

THE UNIVERSITY OF MINNESOTA

GRADUATE SCHOOL

Report
of
Committee on Examination

This is to certify that we the undersigned, as a committee of the Graduate School, have given Sam Brock final oral examination for the degree of

Master of Science in Surgery

We recommend that the degree of

Master of Science in Surgery

be conferred upon the candidate.

James C. Jasson
Chairman

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REPORT
of
COMMITTEE ON THESIS

The undersigned, acting as a Committee of the Graduate School, have read the accompanying thesis submitted by Sam Brock, for the degree of Master of Science in Surgery. They approve it as a thesis meeting the requirements of the Graduate School of the University of Minnesota, and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science in Surgery.

James C. Nilsson J.C. M.
M. S. Henderson
E. C. Rosensow
J. P. Schneider

THESIS

CHRONIC ARTHRITIS

A CLINICAL AND BACTERIOLOGICAL STUDY OF EIGHTY CASES.

Sam Brock, B.A., M.D.

Submitted to the faculty of the Graduate School of the
University of Minnesota in partial fulfillment of the
requirements for the degree of Master of Science in
Surgery.

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This paper is based upon a clinical and bacteriological study of eighty cases of chronic arthritis. The patients were observed clinically in the Orthopedic Section, and the bacteriological studies were made in conjunction with Dr. J. G. Meisser in the Department of Bacteriologic Research of the Mayo Foundation. The studies were conducted over a period of eight months, from April to December, 1921. The period of observation was necessarily short in most of the cases. We have endeavored to remove all dental and tonsillar foci of infection and carry out bacteriological studies of the foci removed. In a subsequent report, we shall give the end results obtained in these cases.

The studies of Ruffer, Jones and others in paleopathology have shown that arthritis is one of the oldest diseases of which we have any historic evidence. Skeletons of the ancient Egyptians of the predynastic periods showed the disease to have been quite prevalent from the earliest times, and the pathological anatomy to have remained the same during a period of eight thousand years.

Up to the present time, there has been a tendency for the investigators in chronic arthritis to be too exclusively clinical or too purely pathological or bacteriological. These studies should be carried on with an effort to combine the scientific and practical sides of the problem.

Barker, in 1913, emphasized the importance of making clinical, pathological and etiological factors coincide.

If we can regard the changes which take place in the joints in chronic arthritis as produced by the same causative agent, and recognize the clinical variations met with as merely degrees of the same pathological process, the chronic arthritides will be brought out of their present state of vagueness and hopeless confusion of terminology and classifications.

This study does not include cases of purpura rheumatica (acute rheumatic fever) and those cases of arthritis of acute infectious origin which are sometimes seen during or directly following pneumonia, diphtheria, dysentery, scarlet fever, gonorrhoea, syphilis, etc., but deals only with cases of chronic

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arthritis in which a chronic focus or foci of infection have been demonstrated. As a rule, joint symptoms rapidly subside when an acute infectious process has been overcome, and no apparent damage to the joints involved can be found. In the great majority of cases permanent damage to the affected joints takes place only after a chronic focus has become established. The acute infections, injury, exposure, chronic constipation, constitutional disturbances (such as take place at the climacterium) and general debility may undoubtedly be predisposing factors in chronic arthritis. A chronic focus, otherwise dormant, may become activated by a sudden lowering of vital resistance. Any intercurrent infectious disease may aggravate the symptoms in an already existing arthritis.

Billings, in 1912, enumerated most of the possible sites of focal infection. A chronic focus or foci may exist in several places in the body at the same time, and a most careful search may fail to reveal them. Ely, in 1917, stressed the importance of teamwork in the search for possible foci of infection. A careful history and routine, systematic examination are essential in every case of chronic arthritis, whether symptoms pointing to a possible focus are present or absent. A Wassermann test and radiograms of antra and sinuses should be a part of every routine examination.

That chronic arthritis is a systemic, infectious disease with joint manifestations is shown by the constitutional disturbances met with in many cases. An upset metabolism, the secondary anemia, the low blood pressure, the loss of weight and strength, the nervous exhaustion and the general debility prove the systemic nature of the affection.

Femberton and his co-workers have shown that there is a limit of tolerance for carbohydrates and proteids in chronic arthritis. The lowered sugar tolerance returned to normal in many cases after the removal of causative foci of infection. In some cases, however, there may be a "permanent dislocation of normal physiology," and the removal of a definite focus of infection is not

sufficient to restore the underlying physiology of the affected joints. Any agent, therapeutic or otherwise, which tends to promote, hasten or increase metabolism, at the same time benefits the existing arthritis. A lowered sugar tolerance is indicative of some disturbance in the oxidative process.

Those cases of arthritis with onset at the menopause, or those in which the arthritic symptoms are aggravated at the climacterium might be explained on the basis of an altered metabolism. Many cases have been reported in the literature of transient improvement in arthritic symptoms during or following pregnancy.

There was nothing characteristic in the blood picture in our cases other than a variable degree of secondary anemia. Differential counts made in thirty cases do not corroborate the findings of Dahland who claims that he has been able to employ the differential count as indicative of a chronic focus of infection. Dahland holds that small cell lymphocytosis is an important diagnostic sign of periapical infection.

Draper has called attention to the presence of asthma, angioneurotic-
cedema, eczema and urticaria sometimes met with in cases of chronic arthritis. This probably is an indication of the close relationship which exists between the joint synovia and the skin, mucous and serous surfaces of the body. Draper believes that constitutional disturbances and sensitization processes are concerned in the production of these associated conditions. Lane, in 1915, advanced the theory that intestinal stasis, with resulting toxemia, lowers the general resistance and makes possible the invasion of the bacteria which cause arthritis. In order to remove this possible source of infection, he advocated colectomy or ileocolostomy and reported excellent results in his cases. In the hands of others, this procedure has met with variable degrees of success. Moynihan has observed a few improvements after colectomy. Rea Smith claims "that the method will effect a cure in a higher percentage of cases than any other method of treatment heretofore suggested".

Bassler, in 1920, reported a series of thirty-five cases of chronic arthritis in all of which all demonstrable foci of infection had been removed. Only one case had been improved. The remaining thirty-four cases were placed under observation for metabolic and gastro-intestinal study. Ten additional cases in which no focus of infection had been demonstrated were added to this number. Thirty-four were classified as saccharobuturic, two as indolic and eight as mixed types. Diets suitable to the type of toxemia present were given for a period of seventeen months. Bassler noted marked improvement in twenty-one cases, moderate improvement in nineteen and no improvement in four cases.

Schittenhelm and Schlecht, in 1920, reported a series of 140 cases of arthritis associated with enteric disturbances without previous history of intestinal disorders. The course of the arthritis in these cases was subacute and at times lasted several months with ultimate recovery and without bony change. These observers believe that the lymphatics, and rarely the mucous membrane afford the portal of entry for the bacteria. The mesenteric and retroperitoneal glands probably harbor the bacteria for a long time. Schittenhelm later called attention to the history of previous attacks of acute rheumatic fever as having favored the appearance of arthritis in many cases.

The simultaneous or subsequent development of exophthalmic goiter and arthritis have been reported, especially by French observers. Vincent, in 1908, observed an incidence of 43 per cent of cases, and regarded the hyperthyroidism as "an expression of the reaction of the defense of the organism against the arthritic process". What relation, if any, there may be between these two diseases, has not been definitely determined. The gouty and haemophilic diatheses have been recognized for a long time. A diathesis in chronic arthritis, however, has not been generally accepted. Some investigators nevertheless, claim that the familial disposition is of more importance than the specificity of the infecting bacteria. Our studies have led us to believe that

heredity does play an important part in chronic arthritis and that some individuals do have a lower joint resistance than others. Fifty per cent of our patients gave a familial history of arthritis. Billings has suggested that some protective agency might well be present in certain individuals.

EIGHTY CASES OF CHRONIC ARTHRITIS

Table 1
TYPES

	<u>Patients</u>	<u>Per Cent</u>
Proliferative-----	50	62.5
Degenerative -----	24	30.0
Spondylitic -----	6	7.5

Table 2
AGES BY DECADES

	Proliferative		Degenerative		Spondylitis		Total	
	Patients	Per cent	Patients	Per cent	Patients	Per cent	Patients	Per cent
1-10 yrs.	0	-	1	4.16	0	-	1	1.25
11-20 "	5	10.00	0	-	0	-	5	6.25
21-30 "	10	20.00	6	25.00	3	50.00	19	23.75
31-40 "	19	38.00	4	16.66	2	33.33	25	31.25
41-50 "	9	18.00	4	16.66	1	16.66	14	17.50
51-60 "	6	12.00	8	33.33	0	-	14	17.50
61-70 "	1	.196	1	4.16	0	-	2	2.50

Table 3
AVERAGE DURATION OF CHRONIC ARTHRITIS

Proliferative	-----	54.46 mos.
Degenerative	-----	96.75 "
Spondylitis	-----	58.16 "
Total Average	-----	67.42 "

Table 4
PREDISPOSING FACTORS IN CHRONIC ARTHRITIS

	Proliferative		Degenerative		Spondylitis		Total	
	Patients	Per cent	Patients	Per cent	Patients	Per cent	Patients	Per cent
Infected Teeth	40	80.00	20	83.33	5	83.33	65	81.25
Infected Tonsils	31	62.00	14	58.33	3	50.00	48	60.00
Constipation	16	32.00	11	45.83	1	16.66	28	35.00
Endometritis and endocervicitis	16	32.00	6	25.00	0	-	22	27.50
Exposure	11	22.00	5	20.83	0	-	16	20.00
Influenza	5	10.00	0	-	0	-	5	6.25
Cholecystitis	2	4.00	2	8.33	0	-	4	5.00
Injury	1	2.00	2	8.33	1	16.66	4	5.00
Antrum Infection	2	4.00	0	-	0	-	2	2.50
Exophthalmic Goiter	2	4.00	0	-	0	-	2	2.50
Menopause	1	2.00	1	4.16	0	-	2	2.50
Negative History	3	6.00	1	4.16	0	-	4	5.00

Pneumonia, low resistance, cold, hard work, sinus, ear, fissure, and hemorrhoids--one each in the proliferative type.

Our statistics agree with the observations of others in that there was a greater predilection for females than males. There were fifty-five females and twenty-five males, a proportion of two and two-tenths to one. Garrod reported the proportion as five females to one male. Boorstein reported sixty-five females to forty males, a ratio of one and sixty-two hundredths to one.

The pathology of chronic arthritis has been accurately and comprehensively described by Nichols and Richardson in 1909, by Pommer in 1912 and by Nathan in 1917. We have taken the pathologic classification of Nichols and Richardson as a basis for our clinical and bacteriological studies. We have accordingly divided our cases into fifty of the proliferative type and twenty-four of the degenerative type of arthritis. Six cases of spondylitis will be discussed separately.

The Roentgenologic Section at the Mayo Clinic reports the articular changes seen in chronic arthritis as slight, hypertrophic and destructive arthritis. These are objective, morphological findings and are of value only after definite changes in the joints have taken place. A radiographic report of slight arthritis does not suffice to make a differential diagnosis between the two types of chronic arthritis. The term "hypertrophic" is in itself misleading, as it is employed to describe bony proliferations which are met with in a variable degree in both arthritic processes. We must, therefore, depend on the clinical history and physical findings to arrive at a differential diagnosis in the very early cases. There were fifty-three positive and twenty-one negative roentgenologic interpretations made. Of the fifty-three positive roentgenograms, there were twelve with only slight cartilagenous or bony changes. Of these twelve cases, fibrous ankylosis was present in six cases. Of the twenty-one cases with negative radiograms, fibrous ankylosis was present in six cases. There remain, therefore, twenty-one cases in which the arthritic process had not yet produced sufficient osseous change so that the character of the lesion could be determined.

Twenty of this group of cases have been classified as proliferative and one as degenerative arthritis on the clinical history and physical findings alone.

There are no hard and fast rules of differentiation in the clinical course of proliferative and degenerative arthritis. In the very early stages of the disease, it is well nigh impossible to differentiate between the two types. The onset may be stormy or insidious in both and may progress with or without exacerbations in either case. Ninety per cent of our cases gave a history of gradual onset of their joint symptoms. As a rule, however, the onset in proliferative arthritis is more acute, and the progress of the disease is accompanied by exacerbations of a greater or less degree of severity. There may be a slight elevation of temperature during the attack and the affected joints may present all the signs and symptoms of an acute or subacute inflammatory reaction. The temperature was recorded while the patients remained under our observation from one to six weeks. It was found to be normal in all but a few cases. In no case was there an elevation of temperature above 100°F. except in those few which experienced reactions following the removal of their foci of infection. The pain may be so severe that the patient is completely incapacitated for several days. The process may be confined to one or more joints for a variable length of time, but the tendency is towards polyarticular bilateral involvement and true fibrous and bony ankylosis. The joints have been described as spindle-shaped which is characteristic in the proximal interphalangeal articulations of the fingers. The enlargement is due to the swelling of the periarticular tissues. Myositis and neuritis were present in 16.32 per cent and myositis alone in 40.8 per cent of the proliferative group of cases. In only one case of the degenerative group was a history of myositis and neuritis associated with arthritic symptoms obtained.

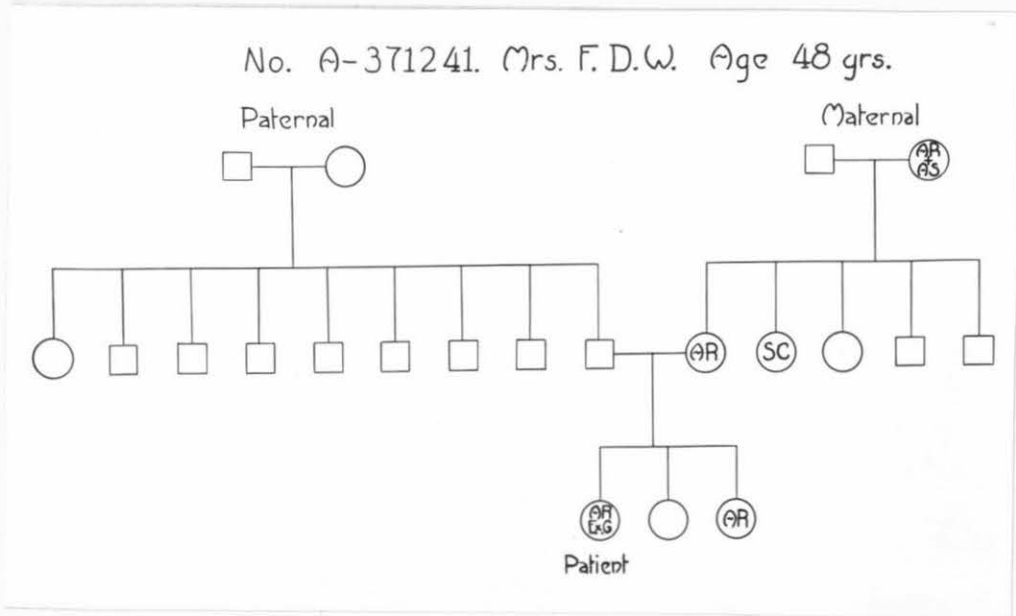


Chart 1

CASE NO. A371241 Mrs. F. D. W. Age 48. Occupation, Housewife.

The patient was admitted to the Orthopedic Section September 6, 1921.

FAMILY HISTORY: Her maternal grandmother had had arthritis and asthma. Her mother had had severe arthritis and had been an invalid for many years. One maternal aunt had had severe sciatica. One sister had arthritis.

CLINICAL HISTORY: For twenty-five years, the patient had had frequent attacks of sharp, lancinating pains across the upper back and shoulders. Nine years ago, she had had a sudden severe attack of pain in the joints of the knees, ankles, fingers, wrists and shoulders. The joints had become swollen, tender and stiff, and there had been much local heat present. The temperature had not been high and there had been no chill. The attack had lasted two weeks and the swelling of the joints had gradually subsided. There had remained a limitation of motion of the knee joints. She had continued having slight exacerbations in the affected joints and the knees had become so stiff that she had been obliged to use crutches. Six years ago, following tonsillectomy, she had had a second severe relapse and the elbows had become affected. About the same time she had begun having severe attacks of "sciatica". She had been quite nervous for the past ten years and had had frequent attacks of tachycardia and dyspnea on exertion. During the past summer she had perspired profusely. Her appetite had remained good, never ravenous. She had lost as much as twenty-five pounds at times, but had always regained the weight lost. She had had frequent attacks of tonsillitis until the tonsils had been removed six years ago. Following tonsillectomy, the arthritis had improved for about a year. She had had much dentistry, and several teeth had been devitalized. Two infected teeth had been extracted three months ago. Menopause five years ago without having affected the arthritic condition. Bowels regular. Her general condition had been improving for the past nine months.

PHYSICAL EXAMINATION: Well nourished. Weight 141 pounds. Pulse 108. Temperature 98.6. Systolic Blood Pressure 170. Diastolic Blood Pressure 70. Right elbow limited to 135 degrees extension. Both knees symmetrically enlarged. Figures 1, 2 and 3. Extension to 150 degrees and flexion to 135 degrees. Attempt at motion caused severe pain. No crepitation elicited. Ankles enlarged and motion somewhat limited. The patient was kept under observation for two weeks during which time four infected teeth were extracted. It was then decided to attempt gradual straightening of the knees. Extensions were applied. Within twenty-four hours, she had developed definite signs and symptoms of hyperthyroidism. The Basal Metabolic Rate was plus 68. Thyroidectomy October 13, 1921.



Figure 1. (Case A371241). Proliferative Arthritis Knee Joints.



Figure 2. (Case A371241). Roentgenogram of Proliferative Arthritis of the right knee joint shown in Figure 1. Antero-posterior view.

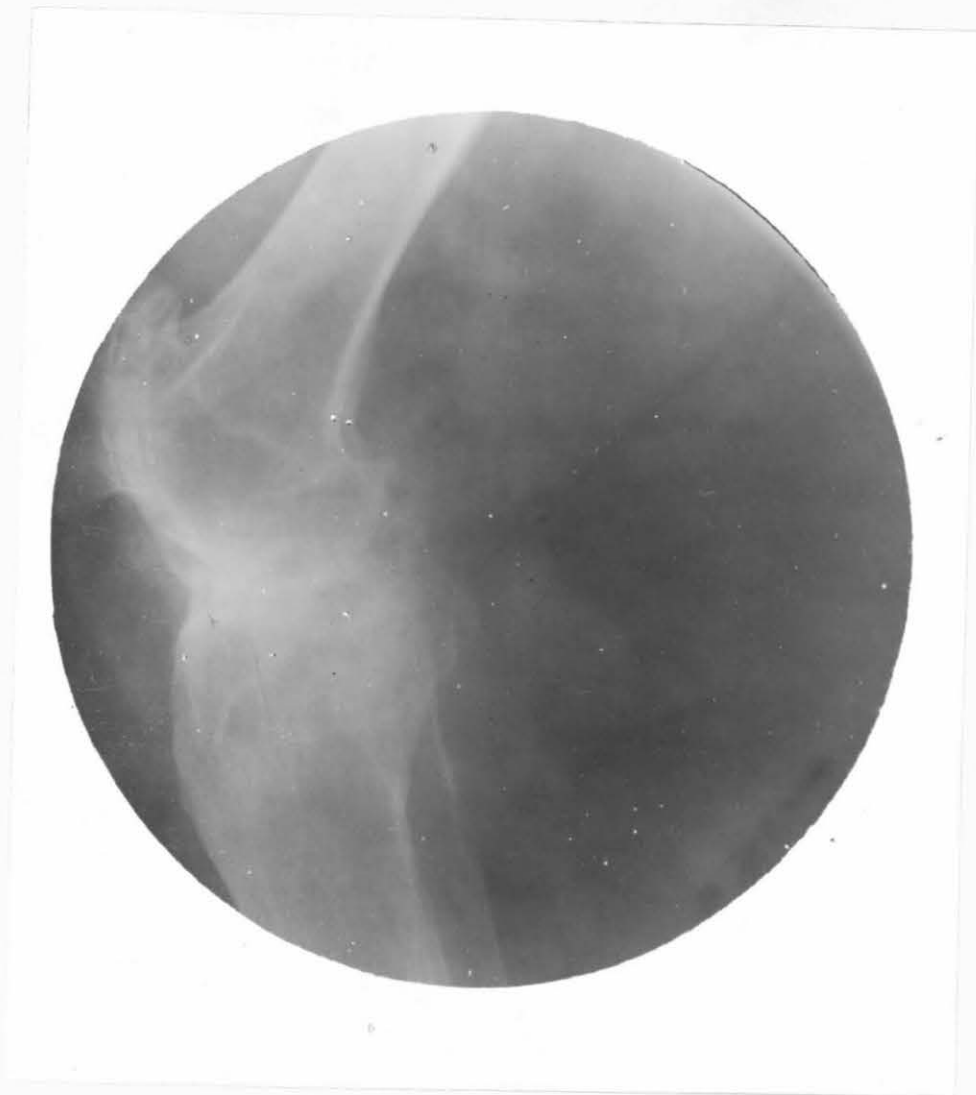


Figure 3. (Case A371241). Roentgenogram of Proliferative Arthritis of the left knee joint shown in Figure 1. Lateral view.

The degenerative type of arthritis may simulate the proliferative type, especially in its incipiency and the process may continue with exacerbations throughout the course of the disease. This has naturally lead to confusion in classification, as the clinical course is that of proliferative arthritis, whereas the deformities produced and the subsequent bony changes are those of degenerative arthritis.

CASE NO. A355744. N. R. Male. Age 51. Occupation, Salesman.

The patient came under observation April 19, 1921.

FAMILY HISTORY: His father had had the same type of arthritis at forty-five years of age.

CLINICAL HISTORY: Gradual onset nine years ago with slight pain in the left shoulder joint. Two months later, the pain had set in in the right shoulder joint and the fingers and knuckle joints of the right hand had become involved. The fingers and knuckles had been slightly swollen, red and tender, and there had been local heat present. Three months later, five months after the first symptoms had begun, both knees, the right ankle and the right metatarsal joints had become affected. Two years ago, the left hand had been attacked. He had had six exacerbations which had confined him to bed for three or four days. The pain had been very severe during attacks and the joints had always been tender. Last severe attack one week ago. He had noticed that the muscles of the forearms and hands had been wasting away. There had been numbness in the hands and fingers for several years. Six months ago, the arthritis had become more severe. The sterno-clavicular and the temporo-maxillary joints had been involved recently and he had had difficulty in eating. He had lost fifteen pounds in weight and had become quite nervous. The patient had been a boiler in-

spector for twelve years prior to the onset of his arthritis, and had undergone much exposure. He had always been subject to colds and sore throat. Tonsillectomy three years ago, but the sore throat had persisted on the right side and had been especially severe during the past six months. Ten months ago, he had had two teeth extracted. His bowels had always been regular.

PHYSICAL EXAMINATION: The finger joints were slightly enlarged and tender.

There was ulnar deflection of the fingers of both hands, more marked on the right. Figures 4 and 5. Crepitation was present in fingers and wrists. Both knees slightly enlarged. No free fluid. Motion free. Grating and cracking in joints on motion. Ankles slightly swollen and painful. Some limitation of motion. Tenderness present over right metatarsal joints and sterno-clavicular joints. Could not open mouth to full extent. Spine free.

OPERATION: Close inspection revealed a very large tonsillar tag, buried in scar tissue, in the upper right fossa. Removed cleanly.



Figure 4. (Case A355744). Degenerative Arthritis of the finger joints.



Figure 5. (Case A355744). Roentgenogram of Degenerative Arthritis of the finger joints shown in Figure 4.

As a rule, however, degenerative arthritis has an insidious onset and pursues a slow, progressive course without definite exacerbations and without marked constitutional symptoms.

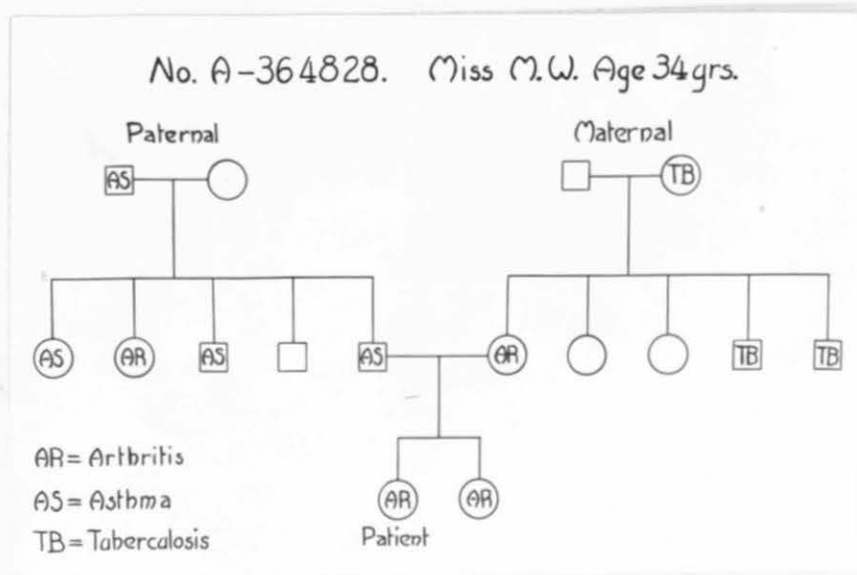


Chart 2.

CASE NO. A364828. Miss M. W. Age 43. Occupation, Teacher.

The patient was admitted to the Clinic July 14, 1921.

FAMILY HISTORY: The patient's mother had had the same type of arthritis with onset at 30 years of age. One sister had arthritis.

CLINICAL HISTORY: Eighteen years ago, the patient had noticed a very gradual stiffening and loss of motion of the finger joints of both hands. The process had advanced so slowly that she had hardly realized the loss of function of the affected joints. After ten years the proximal phalangeal joints had become dislocated with resulting ulnar deflection. The finger joints, temporomaxillary joints, elbow joints and dorsal spine had become involved in sequence over a period of years. Twenty years ago, she had had a periapical abscess of tooth number eight, which had drained for three months. Subsequently, several teeth had been devitalized and there had been much dentistry from time to time. In 1905 and 1907, she had had an infection of the right antrum which had cleared up each time with puncture and lavage. There had been a slight vaginal discharge for many years. There had always been a tendency towards constipation. Tonsillectomy six years ago had not affected the progress of the disease. Her general health had always remained good.

PHYSICAL EXAMINATION: The skin of the forearms and the hands was dry and atrophic. The joints of the fingers showed marked deformity with ulnar deflection, relaxation and free lateral motion with crepitation. Figures 6, 7 and 8. There was false ankylosis of both wrists and left elbow joints; slight motion elicited and crepitation felt. There was slight limitation of motion of the dorsal spine. Other joints were apparently negative.

Note: The teeth were numbered beginning with the upper left third molar as tooth number one; upper right third molar as tooth number sixteen; lower left third molar as tooth number seventeen; lower right third molar as tooth number thirty-two.

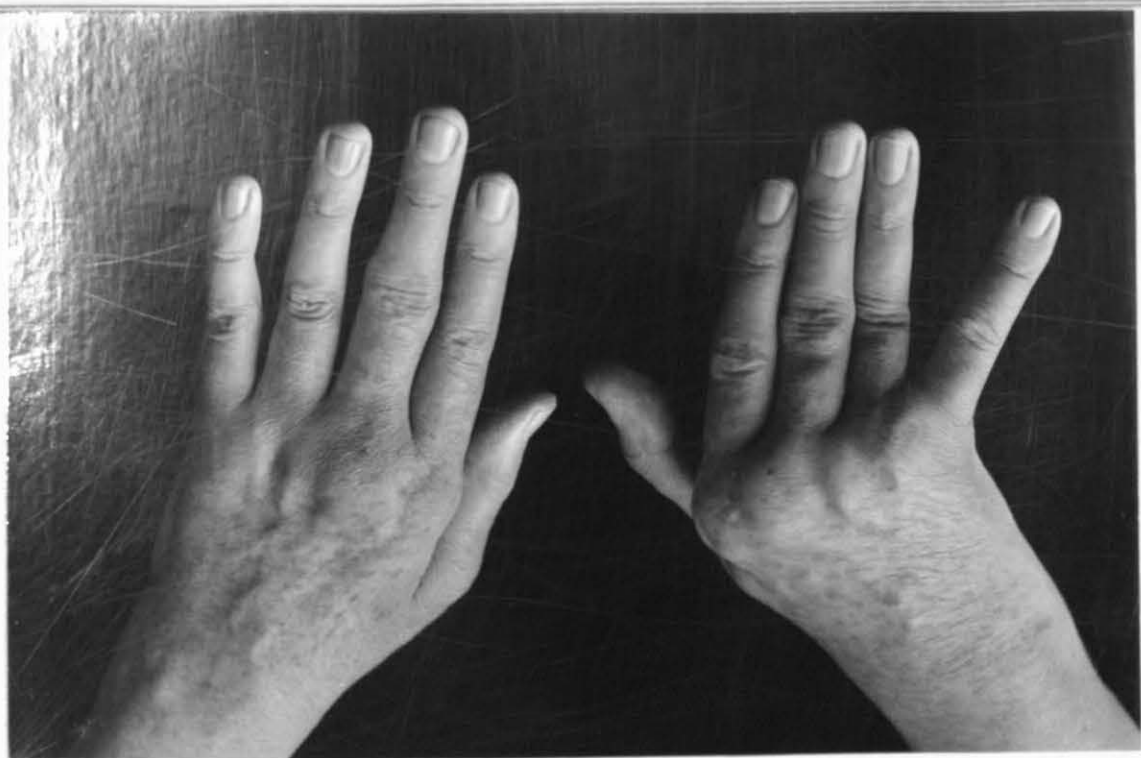


Figure 6. (Case A364828). Degenerative Arthritis of the finger and wrist joints.



Figure 7. (Case A364828). Roentgenogram of Degenerative Arthritis of the finger and wrist joints shown in Figure 6.



Figure 8. (Case A304828). Roentgenogram of Degenerative Arthritis of the right elbow joint.

One or more joints may be affected, but there is little tendency in degenerative arthritis towards rapid joint involvement. The arthritic process may, in fact, remain confined to one or more joints without further joint involvement. This is the case especially where the large joints alone, usually the hip or knee joints, are affected. Petren and Johansson, in 1921, have shown that in chronic arthritis of the hip joint, without involvement of the other joints, with very few exceptions both joints were affected by the arthritis. A bilateral involvement was established in ninety of the 103 cases reported by these investigators. Ely regards an uniarticular involvement as probably only apparent. Monarticular or oligoarticular degenerative arthritis does not lead to fibrous or true bony ankylosis. If ankylosis should occur, it is through interlocking of the joint ends, causing ankylosis by deformity. The joints are nodular and not fusiform, as is the case in the proliferative type.

CASE NO. A370938. Mrs. H. L. H. Age 58. Occupation, Hotel Keeper.

The patient came to the Clinic September 2, 1921.

FAMILY HISTORY: Maternal grandmother had had arthritis.

CLINICAL HISTORY: Twelve years ago the patient had had a severe attack of influenza which had left her in poor general health. Three months after the attack of influenza, the ankles and feet had become slightly swollen, stiff and painful, and a few weeks later the knees had become involved. Six months later, the wrists, fingers and cervical spine had gradually become affected. The arthritis had never been very severe and after the third year of the disease, the exacerbations had been slight and few. The finger joints had become markedly enlarged and deformed, but there had been no complete fixation of any joint. For the past five years the arthritic condition had been at a stand still and her general condition had improved.

She had always been subject to slight attacks of sore throat. She had had much dentistry for the past forty years and many teeth had been devitalized and several extracted. There had been no symptoms of antrum trouble.

PHYSICAL EXAMINATION: The joints of the fingers, especially the metacarpophalangeal joints showed enlargement and nodular deformity. Figures 9 and 10. Crepitation was present in all the affected joints, but there was no great limitation of motion present. Tonsils small and septic. Roentgenograms showed marked degree of infection of eleven teeth and both antra very cloudy. Puncture of both antra revealed a large quantity of foul pus.



Figure 9. (Case A370938). Degenerative Arthritis of the finger and wrist joints.



Figure 10. (Case A370938). Roentgenogram of Degenerative Arthritis of the finger and wrist joints shown in Figure 9.

Pain in the joints was a variable symptom and was present to some extent in 62 per cent of the proliferative and 33 per cent of the degenerative types of cases. The pain was constant in 18 per cent of the proliferative and 16.6 per cent of the degenerative types, and was present only with exacerbations of joint symptoms and on motion in 44 per cent of the proliferative and 16.6 per cent of the degenerative types.

Eleven and twenty-five hundredths per cent of all cases had associated their exacerbations of joint symptoms with either menstrual periods, leukorrhea, sore throat or constipation.

CASE NO. A220008. Miss G. C. Age 45. Occupation, Musician.

The patient was admitted to the Clinic for the first time Jan. 24, 1918.
Second admission August 15, 1921.

FAMILY HISTORY: Mother had had same type of arthritis.

CLINICAL HISTORY: Chronic cholecystitis was diagnosed and the gallbladder was removed, January 30, 1918. There was a marked degree of infection and the gallbladder contained a large number of stones. In 1917, the patient had had an attack of severe sore throat, and a few days later had developed an acute mastoiditis, for which she had been operated upon. The attacks of tonsillitis had continued, especially severe in the winter. She had had her first dental work at sixteen years of age. Eight teeth had been devitalized off and on since that time. She had had leukorrhea for fifteen years. No relation to arthritis. Tendency towards constipation for twenty years, which she had attributed to irregular habits. Seven months after the gallbladder operation, three years ago, pain in the joints of the fingers with swelling, stiffness and local heat had begun. She had had occasional attacks of sharp pain in the back of the neck and shoulders lasting for several days. The ankles, knees, shoulders and hips had become involved in

sequence. The condition had always been worse when she had been very tired. Weather changes, especially cold, damp weather had aggravated the symptoms. She had tired easily, felt exhausted most of the time and had become very nervous. The arthritis had been getting progressively worse.

PHYSICAL EXAMINATION: The patient appeared exhausted. The joints of fingers, ankles, and knees showed slight enlargement, but no limitation of motion. Tonsils slightly septic. Roentgenograms of teeth showed periapical infection of 4, 5, 12, 13, 15, 19, and 20. Roentgenograms of the ankles showed a slight arthritis. The other joints were apparently negative. The teeth were numbered beginning with the upper left third molar as tooth number one; upper right third molar as tooth number sixteen; lower left third molar as tooth number seventeen; lower right third molar as tooth number thirty-two.

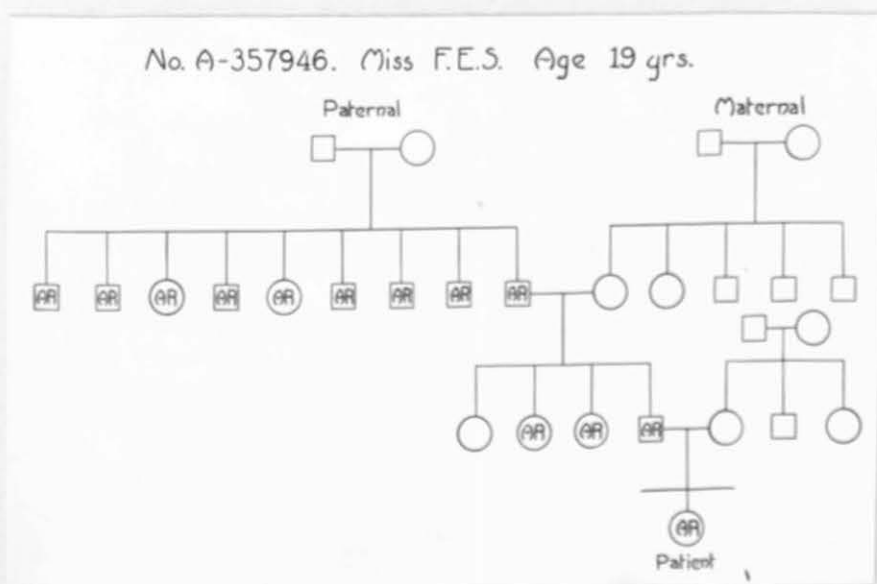


Chart 3.

CASE NO. A357946. Miss F. E. S. Age 19. Occupation, Student.

The patient was admitted to the Clinic May 12, 1921.

FAMILY HISTORY: The paternal grandfather, one great aunt and seven great uncles had had arthritis. Her father had had several attacks of rheumatic fever at the ages of ten and twenty years. Two paternal aunts had had arthritis similar to patient's case.

CLINICAL HISTORY: The patient's arthritis had begun gradually two years ago with slight swelling, stiffness, tenderness and local heat in the left knee. The condition had subsided after a few days. It had soon become apparent that the symptoms of the left knee were definitely associated with the menstrual periods, the swelling of the joint coming on shortly before the onset of the flow and gradually subsiding at the end of menstruation. This state of affairs had continued for a period of one year without having caused any great discomfort. Six months ago, however, during a menstrual period, she had had a sudden attack of very severe pain in the affected knee. The joint had become markedly swollen and she had been obliged to remain in bed for three weeks. She had had fever of 99° to 100.5° during this time. The swelling had gradually subsided, but the knee joint had had a tendency to remain stiff and she had only kept it from remaining so by massage. She had continued to have slight exacerbations at her periods, but there had been no further severe attacks. There had been slight leukorrhoea since her periods began four years ago. She had never had sore throat. No dentistry. There had been a slight tendency towards constipation for several years.

PHYSICAL EXAMINATION: Temperature 99.5°. Left knee slightly swollen and tender. Local heat present. Extension limited to 160°, flexion to 80°. No crepitation. Roentgenogram showed a slight arthritis. Tonsils small, fibrous type. Roentgenogram of the teeth, negative. Vaginal examination (Dr.

Moench) revealed a cervical erosion and a slight purulent discharge. Cultures made from the cervix (Dr. Moench) revealed a green producing streptococcus, which on animal inoculation, produced joint lesions. An autogenous vaccine was prepared. The patient was dismissed with instructions to take hot douches.

SUBSEQUENT REPORT: October 26, 1921, the patient returned to the Clinic and reported that her arthritis had become worse. The cervical spine, right knee, fingers and wrists had become involved. The exacerbations and further joint involvement had continued to be associated with her periods. The cervical erosion had practically healed (Dr. Moench). Cultures from the cervix again produced joint lesions in animals. The tonsils were removed and cultured with negative results.

CASE NO. A345669. Mrs. R. E. H. Age 24. Occupation, Housewife.

The patient came to the Clinic May 26, 1921.

FAMILY HISTORY: negative.

CLINICAL HISTORY: Five months previously, she had noticed a slight puffiness of the right knee. There had been no pain. The knee had been strapped and the swelling had soon disappeared. Two months ago, the swelling of the knee had returned, but had soon subsided. One month ago, the patient had had a very severe attack of sore throat and she had noticed that the right knee had again become swollen and that there had been slight pain on motion. The tonsillitis had cleared up and the knee apparently had become normal. One week ago, the right knee had become enlarged for the fourth time and there had been more pain than at the previous attack. This attack had also been associated with a severe sore throat.

PHYSICAL EXAMINATION: The right knee was slightly enlarged and there was a small

amount of free fluid in the joint. Slight tenderness over the median and lateral aspects. Motion not impaired. The Ear, Nose and Throat Section reported the tonsils septic and advised tonsillectomy after the acute manifestations had subsided. The cervical glands were enlarged and tender on both sides. Tonsillectomy was performed three weeks later. The Dental Section reported periapical infection of teeth numbers 4, 5, 6, 13, and 20 which were extracted.

CASE NO. A377286. Miss V. S. Age 30. Occupation, Stenographer.

The patient was admitted to the Clinic November 14, 1921.

FAMILY HISTORY: Negative.

CLINICAL HISTORY: Onset two years ago with slight swelling, stiffness and tenderness of the joints of both hands, wrists and elbows. Three months later the shoulder joints, knees, hips, ankles and lumbar spine had become involved. Recently the temporo-maxillary joint had been affected. The pain had been constant in all the joints involved, but never severe. She had been subject to occasional slight attacks of sore throat. The tonsils had been removed cleanly two years prior to the onset of her arthritis. One tooth had been devitalized ten years ago. She had had several teeth filled and two teeth had been extracted since that time. She had had irregular periods and moderate leukorrhoea since the arthritic symptoms set in. There had been a tendency towards constipation for several years, and the slight exacerbations of her joint trouble had always been associated with her constipation. Rich foods had frequently caused an urticarial rash. She had never been able to drink fresh sweet milk on that account. She had noted that the muscles of her forearms and hands were becoming smaller. There had been numbness and tingling of the hands and fingers and twitchings of the muscles.

She had lost 35 pounds in weight since onset of symptoms and had become very nervous.

PHYSICAL EXAMINATION: The patient was not able to stand on account of the pain in feet and ankles. All the affected joints showed slight enlargement and limitation of motion and grating, but there was no ankylosis present. One infected tooth No. 2 was extracted. The patient was under our observation for ten days. She was given a small dose of magnesium sulphate each morning. Cultures were made from the stools. Improvement in both arthritic and general condition was noted.



Figure 11. (Case A377286). Degenerative Arthritis of the finger and wrist joints.



Figure 12. (Case A377286). Roentgenogram of Degenerative Arthritis of the finger and wrist joints shown in Figure 11.

CASE NO. A287393. Miss R. R. Age 60. Occupation, Teacher.

The patient was admitted to the Colonial Hospital Sept. 1, 1919. Ambulance case.

FAMILY HISTORY: Negative.

CLINICAL HISTORY: In February, 1912, the patient had had a severe pneumonia

which had left her in a generally run down condition. In May, three months later, she had noticed a slight enlargement of the fingers of both hands. In July, she had had a slight chill and fever following which she had had marked swelling and pain in the hands and right elbow joint. She had gone to Hot Springs, Arkansas for six weeks and had returned entirely well. In March, 1913, she had nursed a sick sister for six weeks, and had undergone much strain and worry. In August, the hands had again become affected. A second visit to the Springs had cleared up the condition. She had taught during 1914 in a cold school house and in May she had had a relapse of joint symptoms with chills and fever. The right elbow had become partially ankylosed. To Springs for third time with only slight improvement. Christmas, 1914, had had fourth relapse and shoulder joints had become affected. Early 1915, ankles, knees and left hip had become involved. June, 1915, to Springs with some relief. Prior to 1906, the patient stated that she had had occasional attacks of sore throat. The tonsils had been "clipped" and she had had no further tonsillitis. June, 1916, the tonsils had been completely removed. Severe reaction had followed for five days. The following two months, she had gained 25 pounds, and all joints except the right elbow had become free. August, 1916, she had taken severe cold and had had return of all joint manifestations. Bed ridden to April, 1917. February, 1918, temporo-maxillary joints had become involved. Improved to November, 1918, when she had had influenza and condition of joints had become rapidly worse. May, 1919, two abscessed teeth had been removed. She had never had any teeth devitalized. From May to July, the remaining upper teeth had been

extracted and she had suffered severe reactions in all the affected joints following each extraction. The left antrum had been drained through tooth number 5.

PHYSICAL EXAMINATION: The patient was helpless. For two weeks following admission to hospital she could scarcely move without causing excruciating pain in all the affected joints. The temperature was normal. There was marked swelling of both hands and all the fingers, and the skin was tense and glossy. Figures 13, 14 and 15. The middle phalangeal joints of the left hand and the metacarpophalangeal joints of both hands were partially dislocated. Motion of the right elbow joint was limited to ten degrees flexion and extension. Abduction of the arms impossible. Circumduction of shoulder joints was markedly limited. Partial ankylosis of cervical and dorsal spine. Motion left hip, knees and ankle joints was somewhat limited and painful. The mouth could be opened about one third normal extent. All reflexes were exaggerated. Disturbances in sensation and paraesthesia of both forearms and hands and areas of hyperaesthesia over the anterior chest were present. September 29, 1919, extraction infected teeth numbers 17 and 18. November 13, 1919, Ethmoid exenteration and window resection. April 2, 1920, amputation of left middle turbinate. Ethmoid exenteration. Double antrum window resection. November 1, 1921, Denker operation, left side. Radical antrum. Cultures taken.



Figure 13. (Case A287393). Proliferative Arthritis of the finger, wrist and right elbow joints.



Figure 14. (Case A287393). Roentgenogram of Proliferative Arthritis of the finger and wrist joints shown in Figure 13.



Figure 15. (Case A287393). Roentgenogram of Proliferative Arthritis of the right elbow joint shown in Figure 13.

CASE NO. A255910. Miss G. H. Age 27. Occupation, Stenographer.

The patient entered the Orthopedic Section of the Clinic April 21, 1921.

FAMILY HISTORY: Negative.

CLINICAL HISTORY: Six months prior to admission, she had felt a slight pain in the right elbow. She had thought that she had injured the arm. The following day she had experienced the same pain in the left elbow, the pain having disappeared from the right side. A few days later, she had begun having severe pain in the left wrist and finger joints, the hand could not be raised and the fingers "drew up". The finger joints had become markedly swollen, hot, red and tender. The entire hand had felt numb, and in time she had noted atrophic changes in hand and forearm. The skin of hand and fingers had become smooth and glossy. About one month after the onset of her trouble, the right knee had become involved and she had been confined to bed for the following three months. Her fever had ranged from 99° to 100.5° during this time. After the acuteness of the attack had subsided, she had not been able to move the joint. The patient had been subject to occasional attacks of sore throat, but she had had no throat trouble at the time of onset of the arthritis. She had had four teeth devitalized three years previously. Her bowels had always been regular. She had become quite nervous and irritable. She had lost ten pounds in weight and her general health had been greatly impaired.

PHYSICAL EXAMINATION: The right knee was symmetrically enlarged and firmly ankylosed at 110° flexion. Figures 16 and 17. No free fluid present. There were localized areas of tenderness along the capsular attachment over the internal and external condyles. There was a left sided wrist drop. The skin of the hand and fingers was smooth and glossy, and a slight disturbance of sensation was present. The patient was under our observation and treatment for five weeks. Eight infected teeth and septic tonsils were removed.

She experienced a severe reaction with chills and fever to 102° following the first extraction. There were only slight reactions at the subsequent three sittings. There was no reaction following tonsillectomy. The wrist drop was transitory, and she was able to lift her hand before she was dismissed.



Figure 16. (Case A255910). Proliferative Arthritis of right knee joint.



Figure 17. (Case A265910). Roentgenogram of Proliferative Arthritis of right knee joint shown in Figure 16.

CASE NO. A372767. Mrs. F. M. P. Age 62. Occupation, Housewife.

The patient was admitted to the Clinic September 6, 1921.

FAMILY HISTORY: Negative.

CLINICAL HISTORY: Twenty-two years ago, she had noticed a slight stiffening and enlargement of the joints of both hands, more especially the distal phalangeal joints. There had been slight discomfort at times, but never any pain. There had been no appreciable change in the condition of the joints during the past ten years. No further joint involvement. She had never had any sore throat. She had had much dentistry. The lower teeth and all the upper teeth except seven had been removed twelve years ago. She had intended having the remaining teeth removed as they were bad. There had never been any sinus or antrum symptoms.

PHYSICAL EXAMINATION: Slight enlargement of all the phalangeal joints, especially the terminal joints, where small protuberances on the lateral and median aspects were present. (Heberden's Nodes). Figures 18 and 19. The articular cartilages of the terminal joints were destroyed, and the terminal phalanges could be moved freely in all directions causing crepitation. Slight tenderness on pressure, but motion caused no pain. The Ear, Nose and Throat Section reported the tonsils septic and advised their removal. The Dental Section reported the remaining seven teeth infected and advised their removal. The X-ray Section reported the left antrum markedly clouded. The antrum was punctured and a large amount of pus washed out. Tonsillectomy was done and the infected teeth extracted.



Figure 18. (Case A372767). Degenerative Arthritis of terminal phalangeal joints of hands. (Heberden's Nodes).



Figure 19. (Case A372767). Roentgenogram of Degenerative Arthritis of terminal phalangeal joints of hands shown in Figure 18.



Figure 20. (Case A357956). Marked Degenerative Arthritis of the finger and wrist joints.



Figure 21. (Case A357956). Roentgenogram of marked Degenerative Arthritis of the finger and wrist joints shown in Figure 20.



Figure 22. (Case A369570). Roentgenogram of Degenerative Arthritis of the right knee joint.



Figure 23. (Case A383948). Roentgenogram of Degenerative Arthritis of the right metatarsophalangeal joints.



Figure 24. (Case A379271). Roentgenogram of Degenerative Arthritis hip joints.



Figure 25. (Case A382747). Roentgenogram of Degenerative Arthritis hip joints.

Fifty per cent of the proliferative and 25 per cent of the degenerative types had been affected by some change in the weather. Forty per cent of all cases had been affected by some change, 31.25 per cent had noticed no difference in joint symptoms, 11.25 per cent had been worse in cold weather, 13.75 per cent in cold, damp weather and the joint symptoms in 3.75 per cent of the cases, had been worse in the spring and summer months.

The pain naturally depended on the activity of the arthritic process, and varied from merely a stiff aching to the most acute joint pain. There was, in many cases, a tendency for the pain to shift from joint to joint.

In the proliferative type of arthritis, the sequence of joint involvement was: knees, fingers, ankles, wrists, elbows, spine, hips and temporomaxillary joints; and in the degenerative type the sequence was: fingers, knees, wrists, hips, elbows, spine, temporomaxillary and sternoclavicular joints. There was a tendency towards symmetrical involvement in every case.

The researches of Nichols and Richardson have shown that the blood supply of the joints is relatively poor, the synovial membranes receiving their nutrition indirectly from the synovial fluid. Barcroft has shown that the blood carries about forty times as much oxygen as does the same volume of plasma, and that reduction of temperature lowers the dissociation curves of hemoglobin for oxygen. The decreased oxygen tension would produce ideal conditions for the growth of selectively anaerobic bacteria in and around the joint structures, as has been shown by Rosenow. Cole and Blake have shown that the pneumococcus and streptococcus viridans convert hemoglobin into methemoglobin, thus inducing sub-oxidation. Forty per cent of our cases had been able to foretell a change in temperature by a sudden activation of their joint symptoms.

The reaction experienced by a case of arthritis following the removal of a chronic focus may be regarded as an indication of the degree of virulency of the invading bacteria. The reaction is described by the patient as simulating

an exacerbation of the joint pain. It is usually transitory, disappearing as does the exacerbation within two or three days. The reactions vary from a slight stiffness in one or more joints to more severe joint pain and systemic disturbances with elevation of temperature.

Following the removal of a chronic focus, 25 per cent of our cases experienced a negative phase, having had almost complete relief of all joint symptoms for a period of twenty-four to forty-eight hours. This negative phase was then followed by a recurrence of joint symptoms, which in 15 per cent of the cases was more or less severe. Lillie and Lyons reported 55.3 per cent of their cases as having experienced improvement immediately following tonsillectomy, whereas 12 per cent of their cases had had acute exacerbations of joint symptoms. Even fatalities have been known to have occurred following the removal of chronic foci during a period of activity of the arthritic process. An exacerbation of joint symptoms following the removal of a chronic focus of infection might be attributed to the sudden shower of bacteria thrown into the circulation. The reaction has been observed especially whenever the socket of a tooth containing a large granuloma has been thoroughly curetted.

Pemberton has attributed the negative phase, or amelioration of symptoms, following the removal of a chronic focus of infection to postoperative starvation. This does not, however, seem to account for the transitory lapse of symptoms in many cases, as the period of starvation is entirely too short.

Many investigators have called attention to the absence of cardiac disease in chronic arthritis. There was no evidence of valvular disease in any of our cases.

SPONDYLITIS.

The joints of the spine are subject to the same proliferative and degenerative changes in chronic arthritis as those which take place in the other joints of the body. The disease may begin in the small joints of the articular processes and the costovertebral articulations, or may be confined largely to the intervertebral discs. The spine is usually involved throughout its entire extent when the small articulations are affected, but the entire spine is rarely involved when the arthritic process limits itself to the intervertebral discs. The erosion which takes place in the discs leads eventually to approximation of the bony segments. The round, lateral borders of the bodies of the vertebrae are replaced at times by irregular exostoses. The spiky prolongations thus formed sometimes fuse and produce complete rigidity of the vertebrae, the so-called poker spine.

The arthritis may be confined entirely to the spinal column or the large joints, most commonly the shoulder, hip or knee joints may be affected at the same time. The large joint involvement frequently precedes the spondylitis. McCrae reports that in thirty-nine out of eighty-one cases of spondylitis, the spine alone was involved, and in forty-two cases, this was associated with arthritis in other joints.

Beer was the first to call attention to the involvement of the muscles and tendons near the affected vertebrae in the arthritic process. These structures may be affected quite early and may well explain why the radiograms in the early stages of the disease show little or no bony changes, even though complete ankylosis is present. The anterior common ligament has been shown by Ruffer and others to be the first affected. Ossification of the supraspinous ligament alone is sufficient to prevent all movements of extension and flexion.

Bechterew, Strümpfe and P. Marie were the first to describe in detail the neurological phenomena in spondylitis. Occasional motor disturbances with cramplike twitchings of the hands and feet and contractures of the extremities

were present in some cases described by these investigators. In other cases marked muscular atrophy and parietic weakness of the extremities were noted, while in still others little or no atrophic changes were observed.

Sensory disturbances consisting of pain, hyperaesthesias, analgesias, atrophic changes in the skin, oedema, increase of tendon reflexes, etcetera, have also been observed.

Marie and Strümpfe have described cases in which the progress of the affection proceeded without pain to complete ankylosis of the spine and hip joints, while all other joints remained free. Bechterew has described cases in which the spine alone was involved, and in which pain and muscular atrophy were the chief findings.

Bechterew insists, however, that all the clinical aspects of spondylitis are merely varieties of the same affection which differ only in degree of bone and nerve involvement and the localization of the lesions.

Bechterew suggested that the neurological symptoms in spondylitis might be attributed to a gradual, increasing compression caused by an exudative process around the spinal nerve roots. He also considered the possibility of an extension of the inflammatory process along the nerve paths. In a subsequent report, these views were borne out at autopsy. A degeneration of the spinal nerve roots, especially the posterior ganglia at their exit from the spinal column was found.

Ruffer in his studies in palaeopathology among the ancient Egyptians, noted the frequent involvement of the lumbar spine and inferred that those people must have suffered severely from lumbago and sciatica.

Brican has studied spondylitis in cats. This investigator regards the affection as analagous to the condition in man. The disease is found among the big cat family as well.

Nathan, in 1916, produced spondylitis experimentally in animals by intravenous inoculations of streptococci. An epidural exudate was

found in the spinal canal. Nathan believes that similar epidural and peridural exudations which surround the nerve roots and cause irritation and compression must be held accountable for the neural symptoms produced in spondylitis cases.

There were six cases of spondylitis among the eighty cases of arthritis, constituting 7.5 per cent of the total number. All six cases were males. There was a familial history of arthritis in 50 per cent of the cases. Both Bechterew and Marie have called attention to the hereditary tendency in spondylitis. The onset of symptoms had been gradual in every case.

Arthritis of the large joints had preceded that of the spine in five cases. The small joints were not involved in any case. Only one case had no joint involvement other than the spine. There was bilateral involvement of the shoulder joints in three cases, and bilateral involvement of the hip and knee joints in two cases.

The onset of symptoms had begun in the third decade in three cases, in the fourth decade in two cases, and in the fifth decade in one case. There was an average of fifty-eight and one tenth months duration of the disease.

Four of the cases showed variable degrees of muscular atrophy, pain of greater or less severity, areas of hyperaesthesia, increase in tendon reflexes and general weakness. Two cases had had no symptoms other than an increasing stiffening of the spine. The pain was localized chiefly in the muscles of the back, shoulder and lumbar regions. The pain had been present constantly in two cases and so severe that opiates had been required at times. One case had had pain only with motion and one only with exacerbations, while two cases had had no pain at all. The symptoms had been aggravated by changes of the weather in three cases.

Four patients had become very nervous and had lost much strength and weight, and their symptoms were becoming progressively worse. The greatest loss of weight had been fifty pounds, the least ten pounds, an average loss of

twenty-seven and five tenths pounds since the onset of arthritic symptoms. Five cases gave a history of dental infection, one case of chronic constipation and one case of injury. Three patients had received previous treatment elsewhere by the removal of foci of infection, and one case had been improved for a short time following tonsillectomy.

Only two cases showed osseous changes in the roentgenograms although the spine was affected throughout its entire length in five cases.

CASE NO. A375693. S. C. Male. Age 44. Occupation, Bartender.

The patient was admitted to the Clinic October 24, 1921.

FAMILY HISTORY: Two brothers had arthritis.

CLINICAL HISTORY: Six years ago, the patient had had a heavy cold and severe sore throat following which he had had slight pain, swelling and stiffness in both knees and a sharp catch in the back of the neck. The trouble in the knees had soon cleared up, but the spinal involvement had become gradually worse, the stiffening process having extended downwards until the entire spine had become rigid. The pain had been constant and at times excruciating, especially severe at night. Recently he had felt slight pain in both shoulder joints, and in the right elbow and temporo-maxillary joints at times. Twenty-four years ago, he had contracted lues for which he had received intensive treatments, especially since the onset of joint symptoms. No relief had been obtained. He had had many severe attacks of sore throat. No dentistry, but the teeth had been bad for many years. The many exacerbations of the arthritis had been especially severe in cold, damp weather and when he had had colds. He had lost fifty pounds in weight in five years and had become extremely nervous and exhausted.

PHYSICAL EXAMINATION: Poorly nourished with evident atrophic changes in arms,

hands and legs. The spine was rigid and the chest expansion was one half inch. Any attempt at flexion painful. Abdominal respiration. Left knee was slightly enlarged. No free fluid. Motion slightly painful, but not limited. Grating in joint present on extension and flexion. The neurological and syphilological examinations were negative.

CASE NO. A365268. J. H. H. Male. Age 28. Occupation, Clerk.

The patient was admitted to the Clinic July 19, 1921.

FAMILY HISTORY: Negative.

CLINICAL HISTORY: The patient had first noticed a slight stiffness of the cervical spine four years ago. The stiffening process had extended gradually downwards and within a year, the entire spine had become rigid. There had never been any pain. He had felt a slight stiffness and tenderness in the right ankle recently. No other joints had been affected. He had never done any hard work or been unduly exposed. No sore throat. First dentistry at fifteen years of age. Five years ago, he had had some bridge work done and several teeth had been devitalized. Bowels regular.

PHYSICAL EXAMINATION: Poorly nourished. Weight 107 pounds. Spine rigid.

Chest expansion one inch. Slight limitation of rotation of hips, flexion good. Right ankle joint slightly enlarged and tender on motion. Tonsils septic. Fluid pus. Roentgenograms of the teeth showed periapical infection of numbers 19 and 31.

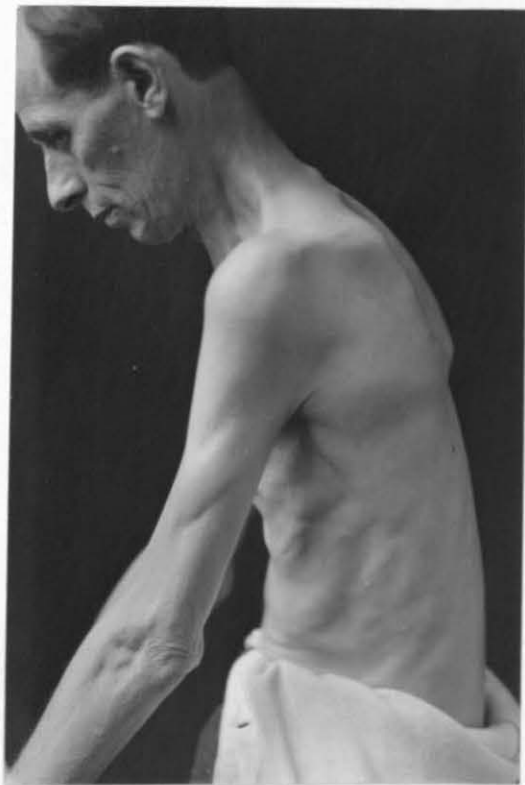


Figure 26. (Case A375693). Spondylitis.

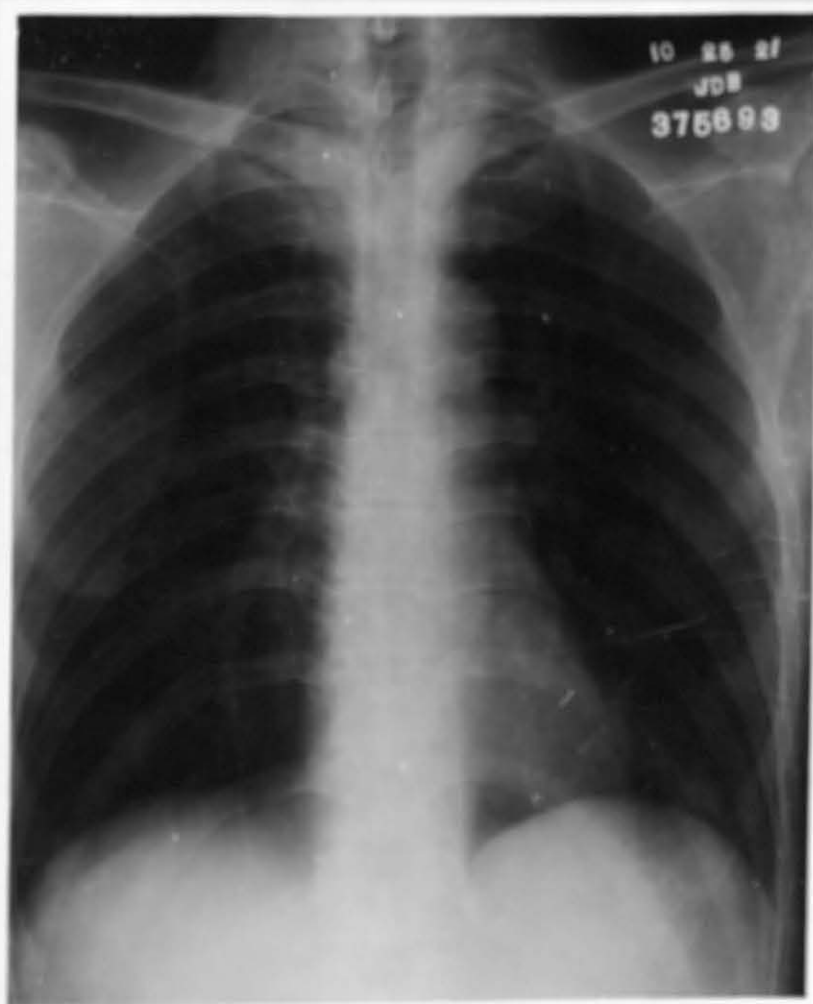


Figure 27. (Case 375693). Roentgenogram of spine of Spondylitis shown in Figure 26.



Figure 28. (Case A372519). Roentgenogram of spine of Spondylitis. Lipping of dorsal vertebrae.



Figure 29. (Case A269594). Roentgenogram of Spine of Spondylitis. Lipping of vertebrae.

S T I L L ' S D I S E A S E .

In 1896, Still described a form of chronic joint disease occurring in children closely resembling arthritis in adults, but offering so many distinctions in both clinical and pathological aspects that he regarded the affection as having a distinct pathology. He defined the disease, "as a chronic progressive enlargement of joints, associated with general enlargement of glands and enlargement of spleen".

Still claims, however, that "there occurs also in children a disease in every respect identical with rheumatoid arthritis of adults". He described the post mortem changes in three cases, two of which had had the joint affection for eighteen months and which showed no joint pathology. The third case however, had had arthritis for three years and the articular cartilages had showed pitting of their surfaces "with little processes of the thickened synovial membrane fitting accurately into the pits". It would appear that the time element is lacking in the first two cases reported. We frequently meet with cases of chronic arthritis over a period of years in which no demonstrable roentgenographic bony changes can be found.

The clinical course and physical sign and symptoms of arthritis in children as described by different investigators are almost identical with those of arthritis occurring in adult life. The cases reported in the literature are usually poorly nourished children, which fact adds further to the systemic nature of the disease. Many of our cases in adult life showed glandular enlargement, although splenic enlargement was rarely observed.

Lindsay has called attention to the more exaggerated clinical features of arthritis in children which he ascribes to the more rapid and complete development of the condition.

Rosenfeld has produced joint lesions in animals by intravenous inoculation of cultures of streptococci prepared from carious teeth of a child suffering with chronic arthritis.

CASE NO. A367673. Miss F. C. Age 25. Occupation, Stenographer.

The patient was admitted to the Orthopedic Section August 8, 1921.

FAMILY HISTORY: Negative.

CLINICAL HISTORY: General health always good. Gradual onset of arthritis at the age of four years, twenty-one years ago, without chills or fever. The condition had become progressively worse and more deforming. The pain had been slight and continuous and without exacerbations. The fingers had been first involved and then in rapid sequence the knees, ankles, cervical spine, wrists, metatarsals, hips and elbows. The patient had had very bad teeth as a child. Bilateral otitis media at the age of six years. Never any sore throat. Attack of influenza two years ago and joint symptoms had become aggravated. Bowels regular.

PHYSICAL EXAMINATION: The patient was small, but well nourished. She could stand alone, but was able to drag herself along only with the aid of crutches. The joints of the hands, wrists, knees and hips were very much deformed. Fig. 30,31. There was slight motion in wrists with grating on motion. Both elbows were limited to 160° extension with grating on motion. The knees were limited to 135° extension. The left knee was in marked adduction. Grating on motion. The hips were in markedly abducted position and adduction was very limited. The cervical spine was almost completely ankylosed. The teeth showed periapical infection of numbers 19, 30, and 31 and questionable number 18. The tonsils were small, slightly reddened pillars. No pus expressed. Moderate lateral pharyngitis. The roentgenograms of the hands, elbows, knees and hips showed marked destructive arthritis with much bony overgrowth.



Figure 30. (Case A367673). Degenerative Arthritis of the finger and wrist joints.



Figure 31. (Case A367673). Roentgenogram of Degenerative Arthritis of the left knee joint.

Pathology.

Bone, articular cartilage, synovial membrane, ligaments and capsule are the structures which form a joint. These tissues are mesenchymal in origin and all the cells which compose them may proliferate or degenerate according to the degree of stimulation caused by any given agent.

Axhausen, in 1913, has described the experimental production of arthritis in animals by injury to the joints. Knorpel and Knochennekrose were produced by suturing around the patella, by the homoplastic transplantation of entire joint ends, by the electric cautery and by the injection of caustic substances into the joint.

He held that the necrosis which took place was due to interference in circulation and consequently disturbances in the nutrition of the articular cartilage and bone. Pressure and friction were contributing factors. Comparative studies made with the histologic findings in chronic arthritis showed the processes to be identical.

Lexer, in 1896, has shown that injury plays an important part in the production of osteomyelitis in animals. By striking or fracturing the bones, or temporarily shutting off the blood supply, areas of lowered resistance were produced, thus enabling the bacteria to find more suitable conditions for localization. The bacteria frequently caused infarction in the terminal capillary circulation, thus producing disturbances in nutrition. Bacterial emboli may in the same manner deprive the joint tissues of nourishment and so produce identically the same arthritic changes in the joints as have been produced experimentally by Axhausen. Nathan has shown that streptococci could frequently be found in the epiphysis in the early cases of epiphyseal involvement. Rosenow has frequently demonstrated the streptococci in the periarticular tissues.

Whether a proliferative or a degenerative process in the joint is in the ascendency would depend upon the degree of virulency of the invading bacteria

and the susceptibility of the joint tissues to the micro-organisms. If the bacteria should be of a high degree of virulency and the joints affected should respond actively to the stimulus, a proliferative process is most likely to ensue. In the degenerative type of arthritis we have to do with a low grade of virulency of the bacteria, and consequently a relatively inactive response on the part of the joint structures.

Nichols and Richardson, in 1909, have shown that both proliferative and degenerative changes take place in the joint at the same time. There are many gradations between these two processes. The process begins as a subperiosteal inflammation in the region of the capsular insertion which leads to a localized periostitis. If the synovial pannus predominates, the ankylosis, as a rule is fibrous, whereas predominance of perichondrial proliferation leads to cartilagenous or bony ankylosis. The two bones may become united with continuous marrow cavity. In the early stages, the effusion into the joint may be so great as to cause a relaxation of the capsular and periarticular tissues, resulting in dislocation of the joint.

The degenerative type of arthritis leads eventually to false ankylosis or ankylosis by deformity or locking. Degeneration takes place by fibrillation of the articular cartilages, commencing with the disappearance of the spindle celled perichondrium. The underlying bone becomes exposed and the two ends come in contact. After years of weight bearing and continuous friction, the articular ends become worn away and highly polished. Compensatory growth of bone and cartilage takes place. The exposed, dense bone has an appearance of ivory, hence the term eburnation of bone.

In the distal, phalangeal joints, an increase in the activity of the perichondrium at the periphery of the joint where the capsule and cartilage come together, gives rise to small nodosities. These were first described by Heberden, and are known as Heberden's Nodes.

The appearance of any arthritic joint depends upon the predominance of the proliferative or degenerative process in the joint, the duration of the disease and the injury to the joint.

Rarefaction of the bones, similar to that seen in radiograms of bones kept at rest for a long period following injury, is frequently seen in the radiograms of chronic arthritis. It does not seem that the increased permeability, most marked in the epiphysis, could be explained by inactivity alone in these cases.

Nathan has attributed the premonitory weakness accompanying the deformities frequently met with in some cases of chronic arthritis to peripheral and central neural involvement. This view is borne out by the occurrence of contracture and trophic disturbances commonly met with in ulnar, radial and median nerve involvement. The extensors of the arms and legs and the interossei of the hands usually show the most marked atrophic changes. The contracture deformities are seen most often as hyperflexion. The disturbances in sensation, the glossiness of the skin, the profuse perspiration, and cold, clammy extremities frequently met with would also lead one to suspect neural involvement.

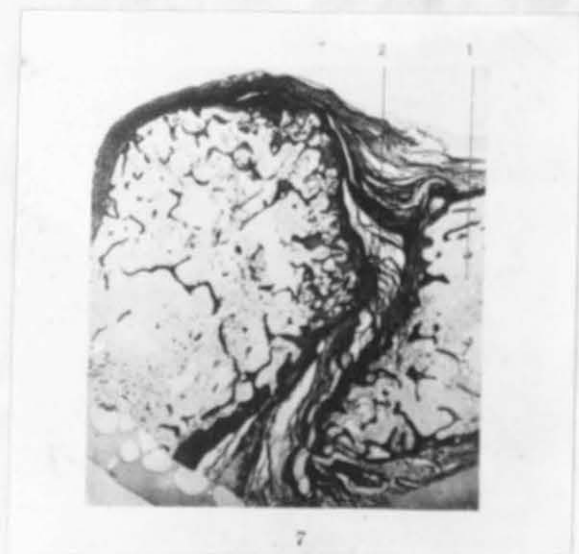


Figure 32. Proliferative Arthritis. Dense, fibrous adhesions joining the two articular surfaces. (Nichols and Richardson).



Figure 33. Proliferative Arthritis. Bony ankylosis with beginning obliteration of the joint cavity. (Nichols and Richardson).

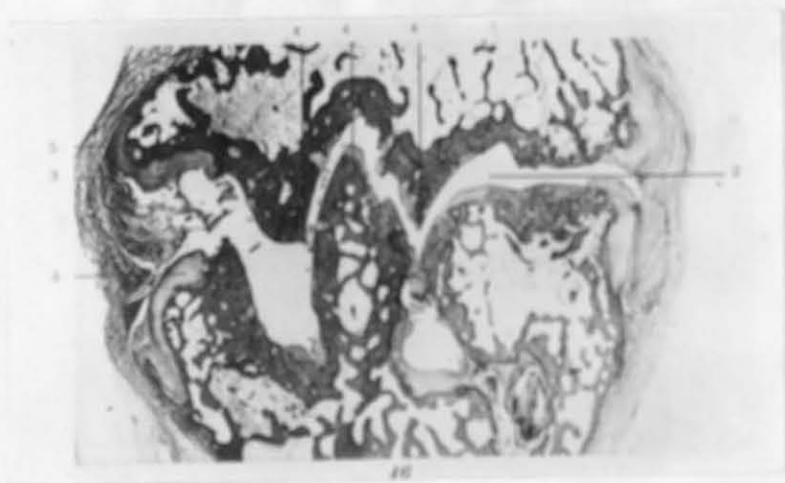


Figure 34. Degenerative Arthritis. Destruction of the joint cartilages. Dense, eburnated bone forming the articular surfaces. Persistence of the joint cavity. (Nichols and Richardson).

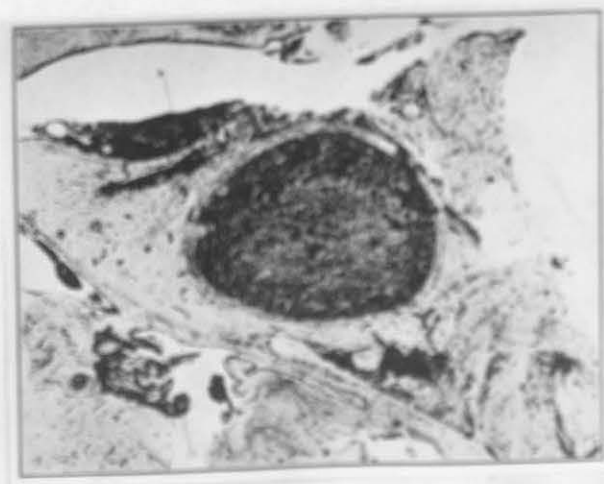


Figure 35. Exudate surrounding spinal ganglion. (Nathan).

BACTERIOLOGY.

The technic employed in our bacteriological studies was the same as that carried out by Rosenow in his studies of elective localization of streptococci.

We have felt the importance of eradicating all possible dental foci in chronic arthritis cases. Therefore, every devitalized tooth was removed, whether evidence of infection in the roentgenogram could or could not be demonstrated. Cultures made from the roentgenologically positive and negative devitalized teeth yielded the same type of microorganisms, which on animal inoculation had the same selective action for joints.

Table 5

A Bacteriological Study of Infected Teeth.
Thirty-five cases Proliferative Arthritis.

	Number Condemed	Number Cultured	Cultural Results.			
			Pure Strep.	Strep. Staph.	Strep. Staph.	Gram negative Gram positive Gas producing bacilli
Pulpless, roentgenograms positive	64	26	16	9	1	
Pulpless, roentgenograms negative	43	32	24	7	1	
With Putrescent Pulps	15	11	10	0	1	
With extensive pyorrhea	3	2	2	0	0	
Roots	3	1	0	1	0	
Impacted teeth	2	1	1	0	0	
Residual granuloma	1	1	1	0	0	
With extensive caries	1	1	1	0	0	
Total	131	75	55	17	3	

Table 6

A Bacteriological Study of Infected Teeth.
Seventeen cases of Degenerative Arthritis.

	Number Condemed	Number Cultured	Cultural Results.			
			Pure Strep.	Strep. Staph.	Strep. Staph.	Gram negative Gram positive Gas producing bacilli
Pulpless, roentgenograms positive	40	31	22	7	2	
Pulpless, roentgenograms negative	17	10	6	4	0	
With Putrescent Pulps	5	3	2	1	0	
With extensive pyorrhea	6	-	-	-	-	
Roots	3	1	1	0	0	
Residual granuloma	1	1	1	0	0	
With extensive caries	1	1	1	0	0	
Total	73	47	33	12	2	

Table 7

A Bacteriological Study of Infected Teeth.
Five cases spondylitis.

Cultural Results.

	Number Condemned	Number Cultured	Pure Strep.	Strep. Staph.	Strep. Staph.	Gram negative Gram positive Gas producing bacilli
Fulpless, roentgenograms positive	7	5	4	1	0	
Fulpless, roentgenograms negative	3	3	2	1	0	
With Putrescent pulps	3	2	0	2	0	
Total	13	10	6	4	0	

Table 8

RESULTS IN ANIMALS FOLLOWING THE INJECTION OF CULTURES
OBTAINED FROM INFECTED TEETH IN CHRONIC ARTHRITIS.

	No. of Cases	No. of animals injected	Percentage incidence of lesion					
			Joints	Muscles	Kidneys	Stomach	Endo- cardium	Myo- cardium
Proliferative	35	102	57	30	4	4	0	0
Degenerative	17	58	57	29	16	7	2	4
Spondylitis	5	13	69	6	0	2	0	0

Table 9

RESULTS IN ANIMALS FOLLOWING THE INJECTION OF CULTURES
OBTAINED FROM TONSILS IN CHRONIC ARTHRITIS.

	No. of Cases	No. of animals injected	Percentage incidence of lesion						
			Joints	Muscles	Kidneys	Stomach	Endo- cardium	Myo- cardium	Bladder
Proliferative	18	45	22	11	13	6	0	0	4
Degenerative	12	28	18	7	0	7	7	0	0
Spondylitis	3	7	60	14	14	14	0	0	0

In one case of proliferative and two cases of degenerative arthritis, cultures from infected antra were made and animal studies carried out. Joint lesions were produced in animals from the cultures made in the proliferative arthritis case and in one of the degenerative arthritis cases.

The stool of one degenerative arthritis case was cultured. Streptococci were recovered and on animal inoculation produced lesions in the joints. A cervical gland was removed from one case of proliferative arthritis and cultured. Streptococci were recovered in pure culture which on animal inoculation produced arthritis.

The low percentage of positive results in our tonsil studies may be explained in part by the practice we have made of a routine tonsillectomy in every case of arthritis, if the general condition of the patient did not contraindicate the operation. It is a well known fact that the small, flat fibrous buried type of tonsil, which may appear quite harmless, has frequently been demonstrated to have been the chronic focus of infection. The importance of a clean tonsillectomy can not be overestimated, as even the smallest tag may continue to act as a chronic focus of infection. It is impossible to obtain pure cultures from extirpated tonsils. The contaminating bacteria may completely overgrow the infecting microorganisms. A negative result, therefore, would not detract from the possibility of the tonsils acting as a chronic focus. A third factor might be ascribed to the interval which elapsed following the extractions of teeth before tonsillectomy was performed. Are there, during this interval, sufficient antibodies produced to attenuate the virulency of the invading bacteria and thus prevent a positive result in cultures from the tonsils which were acting as a chronic focus? We have frequently observed that with each extraction of teeth, the animals subsequently inoculated showed less joint involvement than those inoculated with cultures from the teeth first extracted.

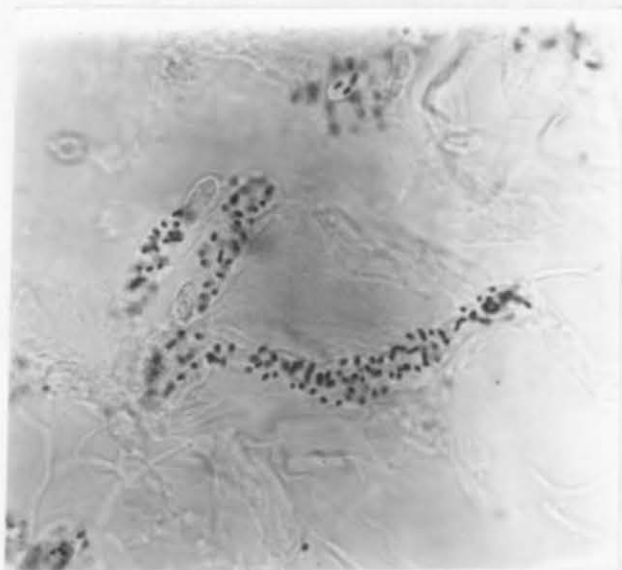


Figure 36. Periarticular Tissue showing streptococci in the capillaries. (Rosenow).

P R O G N O S I S .

Hammond, in 1918, sent out questionnaires to 177 orthopaedic surgeons as to the end results obtained following the removal of chronic foci of infection in chronic arthritis. The consensus of opinion was that improvement and cure have been obtained in many cases, but that the beneficial results were more in evidence in the acute than in the chronic arthritis cases. The cases with acute onset came earlier for treatment than those with insidious onset and without constitutional symptoms. The more acute cases, therefore, have the best prospect for early eradication of their focus or foci of infection. We are forced, nevertheless, to regard many cases of chronic arthritis as incurable. In spite of the removal of every demonstrable focus of infection and the general measures resorted to, the disease progresses with relapses until the patient becomes helpless. The duration of the disease can not be established. In some cases, especially those of the oligoarticular degenerative type, the disease may come to a standstill or improvement take place, even though nothing is done to stop its progress.

Jones, Bassler, Hartzell and Henrici and others have called attention to the fact that cases of chronic arthritis frequently suffer relapses over a period of years. The relapse may be associated with colds, coryza, pharyngitis, etcetera. During the longer intervals of quiescence of joint symptoms, it may be thought that the arthritis has entirely subsided. Once the joint has become sensitized to the infection, however, even though the chronic focus has been removed, the exacerbations of joint symptoms may continue. The joint may in itself act as a secondary focus for subsequent joint involvement. Other secondary foci in the gallbladder, in the appendix or elsewhere in the intestinal tract may suffice to keep the arthritic process activated.

Those cases which show bony changes in the roentgenogram are least favorable from a prognostic standpoint. Nathan and Richardson have shown that restoration of the articular cartilage is rare, as cartilage has a relatively

small power of repair. The mechanical interference with joint function will persist in spite of the fact that every focus of infection has been removed.

Table 10 gives the condition in percentage of the eighty cases of chronic arthritis when the patients arrived at the Clinic.

Table 10.

	CONDITION UPON ARRIVAL AT MAYO CLINIC						Total	
	Proliferative Patients Per cent	Degenerative Patients Per cent	Spondylitis Patients Per cent			Patients Per cent		
Worse	42 84.00	17 70.80	4 66.66			63 78.75		
Standstill	3 6.00	6 25.00	2 33.33			11 13.75		
Better	5 10.00	1 4.16	0 -			6 7.50		

Table 11 gives the results in percentage of improvement and no improvement following the removal of chronic foci when the cases came under our observation.

Table 11.

	RESULTS OF PREVIOUS TREATMENT						Total	
	Proliferative Patients Per cent	Degenerative Patients Per cent	Spondylitis Patients Per cent			Patients Per cent		
No. with previous treatment	35 70.00	14 58.33	3 50.00			52 65.00		
No. with improvement	11 31.42	4 28.57	1 33.33			16 30.77		
Improvement by								
Tonsillectomy	7 63.63	0 -	1 -			8 50.00		
Dentistry	3 27.27	4 -	0 -			7 43.75		
Tonsillectomy & Dentistry	1 9.09	0 -	0 -			1 6.25		
No. with no improvement	24 68.57	10 71.42	2 66.66			36 69.22		
No improvement by								
Tonsillectomy	13 54.16	7 70.00	0 -			20 55.55		
Dentistry	5 20.83	3 30.00	2 -			10 27.77		
Tonsillectomy & Dentistry	5 20.83	0 -	0 -			5 13.88		
Mastoidectomy & G.B. operation	1 4.16	0 -	0 -			1 2.77		

Table 12 gives the treatment carried out at the Clinic.

Table 12.

	TREATMENT AT THE MAYO CLINIC						Total	
	Proliferative Patients	Per cent	Degenerative Patients	Per cent	Spondylitis Patients	Per cent	Patients	Per cent
Dentistry	24	48.00	7	29.16	2	33.33	33	41.25
Tonsillectomy and dentistry	12	24.00	8	33.33	3	50.00	23	28.75
Tonsillectomy	10	20.00	7	29.16	1	16.66	18	22.50
Tonsillectomy, dentistry, and antrum drainage	0	-	2	8.32	0	-	2	2.50
Dentistry and radical antrum operation	1	1.96	0	-	0	-	1	1.25
Antrum drainage	1	1.96	0	-	0	-	1	1.25
Dentistry and hemorrhoidectomy	1	1.96	0	-	0	-	1	1.25
No treatment	1	1.96	0	-	0	-	1	1.25

In view of the above facts it would be impracticable to make a report on end results at this time.

It would seem from a clinical study that a chronic focus or foci anywhere in the body might be the cause of chronic arthritis. Further study along bacteriological lines will be necessary to emphasize the importance of foci other than the teeth and the tonsils in chronic arthritis.

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