

The Problem of Osteoarthritis

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"Arthritis is a mean disease. It will not turn you blue
(Though, if it did, the doctor's task were easier, 'tis true).
It doesn't kill you suddenly - you're apt to live for years.
It doesn't fill your family with sympathetic tears.
The Early Briton suffered on his Early British cliff
And told the local druids that his joints were feeling stiff."

(From a poem by Stephen Vincent Benet who suffered from arthritis.)

I. The Differential Diagnosis of Osteoarthritis.

Case #1: [REDACTED] This 65-year-old WM was admitted [REDACTED], 1962, in congestive cardiac failure. He had auricular fibrillation, mitral and aortic murmurs and gave a history of rheumatic fever in 1917. A diagnosis of rheumatic heart disease was made. In 1949 he first complained of pain in his fingers and hips. His [REDACTED] told him he had rheumatoid arthritis and started him on cortisone in 1952. He obtained some relief and continued thereafter on the appropriate fashionable steroid although troublesome edema was induced by some of the tablets. At the time of admission, he was taking 10 mg. prednisone daily. Examination showed swelling of the DIP's and PIP's and marked limitation of the left hip movements. X-rays revealed classical changes of osteoarthritis and rheumatoid factor tests were negative.

Case #2: [REDACTED] This 52-year-old WF presented on [REDACTED] 1959 with a one year history of pain in the hands, shoulders, knees, ankles and feet plus a chart of her family tree for six generations showing 9 female relatives with arthritis. The PIP's and DIP's were swollen, right shoulder movements were limited, and a small effusion was noted in the left knee. The latex and sensitized sheep cell tests were negative, ESR 20, uric acid 5 mg%. She was at first considered to have rheumatoid arthritis. However, later examination showed Heberden's and Bouchard's nodes, and the x-rays osteoarthritic changes in the DIP's, PIP's and right shoulder. At present she is doing well and has had no further joint involvement.

II. Arthritis as a Diagnostic Clue

case #3: [REDACTED] This WF was first seen here in [REDACTED] 1962 at the age of 44 c/o visual difficulties. She had the following history: She was in good health until 1949. Pain both knees and many PIP joints. Noticed increase in finger size and had wedding ring cut off. 1952. Menorrhagia and gyn. op. ?type. 1953. Weight loss, polyphagia and polydyspia. Diabetes diagnosed and insulin therapy commenced. About this time, joint pains worsened and had to increase shoe size 6 → 9. She began to have severe headaches. 1954. Acromegaly diagnosed and patient given pituitary irradiation. She remained asymptomatic until 1962 when, during [REDACTED], she noticed pain in the hands and ribs. She had a further course of irradiation with improvement in the joint symptoms but visual difficulties and fatigue continued. On admission to [REDACTED] on [REDACTED]/62, she had obvious acromegaly. X-rays revealed a very enlarged sella turcica, thickening of the shafts of the phalanges of both hands, with tufting of the PIP's, tufting of the distal portions of the metatarsals of both feet, and changes of degenerative joint disease in the thoracic spine. She has had lens extractions and remains relatively well.

III. ?Cervical Spondylosis

Case #4: [REDACTED]. This 66-year-old CM was first seen in the [REDACTED] 1957 with a "spastic gait." He had been well until 1953, when he developed pain and swelling in the left ankle, hips, and right thumb. Some time later, his neck was painful and stiff and he noticed weakness of the left arm. He was admitted to [REDACTED] and given "shots." By 1956, he had marked difficulty in walking and by 1957 was using sticks. His first thorough work-up was in [REDACTED] 1962. The BP was 180/110 but the rest of the chest, heart and abdominal examination was WNL. The CNS findings could be summarized as a spastic tetraplegia, more marked on the left side with atrophy of the arm musculature. There was no real evidence of peripheral joint involvement. The following diagnoses were considered during the next few months: Multiple sclerosis, motor neurone disease, basilar artery insufficiency. An x-ray of the cervical spine was taken [REDACTED] 1962, and showed marked changes. He was then admitted for evaluation.

Laboratory tests showed Hb 12.6, ESR 36 mm/hr., globulin 4 G%, ceph flocc 3+, latex (slide test) 2+, SCAT, Antinuclear test and serology neg. Extensive x-rays of the cervical spine showed disappearance of all disk spaces, osteoporosis of vertebral bodies, juxta-articular spurring esp. of C 6 and 7, and narrowing of many neural foramina, esp. upper cervical region. There was also an abnormal relationship between the odontoid and C 1, with marked anterior displacement of C 1, resulting in reduction of the caliber of the neural canal. The right atlanto-occipital joint was narrowed. Clinically, there was complete loss of the cervical curve. The remainder of the skeletal survey showed generalized demineralization with slight osteoarthritic changes in the lumbar spine and hips. The hands showed

cystic changes with subluxation of the proximal phalanges right thumb. The CSF was normal except that protein was 76 mg%. Myelogram was unsuccessful as the dye would not fill the cervical canal. A pneumoencephalogram showed filling of the ventricles. Electromyography confirmed a widespread neuropathic lesion with frank denervation in C-5 region. He was discharged without a definite diagnosis, and was last seen [REDACTED]/63 when there was little objective change. He was, however, subjectively improved.

Diagnosis
Father

Secondary osteoarthritis

Causes: Trauma (i.e. contusions, lacerations or juxta-articular fractures or dislocations)
Obesity
Malformations, malalignments of osseous, congenital or neoplastic origin
Infections and inflammatory joint diseases
Osteochondritis and aseptic necrosis of epiphyseal bone
Pulmonary osteoarthropathy
Hemophilia
Hemochromatosis
Ochronosis
Acromegaly
Gout
Neuropathies (e.g. tabes dorsalis and syringomyelia)

TABLE 2.

Specific Forms of Osteoarthritis

1. Heberden's nodes ("What are those little hard knobs, about the size of a pea, which are frequently seen upon the fingers, a little below the top, near the joint."
William Heberden, 1802)
2. Primary generalized osteoarthritis (P.G.O.)
3. Knees
4. Hips
5. Spine

TABLE 1.

Classification

Primary osteoarthritis

Causes: Degeneration
?Genetic
?Other

Secondary osteoarthritis

Causes: Trauma (inc. contusions, intra- or juxta-articular fractures or dislocations)
Obesity
Malformations, malalignments of traumatic, congenital or neoplastic origin
Infections and inflammatory joint diseases
Osteochondritis and aseptic necrosis of epiphyseal bone
Pulmonary osteoarthropathy
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- Progress of disease Marked tendency to progression Slow progress
- Prognosis Variable Usually good as regards function unless hips involved

TABLE 3.

<u>Differential Diagnosis of Rheumatoid Arthritis vs. Osteoarthritis*</u>		
Age of onset	Usually 20-45 years	Usually over 40 years
Hands	Proximal inter-phalangeal and metacarpophalangeal joints	Distal and proximal interphalangeal joints First carpo-metacarpal joints
Other joints	Any joint may be affected	Knees, hips, sacroiliac, lumbar and lower cervical
Number joints	Many	Few (except in P.G.O.)
Type onset	Usually insidious; may be acute	Insidious
Constitutional symptoms	Yes	Usually none
Type joint swelling	Usually fusiform or spindle shaped	Usually irregular or knobby
Muscle atrophy	Usually present and may be marked	Infrequent Not marked
Joint effusion	Frequent	Infrequent Commonest in knees
Subcutaneous nodules	15%	Absent
ESR	Usually elevated	Usually normal Occasionally slightly elevated
Rheumatoid factor (by standard tests)	80% of cases	Negative, except when diseases associated with rheumatoid factors present
Progress of disease	Marked tendency to progression	Slow progress
Prognosis	Variable	Usually good as regards function unless hips involved

Rheumatoid Arthritis vs. Osteoarthritis

X-ray Findings

Early

Periarticular soft tissue swelling

Narrowing joint space

Rarefaction of trabeculated ends of bones

Formation bony spicules and osteophytes at margins of joints

Later

Progressive narrowing joint space

Cysts at bone ends

Cortical erosions with punched out areas of bone at articular margins

Condensation of subchondral bone

Deformities from pressure and traction

Subluxations and dislocations

No ankylosis

Ankylosis

*Adapted from "Arthritis," ed. J. L. Hollander.

TABLE 4.

Differential Diagnosis of Cervical Spondylosis

A. Cord Compression

1. Motor neurone disease
2. Multiple sclerosis
3. Syringomyelia
4. Syphilitic disease in its various forms
5. Sub-acute combined degeneration
6. Spinal cord tumors

B. Root Compression

1. Primary and metastatic tumors
2. Syringomyelia
3. Median nerve compression
4. Peri-capsulitis of shoulder joint
5. Syndromes of the thoracic inlet and cervico-axillary canal
6. Shoulder-girdle neuritis
7. Angina, coronary occlusion

TABLE 5.

Presenting Symptom or Syndrome
in 100 Patients with Cervical Spondylosis
(Brain, ref. 29)

Brachial radiculitis	32
Headache	28
Vertigo	17
Myelopathy	13
Pain in neck	13
Vertebro-basilar ischemia	5
Attacks of unconsciousness	4
Drop attacks	3
Acute lesion of spinal cord	3

TABLE 6.

Articular Cartilage

Hyaline type in synovial joints.

Average thickness 1 to 7 mm.

Aneural.

Devoid of blood vessels and lymphatics except in deepest layer adjacent to bone. Osteophyte formation occurs here.

Has no perichondrium, not covered by synovial membrane.

Never ossifies.

Consists of cells, the chondrocytes, which lie in small cavities distributed in intercellular matrix.

Chondrocytes contain glycogen and lipids.

Mitotic cell division does not occur in adult cartilage.

Matrix consists of collagenous fibers in homogeneous ground substance.

Matrix contains high proportion of the mucopolysaccharide, chondroitin sulphuric acid with a polypeptide.

The chondroitin sulphate consists of a disaccharide unit containing glucuronic acid and glucosamine. Only types A and C chondroitin sulphate in cartilage. Probable molecular weight 260,000. Mucopolysaccharide imparts toughness and resilience to the tissue.

Ratio of chondromucoprotein to collagen highest in those joints which withstand the most pressure.

Metabolic activity of cartilage decreases with aging.

In osteoarthritis, changes occur first in the superficial layer of cartilage.

Modified from M.W. Ropes and W. Bauer: Synovial Fluid Changes in Joint Disease, Harvard University Press, Cambridge, Mass., 1953.

TABLE 7.

The Composition of Normal Synovial Fluid*

	Range	Average
Amount in knee, ml	0.13-3.5	1.1
Relative viscosity at 25°C	5.7-1160	235
pH	7.2-7.4	7.4
Leukocyte count, per cu mm	13-180	63
Differential, per cent		
Polymorphonuclears	0-25	6.5
Lymphocytes	0-78	24.6
Monocytes	0-71	47.9
Clasamatocytes	0-26	10.1
Unclassified phagocytes	0-21	4.9
Synovial lining cells	0-12	4.3
Total solids, gm per 100 gm	2.4-4.83	3.41
Total albumin and globulin, gm per 100 ml	1.07-2.13	1.72
Albumin, gm per 100 ml		1.02
Globulin, gm per 100 ml		0.05
Mucin, nitrogen, gm per 100 ml	0.068-0.135	0.104
Mucin glucosamine, gm per 100 ml	0.012-0.132	0.074
Fibrinogen	0	
Glucose	Approx. the same as in plasma	
Nonprotein nitrogen	" " " " " "	
Uric acid	" " " " " "	
Electrolytes	Approx. the same as plasma dialysate	

*Modified from M.W. Ropes and W. Bauer: Synovial Fluid Changes in Joint Disease, Harvard University Press, Cambridge, Mass., 1953.

TABLE 8

Differential Diagnosis of Synovial Fluid*

	Appearance	Viscosity	Mucin Clot (Ropes Test)	WBC	RBC	Protein (gm%)	Urate Crys- tals	Cartilage Fibrils	Bac- teria
Normal	Straw; clear	High	Good	100 25% polys	0	1.3	0	0	0
Traumatic	Yellow to bloody; cloudy	Moderately High	Good	1,500 +	Few to grossly bloody	4.2	0	0 or +	0
Osteo- arthritis	Yellow to straw; clear	High	Good	700 +	0	3.0	0	++	0
Gout	Yellow to milky; cloudy to turbid	Decreased	Poor	13,000 + 70% polys	0	4.0	+	0	0
Rheumatoid Arthritis	Yellow to green; cloudy	Low	Poor	15,000 + 70% polys	Occa- sional	4.7	0	0	0
Rheumatic Fever	Yellow; sl. cloudy	Decreased	Good	10,000 + 50% polys	0	3.7	0	0	0
Tuberculous Arthritis	Yellow; cloudy	Low	Poor	20,000 + 60% polys	0	5.3	0	0	+
Septic Arthritis	Grayish, creamy bloody; cloudy	Low	Poor	25,000 to 100,000 85% polys	Some- times bloody	5.6	0	0	+

*Adapted from "Synovial Analysis." R.A. Jassar, Philadelphia, 1960.

SELECTED BIBLIOGRAPHY

General

1. Chapters 48, 49, 59 and 68 in Arthritis, ed. J.L. Hollander, Lea & Febiger. Philadelphia, 1960.
2. Conference on The Comparative Pathology of Arthritis and Rheumatism, Paul Hoeber. New York, 1959.
3. Barnett, C.H., Davies, D.V. and MacConaill, M.A. Synovial Joints--Their Structure and Mechanics, Charles C. Thomas. Springfield, 1961.
4. Collins, D.H. The Pathology of Articular and Spinal Diseases, Arnold. London, 1949.
5. Structural Aspects of Aging, ed. G.H. Bourne, Hafner. New York, 1961.
6. Fifteenth Rheumatism Review, ed. C.J. Smyth. Supplement 4, Ann. Int. Med., 59, Nov. 1963.
7. The Epidemiology of Chronic Rheumatism, ed. J.H. Kellgren, F.A. Davis. Philadelphia, 1963.
8. Hamerman, D. and Schubert, M. Diarthrodial joints, an essay. Am. J. Med. 33, 555, 1962.
9. Tobin, W.J. Osteoarthritis. J. Chron. Dis. 13:495, 1961.
10. Kellgren, J.H. Osteoarthrosis in patients and populations. Brit. Med. J. 2:1, 1961.
11. Stecher, R.M. Osteoarthritis and old age. Geriatrics 16:167, 1961.
12. Waine, H. Observations on osteoarthritis. Arth. & Rheum. 1:454, 1958.
13. Hartung, E.F. Current methods of treatment of osteoarthritis. Arth. & Rheum. 6:389, 1963.
14. Stecher, R.M. Hereditary factors in arthritis. Med. Clinics N.A.M., March 1955.

Cervical Spine

27. Brain, W.R., Northfield, D.W.C. and Wilkinson, M. The neurological manifestations of cervical spondylosis. Brain 75:167, 1952.

Heberden's Nodes

15. Stecher, R.M. Heberden's nodes. A clinical description of osteoarthritis of the finger joints. *Ann. Rheum. Dis.* 14:1, 1955.
16. Crain, D.C. Interphalangeal osteoarthritis. *J.A.M.A.* 175:97, 1961.
17. Jackson, D.S. and Kellgren, J.H. Hyaluronic acid in Heberden's nodes. *Ann. Rheum. Dis.* 16:238, 1957.

Primary Generalized Osteoarthritis

18. Kellgren, J.H. and Lawrence, J.S. Osteoarthrosis and disk degeneration in an urban population. *Ann. Rheum. Dis.* 17:388, 1958.
19. Kellgren, J.H., Lawrence, J.S. and Bier, F. Genetic factors in generalized osteoarthrosis. *Ann. Rheum. Dis.* 22:237, 1963.
20. Kellgren, J.H. and Moore, R. Generalized osteoarthritis and Heberden's nodes. *Brit. Med. J.* 1:181, 1952.

Knee Joint

21. Bennett, G.A., Waine, H. and Bauer, W. Changes in the knee joint at various ages. *The Commonwealth Fund.* New York, 1942.
22. Hollander, J.L. Treatment of osteoarthritis of the knees. *Arth. & Rheum.* 3:564, 1960.
23. Vignos, P.J. Current methods of treatment of osteoarthritis of the knee. *Arth. & Rheum.* 5:95, 1962.

Hip Joint

24. Pearson, J.D. and Riddell, D.M. Idiopathic osteoarthritis of the hip. *Ann. Rheum. Dis.* 21:31, 1962.
25. Steinbrocker, O. Current methods of treatment of osteoarthritis of the hip. *Arth. & Rheum.* 4:89, 1961.
26. Charnley, J. Arthroplasty of the hip. *Lancet* 1129 (May 27), 1961.

Cervical Spine

27. Brain, W.R., Northfield, D.W.C. and Wilkinson, M. The neurological manifestations of cervical spondylosis. *Brain* 75:187, 1952.

28. Friedenberq, Z.B. et al. Degenerative disk disease of cervical spine. J.A.M.A. 174:375, 1960.
29. Brain, W.R. Some unsolved problems of cervical spondylosis. Brit. Med. J. 1:771, 1963.
30. Lees, F. and Aldren Turner, J.W. Natural history and prognosis of cervical spondylosis. Brit. Med. J. Dec. 28, 1963.
31. Rowe, C.R. Current concepts in therapy of cervical osteoarthritis. New Eng. J. Med. 268:1178, 1351, 1963.
32. Jackson, R. The Cervical Syndrome. Charles C. Thomas. Springfield, 1958.
33. Logue, V. Cervical spondylosis in Modern Trends in Diseases of the Vertebral Column. Paul Hoeber. New York, 1959.
34. Wilkinson, M. Cervical spondylosis in Recent Advances in Neurology and Neuropsychiatry. Little, Brown & Co. Boston, 1962.

Types of Secondary Osteoarthritis

35. Waine, H., Bennett, G.A. and Bauer, W. Joint disease associated with acromegaly. Am. J. Med. Sc. 209:671, 1945.
36. Kellgren, J.H., Ball, J. and Tutton, G.K. The articular and other limb changes in acromegaly. Quart. J. Med. 21:405, 1952.
37. Good, A.E. Acromegalic arthropathy. A case report. Arth. & Rheum. 7:65, 1964.
38. Jordan, H.H. Hemophilic arthropathies. Charles C. Thomas. Springfield, 1958.
39. Rodnan, G.P. et al. Hemophilic arthritis. Bull. on Rheum. Dis. 8:137, 1957.
40. Webb, J.B. and Dixon, A. Hemophilia and hemophilic arthropathy. Ann. Rheum. Dis. 19:143, 1960.
41. Schumacher, H.R. Hemochromatosis and arthritis. Arth. & Rheum. 7:41, 1964.
42. La Due, B.N. Alcaptonuria in The Metabolic Basis of Inherited Disease., ed. J.B. Stanbury, McGraw-Hill, New York, 1960.
43. O'Brien, W.M., Banfield, W.G. and Sokoloff, L. Studies on the pathogenesis of ochronotic arthropathy. Arth. & Rheum. 4:137, 1961.
44. Vogl, A. and Goldfisher, S. Primary or idiopathic hypertrophic osteoarthropathy. Am. J. Med. 33:166, 1962.

45. Holling, H.E. and Brodey, R.S. Pulmonary hypertrophic osteoarthropathy. J.A.M.A. 178:977, 1961.
46. Diggs, L.W., Pulliam, H.N. and King, J.C. The bone changes in sickle cell anemia. South. M. J. 30:249, 1937.
47. Sherman, M. Pathogenesis of disintegration of the hip in sickle cell anemia. South. M. J. 52:632, 1959.
48. Waine, H. et al. Association of osteoarthritis and diabetes mellitus. Tufts Fol. Med. 7:13, 1961.
49. Nesterov, A.I. The clinical course of Kashin-Beck disease. Arth. & Rheum. 7:29, 1964.

Experimental

50. Sokoloff, L. et al. The genetics of degenerative joint disease in mice. Arth. & Rheum. 5:531, 1962.
51. Sokoloff, L. Experimental studies of degenerative joint disease. Bull. Rheum. Dis. 14: Sept. 1963.
52. Pearson, C. and Wood, F.D. Studies of arthritis and other lesions induced in rats by the injection of mycobacterial adjuvant. Am. J. Path. 42:73, 1963.
53. Milch, R.A. Blood supply and the localization of tetracycline fluorescence in arthritic femoral heads. Arth. & Rheum. 6:377, 1963.
54. Bollet, A.J., Handy, J.R. and Sturgill, B.C. Chondroitin sulfate concentration and protein-polysaccharide composition of articular cartilage in osteoarthritis. J.C.I. 42:853, 1963.