

中文題目：電腦輔助定量分析能量杜卜勒超音波影像於接受生物製劑治療的類風濕性關節炎

英文題目：Computer-aided quantitative analysis of power Doppler ultrasound images of rheumatoid arthritis during biological therapy

作者：賴國隆^{1,2}

服務單位：¹台中榮民總醫院內科部過敏免疫風濕科，²國立台灣大學生醫電子與資訊學研究所

Background: Power Doppler ultrasound (PDUS) has been widely used to assess the synovial inflammation in rheumatoid arthritis (RA). Synovitis is semiquantitatively scored using 0-3 according to OMERACT (Outcome Measures in Rheumatoid Arthritis Clinical Trials) criteria. However, a milder change in synovial inflammation after treatment may have a same score in pre- and post-treatment PDUS images, thus the treatment response would not be well described by semiquantitative scoring. Here we propose a new method of computer-aided quantitative analysis of synovitis.

Methods: A 55-year-old man with seropositive RA received subcutaneous tocilizumab 162mg every 2 weeks (week 0-12) and every week (week 13-24) in combination with methotrexate 15mg per week since Dec 2018. The most symptomatic joint, left wrist, was chosen for PDUS imaging at week 0, 12 and 24 of tocilizumab therapy. The ultrasound system, Philips iu22, was equipped with a 12 MHz linear probe and adopted appropriate power Doppler (PD) settings: pulse repetition frequency 500Hz and wall filter 47 Hz. All PDUS images were saved digitally in bmp file format. Quantitative image analysis was done using Matlab software. The boundary of synovium was determined manually, then with appropriate codes, the synovial hypertrophy (SH) area, PD area and PD value were calculated automatically. PD value was defined as the summation of red value of all pixels in PD

area.

Results: The patient had a clinical response to tocilizumab including normalization of blood inflammatory indices and a significant decrease in 28-joint disease activity score at week 12 and 24. Left wrist remained swollen and tender at week 12, followed by less tenderness but persistent swelling at week 24. With OMERACT semiquantitative scoring method, the grayscale scores were same (score 2) and the PD scores were same (score 2) at week 0, 12 and 24. With computer-aided quantitative analysis, a series of SH areas (4293, 6188, 4700 pixels), PD areas (210, 498, 748 pixels), PD-to-SH area ratios (4.89%, 8.05%, 15.9%) and PD values (53683, 126730, 191022) were obtained at week 0, 12 and 24 respectively. Quantitative analysis revealed an ongoing exacerbation of synovial inflammation at left wrist despite tocilizumab therapy.

Conclusions: Computer-aided quantitative analysis of PDUS images could give more details of the dynamic changes in rheumatoid synovitis during biological therapy.

Keywords: rheumatoid arthritis, power Doppler ultrasound, image analysis, biological therapy