

Comparative Study of Rheumatoid Arthritis Diagnosis Using Two Method

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ABSTRACT

Rheumatoid arthritis (RA) diseases generally diagnosis referred from patient symptoms, Physical examination, x-rays, Scans, Biopsy test and blood test. In this paper comparative analysis of two different methods for diagnosis of RA has been done. First method deals with diagnosis of RA using image processing and another method was using non invasive bio impedance technique. During both methods synovial fluid level was considered as common based. Study has been done on impact of synovial fluid on diagnosis of arthritis using image processing and non invasive bio impedance method.

Key words: Rheumatoid Arthritis, Synovial Fluid, Image processing, Bio impedance.

INTRODUCTION

The Rheumatoid arthritis (RA) is a multiple organ dysfunction syndrome that affects a number of organs and tissues, or affects the body as a whole. RA is generally very difficult to diagnose especially during early stages because of wide variation in symptoms between each arthritis patient. Rheumatoid arthritis is type of diseases caused by antibodies produced against substances naturally present and with the body becomes reddened, swollen, hot, and often painful. The diagnosis process for rheumatoid arthritis starts with the medical history of the patient followed by physical examination of doctor and clinical test for finding out rheumatoid factor¹. As a result of these preliminary tests the doctor directs for blood tests such as erythrocyte sedimentation rate (ESR) or C-reactive protein (CRP), CBC (complete blood count) and X-rays and other imaging techniques such as MRI². Once RA synovitis established, a number of amplification mechanisms serve to sustain the process leading to the persistence of the disease.

These mechanisms include engagement of the resident mesenchymal cells and the establishment of ectopic lymphoid structures in the synovium, although the relationship between these lymphoid structures and the presence of RA autoantibodies remains unclear¹. In the advanced level of diagnosis of arthritis the doctor suggest for doing histopathological study of the disease. The Laboratory test is carried out by taking a sample of tissue or synovial fluid from the region of interest known as biopsy and after proper staining the microscopic image obtain using camera^{3, 4}.

The Synovial fluid is viscous and whose viscosity changes as a function of shear stress and time, which is normally found in joints, tendon sheaths, and fluid-filled sacs in the joints^{7, 8}. The synovial fluid contains 3 layers of synoviocytes which is loonnective tissue of fat, collagen and blood vessels and grows as layers that surround fluid filled spaces. During joint disease affected condition the synovium and surrounding muscles, ligaments and tendons weaken^{5, 6}. In Rheumatoid arthritis (RA) with and without joint effusion,

Spondyloarthropathy (SpA) with and without joint effusion and Osteoarthritis (OA) with and without joint effusion there is a variation in Mean lining thickness, Max lining thickness, Vascularity etc., of the synovial lining^{9,10}.

Comparative study

Twenty samples of incisional biopsy of patients with different stages of Rheumatoid arthritis having different age group and gender are taken and the aematoxylin and eosin staining was done⁵. The images are taken using cybemetics camera which is viewed from the microscope. The 20 biopsy images were inclusive of five images of each stage. With the assistance of Matlab programming environment created by Mathworks the high degree of complicity in medical image processing is identified without sufficient programming knowledge.

The stained biopsy image is given as input and as the first step the colour image was converted in to grey scale image. The entropy and highest grey of the greyscale values of the input image was calculated to measure the number of specific ways in which a system may be arranged, often taken to be a measure of disorder in image. The excess kurtosis of the greyscale values of the input image is calculated using KurtosisCalc tool. The electrical property of synovial tissue can be obtained by measuring the developed voltage due to applied electrical signal. The synovial fluid level varies from normal patient to arthritis patient as disease prolongs due to weakening of synovium and surrounding muscle tissues. The synovial fluid density increases and WBC count increases across joint affected region. These weakening of muscle tissues can be observed

in terms of variation in voltage drop due to applied high frequency electrical signal.

The electrical bio impedance value is measured in terms of voltage drop as resistance increases voltage drop increases according to Ohm's law. The normal and disease affected condition can be identified by measuring the voltage drop across the joint region. For normal patient joint region fluid density is less leading to more conductivity and similarly for arthritis affected patients joint region fluid density is large leading to less conductivity. Based on the voltage value varying from 1V to 3V and its corresponding impedance values of joint diseases were diagnosed.

CONCLUSION

The Matlab software has been utilized with functions like Entropy Calculation, Highest Grey, Kurtosis calculation, Lowest Grey, Variance Calculation and STD calculation. The twenty biopsy images of different stages were diagnosed and categorized as Stage I, Stage II, Stage III and Stage IV with the assistance of expertise doctor in pathology, an image processing tool has been developed using Matlab. . For arthritis affected patients synovial fluid density increases based on disease condition rather than age and gender. This result indicates that synovial fluid density increases uniformly as age increases for normal patients and for arthritis patient synovial fluid volume change depends on arthritis disease level. Under study we conclude both image processing and non invasive method can be used for diagnosis of RA. Under image processing different stages of RA can be diagnosed.

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