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Breast cancer

Applications of Actigraphy

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Why actigraphy?

Actigraphy is the measurement of motion used to monitor 24-hour activity patterns, usually performed with a small accelerometer contained in a watch-like device worn on the wrist or hip. Motion patterns may be displayed as an actogram that shows daily activity and rest periods. The motion data time-series can be analyzed to provide a range of validated endpoints relating to activity, sleep, and circadian rhythms.

The ability to measure motion precisely and continuously through-out a clinical trial, rather than at discrete study visits, allows for the application of advanced statistical techniques to model day-by-day (or night-by-night) changes between arms and over time, increasing statistical power. Actigraphy is non-invasive, meaning that the data reflect the experiences of the study participant undergoing their usual routine in their normal environment.

Sleep complaints in breast cancer

Up to 70% of breast cancer patients report symptoms of insomnia,[1] which is approximately double the prevalence observed in the general population.[2] Studies suggest that optimal sleep is an important predictor of cancer prognosis; for example, in 2014 Palesh et al. demonstrated that increased sleep efficiency, decreased wake after sleep onset, fewer wake bouts, and shorter wake bout duration were all significantly associated with reduced mortality amongst women with advanced breast cancer, after adjustment for known prognostic factors.[3] Disturbed sleep can have a profound impact on functional status and quality of life in breast cancer sufferers;[4] sleep duration and quality therefore represent important secondary endpoints in studies assessing the impact of chemotherapy.

Despite being one of the most common complaints of cancer patients, poor sleep is often overlooked clinically,[5] and objective assessments of sleep have been under-utilized in clinical trials. For example, in a recent meta-analysis of studies assessing the impact of sleep interventions in cancer patients, over 80% of studies relied solely on self-reported sleep endpoints.[6] In a sample of women in breast cancer remission, sleep

diaries overestimated total sleep time by almost 1.0 hour/night, and underestimated wake after sleep onset by almost 1.5 hours/night compared with actigraphy.[7] Such large discrepancies highlight the importance of using actigraphy to capture habitual sleep patterns objectively while investigating the efficacy and effectiveness of cancer treatment.

Altered circadian rhythms

Actigraphy has been used to demonstrate that the circadian rhythms of breast cancer patients become desynchronized during chemotherapy,[8] and that greater desynchronization is associated with decreased quality of life.[9] Circadian disruption measured by other means is a significant independent predictor of early mortality amongst breast cancer patients,[10] a finding that has been replicated in colorectal cancer using actigraphy.[11] Thus, actigraphy-derived markers of circadian rhythms represent important pharmacological endpoints. There is also evidence that tumor cell proliferation demonstrates circadian rhythmicity[12] emphasizing the potential utility of chronotherapy (the administration of anti-cancer drugs with respect to circadian timing) and possibly also a role for adjunct treatments such as light therapy to maximize response to chemotherapy.

...and more

Beyond conventional sleep and circadian endpoints, there is opportunity to use Philips' Rapid Actigraphy Data Analyzer ('RADA') software to delve much deeper into rich and complex actigraphy datasets by investigating mathematical patterns which may be responsive to pharmacological therapy. Actigraphy datasets never 'expire', and can be re-analyzed quickly and easily as new algorithms are developed.

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