

PD-37. EFFICACY OF LASER DOPPLER FLUXMETRY FOR THE DIAGNOSIS OF CRPS IAckerman, W.E.¹; Zhang, J.²; Munir, M.A.²; Ahmad, M.²; Ackerman, C.¹

1. Division of Pain Medicine, Arkansas Specialty Care Center, Little Rock, Arkansas; 2. Anesthesiology, University of Arkansas for Medical Sciences, Little Rock, Arkansas

INTRODUCTION: The Complex Regional Pain Syndrome (CRPS) occasionally follows trauma or surgery to an extremity. The clinical diagnosis of CRPS is often delayed as CRPS can resemble some of post-traumatic or post-operative states (pain, edema, loss of function, etc.). Diagnosing CRPS at an early stage is important because treatment in the early stage affects the outcome. CRPS I is often accompanied by a dysfunction of the sympathetic nervous system, which results in changes in skin perfusion of affected extremities. Schurmann et al.(1) first reported the efficacy of Laser Doppler Fluxmetry (LDF) to diagnose CRPS I during early stages. The purpose of this study was to further assess the role of LDF in the diagnosis of CRPS I, and to compare the efficacy of LDF with the Triple Phase Bone Scan (TPBS) for the diagnosis of upper extremity CRPS I.

METHODS: A total of 45 subjects, aged between 26 and 56, were included in this study following IRB approval and informed patient consent. Out of 45 subjects, 25 had a clinical diagnosis of CRPS I of one upper extremity while, and 20 were normal subjects. All 25 CRPS I patients met the following criteria for diagnosis: edema, abnormal skin color, hyperhidrosis, joint stiffness, changes in skin temperature from the opposite extremity and pain that was disproportionate to the causative event. Furthermore, there was no pain in single nerve distribution in any patient. Subjects were excluded from the current study if they had a history of smoking, Raynauds disease, cellulites, neuropathy or current vasoactive medication. All 25 CRPS I patients had an LDF and a TPBS whereas the 20 normal subjects only received an LDF measurement. The LDF was done with and without Mueller's maneuver (an inspiratory gasp against resistance), which was used to assess the function of sympathetic nervous system. LDF was done at 50 cm at a scan speed of 4 ms/pixel. The room temperature for the LDF was kept constant at 23°C. Mueller's maneuver was not used during the TPBS because of the long duration (3 hrs) of the TPBS and because of the short transient duration of Mueller's maneuver. Data were expressed as mean \pm SEM unless otherwise specified. Changes in perfusion values for individual subject are expressed as the percent differences between the affected and control limbs. Perfusion changes before and after Mueller's maneuver were expressed as the differences in the perfusion values. The Z-test was used to compare the percentage of positive diagnosis between LDF and TPBS. In all cases, a P value <0.05 was considered significant.

RESULTS: In normal subjects, the differences in the perfusion values between two limbs averaged $2.2 \pm 0.5\%$ (0.2 to 3.8%) before, and $2.2 \pm 0.6\%$ (0.2 to 4.9%) after the Mueller's maneuver ($P > 0.05$, $n = 10$). For patients with CRPS I, an abnormal perfusing value for the affected limbs occurred in all 25 patients without Mueller's maneuver. The differences between control and affected limbs averaged $15 \pm 1.4\%$ ranging between 4.8% and 37%. After Mueller's maneuver, two of 25 patients showed >90% decrease in the perfusion differences between two limbs demonstrating a normal sympathetic function. Five patients showed partial decrease in the perfusion differences (30 to 90%). The remaining patients showed less than 30% or no changes in the differences indicating a severely impaired sympathetic function. The TPBS was positive for the diagnosis of CRPS (by increased or decreased blood flow) in 9/25 (36%) patients, which is significantly smaller than that of LDF (100%, $P < 0.001$, Z-test).

DISCUSSION: The results of this study demonstrated that the LDF is very sensitive in detecting changes in skin perfusion in patients with CRPS I, and is useful to assess the sympathetic function when combined with the Mueller's maneuver. LDF was more reliable for the diagnosis of CRPS I than TPBS. The results of this study suggest that patient who has signs of CRPS I after surgery or trauma to an extremity may be considered for a LDF examination. Results of this study also suggest that LDF may be used in selecting the patients for sympathetic blockade, and also monitoring the progress of treatment.

1. Schurmann M. Gradl G. Zaspel J. Kayser M. Lohr P. Andress HJ. *Autonomic Neuroscience-Basic & Clinical*. 86(1-2):127-34, 2000

