

Krumova EK, Frettlloh J, et al. Long-term skin temperature measurements: A practical diagnostic tool in complex regional pain syndrome. Pain 2008;140:8-22.

Design: Physiology experiment

Brief summary of results:

- 40 patients with CRPS and painful non-CRPS participated, along with 24 healthy controls, in an experimental study of limb skin temperatures in university settings in Bochum and Kiel, Germany
- 22 patients (16 women, 6 men, mean age 53) had CRPS (19 CRPS-I and 3 CRPS-II); none had had sympathetic blocks or sympathectomy
- 18 patients (9 women, 9 men, mean age 41) had limb pain other than CRPS
- 24 healthy participants (15 women, 9 men, mean age 33) were recruited from students and hospital staff
- The experiment involved skin temperature measurements of the palmar pad of the index finger of both hands, using probes which were fixed with sticking plaster; a sensor on the dorsum of the hand measured air ambient temperature
- All participants were instructed to perform certain activities to change the ambient temperature (e.g., go out onto a balcony for a few minutes), and to carry out their ordinary daily activities, keeping a diary of meal times, walking, resting, etc. for a period of 5 to 8 hours
- The temperature sensor sensed and stored data at 1 minute intervals, so that each participant had several hundred data points for analysis
- The main outcomes were based on side-to-side skin temperature differences (ΔT), and on the percentage of time in which the absolute value of ΔT was more than 2°C ; this was one element of a summary score which was used to distinguish CRPS from normal and non-CRPS conditions
- An additional outcome was based on the square of the correlation coefficient of temperatures between the two hands (r^2): this was the second element of the summary score to distinguish CRPS
- The number of oscillations more than 2°C was counted for the test hand and the control hand, and their quotient ($>2^\circ\text{C}$ oscillations on test hand/ $>2^\circ\text{C}$ oscillations on control hand) was calculated; this was the third element of the summary score
- In the healthy controls, ΔT exceeded 2°C an average of 8% of the recorded time; in CRPS patients, ΔT exceeded 2°C an average of 32.3% of the time, and in non-CRPS, the average was 19.4% of the time
- In the healthy controls, there was nearly perfect correlation between the temperatures of the two hands ($r^2 = .93$); in CRPS, the correlation ($r^2 = .74$) was less; and in non-CRPS, the correlation was intermediate ($r^2 = .84$)
- In healthy controls and in non-CRPS patients, the number of oscillations greater than 2°C was equal in the two hands (their quotient was 1.01), but in CRPS patients, there were fewer 2°C oscillations in the affected hand than in the control hand (their quotient was 0.87)
- Sensitivities and specificities were calculated for several criteria; the three-element summary score defined above was the principal criterion used

- Using this summary score, CRPS could be distinguished from non-CRPS pain with a sensitivity of 73% and a specificity of 67%
- The same summary score could distinguish between CRPS and healthy controls with a sensitivity of 94% and a specificity of 79%

Authors' conclusions:

- Patients with CRPS differ significantly from healthy controls in all parameters measuring skin temperature differences
- Asymmetries in skin temperature changes over a long-term period during daily activities with alternating ambient temperatures can be helpful in distinguishing CRPS from non-CRPS conditions; the skin temperature difference alone is not sufficient for the diagnosis of CRPS
- The difference between minimum and maximum skin temperatures in the healthy limb was on average 15° C, indicating that the several-hour observation period involved significant skin temperature differences involving the sympathetic nervous system

Comments:

- The summary score is likely to be weak in distinguishing between CRPS and conditions which resemble CRPS; with a sensitivity of 73% and a specificity of 67%, the likelihood ratio (true positive rate/false positive rate) is only 2.2, which is not high enough to be a practical clinical test
- The data seem to show that CRPS is characterized by an inhibited sympathetic response to physiologic stimuli of an autonomic response, and that observation of skin temperatures over an extended period of time is more informative than a single measurement of skin temperatures

Assessment: For evidence that a summary of indicators of skin temperature differences in an ambulatory setting can reliably distinguish CRPS from conditions that may resemble CRPS: inadequate

For evidence that CRPS is characterized by blunted sympathetic responses to physiologic stimuli: adequate