF URETERAL REPAIR

Certain general principles are common to all types of ureteral repair. Nonabsorbable sutures should never be used in the urinary tract, not even to reenforce the adventitia, because whenever such sutures come into contact with the urine, they will serve as nuclei for stones; it is well established that stitches in the outer coat of the urinary collecting system often work their way into the lumen. All sutures should be loosely tied to avoid necrosis, and should consist of 0000 or 00000 chromic catgut. While it is often said that the mucosa should not be perforated by sutures, it has been my experience that this is of no consequence. It is unwise to wrap the anastomosis in such structures as omentum or peritoneum, lest subsequent fibrosis narrow or occlude the ureter. There must be no tension whatever at the suture line.

The urine should invariably be diverted from the area of the repair, except in the case of perforation, short vertical incision, or vesical reimplantation, by means of pyelostomy or preferably, nephrostomy so that no pressure can develop from within during the critical period of healing of the anastomosis. This is particularly important when a vesical flap has been constructed, in which event it is necessary also to establish suprapubic drainage to prevent the transmission of intravesical pressure to the suture line. It is important to leave a catheter in the repaired ureter to serve as a splint so as to prevent distortion or misalignment of the ureter or agglutination of suture lines across the ureteral lumen. Great pains should be taken to secure all urinary drainage tubes so that they cannot slip until their work is done. A nephrostomy catheter should be stiched to the renal capsule. If the ureteral splint can be brought out of the ureter below the anastomosis, it can be sutured directly to its wall, the best insurance against slipping; if it must be brought out through the bladder, the latter

should be opened so that the tube can be secured to the vesical wall close to the ureteral meatus. In no other way can one be so sure that the catheters will not be dislodged prematurely and ruin the result. Catheters should be brought out of the wound in such a manner that they cannot become kinked, and should be left in place for fourteen to twenty one days, or even longer if the ureter has been stripped for any distance.

While T tubes have been recommended as ureteral splints, they are too short to reach into the renal pelvis in any but high injuries; as a result, urine will almost invariably drain alongside the tube, often disrupting the anastomosis or, through extravasation, causing periureteral fibrosis and later stricture. There is no evidence that it is important whether a tube conveying urine is made of rubber, latex, or polyethylene; most of the polyethylene and polyvinyl catheters are too stiff.

It is wise to administer an antiseptic or antibiotic while the drainage catheters are in place. A mixture of penicillin and streptomycin is given until the patient can take oral medication, when it is replaced with sulfadiazine or Gantrisin. The more potent agents such as the tetracyclines and chloramphenicol are not ordinarily used until the catheters have been removed, because it is well established that infection cannot be prevented completely as long as foreign bodies are present in the urinary tract; it is thus inadvisable to make the organisms resistant to these agents during this period; they are reserved for attempts at final sterilization of the urinary tract after healing has occurred.

One of the real dangers of the period of postoperative urinary drainage is the entrance into the urinary tract of urea splitting bacteria, which cause the precipitation of urinary salts upon the catheters. If encrustations drop off as the catheters are withdrawn, they will serve as the nuclei for stones. Since these infections cannot be prevented with

any certainty, one employs methods designed to prevent encrustation. The fluid intake should be maintained at a minimum of 2500 cubic centimeters per day to flush the catheters, to dilute the urinary salts, and so to reduce the danger of precipitation and plugging. Basaljel is given during this period to reduce the urinary phosphorus since phosphates are important constituents of encrustations upon tubes. If there is a tendency to precipitation despite these measures, solution G is instilled periodically into the catheters. Early and frequent ambulation is practised, as well as frequent movement in bed to discourage stagnation in dependent calices.

If a period of anuria has preceded repair, one must remember that the ensuing diuresis may carry an excessive quantity of salt and water from the body, and should adjust their intake accordingly.

Late followup after a successful operation for ureteral injury is just as important as the surgical procedure itself to ensure that neither infection, lithiasis, nor stricture develop and ruin the result. This means that the urine must be sterilized, that the ureter must be dilated periodically during the ensuing year, and that periodic X-rays must be made until the urine has remained sterile for some months.

NEPHRECTOMY AND URETERAL LIGATION; URETEROSIGMOIDOSTOMY

Since one can determine pretty well in advance of operation which patients are most liable to injury of the ureters (large pelvic tumors, pelvic inflammations with fibrous adhesions, radical hysterectomy, operations for extensive abdominal neoplasms, especially the "second look") it is a common sense precaution to secure an excretory urogram ahead of time. Then, if ureteral injury occurs, the state of the kidneys is known, and one will not be dependent upon the notoriously unreliable evidence of palpation to determine whether one can be sacrificed; there is no excuse

for removing the only functioning kidney.

In older people with unilateral ureteral injury and a known normal kidney on the opposite side on which there is no evidence of damage to the ureter, nephrectomy is the method of choice if the patient's condition is precarious. While ligation of the ureter is an engagingly simple solution in such circumstances, it should be used only in a real emergency, because a pre-existing infection will lead to an acute pyelonephritis which may require an emergency nephrectomy in a depleted patient; or the ligature may cut through or slip off and cause an extravasation of urine. If injury does occur in a patient whose renal status is unknown, and whose condition does not permit expenditure of the additional time necessary for the ureteral repair, it is far better to make a cutaneous ureterostomy (a matter of a few additional moments), and leave the definitive operation until the general condition permits it. To be sure, this requires unpleasant explanations, but it gives the patient the best chance of survival with adequate kidneys.

There will undoubtedly be situations in which it will seem desirable to anastomose the upper segment of an injured ureter to the colon; the availability of the ileal loop as a substitute for a missing piece of ureter makes ureterosigmoidostomy undesirable because the chances of late renal damage thereafter are so great.

PREVENTION OF URETERAL INJURY

The importance of a preliminary urogram of good quality before an operation likely to lead to damage to the ureters has already been stressed. Avoidance of injury is largely a matter of foresight and of care in dissection, hemostasis, and of subsequent suturing in the vicinity of the ureters. One must remember that the ureter may be displaced by neoplasms and adhesions; it is often inadvertently pulled up with the peritoneum during dissection. Rough, hasty dissection, and clamping or suturing at the

bottom of a pool of blood carry the greatest danger. If one encounters unexpectedly a situation in which the ureters cannot be identified and injury seems likely, there is no reason why they cannot be catheterised through a cystoscope on the operating table while the surgeon performs some other part of his dissection. Actually, it is desirable to insert ureteral catheters just before operation when trouble is anticipated; they make identification of the ureters, both intact and cut, much easier particularly if large catheters are used.

ILLUSTRATIVE CASES

Case one. Immediate repair of bilateral injury. Mrs. , aged 47. During the course of a "second look" for carcinoma of the ovary the right ureter was divided at the iliac crossing, and a piece of the left pelvic ureter was excised because it was attached to invaded lymphatics. Since the right ureter was somewhat dilated, an end to end anastomosis was made with fine chromic catgut over a Robinson catheter brought out through the ureteral orifice. A Boari flap was constructed on the left; the catheter was led out through the bladder, and no nephrostomy was done. During mid convalescence fever and left renal pain developed but subsided promptly. Repair on the right was successful; no stricture nor hydronephrosis have developed in thirty months. At cystoscopy six weeks after operation the left kidney was functionless, and there was an impassable stricture at the junction of the vesical tube and the ureter. A thin walled hydronephrosis was removed at a "third look" at which no tumor was found.

Loss of the left kidney occurred because the catheter in the ureter did not drain properly; extravasation at the suture line led to complete obstruction. This could have been prevented by nephrostomy and cystostomy at the original operation, and probably by nephrostomy at the time of left renal pain

and fever. Nephrostomy should be done at the time of repair if severance of the ureter has been complete.

Case two. Closure of ureteral fistula with inlying ureteral catheter. Mrs. H. A., aged 39, had a cyst of the right ovary removed elsewhere on February 5, 1954. The right pelvic ureter was divided inadvertently and was repaired over a ureteral catheter. This slipped out on the seventh postoperative day. Fever with pain and swelling in the right lower quadrant developed at once. The extravasation was drained surgically on February 21st, and she was transferred to the University Hospital five days later. It was possible to insert a number five ureteral catheter to the right renal pelvis; it was left in situ for two days, then replaced with a number eight bulb. The fistula closed. She was discharged on March 12, 1954. On March 26 she was well, but two number five catheters were passed to the renal pelvis with some difficulty; pyelography showed a pronounced reduction in the hydronephrosis present at the original cystoscopy. Difficulty in catheterization is doubtless due to rigidity of the site of injury, and should disappear with passage of time and repeated ureteral dilatation. The kidney has probably been salvaged with a nonsurgical procedure.

Case three. Repair of ureterovaginal fistula by reimplantation of left ureter. Mrs. , aged 49, developed a fistula immediately after hysterectomy done elsewhere. The right kidney was normal; the left was moderately hydronephrotic, and there was an impassable obstruction just above the left ureteral orifice. All urine from the left kidney drained from a fistula in the left vaginal vault. Three months after the original operation the left ureter was mobilized for a short distance above the bladder, and a terminolateral anastomosis was made between it and a stab in the left posterior wall of the bladder; the kidney was drained by an inlying Robinson catheter. Twelve months later the patient was free from symptoms, and the

hydronephrosis had disappeared.

Case four. Repair of ureteroabdominal fistula by preliminary nephrostomy and subsequent end to end anastomosis.

Mrs. aged 30, was admitted two months after a hysterectomy done elsewhere had resulted in a painful mass in the left loin above the iliac crest. Incision had resulted in a persistent urinary fistula with bouts of left renal pain, chills, and fever. She came in during such an episode; the fistula had to be reopened. There was an impassable obstruction in the left lower ureter with a grade two left hydronephrosis. Because of active inflammation around the fistula, primary repair seemed inadvisable. Nephrostomy was done; a catheter passed down the ureter was arrested at the iliac crossing. On March 26, 1953, a short segment of the left ureter opposite the iliac crossing was found to be missing. The ureter was mobilized and united over a polyethylene tube. The ureter was last dilated on December 21, 1953. The pyeloureterogram was normal a year after repair.

Case five. Replacement of missing pelvic segment of left ureter by Boari flap.

Mrs. aged 39, began to drain urine from the vagina immediately after a hysterectomy done elsewhere on August 27, 1953. When first seen a month later, she had a left ureterovaginal fistula with an impassable obstruction at three centimeters, and a left hydronephrosis. There was a large inflammatory mass in the left iliac fossa. By November the mass had disappeared. At operation on November fifth the left ureter ended in a mass of scar tissue just below the iliac crossing. A Boari flap was made and united to the upper segment of the ureter. A Robinson catheter was left in the ureter, but suprapubic cystostomy and nephrostomy were done. In February of 1954 the urine was clear and the excretory urogram was normal.

Case six. Bilateral complete occlusion of both ureters during vaginal hysterectomy. Emergency nephrostomy and subsequent reimplantation of ureters in-

to bladder. Mrs. aged 70, was admitted because of abdominal distension and anuria persisting five days after vaginal hysterectomy done elsewhere. She was in poor general condition. Nasal suction was instituted, measures to correct fluid and electrolyte balance was instituted, and cystoscopy was done within a couple of hours of admission. Both ureters were completely blocked just above their orifices. Left nephrostomy was performed on the evening of admission. The general state improved remarkably coincident with diuresis; a right ureterovaginal fistula appeared within a few days. Fifteen days after nephrostomy abdominal exploration disclosed that both ureters were obliterated in the angle between the vaginal wall and the base of the bladder. Both were reimplanted into stabs in the posterior wall of the bladder. An excretory urogram four months after operation showed a considerable reduction in the advanced bilateral hydronephrosis present in the first postoperative roentgenograms. The ureters are somewhat hard to catheterize because of their position, but she feels perfectly well.

SUMMARY AND CONCLUSIONS

1. Surgical injuries of the ureters occur most frequently during difficult or bloody pelvic or abdominal dissections.
2. Their recognition is usually simple; methods are discussed.
3. Principles of repair are discussed in some detail.
4. Illustrative cases are presented.

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II. MEDICAL SCHOOL NEWS

Coming Events

- April 26 Special Lecture; "The Paris Clinical School, 1800-1850;" Dr. Erwin H. Ackerknecht, Chairman of the University of Wisconsin Department of Medical History; Eustis Amphitheater; 4:00 p.m.
- May 3 - 5 Continuation Course in Radiology for General Physicians
- May 6 E. Starr Judd Lecture; "Surgical Aspects of Splenic Disease;" Dr. Warren H. Cole, University of Illinois; Owre Amphitheater; 8:00 p.m.
- May 6 - 8 Continuation Course in Surgery for General Surgeons
- May 10 - 15 Continuation Course in Electrocardiography for General Physicians
- May 17 - 22 Continuation Course in Proctology for General Physicians
- May 20 Medical Six O'Clock Dinner; Main Ballroom, Coffman Memorial Union; 6:30 p.m.
- June 3 Luncheon for Senior Medical Students sponsored by the Minnesota Medical Alumni Association; Junior Ballroom, Coffman Memorial Union; 12:30 p.m.

* * *

Continuation Course

The University of Minnesota will present a continuation course in Radiology for General Physicians next May 3 to 5, 1954, under the direction of Dr. Leo G. Rigler, Professor and Head, Department of Radiology. Registrants for the course will spend the major portion of their time in the University Hospital Department of Radiology reading films and carrying out procedures in association with members of the faculty of that department. Registration will be strictly limited.

* * *

Faculty News

Dr. Wesley W. Spink, Professor of Medicine, attended the annual meeting of the American College of Physicians which was held in Chicago from April 5 to 9. As Governor of the College for the State of Minnesota, he participated in the meeting of the Board of Governors. He also acted as moderator of a panel on chemotherapy and participated in a clinical-pathological conference.

Dr. Jack Friedman, Clinical Instructor, Department of Radiology, and Dr. Lyle J. Hay, Clinical Associate Professor, Department of Surgery, participated in the North Dakota Cancer Society Caravan last week which presented a series of talks on the cancer problem in Williston, Minot, Devils Lake, and Grand Forks, North Dakota. The meetings were open to physicians and lay persons.

Dr. Raymond N. Rieter, Professor and Head of the Department of Pharmacology, attended a Symposium on "Origins of Drug Resistance and Related Problems" which was held in Washington, D. C. from March 25 to 27.

Miss Annie Laurie Baker, Miss Harriet Balzer, Mr. Fred Gross, and Miss Gertrude Schiely, of our Social Service Department, attended the Minnesota Welfare Conference which was held in St. Paul from March 29 to 31. Miss Baker was named President of the conference. Miss Balzer presented a paper entitled "Social Group Work with Patients" and Mr. Gross participated in a panel discussion on the care of patients discharged from mental hospitals.

III.

UNIVERSITY OF MINNESOTA MEDICAL SCHOOL

WEEKLY CALENDAR OF EVENTS

Physicians Welcome

April 12 - 17, 1954

Monday, April 12

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; Heart Hospital Auditorium.
- 12:15 - Obstetrics and Gynecology Journal Club; Staff Dining Room, U. H.
- 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; Station 43, U. H.
- 4:30 - Public Health Seminar; Health Work Under the United Mine Workers Retirement and Welfare Fund; Asa Barnes; 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

- 8:30 - Pediatric Rounds; L. Arey; Stations I and J.
- 10:30 - 12:00 Medicine Rounds; Thomas Lowry; Station F.
- 11:00 - Orthopedic and Fracture Rounds; Drs. John Moe and Arthur Zierold; Station A.
- 11:00 - Pediatric Rounds; Erling Platou; Station K.
- 12:30 - Surgery Grand Rounds; Dr. Zierold; Station E.
- 1:30 - 2:30 Tuberculosis Conference; J. A. Myers; Station M.
- 2:00 - Pediatric Rounds; Stations I and J.

Monday, April 12, (Cont.)

Veterans Administration Hospital

- 9:30 - Infectious Disease Rounds; Drs. Hall, Zinneman, Lubin and Sherman.
1:30 - Cardiac Conference; Drs. Berman, Smith, Hoseth, and Wexler;
Conference Room, Bldg. I.; Rounds immediately following conference.

Tuesday, April 13

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 - 1:20 Pathology Conference; Autopsies; J. R. Dawson and Staff; 102 I. A.
12:30 - Bacteriology Seminar; Papers to be presented at The Society of American Bacteriologists Meeting; 214 Millard Hall.
3:30 - Pediatric Seminar; Sarcoidosis; Mildred Schaffhausen; Sixth Floor, U.H.
3:30 - Biophysics-General Physiology Seminar; 323 Zoology.
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 Minneapolis General Hospital; Drs. Lipschultz and Conklin; 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

- 9:30 - Pediatric Contagion Rounds; Elizabeth Lowry; Station K.
10:00 - Cardiac Rounds; Paul F. Dwan; Classroom, Station I.
10:00 - Psychiatry Grand Rounds; R. W. Anderson; Station H.
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.
3:00 - 5:00 Pediatric Psychiatry Conference; Jack Wallinga; Classroom, Station I.

Veterans Administration Hospital

- 7:30 - Anesthesiology Conference; Conference Room, Bldg. I.
8:30 - Surgery Staff Seminar; Conference Room, Bldg. I.
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.

Tuesday, April 13, (Cont.)

Veterans Administration Hospital

- 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, April 14

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 - 1:20 Radioisotope Seminar; Underground Cobalt Unit, U. H.
12:30 - 1:30 Physiology 114B -- Transport Seminar; Nathan Lifson and M. B. Visscher; 214 Millard Hall.
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; The Retrospectroscope; Leo G. Rigler; 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

- 8:30 - 9:30 Obstetrical and Gynecological Grand Rounds; William P. Sadler and Staff; Station C.
9:30 - Pediatric Rounds; Richard Raile; Station J.
10:30 - 12:00 Medicine Rounds; Thomas Lowry and Staff; Station D.
10:30 - Pediatric Seminar; Arnold Anderson; Classroom, Station I.
12:30 - Pediatric Staff Meeting; Classroom, Station I.

Wednesday, April 14, (Cont.)

Minneapolis General Hospital (Cont.)

- 1:30 - Pediatric Rounds; Erling Platou; 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.
11:00 - Gastroenterology Conference; Conference Room, Bldg. I.
12:30 - Medical Journal Club; Doctors' Dining Room.
12:30 - X-ray Conference; J. Jorgens; Conference Room, Bldg. I.
1:30 - 3:00 Metabolic Disease Conference; Drs. Flink, Schultz and Brown.
7:00 - Lectures in Basic Science of Orthopedics, Conference Room, Bldg. I.

Thursday, April 15

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; Current Therapy of Leukemia; Martha Larsen; 116 Millard Hall.
12:30 - 1:30 Electrocardiography Conference; Ernst Simonson; Staff Room, Cardiac Clinic, Heart Hospital.
12:30 - Physiological Chemistry Seminar; Recent Studies in Transmethylation; N. Mizuno; 214 Millard Hall.
1:30 - 4:00 Cardiology X-ray Conference, Heart Hospital Theatre.
5:00 - 6:00 Radiology Seminar; Ultrasonics in Medicine; James C. Carlson; 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.
9:30 - Pediatric Contagion Rounds; Elizabeth Lowry; Station K.
10:00 - Psychiatry Grand Rounds; R. W. Anderson and Staff; Station 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.

Thursday, April 15, (Cont.)

Minneapolis General Hospital (Cont.)

- 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.
- 8:30 - Hematology Rounds; Drs. Hagen and Fifer.
- 11:00 - Surgery-Roentgen Conference; J. Jorgens; Conference Room, Bldg. I.
- 1:00 - 3:00 Bacteriology Conference; Anaerobes; Wendell Hall; Conference Room, Bldg. I.
- 4:00 - Medical-Surgical Conference; Conference Room, Bldg. I.

Friday, April 16, (HOLIDAY)

Saturday, April 17

Medical School and University Hospitals

- 7:45 - 8:50 Orthopedic X-ray Conference; W. H. Cole and Staff; M-109, U. H.
- 9:00 - 10:30 Pediatric Grand Rounds; 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. Wangenstein 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; Reports on Galveston Meeting of American Association of Anatomists; 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; Station 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 - Medical X-ray Conference; Conference Room, Bldg. I.