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Can we personalize therapy for lupus nephritis using mathematics?

Lupus nephritis is a chronic, relapsing-remitting autoimmune disease that damages the kidneys - immune complexes and auto-antibody accumulate within the kidneys resulting in inflammatory injury to the kidneys. Although the prognosis for lupus nephritis has dramatically improved with aggressive immunosuppressive therapies, these drugs carry significant side effects. To improve the effectiveness of these drugs, biomarkers of renal flare cycle are integrated into a mathematical model of kidney inflammation to detect the onset, severity, and responsiveness of kidney relapses, and to modify therapy accordingly. The mathematical model is calibrated to actual individual patient data sets to qualitatively reproduce the observed clinical behavior for each patient, and to better understand disease mechanisms specific to each patient. Furthermore, simulations based on patient-specific parameters suggest that effective combination of clinical data and physiologically based mathematical modeling may provide a basis for more comprehensive modeling and improved clinical care for lupus nephritis patients. (Received July 30, 2011)