THE VALUE OF CONVENTIONAL VIEWS AND RADIOGRAPHIC MAGNIFICATION IN EVALUATING EARLY RHEUMATOID ARTHRITIS

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BY

Dr. Boulos Mounir Abou El-Seoud

Supervised By

Prof. Dr.
Mohamed Fathy Tamara
Prof. of Internal Medicine

Prof. Dr.
Mohamed Samy El-Beblawy
Prof. of Diagnostic Radiology

Prof. Dr.
Hussein El-Sayed El-Damassy
Prof. of Internal Medicine

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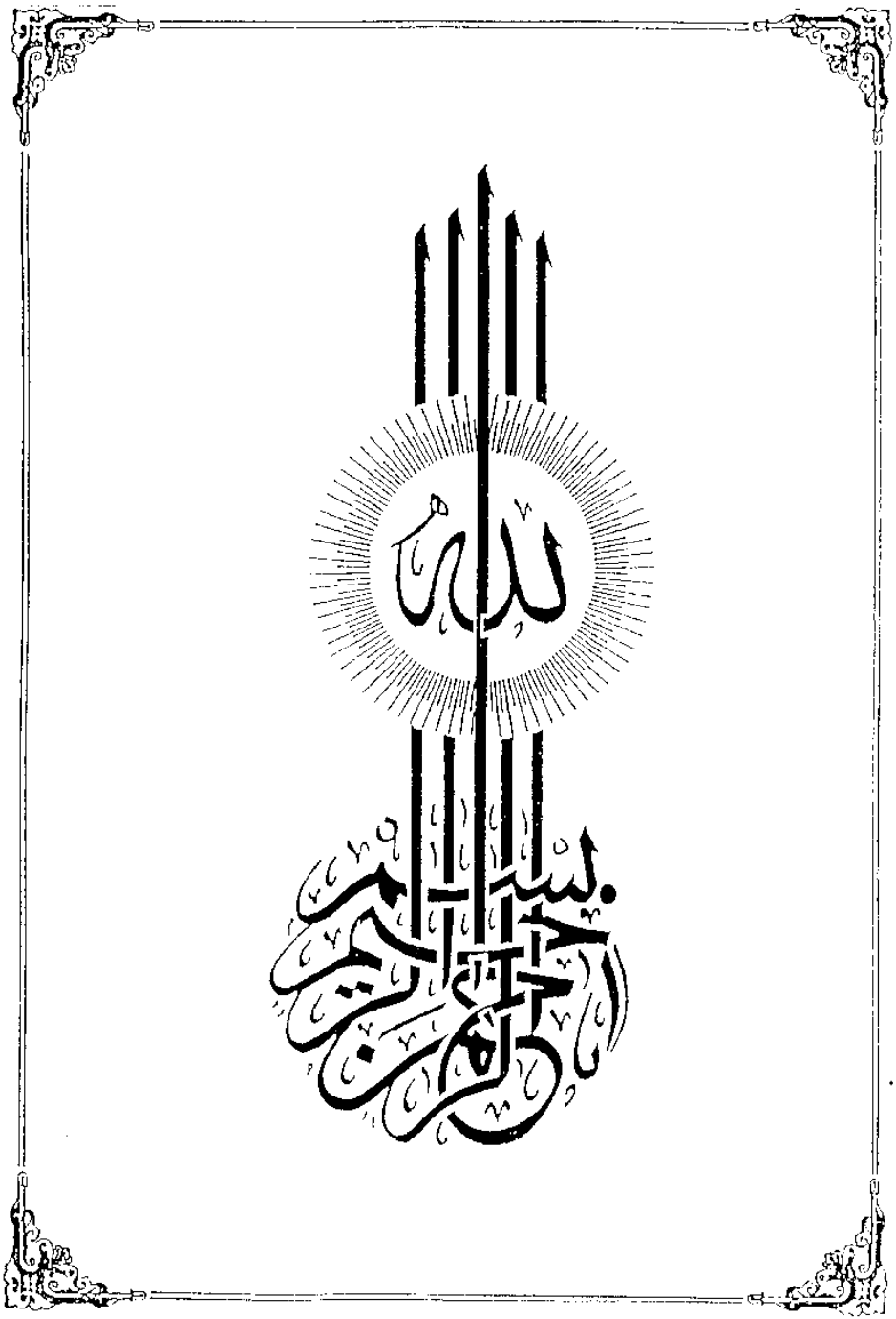

ABBREVIATIONS

ANA	:	Anti-nuclear antibody.
A. R. A.	:	American Rheumatism Association.
CRP	:	C-reactive protein.
ESR	:	Erythrocyte sedimentation rate.
JRA	:	Juvenile rheumatoid arthritis.
MCP	:	Metacarpophalangeal.
MTP	:	Metatarsophalangeal.
PA	:	Postero-anterior.
RA	:	Rheumatoid arthritis.
RF	:	Rheumatoid factor.
SLE	:	Systemic lupus erythematosis.
TMJ	:	Temporomandibular joint.

INTRODUCTION
and
AIM OF THE WORK

INTRODUCTION AND AIM OF WORK

The purpose of radiographic examination in rheumatology is not only to be diagnostic, but also to form a basis for the therapeutic strategy and for the evaluation of the therapeutic results and prognosis. Radiography reflects biologic process which do not always conform to the social sequences of the disease. (De Carvalho, et al., 1980).

The radiographic abnormalities in rheumatoid arthritis reflect bone and cartilage destruction and may progress to become stationary, but are mainly irreversible. It is possible that remissions during treatment and spontaneous remissions may be followed by cessation of the radiologic progression. Thus, the radiologic progression can be considered to reflect the natural history of the disease. (De Carvalho and Graudal, 1980).

Recent technological advances have led to the development of new improved imaging methods suitable for the evaluation of articular disorders. The variety of techniques available, including radiographic magnification make it necessary to be familiar with basic principles of each modality. (Seltzer, et al., 1982).

Resnick (1980) has indicated that radiographic abnormalities are important early features of rheumatoid arthritis. Radiographic magnification has proved to be of definite clinical value in evaluating early rheumatoid arthritis. (Hartley , et al., 1984).

The direct radiographic enlargement technique can be used as a standardized examination during the consulting hour of polyclinic without significant additional work. (Lamprecht, 1980).

If the early stages of any disease begin with the involvement of small area of cells or tissue, the early diagnosis of pathologic changes by means of radiography should concentrate first on the detection of minute changes. The ideal solution would be to produce X-ray images of findings much finer than those observable by the naked eye, and herein lies a new field of research that is believed to be with developing.

The introduction of a 0.3 mm focal-spot rotating-anode tube about 25 years ago opened the way to the clinical application of magnification radiography. Recent advances in technology have made radiographic magnification of the skeleton clinically feasible. A new electron gun microfocal tube combined with new high-resolution recording systems were used to perform magnification radiography which was then compared with conventional contact radiographic mag-

nification is confirmed and clinical areas in which it proved most helpful are defined. (Genant, et al., 1977).

Macroradiography by definition is a radiograph directly related to the size of the tube focus, and to the relationship in distance between the tube focus, the subject and the film. High resolution radiography for the detection of subtle changes in the peripheral skleton may be performed by two different magnification techniques; optical magnification and radiographic magnification. It was found that thin objects such as the hand, optical magnification provides better bone images than radiographic magnification, whereas for thicker parts such as the knee, radiographic magnification is superior. (Doi, et al., 1976).

Lamprecht (1980) described in detail a simplified technique, suitable for orthopaedic radiography. The greater information obtained from magnified exposures was demonstrated by numerous examples. The measurably better image quality of magnification exposures results principally from the increased object-film distance and from the small field size-high degree of collimation-generally used which leads to such a reduction in scattered radiation that an anti-scatter grid can be dispensed with even in the case of relatively thick objects. The importance of fine focus lies mainly in the fact that it

reduces the goemetrical unsharpness to be expected with an increased object film distance to the minimum. The optimal degree of magnification is a function of tube characteristics (focus loadability), the type of object (radiation scatter), the exposure data, and the imaging system (film, screen). The factors with the greatest limiting effect on the degree of enlargement are relatively low.

In several arithritides, the evaluation of subtle articular changes may be of clinical importance. The distinction between the proliferative erosions of Reiter's or psoriatic arthritis, and the non-proliferative erosions of rheumatoid or sclerodermatous arthritis is facilitated by magnification. (Genant, et al., 1976).

The detection of early articular calcification in cases of pseudogout is also improved with high-quality radiography. Direct radiographic magnification is an adequate method for diagnosis of the early changes in bone structure in hyperparathyroidism. (Genant, et al., 1977).

Radiographic magnification can provide helpful or sometimes necessary information in the differential diagnosis of musculoskeletal abnormalities. It is easily performed using available X-ray equipment within a radiographic department, although the addition of microfocal spot X-ray tube is necessary. Goemetric magnification radiography

is especially helpful in the early diagnosis of bone infection, joint inflammation, metastatic lesions to the skeleton as well as other pathological conditions. (Guilford, 1983).

Radiographic magnification in musculoskeletal diagnosis can be regarded as possible technique in hospital routine. The reason for somewhat hesitant clinical application of the magnification technique lies less in the slightly higher radiation exposure of the skin. (Lamprecht, 1980).

The principal limitation of magnification radiography is the restricted field of view imposed by the proximity of the object to the source , requiring, in a number of instances, an increase in the number of films. In the future it is hoped to reduce the expense of X-ray film and the problem of handling a large number of film sheets by using more advanced technology. (Buckland-Wright, 1983).

The aim of work in this thesis is to show how interpretation of magnified X-ray pictures shows special features in evaluating rheumatoid arthritis that are not seen in the conventional films , especially in the early stages.

REVIEW

AETIOLOGY AND PATHOGENESIS OF RHEUMATOID ARTHRITIS

The basis of pathogenesis of rheumatoid arthritis is an inflammatory response involving the immune system. Thus, rheumatoid arthritis is considered as an autoimmune disease, since it involves antibodies againest autologous immunoglobulin G. Such an immune response may be triggered by a specific external aetiologic agent that is responsible for the disease process into motion. It remains uncertain whether the apparant autoimmunity results from the aquestion of a new antigen to an external stimulus or due to primary abnormality in the regulation of cells which mediate these reactions. There are many reasons for believing that cellular and humoral immunity mediate joint inflammation.

Anti- cartilage Antibody:

It has been theorized that immune reactivity to type II collagen, the predominant collagen in the articular cartilage, plays a crucial role in the pathogensis of RA. Recently, anti-cartilage antibodies were found in RA patients. In most cases, the anti-cartilage antibody appears to be specific for type II collagen which is present in cartilage. It seems possible that these antibodies have re-

acted with some other molecule attached to collagen and formed an antigenic hapten. Anti-collagen antibodies have been associated with disease activity since they occur significantly more often with raised C-reactive protein. Anti-collagen antibodies are associated with an erosive disease. (Beard, et al., 1980).

The immune response under genetic control may be reactivity to collagen. Normal HLA-DR4 positive individuals demonstrated cell-mediated reactivity to collagen, thus, supporting the idea that HLA-DR4 linked genes are immune response (Ir) genes which influence the expression of collagen immunity. (Collier, et al., 1984).

There was a positive correlation between anti-cartilage antibodies and the presence of articular erosions revealed in X-ray. There is also some suggestion of a correlation between anti-cartilage antibody and positive rheumatoid serology. The low incidence of anti-cartilage antibody suggests that it is unlikely to be a prime aetiologic factor. (Greenburry and Skingle, 1979).

Collagenase and Connective Tissue Degradation :

Studies proved that the tissue releases a specific collagenase capable of cleaving native collagen. Augmented production of collagenase by hypercellular synovial tissue may be an important

cause of the destruction of joint structures which characterizes RA. By 1966, it was possible to explore some of the mechanisms of joint destruction in RA. All samples of rheumatoid synovium examined produced collagenase. Active collagenase could be detected in synovial fluids from some patients with RA, establishing that collagenase is actually produced in vivo. (Krane, 1981).

In chronic active RA two principal mechanisms for joint destruction have been postulated : one is mechanical, and the other is enzymatic. In the former, it has proposed that fragmentation and mechanical breakdown can occur after depletion of protoglycan from cartilage matrix and other connective-tissue components. Articular cartilage in arthritis remote from granulation is frequently depleted of proteoglycans. Cartilage in this state has a diminished capacity to resist deformation, and could be more easily fragmented by stress such as weight-bearing. However, it is unlikely that mechanical breakdown can be responsible for all deformities and erosions of rheumatoid joints. Erosion of cartilage begins at the articular margin where substrate was in intimate contact with cells capable of releasing collagenase. (Harris and Krane , 1974).

It is therefore logical to assume that the cells of the pannus interact and this interaction results in degradation of extracellular

matrix. It is probable that the degradation is mediated by the action of collagenase, and possibly by other natural proteases. Prostaglandins produced in large amounts by rheumatoid synovial fragments are implicated in several aspects of synovial inflammation and could be important in mediation of bone resorption through stimulation of osteoclasts. The collagenase and PGE_2 are thought to play a role in the degradation of extra-cellular matrix macromolecules that is a major feature of chronic active synovitis. (Krane, 1981).

Hypohistidinemia :

A subnormal serum histidine level is a unique finding in RA. The degree of hypohistidinemia is proportional to the activity of rheumatoid arthritis. The hypohistidinemia of rheumatoid arthritis is acquired with the disease and does not provide a biochemical marker of those at risk . (Kirkham, et al., 1981).

It has been proposed that the hypohistidinemia of RA results in a low synovial fluid histidine concentration which contributes to the pathogenesis of the disease by allowing hyaluronate-augmented formation of synovial fluid gamma globulin which is proposed as the inflammatory and antigenic substance responsible for rheumatoid synovitis. (Gerber, et al., 1977).