Staff Meeting Bulletin
Hospitals of the » » »
University of Minnesota

Splenomegaly

Volume IX Friday, October 22, 1937 Number

STAFF MEETING BULLETIN
HOSPITALS OF THE . . .
UNIVERSITY OF MINNESOTA

Volume IX | Friday, October 22, 1937 | Number 3

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Published for the General Staff Meeting each week during the school year, October to May, inclusive.

Financed by the Citizens Aid Society

William A. O'Brien, M.D.

I. LAST WEEK

Date: October 15, 1937

Place: Recreation Room
Nurses' Hall

Time: 12:15 to 1:15 P.M.

Program: Movie: Aviator Shorty

Announcement: Ray Amberg

Convulsions Complicating Anesthesia:
C. Burling Roesch
W. P. Ritchie
Carl Lind
H. A. Hilger
J. B. Carey
Ralph T. Knight
A. A. Nelson
A. B. Baker
W. A. O'Brien

Present: 116

Discussion: A. D. Hirschfelder
W. P. Ritchie
Lillian B. Clayton
H. N. Wright
R. N. Bieder
Ray Amberg
O. H. Wangensteen

Additional:
Willis Thompson urges more careful use of atropine in children.

Gertrude Gunn,
Secretary

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II. MOVIE

Title: Popular Science, No. 3

Released by: Paramount Pictures, Inc.

(In Color)

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III. ANNOUNCEMENTS

1. INTERDEPARTMENTAL SEMINAR

Wednesday, Oct. 27, 1937
8 p.m.
Eustis Amphitheater

Immunization against Scarlet Fever through the Use of Formalized Toxins.

Dr. Gaylord W. Anderson, Professor of Preventive Medicine and Public Health, University of Minnesota.

Transplantation and Regeneration of the Adrenal.

Dr. George M. Higgins, Associate Professor of Experimental Biology, Mayo Foundation.

* * *

2. CENTER FOR CONTINUATION STUDY

The Center for Continuation Study of the University of Minnesota announces the program of medical seminar for 1937-1938. The faculty will be selected from the Medical School, Graduate School, Mayo Foundation, and Genera Extension Division, and will also includ distinguished teachers from other medica centers. Lectures will be given in the classrooms of the Center, and clinics and demonstrations in the Medical School University of Minnesota Hospitals, and affiliated institutions.

Each seminar will occupy the full time of the graduates from Monday to Saturday, inclusive. There will be no evening classes. Special library facilities for each seminar will be provided at the Center. If the interest warrants, lecture, clinic and demonstration mimeographed outlines will be sold for a nominal fee after each week's program. A special feature will be round table conferences at the close of the daily program to give the graduates an opportunity to ask questions.

Studies in Adult Education indicate that the most effective instruction is given by concentrating on limited fields

For this reason the program of each seminar will include only the subject material announced in advance. Also, the best results are apparently obtained from repeated exploration in a single field of knowledge with opportunities to apply this knowledge between seminars in the regular practice of the postgraduate students. Until this method is demonstrated to be inferior to courses of greater length the University will continue to offer one-week seminars for physicians in active practice. Advanced classes will be formed for those seminar groups that desire it, provided the enrolment is sufficient and a suitable time for all concerned can be arranged.

Living Accommodations

The Center is located in the heart of the main campus of the University of Minnesota in Minneapolis. It is used exclusively for postgraduate instruction of men and women. Erected in 1936 at a cost of over $300,000, it is said to be the only educational unit of its kind in the United States. Containing living accommodations for 78 persons, it may be used simultaneously by several professional groups. Postgraduate physicians should plan on living in the dormitory of the Center. A double room with bath is $6.25 a week for each person; a single room without bath is the same price. Ample bathroom facilities on each floor are provided for those who select rooms without baths. Meals in the Center dining room are priced as follows: breakfast, 35 cents; luncheon, 45 cents; and dinner, 65 cents. Members of the physicians' families are welcome at the same rates. A large parking garage is in the basement; the daytime rate is 20 cents, and 24-hour parking is 50 cents.

Tuition

The tuition for each course is $25. This does not include living accommodations. In order to register for a seminar a fee of $3 should be sent in advance. This payment will be applied on the $25 tuition fee when registration is completed. In case the registrant fails to complete his registration the advance payment of $3 will be applied on the tuition for any future seminar. The right to cancel any course because of insufficient registration is reserved by the University, in which event the registration fee will be returned if desired.

Certificate

A certificate of attendance will be issued by the University of Minnesota upon recommendation of the chairman of the seminar committee and the director of the Center for Continuation Study.

Registration

Any licensed physician who is a member of his local or state medical association or of the American Medical Association may register for the seminars. Physicians residing outside the state are accepted on the same basis as Minnesota physicians. All physicians should register as far in advance as possible. This will give the chairmen of the seminar committees an opportunity to plan for the special needs of those who will attend. This planning has been an important factor in the success of the programs presented previously.

PROGRAM - 1937-38

Diseases of Heart
October 4-9, 1937

Lectures, bedside clinics, demonstrations and conferences.

F. A. Willius, Associate Professor of Medicine, Chairman of the Heart Committee of the Minnesota State Medical Association, and Associates.

Surgical Diagnosis and Treatment
November 1-6, 1937

A series of correlated presentations on the diagnosis and treatment of surgical conditions, mainly acute, but not including fractures and dislocations.

O. H. Wangensteen, Professor and Head of the Department of Surgery, Medical School, and Associates.

Dermatology and Syphilology
December 6-11, 1937

The diagnosis and treatment of syphilis and the more prevalent diseases of the skin for those who encounter problems in these subjects in their practice.

Henry E. Michelson, Professor and Director of the Division of Dermatology, Medical School, and Associates.

Ophthalmology and Otolaryngology
January 16-21, 1938

Studies of diseases of the eye, ear, nose and throat, including special conferences, the subjects to be selected by a survey of the prospective graduate students.

Frank E. Burch, Professor and Head of the Division of Ophthalmology; Horace Newhart, Professor and Director of the Division of Otology, Rhinology, and Laryngology, Medical School, and Associates.

Medical Diagnosis and Treatment
February 7-12, 1938

Diseases of the blood and blood forming organs, gastrointestinal and respiratory tracts, and selected topics from other medical fields.

J. C. McKinley, Head of the Department of Medicine, Medical School, and Associates.

Traumatic Surgery
March 7-12, 1938

The diagnosis and treatment of injuries including fractures and dislocations.

Wallace H. Cole, Professor and Director of the Division of Orthopedic Surgery, Medical School, and Associates.

Endocrinology
April 4-9, 1938

Present-day knowledge of the anatomy and physiology of the endocrine glands, clinical types of disorders, indications for and methods of treatment.

Committee from the preclinical and clinical departments of the Medical and Graduate Schools.

Diagnostic Radiology
Date to be announced
(probably in June, 1938)

The technique and indications for the use of radiological methods in the diagnosis of disease.

Leo G. Rigler, Professor and Head of the Department of Radiology, Medical School, and Associates.

Clinical Pathology
Date to be selected
(at the convenience of the group)

A survey of the various fields of laboratory practice for clinical pathologists and others, in the technique and clinical interpretation of tests.

Committee from the Medical and Graduate Schools.

Proctology
Tentative

The diagnosis and treatment of disorders of the anorectal region.

Walter A. Fansler, Clinical Associate Professor of Surgery, Medical School, and Associates.

Other Seminars

Requests have been received for the formation of groups in addition to the seminars described above. To date, the number in each instance is not sufficiently great to form a class. If you are interested in any of the following subjects, will you please communicate with the director at your earliest convenience. Allergy, anesthesia, arthritis, deficiency diseases, degenerative diseases, diabetes, electrocardiography, gynecology, medical disorders of the kidney, liver and gallbladder, neurology, neurology and psychiatry, obstetrics, obstetrics and gynecology, orthopedics, pediatrics, physiotherapy, psychiatry, public health, refraction, surgical anatomy, minor sur-

gery, surgical pathology, surgical technique, injection treatment of surgical diseases, and urology.

Information

Address all correspondence to the Director of the Center for Continuation Study, University of Minnesota, Minneapolis, or Dr. William A. O'Brien, Medical Representative, at the same address.

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IV. FELLOWS (Concluded)

Hurd, F. D., Tolley, N. D.
B.S., Gettysburg, Pa.
M.B., M.D., University of Minnesota
Rotating Internship - University of Minnesota Hospitals, 1925
Private Practice - Tolley, N. D.
Teaching Fellow - Ophthalmology and Otolaryngology - University of Minnesota Hospitals - 1936.

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V. NEW FACES - - OLD FRIENDS

Anderson, Gaylord W.,
Professor and Head of the Department of Preventive Medicine and Public Health.

Anderson, John A.
Clinical Instructor of Pediatrics.

Arnstein, Margaret,
Assistant Professor of Preventive Medicine and Public Health, and Supervisor of Public Health Nursing.

Baker, Abe B.,
Instructor of Nervous and Mental Diseases.

Barr, Robert N.
Instructor of Preventive Medicine and Public Health.

Cook, Malcolm M.,
Instructor of Physical Therapy.

Cowan, Donald W.
Instructor of Preventive Medicine and Public Health.

Gerdes, Maude M.
Clinical Instructor of Obstetrics and Gynecology.

Gunstad, Borghild
Instructor of Biometry in the Department of Preventive Medicine and Public Health.

Hathaway, Stark R.
Assistant Professor of Nervous and Mental Diseases.

Hilleboe, Herman
Instructor of Preventive Medicine and Public Health.

Kernan, Phillip D.
Physician - Students Health Service; Health Officer of the Hospital.

Keyes, Ancel,
Associate Professor of Physiology.

Koepsell, A. H.,
Clinical Instructor of Obstetrics and Gynecology.

Lyons, Gertrude,
Instructor of Public Health Nursing.

Potthoff, Carl J.
Instructor of Preventive Medicine and Public Health.

Prendergast, John J.
Clinical Instructor of Ophthalmology.

Rea, Charles E.
Instructor of Surgery.

Samuels, Leo T.
Assistant Professor of Physiological Chemistry.

Savage, George.
Instructor of Bacteriology.

Schiele, Burtrum C.,
Assistant Professor of Nervous and Mental Diseases.

Shalit, Pearl
Instructor of Public Health Nursing.

Sherman, Royal V.
Physician - Students Health Service.

Spink, Wesley W.
Assistant Professor of Medicine.

Sweetser, Theodore H.
Clinical Instructor of Surgery.

Todd, Ramona L.
Instructor of Bacteriology.

Treloar, Alan E.
Assistant Professor of Biometry in the Department of Preventive Medicine and Public Health.

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VI. SPLENOMEGALY -

DIFFERENTIAL DIAGNOSIS

John A. Layne

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A. Introduction

At birth, the average weight of the spleen is 9 grams. In adults, it varies within fairly wide limits and averages 150 grams. Splenomegaly may be defined as any measurable increase in the size of the spleen. When the spleen is involved to any appreciable extent by a pathological process, its weight almost constantly exceeds 300 grams; however, should the spleen be broad and more transverse in position than normal, it is easy to appreciate that it may exceed 300 grams in weight and yet not be palpable. After the 40th year, the spleen begins to undergo atrophic changes.

The spleen is capable of showing greater variations in size under abnormal states than any other organ of the body. Spleens weighing from 5 to 20 times their normal size are not infrequently encountered. In the more chronic enlargements of the spleen, the chief characteristic aside from increase in size is its hardness, whereas in the more acute conditions the enlargement is usually not as marked, and the spleen has a softer consistence. Since this organ is so situated that on increase in size it soon becomes palpable, definite enlargement of the spleen is a helpful sign in differential diagnosis. On the other hand, it should be pointed out that as a palpable spleen is occasionally discovered during a routine physical examination, it may be due to increased mobility, abnormally low position, or actual increase in size. Therefore, a palpable spleen cannot be considered in itself as pathognomonic of a morbid process within the body. Spleens which are palpable because of the first two conditions will not be discussed.

In evaluating splenomegaly as an aid in diagnosis, the relative frequency with which diseases causing splenic enlargement are encountered in any one geographical zone must be taken into consideration. As it is impossible to discuss all causes of splenomegaly here, this presentation will be limited for the most part to the occurrence of these conditions in the United States.

B. Physical examination

Both palpation and percussion should be utilized in determining abnormalities in the size and shape of the spleen.

1. Palpation

It is advisable that the patient be resting supine and that the examiner stand on the right side of the patient. The left hand of the examiner is then slipped under the patient's back so as to support the left lumbar region and the right hand applied to the left upper quadrant of the abdomen, directly below the costal angle and to the left of the midclavicular line. On inspiration, the left hand of the examiner supports the left flank of the patient, and should the spleen be enlarged, a rounded edge will be felt by the palpating (right) hand, as the spleen moves diagonally downward; during expiration the mass can be felt receding diagonally upward. At times palpation of the spleen will be facilitated if the patient lies on his right side. A large spleen may be missed if the examiner places his hand over the body of it and attempts to palpate the edge.

2. Percussion

For this procedure it is advisable that the patient be erect with his left arm raised, or lying on the right side with the left arm raised in order to expose the left infra-axillary region. Percussion should be started well outside the splenic area which is approached gradually from all sides. Splenic dullness is usually obtained in the infra-axillary region between the left posterior and midaxillary lines and between the 9th intercostal space and the 11th rib, inclusive. Because of the peculiarities of the neighboring organs splenic dullness cannot always be relied upon to outline exactly the size of the

spleen. The following conditions, when they occur on the left side, may result in a decrease or absence of the splenic dullness:

a. Pneumothorax
b. Emphysema
c. Distention of the stomach or colon
d. Left sided diaphragmatic hernia
e. A large cavity in the left lower lobe of the lung

Other than splenomegaly the following conditions will cause an increase in the normal splenic dullness:

a. Consolidation at the left lung base
b. Left hydrothorax or thickened pleura
c. Left subphrenic abscess
d. Greatly hypertrophied or dilated heart
e. A greatly enlarged left lobe of the liver
f. Renal tumors on the left
g. Pericardial effusion.

Often it is important to differentiate an enlarged spleen from an enlarged kidney or other tumor in the area. The shape of the spleen, its characteristic notch, its mobility during respiration and its position in front of the bowel are of great help in making this differentiation.

C. Incident of splenic enlargement in various diseases.

This table was compiled by Barron and Litman, and shows the results of their study of over 12,000 autopsy records. (University of Minnesota)

SPLEENS WEIGHING 300 GM. AND OVER

Primary Cause of Death	Total Number of Cases	Cases with Enlargement of Spleen Number	Per Cent
1. Heart Disease	1,505	158	10.4
2. Tumors	1,083	72	6.7
A. Carcinoma	990	66	6.9
(a) Stomach	211	7	3.3
(b) Pancreas	80	10	12.5
(c) Colon	72	3	4.1
(d) Lung	62	5	8.0
(e) Rectum	53	4	7.5
(f) Kidney	41	5	12.1
(g) Breast	49	2	4.0
(h) Gallbladder and biliary ducts	28	4	14.3
(i) Bladder	40	1	2.5
(j) Ovary	36	2	5.4
(k) Testicle	17	2	11.7
(l) Liver	18	2	11.1
(m) Uterus	80	4	5.0
(n) Prostate	66	3	4.5
(o) Esophagus	36	1	2.7
(p) Miscellaneous	101	11	10.8
B. Melanoma	18	4	22.2
C. Sarcoma	75	2	2.6
3. Pneumonia	808	50	6.1
4. Miscellaneous acute infections	682	90	13.1
5. Trauma	613	17	2.1
6. Fracture of skull	429	7	1.6
7. Peritonitis	364	24	6.5
8. Suicide	347	17	4.8
9. Tuberculosis	317	36	11.3
10. Cerebral hemorrhage and embolism	241	17	7.05
11. Acute and chronic alcoholism	231	6	2.6
12. Meningitis	229	12	5.2
13. Undetermined	146	8	5.4
14. Cirrhosis	129	69	34.7
15. Septicemia	102	32	31.3
16. Glomerular nephritis	92	8	8.6
17. Amyloidosis	89	12	13.5
18. Subacute bacterial endocarditis	87	74	85.05
19. Pernicious anemia	67	14	20.8
20. Leukemia	64	49	76.5
21. Diabetes	56	5	8.9
22. Abortion	55	9	16.3
23. Puerperal sepsis	52	21	40.3
24. Hodgkin's disease	37	23	62.1
25. Typhoid fever	24	8	33.3
26. Gumma*	7	4	57.1
27. Histoplasmosis	1	1	100.0

*Exclusive of four cases of congenital syphilis.

D. Acute infections which are accompanied by splenomegaly.

Many of the acute infections, particularly the typhoid and paratyphoid fever, undulant fever, pneumonia, peritonitis, septicemia, bacteremia, and subacute bacterial endocarditis, present as a rule only moderate enlargement of the spleen. The various diagnostic procedures which are required in the differentiation of these procedures will not be presented. It should be emphasized, nevertheless, that one should always search for a palpable spleen in a patient having an unexplained temperature elevation.

Barron and Litman found the spleen enlarged in 85% of 87 cases of subacute bacterial endocarditis. The splenic enlargement is the result of a subacute splenitis frequently associated with infarction. A sudden sharp pain in the left hypochondrium which does not immediately disappear, in a patient in whom a cardiac condition and fever are present, should strongly suggest subacute bacterial endocarditis, although the conditions causing mural thrombosis, such as coronary disease, should not be overlooked in this respect.

E. Chronic infections which are accompanied by splenomegaly.

1. Tuberculosis.

The spleen is often involved but rarely enlarged in tuberculosis. It has been shown that tubercles form in the lymphoid tissue along the small splenic arteries, and healed miliary tubercles in the spleen have been reported as an incidental finding at autopsy. Primary tuberculosis of the spleen may produce marked enlargement, but this condition is rare. In these instances the spleen is firm and weights from 2,000 to 3,000 grams are not uncommon. It must also be remembered that tuberculosis is the most important cause of amyloidosis and in this way may cause splenic enlargement.

2. Malaria

The spleen is uniformly enlarged in this disease, and when the diseases become chronic, the spleen may weigh as much as 3,000 to 6,000 grams. The course of the infection and the demonstration of the parasites in the blood make the diagnosis.

3. Syphilis

a. Congenital

The spleen is uniformly enlarged in congenital syphilis. The diagnosis of the condition can be made by the serological examination of the blood of the child and mother. In late congenital syphilis the clinical picture may be that of Banti's disease, the patient having anemia, leukopenia, ascites dilated abdominal veins and even hematemesis. The spleen is greatly enlarged and exhibits marked congestion with widely dilated sinuses on microscopic examination.

b. Acquired

The spleen is usually not enlarged in acquired syphilis.

4. Kala-azar

This disease is relatively common in China, India and Egypt. In the winter of 1935, one case was observe in the Students Health Service here in a Chinese student. Besides splenomegaly, it is characterized by secondary anemia, leukopenia and relative lymphocytosis. This disease is caused by protozoan, commonly called Leishman-Donovan bodies. These organisms may be demonstrated microscopically following diagnostic splenic puncture. The spleen is quite uniformly enlarged in this disease.

5. Histoplasmosis

This rare disease closely simulates Kala-azar, and splenomegaly is a characteristic accompaniment. The causative organism, histoplasma capsulatus (Darling), has been isolated and studied by DeMonbreun, who was able to cultivate it either in the yeast-like form as it appears in the lesions, or as a mycelium The yeast-like form is the pathogenis phase of the fungus.

6. Torulosis

The spleen is often involved in the systemic form of this disease, but is not greatly enlarged.

7. The mycoses

The spleen is moderately enlarged and may contain multiple abscesses with considerable fibrosis in cases of actinomycosis and blastomycosis. Systemic sporotrichosis may cause chronic suppurative changes in the spleen. The diagnosis of these conditions rests upon the demonstration of the causative organism in lesions in other parts of the body.

F. Disturbances of the hemopoietic system which are accompanied by splenic enlargement.

1. Congenital or familial hemolytic jaundice (Chauffard-Minkowki)

The spleen is found to be uniformly enlarged in this disease, varying from 500 to 12,000 grams and averaging about 900 grams. This disease represents one of the purest types of chronic hemolytic anemia. The essential diagnostic feature in the blood is the increased susceptibility of the cells to hemolysis by hypotonic salt solution. It was Gänsslen who originally suggested that the increased sphericity of the red blood cells was responsible for this effect. No correlation exists, however, between the degree of anemia and the decreased resistance of the erythrocytes to hypotonic saline solution. The other points of diagnosis are: tracing of the transmission of the disease as a Mendelian dominant by either parent, increased plasma pigments, indirect positive van den Berth reaction, and increased excretion of urobilinogen in the feces particularly when jaundice is present. At these times, the reticulocytes, platelets and leukocytes will also be increased.

2. Acquired hemolytic jaundice (Hayem-Widal).

This condition is neither as frequent nor as well defined as the congenital or familial type. Certain investigators consider the acquired type to be merely a manifestation of a latent familial type. The acquired type apparently develops following attacks of malaria, after syphilis or other infections, but may also occur without evident cause. Rarely does the elimination of the infection clear up the anemia. The resistance of the erythrocytes to hypotonic saline is decreased, and the spleen is usually moderately enlarged. The presence of a macrocytic type of anemia and the occurrence of auto-agglutination are important in diagnosis.

3. Pernicious anemia

The spleen is only slightly enlarged in pernicious anemia and only occasionally palpable. In only 20% of a series of 67 fatal cases reported by Barron and Litman did its weight exceed 300 grams.

4. The leukemias

The spleen is uniformly involved in the leukemias and attains its greatest size in the chronic forms, especially chronic myelogenous leukemia In this disease, spleens weighing between 2,000 to 4,000 grams are fairly common. The most characteristic histological change in the leukemic spleen is the overgrowth of myeloid or lymphoid cells in varying degrees. The diagnosis of the leukemias and the separation of the individual types requires careful study of the blood and at times bone marrow biopsy.

5. Erythremia (Polycythemia Vera, Vacques-Osler disease).

This relatively uncommon disease is characterized by a great increase of the erythrocytes and hemoglobin in the circulating blood. The spleen is usually enlarged and palpable and sometimes may assume enormous dimensions. This enlargement is due to hyperplasia of the pulp and to the enormous stuffing of the organ with erythrocytes.

6. Hodgkin's disease

The spleen is frequently enlarged in this condition due to a nodular infiltration with the characteristic granulomatous tissue. The usual weight of the spleen is less than 1000 grams but spleens weighing more that this are not uncommon. This condition may be separated from the group of diseases which cause peripheral lymph node enlargement by biopsy and microscopic examination of a peripheral lymph node. The cervical or axillary lymph nodes are best suited for this purpose as wounds made in the groin are slow in healing and lymph nodes taken from the latter area are often overgrown by fibrous tissue resulting from previous chronic nonspecific inflammatory reactions.

7. Idiopathic hypochromic anemia

This condition, which occurs almost exclusively in women between 25 and 45 years, is very rare after the menopause. It is accompanied by enlargement of the spleen in about 50% of the cases. The frequency of gastric achlorhydria combined with a thorough study of the blood and the absence of any other contributing factor to the patient's anemia will serve to differentiate this disease from other similar conditions.

G. Enlargement of the spleen associated with disease of other organs

1. Heart failure

In this condition the spleen may be moderately enlarged and in a few cases has been known to reach the size of 600 to 900 grams.

2. Cirrhosis of the liver

It should be pointed out that in this disease the spleen shows a greater tendency toward enlargement than the liver. In about one-half of the 129 cases reviewed by Barron and Litman, the livers found at autopsy were smaller than normal and in the remaining instances the livers were either normal in size or only moderately enlarged. In 34% of their 129 cases, the spleen weighed more than 300 grams and exceeded 600 grams in 11%. The relative size of these two organs must be kept in mind as many of the characteristic diagnostic features of this disease may be lacking, such as: ascites, collateral circulation between the portal and systemic circulations, leukopenia, increased urobilinogen excretion in the urine, and a positive Takata-Ara test.

3. Amyloid disease

This is a general metabolic disease, brought about by a chronic infectious process, characterized by the accumulation of a peculiar homogeneous material in certain organs (the spleen, liver, kidney and adrenals). The spleen rarely escapes in general amyloidosis and is one of the first organs involved but it is not always enlarged. Barron and Litman found it to be enlarged in but 13.5% of 89 cases at autopsy.

4. Thrombosis of the portal or splenic vein

Excluded from this group were those instances in which portal or splenic vein thrombosis accompany splenomegaly due to other causes, e.g., Banti's Disease. Thrombosis of these veins may be either infectious or bland. The onset is slow or sudden. When infected, the onset is usually sudden and is accompanied by sudden abdominal pain, collapse and moderate splenomegaly. Intra-abdominal suppuration is the most common cause. The formation of bland thrombi in the portal or splenic vein is usually slow in onset and many are unrecognized prior to autopsy. In this instance, the main contributory causes are injuries to the wall of the veins, as from invasive malignant growths, extension of nearby infections, and the slowing of the blood stream. The spleen is usually palpable in these conditions but seldom is it more than moderately enlarged.

5. Felty's syndrome

In 1924, Felty described a syndrome characterized by chronic deforming arthritis, lymphadenopathy, leukopenia, cutaneous pigmentation and

splenomegaly, occurring in middle aged adults, and accompanied as a rule by secondary anemia. This condition, generally thought to be a counterpart in adults of Still's disease in children, has been observed since then by other American investigators. Similar clinical pictures may be found in the European publications referred to as Still-Chauffard's disease. The cause of this condition is not clear although a low grade sepsis has been favored by most writers and the etiological agent believed to be a streptococcus of the viridan's type.

H. Enlargement of the spleen caused by pathological storage in the reticulo-endothelial system.

1. Gaucher's disease

This rare form of splenomegaly is definitely familial but apparently not hereditary. Most of the patients are females of Hebrew extraction? The disease frequently begins in early childhood, only occasionally in later life. The spleen is enormously enlarged and weights of 3,000 to 7,000 grams are common. The microscopic picture is characteristic, showing large, clear hyperplastic reticular cells in the pulp arranged in compact groups and exhibiting an intracellular foamy striation. Additional clinical diagnostic points are: hypochromic anemia, usually not severe until late in the disease, leukopenia, brownish pigmentation of the exposed surfaces of the skin, and hemorrhages from the skin, mucus or serous membranes.

2. Niemann-Pick disease

This rare disease affects female infants and has a predilection for the Hebrew race? The liver as well as the spleen is enlarged. The disease usually runs a very rapid course, terminating within a few weeks or months. Anemia and leukocytosis are characteristic. Microscopically, widespread storage of fats and lipoids are found in the spleen, and these react with the ordinary stains for fat. (Note: Jewish patients go to Jewish physicians who are good observers and reporters? Ed.)

3. Lipoid storage in diabetes mellitus

Occasionally in diabetes, widespread lipoid storage has been observed at autopsy. The reticular and endothelial cells of the spleen contain large amounts of lipoid and neutral fat. The weight of the spleen is only moderately increased, weights from 300 to 500 grams being most common. This complication is more common in diabetic patients having a high grade lipemia.

4. Hemochromatosis

This disease may be defined as an inborn error of metabolism which expresses itself as an intracellular circulation of iron leading to an increase in the amount normally present and the ultimate destruction of the involved cells and their replacement by fibrous tissue. The outstanding features of hemochromatosis are increasing pigmentation of the skin, diabetes mellitus and cirrhosis of the liver and its relative rareness in women. The spleen is often palpable, but large spleens are uncommon. The iron pigment is found in both the endothelial and reticular cells, and considerable proliferation of the latter is observed.

I. Idiopathic fibroses of the spleen which cause enlargement

Diffuse splenic fibrosis of unknown etiology accompanied by a varying degree of splenomegaly may occur as a primary disease, with or without secondary cirrhosis of the liver, as well as in association with primary cirrhosis of the liver. In the former conditions, spleens weighing between 2000 to 4000 grams have been reported frequently. It should be noted that neither the size of the liver nor the degree of portal obstruction bear any relation to the extent of splenic enlargement.

Splenomegaly occurring with thrombosi of the splenic vein has been described as

a distinct entity. There is little basis, however, for the separation of this condition from the other idiopathic splenomegalies, and it is more reasonable to assume that the thrombosis of the splenic vein is merely a part of the disease complex.

In describing the disease complex named for him, in which splenic fibrosis and enlargement are characteristic, Banti divides the clinical course of the disease into 3 stages:

1. The primary stage lasting 3 to 12 years, characterized by splenomegaly and a hypochromic moderately severe anemia showing little evidence of blood regeneration.

2. The second stage of 12 to 18 months duration, characterized by hepatomegaly, jaundice, and commonly gastrointestinal disturbances.

3. In the third stage, the chief symptoms are due to the cirrhosis of the liver, ascites being outstanding. A fatal termination is the rule. At autopsy the spleen is found to be enormously enlarged, weighing between 2000 and 8000 grams and is pale red and firm on section.

Banti's disease, or splenic anemia, usually begins in early adult life. The course is chronic, and as noted above, may extend over many years. The diagnosis is difficult as it cannot always be determined ante-mortem that the condition is primary in the spleen.

J. Splenomegaly due to cysts

1. Primary

Primary, single, or multiple cysts are occasionally observed in the spleen and may cause at times a marked enlargement of this organ.

2. Parasites

Cysts occur frequently in the spleen in echinococcus disease and should such cysts rupture, death from hemorrhage may ensue.

3. Blood

Cystic primary tumors of angiomatous type are rarely observed. In polycythemia, blood filled cysts have been noted.

K. Splenomegaly due to neoplastic disease

In striking contrast to the relative frequency of enlargement of the liver due to either primary or metastatic neoplasm is the almost complete absence of splenic involvement by these conditions. Barron and Litman found malignant tumors, both primary and metastatic, to comprise the principle source of hepatomegaly. In over 1000 cases of malignant growths studied at autopsy in their series, only 7, or less than 1%, showed any splenic enlargement. In only one of these 7 cases was the splenic enlargement due to a tumor metastasis. In five, the splenomegaly resulted principally because of congestion from pressure of enlarged lymph nodes on the splenic veins. Chorionepithelioma is said to metastasize with greater frequency to the spleen than any other neoplasms. Primary tumors of the spleen are equally as rare although lymphosarcoma, fibroma and sarcoma, having their origin in the splenic connective tissue, have been reported.

L. Trauma

A palpable mass, made up of spleen surrounded by clotted blood, may be felt in the left upper abdominal quadrant following rupture of the spleen due to trauma. Diseased spleens, such as those occurring in malaria, are more easily ruptured. Rarely do such tears heal spontaneously, and splenectomy may be a life saving measure.

M. Additional aids in the differential diagnosis of splenomegaly

Only those procedures which relate definitely to the spleen itself will be presented here, as it would be virtually impossible to review the large number of other diagnostic procedures

which are utilized in differentiating the various diseases accompanied by splenomegaly.

1. Splenic puncture

It appears that this valuable aid to diagnosis has been overlooked to a considerable extent. When reasonable care is exercised splenic puncture is a harmless procedure. It is contraindicated, however, in conditions where there is a tendency to bleed as in the septic states and when the spleen is enlarged and soft. Uncontrollable hemorrhage has been known to follow puncture in these instances. The use of the bone marrow biopsy has replaced splenic puncture somewhat in the diagnosis and differentiation of the leukemic states. Even at the present time, however, it may be the only means of confirming a diagnosis of malaria or Kala-azar. (Our experience with Health Service patient).

2. Roentgen visualization

It is sometimes impossible to determine by physical examination alone whether a palpable mass in the left upper quadrant of the abdomen is spleen, tumor of the kidney, subphrenic abscess, or neoplasm arising from the peritoneum. In these instances roentgen examination offers two approaches to this problem.

a. Thorotrast

Following the intravenous injection of thorotrast, which is retained by the liver and the spleen, these organs can be visualized and their location in the abdominal cavity as well as their size and shape determined.

b. An enlarged spleen characteristically displaces the stomach and the colon and the degree as well as the direction of the displacement may be detected when these organs have been filled with barium. Characteristically an enlarged spleen displaces the stomach to the right and compresses the greater curvature. Although the splenic flexure of the colon is usually displaced downward by an enlarged spleen, this need not occur, since the descending arm of the splenic flexure of the colon may be displaced to the right, and the superior margin of the colon remain under the diaphragm. It should be remembered that the spleen is always above and lateral to the colon and that the cardiac as well as the middle portion of the stomach is displaced by it when enlarged.

N. Conclusions

1. Splenomegaly is defined as any measurable increase in the size of the spleen.

2. The spleen, which averages 150 grams normally, will as a rule exceed 300 grams in weight when involved by a pathological process and at this stage it is usually palpable.

3. Because the organ is capable of varying to a greater degree in size than any other organ of the body and because it is so situated that enlargements are readily palpated, splenomegaly is a helpful sign in differential diagnosis.

4. Methods of physical examination helpful in eliciting splenic enlargement are detailed.

5. A table showing the incidence of splenic enlargement in various diseases is presented.

6. Many of the acute infectious diseases are accompanied by a moderate splenomegaly.

7. Of the chronic infections, tuberculosis, malaria, congenital syphilis, Kala-azar, histoplasmosis, torulosis and the mycoses are frequently accompanied by splenic enlargement.

8. In disturbances of the hemopoietic system, the spleen is uniformly enlarged in both types of hemolytic jaundice, averaging about 900 grams. In pernicious anemia, slight enlargement occurs in about 20% of the cases. The spleen is uniformly enlarged in the leukemias and attains its greatest size in the chronic myelogenous form. The spleen is commonly enlarged in erythremia, Hodgkin's disease, and idiopathic hypo-

chromic anemia, but its weight in these diseases seldom exceeds 1000 grams.

9. The spleen is palpable and moderately enlarged in about one-third of the cases of cirrhosis of the liver.

10. In amyloidosis, the spleen is almost always involved, but enlargement does not occur in more than 15% of the instances.

11. Felty's syndrome or splenomegaly accompanied by chronic deforming arthritis, lymphadenopathy, leukopenia and cutaneous pigmentation has now been described by a number of writers, but further investigations as to the etiology of this disease complex are necessary.

12. Gaucher's disease and Niemann-Pick disease are usually accompanied by splenomegaly and the microscopic picture of the spleen in these diseases is very characteristic. In hemochromatosis the spleen is frequently palpable but enlarged spleens are uncommon.

13. In the idiopathic fibroses of the spleen, the spleen may enlarge enormously, and weights from 2000 to 4000 grams are not uncommon.

14. Cysts of the spleen, either primary, parasitic, or those occurring with angiomatous tumors or in polycythemia vera are rare but when present frequently cause enlargement of this organ.

15. The spleen is rarely involved by neoplastic disease, either primary or metastatic.

16. Of the additional aids in the differential diagnosis of splenomegaly, splenic puncture and roentgen examination may be indispensable. The former procedure may be especially useful in confirming a diagnosis of Kala-azar or malaria.

17. Roentgen examination of the spleen, either by utilizing the spleen's ability to retain thorotrast, when this is injected intravenously, or by the effects of an enlarged spleen in displacing nearby organs, is sometimes required in the differential diagnosis of an enlarged or palpable mass in the left upper quadrant.

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P. Case Reports

It would be impossible to present here case reports of each of the diseases which are accompanied by splenomegaly. Therefore, only a few of our more interesting recent cases are included.

1. SUBACUTE BACTERIAL ENDOCARDITIS

This case is that of a white male, aged 46 years, admitted to the University of Minnesota Hospitals 4-20-37, expired 5-3-37. Total hospital stay - 13 days.

Past history

Rheumatic fever at 7 years of age. At 34 had penile lesion for which he was given a 3 weeks course of local treatment. During year prior to admission had attacks of dull epigastric distress, occurring after meals and at night, relieved at times by soda.

Present illness

In middle of January, 1937, developed acute upper respiratory infection from which he apparently recovered uneventfully. On February 4th, had an attack of crampy right upper quadrant pain not accompanied by nausea or vomiting. Shortly after onset of this pain, had chills and fever. On February 5th, jaundice was first noted. Chills, fever, and jaundice persisted for about 10 days and then subsided. Shortly after onset of present illness, a macular rash appeared over the upper chest, but this also subsided during the latter part of February. At about the same time as the onset of jaundice, also developed a left sided pleurisy which persisted for about 10 days before it subsided. The latter part of February the patient felt considerably improved and was allowed to be up and about for short intervals.

Recurrence

On March 3rd, chills and fever recurred, and patient has been more or less confined to bed. During past 10 days chills and fever had been quite marked and were accompanied by profuse perspiration.

Physical examination

Well developed and nourished with evidence of recent weight loss. Appeared acutely ill. Icteric tinge to sclerae; pupils regular and equal but reacted sluggishly to light. Blood pressure 138/88. Small petechia was present on the right tonsillar pillar. Lungs were clear.

Heart

Peculiar rough diastolic murmur heard along left border of sternum, third and fourth interspaces and also in aortic area. Second pulmonic tone was louder than the second aortic. Liver palpable, 4 cm. below right costal margin. Spleen was palpable but soft. Neurological examination revealed lateral nystagmus on looking to the side. Deep reflexes equal but hyperactive.

Laboratory examination

Urinalysis: persistent trace of albumin. Cellular and hyalin casts in the sediment and later waxy casts. White blood cells also present. Hemoglobin 70%, leukocytes 21,300 (89% neutrophils, 11% lymphocytes). Nonprotein nitrogen 97.8 mg. percent, icteric index 5 units. Blood Wassermann negative; no occult blood in stools. Blood cultures sterile. Repeated examinations of blood for presence of reticuloendothelial cells and for malarial parasites were negative.

Radiologic

Chest shows some indefinite mottled areas along the lung markings which could represent small patches of consolidation. A six foot plate of the heart showed the measurements to be as follows: transverse thoracic 31.0 cm., M. L. 10.0 cm., M. R. 4.7 cm., total of 14.7 cm. This was interpreted as a slight enlargement of the left ventricle. Intravenous pyelography showed both kidneys to be well visualized, the right being slightly larger than normal, the left within normal limits. No excretion of intravenous dye could be made out at the end of 47 minutes, due probably to the poor function of the kidneys?

Progress

Several blood transfusions were given. Temperature continued to be of spiking type, ranging from 95° to 104°. Renal insufficiency progressed, nonprotein nitrogen reading being 148 mg. % on

April 26th and 230.8 mg. % on April 30th. Leukocytes in blood remained elevated, being 16,450 with 86% neutrophils on April 28th.

In spite of numerous blood transfusions, hemoglobin had fallen from 70 to 55%. April 29th began to be visibly jaundiced, and jaundice developed rapidly after that, the icteric index being 57 units on April 30th. Accompanying onset of jaundice, positive cuff resistance test was found. Was given amidopyrine, 5 grains, 3 times daily. Following this peaks of temperature subsided, but there was no effect upon the frequency or severity of the chills which still occurred at least once daily. As many white blood cells had been found in the urinary sediment, and as the patient also had a hypospadias, it was believed to be related. Gradually grew weaker, slowly lapsed into coma, and expired on May 3rd. Oliguria for several days prior to death, the patient excreting less than 200 cc. daily during this period. Clinical diagnosis subacute bacterial endocarditis.

Autopsy

The body is that of a well developed, well nourished white male, measuring 176 cm. in length and weighing about 180 lbs. Moderate generalized jaundice; no edema. Conjunctivae jaundiced but showed no petechiae. Heart weighs 430 grams. No pericarditis. Epicardium scattered petechial hemorrhages and a few milk spots. Mitral valve shows moderate degree of old rheumatic valvulitis, especially in anterior leaflet. There are also a few small vegetations at the line of contact of the mitral leaflets. Pulmonary valves show extreme degree of damage, the ventricular surface of each cusp being covered with vegetations up to 5 mm. in diameter. The left ventricle is not hypertrophied, but the right ventricle shows moderate hypertrophy and slight dilation.

Splenomegaly

Spleen weighs 860 grams. The surface is smooth, and on section is dark red in color and soft in consistence. No infarcts are present.

The liver weighs 2860 grams and shows cloudy swelling.

2. HODGKIN'S DISEASE

Case is that of a 35 year old white male, admitted to hospital 11-13-36 and died 11-28-36; total hospital days, 15.

Past history

Essentially negative except for chronic cough for 3 years; no history of tuberculosis or Hodgkin's disease in family.

Present history

March, 1935, first noted development of pea sized mass in left supraclavicular region. More masses subsequently appeared, and these became enlarged like a bunch of grapes. Masses were not painful at this time.

August, 1936, right supraclavicular mass spontaneously decreased in size and almost disappeared. October 1st, epigastrium, disappearing about November 1s October 9th, 1936, was admitted to hospital.

Physical examination

Shows discrete right cervical, axillary and inguinal nodes. Spleen is slightly enlarged. Urinalysis faint trace of albumin. Hemoglobin from 60% to 40%. Biopsy of right supraclavicular node shows Hodgkin's disease.

November 13, 1936, was admitted to this hospital. Forty lb. weight loss during present illness. Palpable right cervical, axillary and inguinal lymph nodes and fullness in abdominal upper quadrant, which was thought to be massiv enlargement of liver. Blood pressure 112/68.

Laboratory

Urinalyses negative. Hemoglobin 42%, erythrocytes 2,550,000, leukocytes 4,80C with 76% neutrophils, reticulocytes 1%; icteric index 13 units November 21st; blood Wassermann reaction negative.

Radiologic examination

Chest shows evidence of no enlargement of mediastinal glands. Some increa in bronchovascular markings.

Progress

Temperature remained constantly elevated, varying from 103° to 104.2° F. At times irrational. Condition grew steadily worse. Blood transfusions given November 17th and November 19th. Unconsciousness during last 3 days of life and expired November 28th, 1936. Because of condition no deep x-ray therapy was given at any time.

Autopsy

Body is that of a well developed, moderately emaciated male, 163 cm. in length and weighing about 115 lbs. Slight edema of left lower extremity. Moderate generalized jaundice. Abdominal cavity contains about 1000 cc. of clear yellow fluid. Liver edge is flush with costal margin.

Splenomegaly

Spleen weighs 525 grams and on section the pulp is dark red and speckled with numerous brown and yellow areas varying in size from 2 mm. to 1 cm. The appearance of the spleen is that seen in Hodgkin's disease.

Liver weighs 1740 grams, and there is slight chronic passive congestion. No Hodgkin's lesions were visible in the liver.

In right supraclavicular region there are about one-half dozen fibrous nodes up to 1 cm. in diameter. There are no palpable axillary nodes. The inguinal nodes are small. Around lower portion of thoracic aorta there are a few small nodes. Around upper portion of abdominal aorta, root of aorta, root of mesentery and pancreas, there is a large fused mass of lymph nodes which surrounds a large portion of pancreas, but has not infiltrated it. This mass measures about 7 x 7 x 12 cm.

3. SPLENIC VEIN THROMBOSIS

The case is that of a white male, 53 years of age, admitted to University of Minnesota Hospitals 3-13-37 and expired 3-30-37; total stay in hospital 17 days.

Past history

During past 6 months had chronic cough with expectoration of grayish greenish sputum containing no blood. Sister had died of tuberculosis about 15 years previously; a brother had tuberculosis for 8 months 13 years ago but was apparently well at the present time. During past 3 to 4 months, the patient had noted tarry stools, progressive weakness and anorexia. There had been no constipation, nausea or vomiting.

Present illness

One week prior to admission to this hospital, developed sudden sharp, severe pain in the epigastrium which did not radiate, was cramp like, and occurred about 1 hour after eating evening meal. Was admitted to a hospital, enamata given, and distress relieved. 2 days later, however, experienced same symptom and these persisted up to the time of admission here. Loss of weight of 15 lb in last 3 months.

Physical examination

Blood pressure 120/78. Heart borders and tones normal. No lymphadenopathy. Dullness, and decreased breath sounds ov left base posteriorly. Abdomen is moderately distended and shows tenderne on pressure in epigastrium. No rebound tenderness. Liver and spleen are not palpable and later on repeated examinati the spleen is not palpable. The remaind of the general physical examination is essentially negative.

Laboratory

Urinalysis 2+ albuminuria, a few granular casts, and 5-10 red and white blood cells per high power field. Hemoglobin 45%, erythrocytes 2,200,000, leukocytes 11,200, 76% neutrophils; nonprotein nitrogen 35 mg. %; chlorides 558 mg. %; blood Wassermann reaction negative; Mantoux test positive. No fre hydrochloric acid in gastric contents. Five examinations of the stools are nega tive for occult blood. Three examinati of the sputums are negative for tubercle bacilli; glucose tolerance test shows a fasting blood sugar of 100 mg. %, and is still elevated to 204 mg. % at the end o 2 hours.

Radiologic examinations

Gastrointestinal study shows large mass in left upper quadrant of abdomen under diaphragm. This displaces stomach markedly, especially at cardiac end, to the right. The small bowel is displaced downward, and the appearance suggests most strongly an extra-gastric mass, although the possibility of sarcoma of the upper end of the stomach could not be excluded. Studies of chest show some fluid at left base. There is no evidence of metastases in lung fields. Examination of colon by barium enema shows no evidence of intrinsic disease within colon. The splenic flexure is displaced downward by mass. Intravenous pyelogram reveals dye appearing promptly in both kidneys. Fairly normal kidney, pelvis, calyces and ureter on right side. On left side kidney could not be distinctly made out and whether the mass was primary in the kidney or not could not be definitely determined. It appeared that the mass is extrinsic to kidney and displaces it downward.

Progress

Repeated blood transfusions plus a high caloric diet with repeated feedings, raises hemoglobin to 85%. Weight, from 111 to 109 lbs. Leukocytosis persisted, increasing from 11,000 to 17,000. Continued to have low grade elevation of temperature during period. Transferred to surgical service on March 21, 1937.

March 25, 1937 - Operation

In neighborhood of spleen is large mass which proved to be a hematoma surrounding spleen. Following its identification entire mass is removed and is found to weigh 600 grams. The distal portion of the splenic vein is thrombosed, and a large portion of the spleen is infarcted.

March 29, 1937

Temperature rose to 104°, and blood pressure fell to 90/58. Soft mass in culdesac. Still feels fairly well, and there are no chest symptoms. 3-30-37, at 1:00 A.M. developed severe pain in right upper quadrant; At 2:00 A.M., pulse became weaker. At 3:15 A.M. condition extremely critical, and expired shortly after this.

Autopsy

The body is that of a well developed markedly emaciated white male. There is mild jaundice of conjunctivae and no edema. The peritoneal cavity contains 800 cc. of fluid, estimated to be about ½ blood and the other ½ purulent exudate. The spleen has been removed except for fragment at the upper pole, ½ x 2½ x 3½ cm. The splenic pedicle is intact.

Microscopic examination

Of the spleen shows small amount of fibrosis which would be expected following a thrombosis of the splenic vein. The remainder of the autopsy findings are not of note in this connection.