The symptoms of Chronic Fatigue Syndrome are related to abnormal ion channel function

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Objective: Many symptoms of chronic fatigue syndrome (CFS), including severity of fatigue, are periodic, fluctuant and are inducible by physical and mental activities. Chest pain is a common symptom of CFS-like patients with syndrome X, an ion channel disorder. Symptoms in CFS such as fatigue, myalgia and headache bear striking resemblance with neurological disorders that affect ion channel function, such as periodic paralysis and familial hemiplegic migraine. Maintenance of normal transmembrane ionic equilibrium is an active, energy-dependent process, and constitutes an important share of the resting energy expenditure (REE). We wanted to compare and contrast the clinical profile of CFS patients with other neurological disorders that are known to affect ion channel function, and estimate REE in CFS. We also studied the myocardial perfusion in CFS by thallium^{201} SPECT scans to compare the results with Syndrome X.

Methods:: All patients who fulfilled the modified CDC criteria for CFS were included in our studies. For investigations that required the administration of radiopharmaceuticals (e.g. cardiac-thallium^{201} SPECT scans), patients between the age of 18 - 65 years were recruited after informed consent. A comparable group of healthy, sedentary volunteers were tested as controls in the REE study.

Results: Fatigue was fluctuant in most patients with CFS. This was induced or worsened by physical activities (exercise), mental stress and chemicals that affect ion channel function (e.g. alcohol, quinine and anaesthetics). Significant perfusion defects were observed in the cardiac-thallium^{201} SPECT scans in 70% of CFS patients, similar to that described in patients with syndrome X. In a separate study, a significant number of CFS patients were found to have elevated REE as compared to the controls using total body potassium (TBK) as the refererence (REE $_{TBK}$).4

Conclusion: Abnormal thallium^{201}-cardiac SPECT scans in CFS similar to those described in syndrome X suggest a common mechanism for

both these conditions. An abnormality of membrane ion channel function is considered the underlying mechanism in syndrome X. Increased REE_{TBK}; in a subgroup of CFS patients suggests that some CFS patients spend more energy in maintaining essential body function at the expense of the energy available for other physical activities. Since 30% of REE is expended to maintain physiological ion gradients in normal health, cell membranes that leak ions increase REE_{TBK} Elevated REE and abnormal cardiac perfusion scans in CFS provide the first objective and indirect support to our hypothesis that symptoms in CFS could be the result of an acquired abnormality of the voltage or ligand-gated ion channels. It is possible that such alteration of transmembrane ion traffic could affect normal receptor sensitivity to neurochemicals and neurohormones such as acetylcholine, serotonin or other monoamines, accounting for the neuroendocrine abnormalities previously documented in CFS.