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Roentgen ray treatment of inflammatory pathology does not constitute a recent therapeutic advancement. Historically, it is recorded that as early as 1903 Williams, Freund, and Eveler observed favorable therapeutic effects of the x-ray in some inflammatory diseases. Musser in 1905, and Edsall and Pemberton in 1907 indicated the value of irradiation in the management of delayed resolution in lobar pneumonia, while treatment of carbuncles by the roentgen ray was reported by Dunham in 1916.

Recognition of the efficacy of irradiation in the treatment of almost all types of inflammatory diseases falls within the past two decades during which period there has been a universal publication of both clinical and experimental data. Within this twenty year interval the relatively early contributions of Fried, Hodges, Manges, Pordes, and Desjardins have been of major significance in advancing the now established sound principles of this therapy.

The above facts and the daily opportunity for routinely observing an ever increasing number of inflammatory lesions receiving x-ray treatment at the Philadelphia Osteopathic Hospital have inspired a review of the literature and this presentation of the present day concept of the mode of action of roentgen rays in inflammatory states.

The rationale of radiation therapy in inflammatory diseases logically warrants an initial consideration of the pathologic physiology of inflammation, the complexities of which after years of keen investigation are only partly understood. Inflammation is defined by pathologists as a local reaction of living tissue to an irritant, therefore it is the most common of all pathologic processes. Our understanding of inflammation evolved from the universally accredited research contributions of Metchnikoff pertaining to phagocytosis. Three major phases of the pathology may be chronologically recorded as the vascular change, the formation of an exudate, and the process of tissue repair.

The vascular change produces the visible sign of the underlying or hidden phenomena of inflammation. Menkin has described the first tissue reaction to an irritant as transient constriction of the minute blood vessels followed by vascular dilatation, the latter being attributed to paralysis of the contractile elements within the vessel walls. There is hence established a vascular engorgement, concomitant decreased velocity of the blood stream, and a peripheral arrangement or distribution of leucocytes within

*Revision of a paper originally read before the Philadelphia Academy of Osteopathy, Philadelphia, April, 1941.
the vessels due chiefly to the globular form and low specific gravity of the white cell. Emigration of the leucocytes through the vessel walls follows, the rapidity of the cellular exodus varying with each and every inflammatory process. There is an associated increased transudation of fluid or blood plasma which together with extravasation of leucocytes may be attributed to an altered hydrogen ion concentration within regional perivascular tissue, and to changes in surface tension. The plasma transudation producing a local edema, the leucocytic migration, and the hyperemia account for the cardinal clinical signs of inflammation.

The vascular changes accompanying an inflammatory state initiate exudate formation which is the prime objective of the inherent defense mechanism of the body. Collectively, the extravasated blood cells, blood plasma and certain cells of the regional tissues form this exudate which serves to neutralize and remove the irritant, and subsequently repair tissue damage.

The area of an acute inflammation will display a predominance of polymorphonuclear leucocytes, and these cells will often prevail to the exclusion of all other blood cells at the onset of an acute pyogenic infection. One notable exception to this statement has been reported by Boyd who, referring to special wound infections, indicates that in erysipelas, or an acute inflammation of the lymphatics of the skin or a mucous membrane, the local defense cells are predominantly lymphocytes and wandering mononuclears.

The severity of the local inflammation or infection and the resistance of the patient will dictate the degree of general leucocytosis which is attributable to chemotactic substance in the inflammatory area reaching the blood stream and hence the bone marrow with resultant hyperactivity of this leucoblastic tissue. This physiological response may be more specifically expressed by saying that the total white blood cell count is an index to the patient’s resistance while the percentage of polymonuclear cells indicates the severity of an infection.

Investigations of Menkin relative to the hydrogen ion concentration prevailing within an inflammatory exudate serve to explain some of the changing cellular characteristics common to the inflammatory area. It is established that the polymorphonuclear leucocytes are attracted by the alkalinity of acute infections; however, as the inflammatory pathology develops, Menkin believes that the carbon dioxide content of the exudate is diminished, with an increase of the regional hydrogen ion concentration. This may occur in a period of even a few hours or even after seventy-two hours. The increasing hydrogen ion concentration within the area of inflammation is thought to explain the progressive and proportionate diminution of the extravasated polynuclear cells and concomitant gradual increase of large mononuclear leucocytes and lymphocytes. Also worthy of note is the apparently established fact that the integrity of leucocytes is disturbed when the pH falls below 6.7 or 6.5 at which time suppuration will occur.
The polymorphonuclear cells possess independent powers of locomotion and by virtue of their ameboid activity distribute themselves over a large area at and about the site of inflammation. This leucocytic distribution may be explained by the surface tension theory and positive chemotactic influence produced by the chemical substances at the site of tissue injury or infection. Polymorphonuclears are the outstanding phagocytes of acute inflammation and upon distintegration liberate antibacterial substances, proteolytic ferments, and thrombin.

The lymphocytes, which apparently have a greater attraction for the more acid medium of chronic inflammatory processes, are relatively few or entirely absent during the early stages of an acute pyogenic infection. Support for this statement is the fact that in a case of established lymphatic leukemia the exudate of an acute inflammatory lesion will be composed of polymorphonuclear leucocytes. Lymphocytes, which are predominant in the basically chronic inflammatory diseases and are of account in an acute inflammatory area only when the disease is of several days duration or begins to assume chronic proportions, are believed to be derived for the major part from the tissues—they are histogenic rather than hematogenic. This histogenesis of the small round cell or lymphocyte may be explained by the fact that they are composed of little mobile cytoplasm and a relatively large nucleus, therefore they are less affected by positive chemotaxis and altered surface tension in the zone of inflammation. It is generally agreed that the defense function of the lymphocyte is accomplished by antitoxic rather than phagocytic activity.

Large mononuclear leucocytes, endothelial cells, and wandering connective tissue cells are also common to the inflammatory area. The large mononuclear cells which are found in the exudate in considerable numbers during the latter stages of inflammation, possess great powers of phagocytosis and remove the end products of the pathology through the lymphatic circulation.

The blood plasma constituent of the inflammatory exudate is equally as important as the migrating blood cells and tissue cells. Increase in the amount of blood plasma common to the inflammatory site brings to the focus specialized globulins or antibodies which react with and serve to neutralize the irritant. The thrombin liberated by disintegrated polymorphonuclear leucocytes interacts with the fibrinogen in the plasma to form fibrin which is essentially protective to adjacent tissues by confining or limiting the local process, and which aids materially in the process of repair. Coagulation of the plasma producing obstructive thrombi within the lymphatics and subsequently the capillaries has been designed as "fixation." The rapidity of "fixation" appears to depend upon the causative irritant and this important deduction has been experimentally established by Menkin who found that the staphylococcus aureus organisms induced lymphatic block in one hour, while a two day period elapsed before a comparable fixation was manifest from cultures of hemolytic streptococci.

The termination of inflammation may be expressed by resolution or
suppuration with final tissue repair, while the many complex variations of the phenomena of inflammation will be directly dependent upon the causative irritant.

Discussion of the mode of action of roentgen rays as employed in the treatment of inflammation logically may be prefaced by the statement of two important facts; first, that leucocytic infiltration is one of the prominent features of most forms of inflammation, and second, that the leucocytes are highly radiosensitive, even to a small quantity of radiation.

The lymphocytes are the most radiosensitive of all cells in the body; however, according to Desjardins the polymorphonuclear leucocytes, large mononuclears, and eosinophiles are only slightly less sensitive. Destruction of lymphocytes by roentgen rays was described by Heineke in 1903, and later Warthin experimentally demonstrated that as early as fifteen minutes after roentgen treatment lymphocytes undergo nuclear disintegration which continues for several days. Larsell conducted an investigation by infecting animal tissue which upon biopsy after irradiation showed early lymphocytic destruction and as well a greater number of macrophages when compared to untreated controls which had been similarly infected. It is notable that there was no evidence of injury to the normal cellular elements of the vessel walls within the field of irradiation. The destruction of lymphocytes with liberation of the antitoxic substances that they are believed to contain and the appearance of macrophages in greater numbers, augment the usual tissue reaction to an infection and hasten repair. This analysis applies to the effect of roentgen rays on the lymphocyte common to the later stages of the acute and to the chronic inflammation.

The polymorphonuclear leucocytes common to the area of acute inflammation experimentally have exhibited evidence of disintegration twelve to twenty-four hours after exposure to the x-ray. Desjardins has reported that there often will occur a transient increase of polymorphonuclears within the zone of inflammation, such continuing from six to twenty-four hours after irradiation with subsequent reduction in the number of cells. The polymorphonuclear disintegration liberates inherent antibacterial substances, proteolytic ferments, and thrombin, while in association with this leucocytolysis there is a notable increase in phagocytic properties of regional polynuclear and large mononuclear cells.

Clinical evaluation of acute inflammatory lesions following irradiation initiates the thought and warrants a conclusion that the favorable response of the pathology corresponds to the degree of leucocytic infiltration and the rate which the radiosensitive leucocytes are known to be affected by identical doses. In contradistinction to acute inflammatory states, chronic inflammation displays a more variable and, in the majority of cases, a slower clinical response to roentgen therapy. This may be briefly and logically explained by the prevailing ratio of leucocytes and decidedly less radiosensitive connective tissue cells, the latter being notably common to the chronic disease.
The roentgen rays as employed therapeutically have no direct bacte­ricidal effect; however, authorities are in agreement that small doses of radiation will transiently increase the bactericidal quality of blood or the opsonic index of the patient. Mischtschenko and his co-workers have reported that in irradiated inflammatory areas there is an increased con­tent of total protein, especially of its globulin fraction, and Pendergrass and Hodes are of opinion that this altered albumin-globulin ratio increases the formation of specialized globulins or antibodies at the site of the pathology.

Vascular changes characterized by an increased quantity of blood supplied to and transported through irradiated tissues have been noted by Pendergrass and Hodes as occurring within six hours and still present, though less intense, twenty-four hours after administration of small doses of radiation. It is their conclusion that within and particularly about the site of an inflammatory disease there will result an active hyperemia, and that this transformation within an area of preexisting passive hyperemia is of considerable importance in the treatment of infections. The induced active hyperemia at the site of inflammatory pathology facilitates lymphatic drainage, leucocytic infiltration, and regional interchange of the complex body fluids. Roentgen treatment of inflammations prior to well-established or complete “fixation” of the inflammatory process with maintenance of a local tissue pH above 6.7 or 6.5 would thereby serve to enhance resolution of the disease. When the pathology has advanced to the stage of complete “fixation” suppuration is inevitable, at which time irradiation accelerates the supplicative phenomenon and inhibits dissemination of the inflammation.

On the basis of experimental investigations, Mischtschenko et al. advanced the theory that the analgesic action of roentgen rays in inflammation is due to “...the influence of stored protein-split products and lipoids on the nerve endings, by lessening the tension and edema, transforming the tissue juices obtained from the colloids and solution of the crystalloids. Irradiation causes, therefore, an interruption in the pathways of the pain reflex.”

In conclusion, it may be stated that if the success of roentgen therapy in inflammatory diseases is to be properly evaluated by physician and surgeon it must not be prescribed as a last resort after other therapeutic procedures have failed and pathologic progression is inevitable.

Summary

Introductory reference is made to the history or annals surrounding the relatively late recognition of the value of roentgen ray therapy in inflammatory diseases.

The pathologic physiology of inflammation is presented with prime attention being given to the vascular change and exudate formation common to this complex phenomenon.
Facts and theoretical principles which now serve to explain the mode of action of roentgen rays in the treatment of inflammatory states have been recorded and permit a conclusion that irradiation augments the natural defense reactions of the body.

Bibliography


Lloyd, P. T.: Personal Communications.


A FOUR YEAR SURVEY EMPHASIZING THE IMPORTANCE OF ROUTINE SEROLOGIC TESTS FOR THE DETECTION OF SYPHILIS

Otterbein Dressler
Pathologist to the Hospital

and

Harold Bruner
Serologist to the Hospital

From the Department of Pathology, Osteopathic Hospital of Philadelphia

When Thomas Parran became Surgeon General of the United States Public Health Service he declared, "Syphilis must be the first disease to go." He was determined to rid our land of this "master of disguise" that is responsible for so much human suffering. Our record in this country is not, and has not been, good in the history of this disease. Vonderlehr estimated that "one out of ten people in the United States will develop syphilis by the age of fifty-five." This estimate was challenged repeatedly, and Vonderlehr was able to produce graphic evidence to support this claim. With a disease as prevalent as these figures would indicate, it is urgent that we employ eternal vigilance to ferret out the individual cases. Syphilis is obviously no respecter of persons and is apt to rear its ugly head where least suspected. For this reason and many others it would seem imperative to employ serologic methods for the detection of syphilis routinely at every opportunity if we are going to screen these cases out of our populace.

In the Commonwealth of Pennsylvania several devices have been set up looking forward to the detection of a greater proportion of syphilitic individuals. It has become mandatory that the doctor attending a pregnant woman secure blood at the earliest possible moment for serological tests. The enactment of a premarital law in the Commonwealth is another step in the same direction. Under this law physicians are required to conduct a careful clinical examination on applicants for marriage to detect stigmas of syphilis and to employ serological tests for the detection of syphilis. The physician is empowered to refuse a certificate for marriage to anyone whom he believes is infected by syphilis in a communicable form.

The above law has been materially strengthened by requiring that serologic tests be performed in laboratories approved by the Department of Health of the Commonwealth. A laboratory is approved only if it can show evidence that it employs competent serologists. Serology is, indeed, a highly developed specialty and no one should engage in it unless he is
well qualified and spending a major portion of his time in that pursuit. Further, these laboratories for approval must show evidence of satisfactory equipment. Laboratories are restrained from reporting serodiagnosis unless both a complement fixation and a precipitation test are performed on each specimen. Another very fundamental and seemingly simple requirement is that these tests be done according to the method of the author of each test. This latter seems so elementary as to appear on the surface almost ridiculous, yet in time past much harm has been done because individual serologists have felt themselves competent to modify the various serological reactions, thus making them very inaccurate and most unsatisfactory.

The experience of our institution with routine serological examinations for the detection of syphilis can be seen by the following tables. Table I shows the number of different specimens of blood examined.

Table I

<table>
<thead>
<tr>
<th>Year</th>
<th>Premarital</th>
<th>Prenatal</th>
<th>Clinical</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1940</td>
<td>252</td>
<td>561</td>
<td>1444</td>
<td>2257</td>
</tr>
<tr>
<td>1941</td>
<td>397</td>
<td>700</td>
<td>1904</td>
<td>3001</td>
</tr>
<tr>
<td>1942</td>
<td>196</td>
<td>883</td>
<td>1925</td>
<td>3004</td>
</tr>
<tr>
<td>1943</td>
<td>175</td>
<td>988</td>
<td>2133</td>
<td>3296</td>
</tr>
<tr>
<td>Totals</td>
<td>1020</td>
<td>3132</td>
<td>7406</td>
<td>11,558</td>
</tr>
</tbody>
</table>

Each specimen of blood had a minimum examination of a Kolmer complement fixation test and a Kahn precipitation test. That column identified as “clinical” refers to those specimens examined from other than premarital and prenatal patients. This column includes the private bed patients of the hospital.

Because of the great demand for hospital beds and the greater amount of money in circulation, a greater percentage of these cases identified as clinical are “pay patients” and the number of “free cases” becomes less and less. There are still some doctors who assume the attitude that routine serological examinations might be quite satisfactory for the poor, underprivileged free cases but that the private bed patient should be excused from this “ordeal.”

Examination of table II will disclose the results of these examinations in the various classes. It is to be noted with interest that these cases
Table II
Results of serologic examinations covering the four year period from 1940 to 1943, inclusive

<table>
<thead>
<tr>
<th></th>
<th>Premarital</th>
<th>Prenatal</th>
<th>Clinical</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>Percent</td>
<td>No.</td>
<td>Percent</td>
</tr>
<tr>
<td>Negative</td>
<td>993</td>
<td>11.013</td>
<td>3008</td>
<td>95.3</td>
</tr>
<tr>
<td>Positive</td>
<td>8</td>
<td>0.78</td>
<td>102</td>
<td>3.3</td>
</tr>
<tr>
<td>Questionable</td>
<td>3</td>
<td>0.3</td>
<td>7</td>
<td>0.3</td>
</tr>
<tr>
<td>Unsatisfactory</td>
<td>16</td>
<td>7.00</td>
<td>15</td>
<td>0.6</td>
</tr>
<tr>
<td>Totals</td>
<td>1020</td>
<td>100</td>
<td>3132</td>
<td>100</td>
</tr>
</tbody>
</table>

Identified as clinical, made up largely of private bed patients of the hospital, show the highest incidence of positive results with an overall positive of 4.4 per cent in a four year period. This figure alone should call attention to the great importance of serodiagnosis as a routine procedure for the detection of syphilis. This figure would seem to indicate that 44 out of each thousand patients need further investigation to determine if they are, or are not, syphilitic.

The terminology negative, positive, questionable, and unsatisfactory is standard in this Commonwealth. These words mean exactly what they say and have been adopted by the health authorities of the Commonwealth to avoid the confusion of such terms as one plus, two plus, etc. Without doubt, we might have tabulated a greater number of unsatisfactory specimens; but, for the most part, these specimens are screened out before they get into the serology laboratory. Much of the difficulty with unsatisfactory specimens arises from the use of mailing containers and from certain misunderstandings concerning postal regulations.

Summary

1. Our findings from routine serodiagnosis for the detection of syphilis are tabulated covering a four year period.

2. Out of 11,558 specimens of blood examined, 3.8 per cent were found to be positive and an additional 0.3 per cent questionable.

3. The highest percentage of positives was found in that group of specimens made up largely from private bed hospital patients.
ECLAMPSIA COMPLICATED BY GAS BACILLUS INFECTION OF THE GALLBLADDER AND PROLONGED ANURIA

WILLIAM E. McDougall

Attending Surgeon to the Hospital

While eclampsia complicating pregnancy is not too uncommon, we believe the unusual features of the case to be reported are of interest.

So-called "gas bacillus" infection may be due to a variety of bacteria. The predominating organism, however, is the bacillus Welchii first described by Welch and Nuttall in 1892. The most reliable diagnostic test for this organism is that introduced by Welch and Nuttall in which inoculations are made into rabbits. Rarely do blood cultures become positive, and this might be due to the inhibiting influence of the oxygen present in the blood stream. Bacillus Welchii has been found to be present for long intervals outside the gastrointestinal tract without producing gas. Gas bacillus infection rarely gives rise to frank pus unless it is complicated by pyogenic organisms. The presence of gas bubbles is one of the diagnostic features of this infection. Death is due to toxemia rather than to blood invasion.¹

Schmidt² states that to his knowledge no cases of gas bacillus infection of the gallbladder had been reported prior to 1937. At the Fifth International Radiological Conference he reported two cases. The first, a 27 year old coal miner, had had symptoms referable to the digestive system for three years; and upon being examined radiologically for gastrointestinal pathology, a gas-filled gallbladder was revealed. The second case was that of a 62 year old farmer with pain in the right hypochondrium, occasional vomiting of bile, and slight jaundice. He disclosed findings at film examination identical with those in the first case.

According to McCorkle and Fong,³ there are two main causes for spontaneous appearance of gas in the gallbladder: Infection of the gallbladder with gas-forming bacteria, or passage of gas from the intestine to the gallbladder through a fistula between the gallbladder and the gastrointestinal tract. They saw three examples of each between 1940 and 1942. Eight cases of the first group (gas-forming bacteria) and thirteen of the second group have been reported by others.

The following report is that of a case of eclampsia, gas bacillus infection of the gallbladder, and anuria in a pregnant woman recently admitted to the Osteopathic Hospital of Philadelphia.

Mrs. I. N., a thirty year old, white, nulliparous patient presented herself on September 23, 1943 for prenatal care. History and physical examination were essentially negative. Blood pressure was 120 systolic, 80 diastolic. The date of the first day of the last menstrual period was July 1, 1943. There had been some nausea and vomiting on several morn-
ECLAMPSIA WITH COMPLICATIONS

ings during the first trimester. No edema of the extremities had been noted.

During the second trimester there had been occasional nausea and vomiting, and the blood pressure was never over 130 systolic or 88 diastolic. There had been slight swelling of the ankles on two or three occasions at the end of the day.

During the third trimester swelling of the ankles was noted on occasions but each time had disappeared by the following morning. Activity was restricted. Throughout her pregnancy, routine urinalyses were negative. At her last office visit on January 28, 1944 the blood pressure was 134 systolic and 80 diastolic.

On February 3, 1944 the patient called by telephone and said her ankles were more swollen than they had been at any time. Complete bed rest was ordered, and on the following day the patient reported that the legs were a "great deal better." She was advised to continue bed rest. That night, February 4, about midnight, the patient's husband called and stated that his wife seemed irrational. She was found in a convulsive seizure and was revived by the use of hot packs. While waiting for an ambulance to transport her to the hospital she again went into a convulsive seizure. Hot packs and morphine sulphate were used and she became rational in a short time.

The patient arrived at the hospital about two a.m. February 5. Fifteen minutes following admission she experienced another convulsion. Obstetrical consultation was secured and treatment for eclampsia instituted consisting of morphine sulphate grain 1/4 by hypodermic injection, oxygen inhalations by mask, application of external heat, and the withdrawal of 650 cc. of blood, followed by the intravenous administration of 50 cc. of 50 per cent glucose and 12 cc. of 10 per cent magnesium sulphate solution. Osteopathic treatment consisting of active manipulation to the spinal tissues of the renal splanchnic area was administered every two hours.

Upon admission the blood pressure was 195 systolic and 110 diastolic, temperature 98.2° F., pulse 122, and respiratory rate 25 per minute. Examination of the urine revealed a two plus albumin, specific gravity of 1.030, acid reaction, and four plus cells per high power field. Two hours later the blood pressure was 150 systolic and 91 diastolic. The patient was sleeping for long intervals. No convulsive seizures were experienced following the one shortly after admission to the hospital. Blood count on admission showed 3,210,000 red blood corpuscles, 12,000 white blood cells, and 94 per cent hemoglobin. By February 19 the red count and hemoglobin had decreased to 2,700,000 and 62 per cent respectively, and the white blood cells had increased to 18,000.

Approximately forty-eight hours following the patient's admission to the hospital, neither fetal heart sounds nor fetal activity could be elicited. On the afternoon of the fifth day in the hospital, labor began spontaneously, and after six hours of moderate labor she spontaneously delivered a stillborn, macerated, seven month old fetus.
The urinary output following admission had gradually increased from 270 cc. in twenty-four hours to 830 cc. on the day of delivery. Catheterization on the night of delivery recovered only 25 cc. of urine. From then on she remained anuric until her death fifteen days later.

Attempts to promote diuresis were made by the use of three nephritin tablets every two hours, saline and glucose infusions of 1,000 cc., and continuous hot packs to the entire body twice daily until sweating was established. Short-wave diathermy was applied twice daily to the renal areas for twenty minutes. Mercupurin, prostigmin, vitamin B complex, depropanax, vitamin B-6, and vitamin K, watermelon juice, and watermelon seed tea were all used to no avail.

\[Figure\ 1\text{—Survey film of upper abdomen 2/16/44. Well defined collection of gas surrounding the gallbladder. Gallbladder contour quite sharp and regular. Lower half of pericholecystic gas shadow altered so as to suggest a fluid level.}\]

Seven days postpartum (February 16) exquisite tenderness was noted on palpation around the region of the right costal arch. A survey film of the abdomen was made. (Figures 1, 2, and 3.) A well-defined collection of gas was found surrounding the gallbladder. The remainder of the abdomen was silent, there being no unusual gas pattern noted in the colon or intestines. Pneumoperitoneum was eliminated. A radiological opinion of emphysema of the gallbladder, probably due to gas bacillus infection, was made.

Radiation therapy to the renal and gallbladder areas was instituted. The gallbladder region was irradiated through a 15 sq. cm. port, a single
anterior portal being employed. Treatment was given daily for three days (February 17, 18, and 19)—117 r. (in air) being delivered daily to the anterior portal. On February 21 the same portal was irradiated, 78 r. (in air) being delivered. All treatments were given under the high voltage tube, utilizing 208 k.v., 25 Ma. of current, added filter of .5 cu. plus 1 al., 50 cm. distance, half value layer—.95 cu. Reexamination of the gallbladder region by film study was made on each of these days.

On February 17 surgical consultation was secured and the opinion rendered that surgical intervention was not advisable.

![Survey film made 2/21/44. Gallbladder relief irregular and mottled due to "bleb formation." Findings indicate pericholecystic and cholecystic gas. Fluid level again noted.](image)

Gas bacillus antisera, consisting of 10,000 units of perfringens plus 10,000 units of bacillus Welchii, diluted with 100 cc. of normal saline solution was administered intravenously on February 19 and repeated on February 22. Serum reaction followed in both instances, the temperature rising to 105° and 102° respectively. Otherwise her temperature was afebrile at all times.

Cystoscopy was performed on February 14 (five days postpartum) and February 19 to rule out the possibility of ureteric obstruction. Ureteric catheterization was accomplished on both occasions but no specimen was obtained due to the anuria.
Blood transfusions of whole blood in amounts of 250 cc. were given February 16, 17, 18, 19, and 23. The recipient was typed and matched prior to each transfusion.

Blood cultures and subcultures taken on February 16 after seven days' observation were all negative.

On February 18, 20, 21, and 22 fluid was obtained from the bladder. On two occasions this was milky in nature, and on the remaining two amber colored. These specimens, upon being submitted to the laboratory for analysis, proved not to be urine.

*Figure 3—Examination 2/24/44. Gallbladder decreased in size, distorted, with changes noted to indicate gas in the lumen of the gallbladder, also in intramural and pericholecystic locations. Fluid level demonstrated.*

Blood pressure readings postpartum ranged between 130/80 and 165/88. The edema of the lower extremities gradually improved, postpartum, until four days before her death. The edema of the hands which became noticeable the fifth postpartum day improved to the point where it was just discernible. Blood urea nitrogen determination on February 12 was 66.8; February 15, 93; February 18, 129, and on February 23 it was 147. Non-protein-nitrogen determination on February 18 was 145.2, and on February 23 was 234. Creatinine determination on these two dates was 6.6 and 6.4 respectively. On February 24 during the early morning she became very listless and dyspneic. The patient expired at 3:50 p.m. that afternoon after being in a state of coma for approximately
three hours. Except for eighteen hours following the convulsive seizures and twelve hours before expiration this patient was rational at all times.

Permission for necropsy was granted and a summary of the autopsy findings follows.

**Autopsy Report**

Mrs. I. N.
No. 15828
Died: 2-24-44, 3:50 p.m.
Autopsy: 2-24-44, 4:45 p.m.
*Clinical Diagnosis:* Eclampsia, postpartum.

*External Examination:* The body was that of a well-developed female, said to be 30 years old. Her length was 65 inches and her weight was estimated as 158 lbs. The scalp was well covered with a heavy crop of reddish-brown hair. The pupils were equal in size. The teeth and mouth were in a foul condition of oral hygiene and there was some bleeding into the mouth. The tongue had a heavy brown coating. There was some cyanosis about the face and trunk. There were no evidences of gross trauma to the body nor any suggestions of caustic poisoning about the face. A number of needle wounds were noted in the antecubital fossae, evidently locations used for intravenous infusions. The breasts were full, but there was no evidence of tumor. Striae gravidarum were pronounced on the abdominal wall and some of them presented a bluish discoloration which we believed to have resulted from hemorrhage. The pubic hair extended over the abdomen toward the umbilicus with a pointed distribution. This distribution of pubic hair associated with marked bluish striae of the abdominal wall suggested the possibility of a pituitary syndrome. Because of certain misgivings on the part of the husband about permitting an autopsy, it was felt indiscreet to open the cranium to investigate the pituitary. The body as a whole presented anasarca.

*Internal Examination:*

The subcutaneous tissues were abundantly edematous.

Upon incising the intercostal spaces on the left side, in the region of the precordium, enormous quantities of hydremic blood escaped under considerable pressure. Upon further dissection one gained the impression that hemopericardium may have been present with the heart floating against the intercostal spaces so that the left atrium was inadvertently incised along with the intercostal muscles. A large quantity of bloody fluid was found in the pericardial sac, but we could not determine how much of it might have been present before the body was opened. The pericardium was roughened, suggesting pericarditis. The heart measured 15 x 12 x 5 cm. The greatest diameter of the thorax at the upper level of the diaphragm was 18 cm. with a cardio-thoracic ratio of 15/18.
Myomalacia was advanced, and as the heart lay on the autopsy table it flattened out. The myocardium could readily be torn with the blunt finger. There were no valvular lesions and no suggestions of syphilitic aortitis. Enormous quantities of very dilute blood were removed from the cardiovascular system.

The lungs had been very much compressed by a high lying diaphragm. The large amount of bleeding, referred to above, somewhat invalidated findings from the pleural cavity. Considerable quantities of bloody fluid were removed from the pleural cavities but the pleurae were not roughened and we gained the impression that perhaps this bloody fluid was an accidental contamination. The right lung weighed 280 grams. The weight of the left lung is not recorded but we would judge it to have weighed approximately the same. The left lung contained a peripheral abscess, smears from which showed staphylococci and many diplococci.

There were no noteworthy lesions of the esophagus.

There were no noteworthy lesions of the stomach.

The intestines were somewhat edematous with the greatest amount of thickening in the upper coils.

The peritoneal cavity contained 800 cc. of amber fluid untinged with blood.

An abundance of adhesions were found in the region of the gallbladder. Upon dissection the fatty tissues of this region were found to be deeply stained with bile. Cultures from this region exhibited B. Coli. The gallbladder itself presented crepitation with abundant evidences of gas in its walls. The interior of the gallbladder contained a moderate quantity of sterile bile. The biliary tract was open allowing bile to enter the duodenum, some of which was regurgitated into the stomach.

The liver was 26 cm. tall and weighed 2120 grams. This liver was deep red in color, giving one the impression of acute hepatitis. The cut surface was wet and shiny but there were no evidences of gas in this organ.

There were no noteworthy lesions of the pancreas.

The spleen measured 21 x 11 x 5 cm. and weighed 375 grams. This spleen gave one the impression of the acute splenic tumor of infection.

The uterus presented the involutionary changes of the puerperium. A well-encapsulated fibroid was found in the myometrium, approximately 3 cm. in diameter. The myometrial vessels and blood spaces were crowded with thrombi. Frank thrombosis was demonstrated in the right ovarian vein. This thrombus extended as far as the junction of the right ovarian vein with the inferior vena cava.

The urinary bladder contained less than 10 cc. of urine. Its walls were not edematous.

The kidneys measured respectively, left and right, 13 x 6 x 55 cm. and 12.5 x 7 x 4.5 cm. The left weighed 250 grams; the right weighed 240 grams. The capsular elements of the kidneys were greatly thickened. The kidneys themselves were of a rather pale yellow color, mottled here
ECLAMPSIA WITH COMPLICATIONS

and there by pin point hemorrhages. On section, the cortical substance presented this same pale yellow color but the medullary substance was somewhat more pink in color with a waxy cut surface. In the gross these kidneys gave the impression of cortical necrosis.

The suprarenal glands did not present any noteworthy lesions.

**Microscopy:**

Sections of the heart show some thickening of the visceral pericardium with here and there accumulations of inflammatory wandering cells suggesting inflammatory disease. The myocardial fibers are comparatively small with small nuclei. Their staining reaction is comparatively poor but we are unable to demonstrate fatty metamorphosis.

Sections of the lung, selected from the area of abscess referred to above, show the alveoli containing hyalinized masses giving one the impression of an organization process succeeding upon pneumonitis. Surrounding these areas are areas of congestion in which the blood in the alveolar spaces is being digested by macrophages. A lining of the abscess wall is well demonstrated and the interior contains purulent debris. From the amount of organization one would judge that this lesion has been present, probably for several months or more.

Sections of the regions surrounding the gallbladder show inflammatory disease with necrosis predominating. Some staining with bile pigments is demonstrated.

Sections of the walls of the gallbladder show deep staining by bile pigments with the individual cells widely separated. These changes, when the gross findings are considered, are interpreted as being dissection by gas.

Sections of the liver show the proper hepatic cells to be comparatively small. The cords of cells are separated by edematous fluid and some protein debris. Hematogenous pigmentation is demonstrated over wide areas about the central lobular veins. The glycogen reserve of the liver would seem to be small or perhaps exhausted. We do not demonstrate fatty metamorphosis.

Sections of the kidneys show a most striking pathological picture. The metanephrotic elements (nephrons) have lost their staining properties so that no cellular details are demonstrated in the glomeruli nor in the tubular apparatus of the nephrons. Ghosts of these structures remain behind but it is difficult to conceive that any of the nephrons have any functional activity. These changes are not demonstrated in the collecting tubular apparatus of the kidneys. The latter presents staining properties, cellular details can be identified; however, most of these tubules are crowded with coagulated protein and debris. One would judge that these kidneys have been influenced by some violent chemical or toxin having a selective affinity for the nephrons.

Sections of the suprarenal glands present no noteworthy changes.
Sections of the spleen present distention of the sinusoids with large quantities of blood and bloody debris.

*Bacteriological Report*

Smears presented from autopsy revealed the following:

2. Interior of spleen—lymphocytes but no micro-organisms.
4. Gallbladder area—many pus cells, gram negative bacilli and staphylococci.
5. Gallbladder interior—no micro-organisms.
6. Lung—many pus cells, epithelium, staphylococci, and many diplococci.

Cultures presented from gallbladder wall were sterile under aerobic and anaerobic conditions, at 48 hour and 96 hour observation.

Cultures from gallbladder area revealed the presence of a gram negative bacillus having the morphological and cultural characteristics of B. coli communior. Negative for presence of any anaerobic organisms including clostridium Welchii on special laboratory media.

A rabbit was inoculated with cultures from gallbladder area. Animal killed and incubated for 24 hours. Cultures from heart blood of animal revealed the presence of a gram negative bacillus having the morphological and cultural characteristics of B. coli communior.

Smears from animal’s blood showed many gram negative bacilli.

After an examination of these materials microscopically, and after considering the bacteriological report, our impressions of diagnosis remain virtually the same as expressed above and our impressions of the mechanism of death likewise remain much the same as expressed above.

**Gross Anatomical Diagnosis**

Hydremia  
Anasarca  
Thrombosis right ovarian vein  
Acute hepatitis  
Emphysematous cholecystitis  
Congestive failure  
Kidney of pregnancy  
Pericarditis  
Lung abscess

*Cause of Death*

Toxemia of pregnancy.


**Discussion**

This patient presented no evidence of renal or gallbladder dysfunction prior to her admission to the hospital. Eclampsia is considered to be a manifestation of toxemia of pregnancy, indirectly due to renal embarrassment with retention of nitrogenous materials within the blood stream. Following hospitalization of this case, an emphysematous cholecystitis probably due to a gas bacillus infection was discovered, accompanied by extensive liver enlargement. As a result of either the gallbladder infection or renal impairment, anuria ensued and continued from the day of delivery until death, a total of fifteen days. Are we to contend that the liver damage resulting from the gas bacillus infection of the gallbladder or the renal suppression resulting from the toxemia of pregnancy was the exciting factor in the production of the eclamptic state and subsequently the anuria?

In this case the liver was extensively congested and weighed 2120 grams (normally the liver of this patient should have weighed about 1200 grams), the omentum had completely surrounded the gallbladder and was firmly adherent to the under surface of the liver, and the thickened wall of the gallbladder upon being compressed emitted bubbles of gas.

**Summary**

A case of eclampsia complicated by gas bacillus infection of the gallbladder and prolonged anuria is presented.

Autopsy findings are reported.

**Bibliography**


INTESTINAL STRANGULATION DUE TO ADHESION OF MECKEL'S DIVERTICULUM SIMULATING ACUTE APPENDICITIS: REPORT OF A CASE

FRANK E. GRUBER
Attending Surgeon to the Hospital

Most cases of acute appendicitis offer no difficulty in diagnosis. Sometimes, however, the diagnosis is not easy because of symptoms or physical findings which may be confusing. At times there are other conditions which may show most of the signs and symptoms of acute appendicitis and which are not found until after the abdomen is opened. Such is the record of a case in the following report.

The patient, a young male, age four, was first seen by the referring physician in her office the morning of November 7, 1943. History as given by his parents was as follows: On November 5 the child came home in the afternoon, after playing outdoors, complaining of severe abdominal pain. He told of having fallen from an express wagon while at play. He was taken to another physician's office, and a sedative was given after a diagnosis of abdominal trauma was made. The pain continued, however, and was still present the following morning. An enema was given with poor results. More sedation was given, but the pain persisted and the child complained of nausea. That evening, November 6, more sedation was given but still the pain persisted with some nausea. Most of the pain during this time was centered chiefly in the lower right quadrant of the abdomen.

The following morning, after another sleepless night, the child was taken to the referring physician's office. At this time his temperature was 99.2 degrees, pulse about 110, and marked rigidity of the lower right rectus muscle was present. A blood count at this time revealed moderate leukocytosis (17,500) with 85 per cent polymorphonuclears and 15 per cent lymphocytes. The patient was then sent to the Osteopathic Hospital of Philadelphia with a diagnosis of acute appendicitis. On admission to the hospital, his white blood cell count was 17,000 and a Schilling hemogram showed 13 stabs and 71 segmenters. Temperature on admission was 99.2 degrees, pulse 122, and respirations 22. Blood sedimentation rate was normal. Urinalysis was negative except for the presence of acetone.

At this time he still complained of severe pain in the lower right quadrant of the abdomen, and there was some rigidity of the lower right rectus. Physical examination elicited the following: Tongue coated, pharynx inflamed, weight 46 pounds, abdominal tenderness most marked over McBurney's point, with slight swelling of the abdomen in the lower right quadrant.
Past history obtained at this time was essentially negative except for whooping cough about three months previously, and a previous history of "growing pains."

After admission to the hospital, an ice bag was applied to the lower right quadrant of the abdomen and a low enema given with only fair results. The pain, however, subsided greatly and the child remained quite comfortable during the early evening and slept most of the night. His temperature dropped to 98 degrees and pulse to 100. Blood count now showed 9,500 white blood cells, with 79 per cent polynuclear neutrophiles, 5 per cent eosinophiles, 1 per cent basophiles, and 15 per cent lymphocytes. The Schilling hemogram showed 4 stabs and 75 segmenters.

During the morning of the following day he remained quite comfortable, complained but little of nausea or pain. His temperature and pulse were normal. The pharynx was still inflamed somewhat and the tongue coated. Late in the afternoon of the same day, however, he again complained of severe pain which still centered chiefly over McBurney's point, nausea, and some vomiting. White blood cell count showed 74 per cent polymorphonuclears and 26 per cent lymphocytes, with 13,400 white blood cells per cu. mm. His temperature rose to 100 degrees and pulse to 120. His abdomen showed evidence of increasing swelling, now over most of its extent. He was prepared for surgery at this time and was taken to the operating room at 8:00 p.m. for appendectomy. While he was being anesthetized with ether, the anesthetist called attention to a fine rash over most of the body which appeared quite suddenly. Scarlet fever in children often gives symptoms of acute appendicitis before the appearance of the rash and should be ruled out before surgery is performed. This rash did not have any characteristics of the acute exanthemata, however, and because of his symptomatology and the abdominal swelling, the surgery was instituted.

On opening the abdominal cavity through a right rectus incision, the small bowel down to about one meter from the cecum was found to be markedly distended. There was a rather large Meckel's diverticulum present, from the tip of which a very fine band extended to the cecum. Beneath this band was a strangulation of the rest of the ileum which was entirely collapsed and purplish in appearance. As soon as the band was severed, the strangulated portion of the ileum immediately filled. The Meckel's diverticulum was then removed. The appendix was found to be retrocecal, bound by adhesions, and moderately inflamed. It was removed, by which time circulation was re-established in the ileum to a sufficient degree to warrant closing the abdomen.

Following surgery, the child made an uneventful recovery and was discharged from the hospital in good condition ten days after surgery. Since that time he has been in good health.

The pathological report on the Meckel's diverticulum revealed a neoplasm which was composed chiefly of tissue resembling pancreas, and was classified as an accessory pancreas (aberrant pancreatic tissue of the
ileum). It is not rare to find aberrant pancreatic tissue in a Meckel’s diverticulum. Sections of the appendix showed evidence of chronic recurrent appendicitis.

Summary

A case is reported with symptoms simulating acute appendicitis which were due primarily to an intestinal obstruction from a Meckel’s diverticulum.

DISTENTION OF THE LOWER ABDOMEN DUE TO CARCINOMA OF THE STOMACH: AUTOPSY REPORT OF A CASE*

Otterbein Dressler
Professor of Pathology in the College, and Special Deputy Coroner, City of Philadelphia

The words “cancer of the stomach” call to mind somewhat variable impressions. Predominantly, however, we are apt to think of an emaciated individual perhaps with a large liver and a mass in the upper abdomen. In the instance of the case to be reported the subject was indeed emaciated, but the liver was not enlarged and there was no mass in the upper abdomen.

The most striking feature of this case was a shifting, obviously fluid mass in an emaciated abdomen. Shifting dullness could be elicited leading one to suspect ascites. It can easily be conjectured that if, during her final illness, the patient had assumed the sitting position, this fluid would have accumulated about the lower abdomen possibly tempting one to perform paracentesis for its removal.

Autopsy: No. 44-3334
Died: 12-13-43, 12:15 a.m.
Autopsy: 12-13-43, 2:00 p.m.
At the City Morgue

Clinical Data

“Unknown.”

External Examination

The body was that of a greatly emaciated white female, said to be 67 years old. Her length was 67 inches and the weight was estimated

*Case reported through the courtesy of Dr. Benjamin Gouley, Chief Coroner’s Physician, City of Philadelphia.
as less than 100 lbs. A fair crop of gray hair was noted on the head. The pupils were equal in size. The mouth was in foul condition with snags of teeth, and large quantities of putrid fluid welled from the mouth on motion of the body. The breasts were atrophied and there were no evidences of tumors in these organs. A fluctuating distention of lower left quadrant of the abdomen was demonstrated. There were no evidences of trauma, no areas of edema, no evidences of caustic poisoning and no incisions of surgery.

Internal Examination

The pericardial sac contained 30 cc. of amber fluid. The greatest diameter of the heart was 11 cm. The greatest diameter of the thorax, 22 cm. at the upper level of the diaphragm with a cardio-thoracic ratio of 11/22. Brown atrophy of the heart was evident; the coronaries were excessively tortuous to accommodate themselves to this diminished size of the heart. The heart, over all, measured 11 x 7.5 x 4.5 cm. There was some distention of each of the chambers of the heart. The foramen ovale was patent.

There was an abundance of adhesions throughout the thorax but particularly in the right thorax. The lungs were somewhat congested, there was a moderate amount of pulmonary edema, and infarctions of the lungs could be demonstrated. The bronchi were congested and contained some mucoid exudate.

The esophagus was enormously distended with fluid.

The stomach extended from the left hypochondrium to a point below and behind the symphysis pubis. The stomach measured 36 x 15 cm., and 2500 cc. of putrid “coffee ground” debris was removed from it. It is to be remembered, however, that large quantities were lost on moving the body, and we would estimate that this stomach probably accommodated in the neighborhood of four liters of fluid before death. An annular carcinoma was demonstrated about the pyloric region and the prepyloric region. This carcinoma was of the infiltrative, indurative type without ulceration, and had reduced the pyloric opening to several millimeters.

The intestines were collapsed and presented an abundance of adhesions about the tumor noted above.

The gallbladder was distended but emptied readily upon pressure.

The liver was atrophied but there were no evidences of tumor.

The spleen measured 9 x 4.5 x 1 cm. and presented a dry cut surface.

There were no noteworthy lesions of the pancreas.

There were no noteworthy lesions of the internal genital organs.

The urinary bladder contained 25 cc. of turbid urine.

The kidneys measured respectively, right and left, 10 x 5.5 x 3 cm. and 10 x 5.5 x 2.5 cm. There were no noteworthy lesions, and the capsules stripped easily.
The suprarenal glands presented no lesions. The body as a whole showed a remarkable state of dehydration with inspissation of blood in the vascular system.

Anatomical Diagnosis

Brown atrophy of the heart.
Patent foramen ovale.
Pulmonary edema.
Carcinoma of the stomach (pyloric region).
Gastrectasis with esophagectasis.
Atrophy of the liver.
Inanition and dehydration.

Cause of Death

Carcinoma of the stomach (pyloric region).
Contributory—Inanition and senility.

Summary

The autopsy protocol of a case of carcinoma of the pylorus is presented.

Enormous gastrectasis and esophagectasis, the former to four or more liters, was found.

The gastrectasis had produced a "shifting dullness" in the abdomen which might have been mistaken for ascites.
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