Extravasation of Urine
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William A. O'Brien, M.D.
I. LAST WEEK

Date: December 8, 1939

Place: Recreation Room
Powell Hall

Time: 12:15 to 1:08 p.m.

Program: Movie: "The Story of Dr. Jenner"

Psychosomatic Relationships
B. C. Schiele
R. L. Meller

Discussion
J. C. McKinley
Eric K. Clarke
Alex Blumstein

Present: 146
Gertrude Gunn
Record Librarian

II. MOVIE

Title: "Hockey Champ with Donald Duck"

Released by: R-K-O

III. ANNOUNCEMENTS

1. STAFF MEETING ASSIGNMENTS
Winter Quarter - 1940

January 5 Bacteriology
January 12 Surgery
January 19 Obstetrics and Gynecology
January 26 Medicine
February 2 Ophthalmology
February 9 Dermatology
February 16 Pediatrics
February 23 Orthopedics
March 1 Neurosurgery
March 8 Radiology
March 15 Surgery
March 22 Vacation
March 29 Vacation

2. MEDICAL AND HOSPITAL PROGRAM

Center for Continuation Study
Winter Quarter - 1940

Incomplete list of faculty appointments from other medical centers:

Hospital Administration - Jan. 15-20
James Hamilton, New Haven
John Mannix, Detroit
Alden Mills, Chicago
Ada Belle McCleery, Evanston
Graham Davis, Charlotte, N. C.

Dietetics - Jan. 29-31
Eaton Mackay, LaJolla
Martha Koehne, Columbus

Newborn and Premature Infant Problems
(Physicians) - Feb. 8-10

Diagnostic Roentgenology - Feb. 12-17

Proctology - Feb. 12-17

Otolaryngology - Feb. 19-24
Albert C. Furstenberg, Ann Arbor
Chevalier L. Jackson, Philadelphia
Dean M. Lierle, Iowa City
Philip E. Meltzer, Boston
George E. Shambaugh, Jr., Chicago

Medical Social Service - Feb. 29-March 1, 2

Physical Therapy Technology - March 4-6

Surgery - March 11-16
Edward D. Churchill, Boston
IV. EXTRAVASATION OF URINE

B. A. Smith

Urinary extravasation, in the true sense of the word, is any infiltration of urine into the tissues about the urinary tract. However, we will discuss only that type more properly referred to as periurethral phlegmon. This, on the contrary, is in most cases not an infiltration of urine but rather a rapidly spreading gangrenous infection beginning in the periurethral tissues. A similar infection may be associated with vesical rupture or more rarely with rupture of the upper urinary tract, but periurethral phlegmon is a clinical entity; Wolfer stated that extravasation is to the urinary tract as peritonitis is to the peritoneum.

The purpose in choosing this subject is not that we have a sufficient number of cases so that conclusions may be drawn nor because the condition is common, but rather because it constitutes a surgical emergency and frequently is not recognized.

For anatomical reasons males only are afflicted. The disease is most common in indigents of middle age, but occurs at all ages. The condition has been known for centuries; Silverberg stated that John Hunter had a clear conception of extravasation and appreciated the part the urethra played. Hippocrates discussed periurethral abscess with which periurethral phlegmon is often associated.

Periurethral phlegmon arises in association with trauma, infection, or both. The trauma may be external, usually a fall astraddle a narrow object, with urethral rupture, or may be incident to instrumentation. In the case of rupture of the urethra in which there is no previous urethral pathology, and the urine is sterile, extravasation may not manifest itself for two weeks or more and in many cases the rupture no doubt heals without one's being aware of its presence.

Infection is by far the most common cause. According to Campbell, strictures of the urethra are present in over 80% of cases while only 4 of 135 cases were secondary to straddle injury and gonorrhea was denied by only 7 patients. Ravenel found strictures in 53 of 57 cases with 4 straddle injuries. Ockerblad and Carlson stated that the strictures in 5 of their 15 cases were secondary to trauma and believed the incidence of extravasation to be greater in traumatic strictures than in gonorrheal strictures. Many cases have no demonstrable strictures but do have evidence of periurethritis while some have no demonstrable urethral inflammation at all. 22 of Campbell's cases (including the cases in infants) fell into these groups. Rathbun and others have reported extravasation associated with urethral calculi and Barwell reported a case following rupture of the urethra during intercourse. Tedenat states that probably all of the idiopathic cases are secondary to inflammation of the urethral glands of Littre. Finger extensively studied periurethritis and stricture formation.

Wolfer and others have studied the effect of the injection of urine into the tissues of experimental animals. Wolfer injected 20-60 cc. of sterile urine of normal specific gravity and chemical content into the subcutaneous tissue and into the peritoneal cavity of guinea pigs and found that the urine was quickly absorbed without signs of general or local toxicity; the injection of infected urine, however, rapidly produced a gangrenous, sloughing wound and he believed that the extensive necrosis was due to the ammoniacal products of the bacteria.

The role of the urinary pressure and of the defect in the urethral wall have been discussed with some feeling by all men writing upon the subject. Most agree that there is very little actual infiltration of urine and that mechanical pressure of urine has but little importance. However, Kidd has found 2% urea in the fluid obtained upon
incision in a number of cases. Tedenat witnessed a patient, mounting the operating table for urethrotomy, make a strenuous attempt to void accompanied by sudden swelling of the perineum, the swelling being due to urine as determined by incision. Ravenel stated that in all but 4 of his cases, "extravasation occurred suddenly after prolonged effort to overcome some form of urethral obstruction." Wolfer believed that periurethritis or periurethral abscess ruptured into the urethra and pressure of urine behind a stricture started the extravasation. One patient stated something broke and he voided but was disturbed because no urine passed in urethra. Ockerblad and Carlson state that the necrosis is probably due not to the irritative properties of urine but rather to pressure of urine which cuts off blood supply to tissues. Solway summarized the points against the importance of mechanics as follows:

1. Extravasation may occur distal to strictures.

2. No strictures are present in some cases and in many cases the strictures are of large calibre.

3. In some cases there is no communication with the urethra at operation.

4. At times there is gangrene of a large area of urethra behind a large calibre stricture.

It is also well known that the distended bladder has much less expulsive force than the normal bladder.

The organisms present in periurethral phlegmon are many and varied. The role of anaerobes is important and some authors state they are present in 75% of cases. The most common anaerobic organism is B. perfringens. B. Coli, streptococci, and staphylococci are very common; gonococci are rare. Solway summarized the points against the importance of mechanics as follows:

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The fascial attachments in the perineum direct the extension of the infection, and it has been stated that one who is familiar with perineal anatomy can locate the point of origin by simple inspection of the patient. Knowledge of these fascial planes is essential in treatment as well as diagnosis. The triangular ligament, or urogenital diaphragm, consists of a superior and an inferior fascial layer enclosing a potential space which contains the membranous urethra and external urethral sphincter, Cowper's glands, and the deep transverse perineal muscles; through this space run the arteries to the penis, the dorsal vein of the penis, and the cavernous nerves. The inferior fascial layer is attached to the pubis anteriorly and laterally and fuses posteriorly with the superior layer and with the superficial perineal or Colles' fascia. The latter passes around the superficial transverse perineal muscle and courses forward subcutaneously over the scrotum and penis, fusing with Buck's fascia at the corona of the glans penis. It is firmly attached laterally to the ischiopubic ramus and to the inguinal ligaments, remaining open about the root of the penis where it continues as Colles' fascia over the abdominal wall. The deep layer of the triangular ligament fuses with the endopelvic fascia (Denonvillier's fascia). Buck's fascia encases the corpora cavernosa and spongiosum in a figure of 8 manner and includes the bulbocavernosus muscle.

About 2/3 of all strictures of consequence are within one inch of the triangular ligament. Extravasation beginning in the penile urethra is limited, at least temporarily, to the penis by Buck's fascia. This type is rather rare and is quite fatal; Brodie has said that the appearance of a black spot upon the glans penis is a fatal sign. Extravasation beginning inferior to the triangular ligament spreads beneath Colles' fascia, rapidly involving the perineum, scrotum, penis, and abdominal wall. Rarely cases are seen where the fascial attachments have been perforated and there is involvement of the thigh or ischiorectal fossa. If the phlegmon arises between the layers of the triangular ligament, it soon perforates the inferior or the superior layer and in the former cases, behaves like extravasation below the ligament; this is more
Occasionally the deep layer is perforated and the extravasation becomes periprostatic, perivesical, retroperitoneal along the rectum, or ischiorectal.

By far the most common is the peri-neal type; the greater frequency of this as compared to phlegmon arising in the membranous urethra may well be due to the fact that the latter type is not easily recognized until it manifests itself by perineal extension. It is indeed fortunate that perforation of the inferior layer occurs more readily than perforation of the superior layer.

Usually the patient has had gonorrhea one or more times and frequently instrumentation has been done because of dysuria and narrowing of the urinary stream. The stream again begins to decrease and the patient notices perineal pain; he may feel a small nodule. After a variable period of time, urethral symptoms become severe and perineal swelling, pain and tenderness are noted. At times acute urinary retention appears. Depending upon the virulence of the infection and the amount of gangrene, symptoms of extreme toxemia begin to overshadow all others. Chills are frequent and soon the patient becomes irrational and stuporous. Coma upon admission is not uncommon.

The diagnosis of the perineal type is readily made by inspection if the examiner is acquainted with the condition. The perineum is distended, red, tender, and edematous. The scrotum is very markedly swollen, often to the size of a grapefruit, and there are usually spots of purple or greenish-black discoloration with the odor of necrotic tissue. The penis may be similarly involved; edema appearing first in the prepuc. If the extravasation has extended to the abdominal wall, there is involvement spreading upward from the symphysis frequently to the costal margins and axillae. This may simulate cellulitis, or gangrene may be manifest in the lower abdomen. The margin of the phlegmon is more readily palpated than seen, and crepitation is often present. Strictures, although they are often of large calibre, are usually met when an attempt is made to pass a catheter.

The diagnosis of extravasation within the triangular ligament is usually made after perforation into the perineum, but may be made by digital examination, care being taken to palpate the region of the membranous urethra, and not the prostate. Involvement above the urogenital diaphragm may be recognized by rectal examination, extension to the ischiorectal fossae, rarely by spread from the space of Retzius to the suprapubic abdominal wall, or by necropsy.

The differential diagnosis is usually not difficult. Streptococcus scrotal and penile gangrene, which has been described by Campbell resembles extravasation very closely. It is a gangrenous streptococcal infection beginning within Buck's fascia and extending to the scrotum after involvement of the penis. The perineum is not involved and there is no demonstrable urethral pathology. The condition is prone to occur in a younger age group, often affecting boys and is thought to be related to chafing from clothing. Inasmuch as the treatment is the same, the differential diagnosis is not of great importance. True erysipelas of the genitals occasionally occurs as does limited diabetic gangrene. Edema due to cardiac failure, cirrhosis, nephritis, and venous caval obstruction is readily differentiated by the presence of edema of the lower extremities. Acute hydrocele orchitis, and epididymitis are not as a rule difficult to diagnose, but periurethral phlegmon is occasionally diagnosed as one of the above. Strangulated hernia and perineal hematoma may at times be confused with extravasation. Because of the systemic reaction secondary to the virulence of the infection and the gangrene, cases are not infrequently admitted upon the medical or psychiatric services. Diagnoses include delirium, coma, pneumonia, typhoid, pyelonephritis, and malaria.

Prognosis is always grave. Campbell's mortality rate was 42.9% and Ravenel's 35%, as was Wolfer's. Ockerblad and Carlson reported 15 cases with one death. However, the treatment in several cases was only "soundings and spontaneous rupture" so that it may be that they were dealing with periurethral abscesses in some instances. The usual renal infection
and insufficiency associated with long-standing urethral obstruction contributes no little to the high mortality. The cardiovacular reserve is frequently greatly diminished by arteriosclerosis.

Treatment must be immediate; mortality rises with delay. In one half of Ravenel's cases, extravasation had been present for from 4 to 14 days and more cases were admitted the fifth day of their illness in Campbell's series than on any other one day. No doubt in many cases the diagnosis is not made until the patient is seen by someone familiar with the condition.

All authors agree that free bladder drainage and radical incision of all involved tissue are immediately essential. Drainage of the bladder may be accomplished by one of a number of means. Most writers8,4,11,15 prefer perineal urethrostomy made over a sound or, if this is not possible, by perineal section after the instillation of methylene blue into the urethra and stripping of the urethra posteriorly. Others16 advocate internal urethrostomy followed by inlying catheter but this is liable to give inadequate drainage. Some authors17 perform suprapubic cystostomy, particularly if a sound cannot be passed. However, the mortality seems to be increased17 by infection of the space of Retzius which occurs since the cystostomy is made through infected tissue if extension has spread above the symphysis. Wolfer states that suprapubic puncture, suggested by a few, to relieve complete urinary retention due to strictures, is a dangerous procedure because of the likelihood of a prevesical gangrenous infection.

Incision of involved tissue should be adequate, deep, and should extend into normal tissue. Keyes and Cabot condemn multiple incisions and advocate a single incision beginning in the perineum with branching incisions opening all sinuses and pockets. "Timorous incision is the patient's death warrant" (Keyes)16 and incision should be made "without any of that fear to cut skin that inhibits the nice surgeon."15 The spermatic cord, testicles, and corpora cavernosa are rarely involved but scrotal tissue to the tunica vaginalis is affected and Keyes states the scrotum should be bisected and the testicles allowed to "swing bare and bald."15 Multiple incisions are quite satisfactory if all subcutaneous tissue is elevated from the deeper structures, preferably by the finger. Speed is necessary because of the patient's condition. Most authors prefer spinal anesthesia.

Postoperatively massive potassium permanganate 1:5000 dressings are applied and transfusions are given; fluids are forced to the point of cardiovacular tolerance. If gas bacilli are present, antitoxin is given; however, adequate incision and drainage probably control the anaerobic infection better than any specific measures. Sulphanilamide is more recent than most of the literature and is not mentioned but it and its derivatives have been used here; its value is not determined because of the multiplicity of therapeutic measures. Close watch must be kept lest incisions have been inadequate and extension be occurring.

Within a few days slough begins and Dakin's solution is used. The wounds rapidly become clean, but the hospitalization period is often more than a month. When the wounds have begun to granulate well, the perineal tube is withdrawn and the strictures are dilated. If suprapubic cystostomy has been done, the dilatation is done in a retrograde manner if there is difficulty using the routine method. The patient may be given tub baths b.i.d. in water19 or in dulate permanganate solution.

The regenerative powers of the penile and scrotal skin are remarkable and rapid. Thiersch grafting of the penis and secondary closure of abdominal wounds may accelerate convalescence. Perineal urethral fistulae are common but usually close readily if the urethra is sufficiently dilated.

Case Report

A single white male, aged 27. This case is chosen partly because it is rather typical, but particularly because
lessons are to be learned from its management. This man had gonorrhea 7 years before admission; he was treated for one month and apparently "cured." Six days prior to admission he developed fever and chills. The next day he noted frequency, decrease in the size of the urinary stream, and severe perineal pain when voiding. A diagnosis of pneumonia was made. The symptoms continued, with the urinary stream becoming smaller, until admission. For two days there had been tender, red swelling of the external genitalia and suprapubic tenderness was noted the day before admission. The patient was referred to this hospital with a diagnosis of cellulitis of the penis and scrotum.

His temperature was 101, pulse 110, and respirations 22. He appeared acutely ill. Physical examination was negative except for the genitalia; the penis was markedly swollen and there was purplish discoloration of the skin on the dorsum; the scrotum was less markedly swollen, and there was redness and marked tenderness in the suprapubic region. The leukocyte count was 21,000 and examination of the urine revealed numerous white cells with clumps to be present. Diagnoses were edema of the penis and scrotum due to venous stasis; and cellulitis of the penis, scrotum, and suprapubic area of undetermined etiology. Treatment consisted of hot packs and elevation.

The condition was recognized the next morning and at that time there was some gangrene of penile skin, the swelling of the scrotum was more marked and there was further extension of the suprapubic infection. Suprapubic cystostomy was done and the suprapubic wound was spread subcutaneously to some extent; the penis was slashed by the surgical resident. Abdominal spread continued and 24 hours later incisions were made in the lower abdomen; this was done on the ward. Crepitation was noted and gas antitoxin was given. Eight hours later the patient was taken to the operating room and the abdomen was further incised, the scrotum was bisected, and the perineum was drained; a periurethral abscess was found beneath the scrotum.

Two important points should be made here. Soloway quotes Lejar: "Waste no time in making superficial inadequate incisions in the most edematous areas, go to the perineum at once." Campbell found that mortality rose with the necessity for reoperation because of insufficient drainage.

Gas bacilli were demonstrated and more gas antitoxin was administered. Daily blood transfusions were given for three days, and fluids were forced to from 6000 to 8000 cc. daily for five days. Two or three incisions in the flanks (done using local anesthesia) were required on two occasions within the first four days after surgery. Sulphanilamide was given for three days but was discontinued because of cyanosis. The wound was treated with massive potassium permanganate packs for 24 hours and then dakinization was begun. Special nurses were employed for five days. The patient's temperature returned to normal in 1 week and most of the slough had been removed, leaving clean, granulating surfaces. Three weeks after surgery, secondary closure was done; urethral dilatations were carried out from time to time. After 87 hospital days he was discharged, well except for persistent urethral fistula. He states he has no recollection of his first 3 weeks' hospital stay.

Five other cases appear in the records since 1935 (none before that time). There was one death in the six cases; gas bacillus infection was present in three. One man had suprapubic extravasation 9 years after suprapubic prostatectomy; multiple incisions and inlying catheter drainage effected a cure. In only one case was the patient referred here with the correct diagnosis and this man had been treated with hot packs and sulphanilamide for four days under a diagnosis of acute bilateral epididymitis. Upon admission, crepitation was present above the clavicles. He succumbed on the fourth hospital day; postmortem diagnosis included urinary extravasation and rupture of the urethra, gas bacillus infection, syphilis, hypernephroma, diabetes mellitus, and coronary sclerosis and thrombosis. Infection of the penile skin, gangrene of the skin of the penis and scrotum, and
bladder and urethral injuries were the referred diagnosis in the remaining three cases. Hospital stay averaged six weeks.

Summary:

Periurethral phlegmon is a surgical emergency. Its occurrence is largely preventable by the periodic dilatation of urethral strictures. Early diagnosis should be possible, but is seldom made; mortality rate is 35% and increases with delay. Treatment consists of free bladder drainage and radical incision.

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19. Schmidt, F. R.
    Discussion of Soloway
After today's meeting, we will not have staff meetings for two weeks. The winter series will open January 5. Probably because of the absence of typical wintery weather, Christmas has come on us before we found ourselves in the mood. Believe it or not, Christmas preparations are going ahead, and we are pleased to announce the following parties: December 21, the Health Service group will have their annual Christmas party. This is one of the oldest and most successful of our gatherings. The custom originated back in the old days when the Health Service family was very small, and everyone had two or three jobs. Dean Diehl was chief of the group, Superintendent Ray Amberg was business manager, and other staff members had other executive positions. The group used to have lunch together every day at a family table, so the Christmas party became a natural event. Last year and for many years before, the arrangements were in charge of the late Eva Dawalt. This year others will carry on the tradition, and every effort will be made to carry on for her. The Traffic Club will have dinner in the main hospital dining room Thursday, December 21, after which the trees will be trimmed. This is the organization which each year takes care of the proper celebration of Christmas for the patients. The ornaments; lights, and stands are kept in our storeroom and brought out each year in advance of the dinner. The trees will be delivered the day before, and a short program will be held preceding the trimming. F. A. Dowling, president of the Minneapolis Traffic Club (Minneapolis and St. Louis, R.R.) A. W. Hendrickson, general chairman (Katy), and Santa Claus himself, H. G. Christianson (B. & O. & C. & A.) and a corps of workers will be in charge. The Christmas party for the children will be held Saturday, December 23, in the afternoon. At this time, each child will receive the present which was requested from Santa Claus. In addition, all the adults will receive Christmas baskets on Christmas day ... The nurses' Christmas celebration also starts Thursday, December 21, with a monster house party at 8:00 p.m. in Powell Hall. Santa Claus will distribute gifts, and there will be a special surprise program.

Christmas Eve, the girls will open their gifts, and, as they usually contain food, coffee will be served to all. Christmas morning, the Carol Singers will go through the hospital. The nurses have sung for the patients on these occasions for many years. The Out-patient Department will hold open house December 20 from 3:00 - 5:00 p.m. This is another annual event which should not be missed. The staff Christmas dinner will be served Saturday evening, December 23. This again is an annual custom which enables the staff members to have Christmas dinner together and also to celebrate with their family and friends on the regular date. The Center for Continuation Study staff Christmas party will be held Thursday evening, December 21. In addition to the visits by the Carol Singers and the presents from the Traffic Club, our patients will enjoy their Christmas dinner on the regular date. Believe it or not, the surgical department is going to celebrate Christmas with its annual party in Powell Hall, December 28 at 3:00 p.m. Everyone who can go home or spend Christmas Day with friends will do so. The nurses, interns, fellows, and all employees who have to be on duty will appreciate it if orders are kept to a minimum. In some of the years gone by, the staff has apparently forgotten what day it was or else left a flock of orders just to show us who was boss. The problem of the holidays is not nearly the dietetic question that Thanksgiving is, but I would like to meet someone who could make the rounds Thursday, December 21, and come up smiling. I tried to do it last year, and added an extra special social event in the evening with disastrous results. This year we will miss Head Ophthalmologist Frank E. Burch and Mrs. Burch, and Head Pediatrician Irvine S. McQuarrie, Mrs. McQuarrie, and the girls, who left for China this week. They will sail together for the Orient to spend the six months at Peiping.

MERRY CHRISTMAS
To the Members of the University Hospital Staff:

My Christmas message of a year ago seems so much more pertinent today even than it was then, that I am asking Doctor O'Brien to reprint it as my Christmas message to you all for 1939:

"Peace on Earth, Good Will toward Men." Never since the days of the world war has this simple Christmas message had the significance that it has this year. War, hatred, selfishness is rampant over the world. Yet, 'Peace and Good Will' is the foremost Christmas wish and prayer of millions of men and women in every land.

What a contrast to this world madness is the spirit of helpfulness and good will which permeates an institution such as this hospital, in which it is the privilege of each one of us to play some part. Here the entire staff is devoting itself wholeheartedly to the health and welfare of others. Here the alleviation, not the infliction of suffering; the prolongation, not the destruction of life are the objectives. Here studies are being conducted the purpose of which is to make the world a better and happier place to live.

Yet even here each one of us can add still more to his own happiness and to the happiness of others during this Christmas Season by a little special thoughtfulness for our colleagues and for the patients under our care. An expression of personal interest, a word of encouragement, a hand clasp and a smile may lighten a burden that seems almost too heavy to bear.

It is in this spirit that I say Merry Christmas and Happy New Year to each and every member of the staff.

Harold S. Diehl
Dean