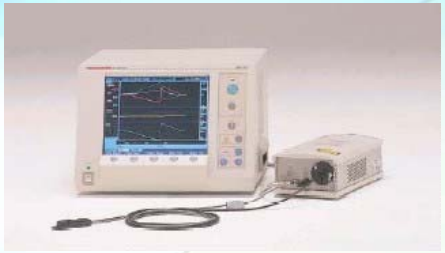

Patterns of Change in Detrusor Cytochrome a,a3 During Urodynamics in Adult Men and Women

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INTRODUCTION:

Modern clinical near infrared spectroscopy (NIRS) emerged in 1977 when Jobsis described the application of NIRS to the study of cerebral metabolism via the mitochondrial respiratory enzyme cytochrome c oxidase (Cyt), also known as cytochrome a,a3.

NIRS devices are commercially available and typically use several wavelengths transmitted to the tissue surface via a fiber optic bundle, and detected with a photodiode array mounted on the skin's surface. The ratio of emitted light intensity to detected light intensity is used to derive absolute changes in cytochrome redox status.

Cyt is the terminal enzyme in the respiratory chain which transfers electrons in step wise fashion to create molecules of H_2O. Changes in the redox status of Cyt reflect changes in ATP availability. Thus, the redox status of mitochondrial Cyt measured by NIRS gives insight into overall cell health, as the balance of oxygen availability and energy expenditure.

METHODS:

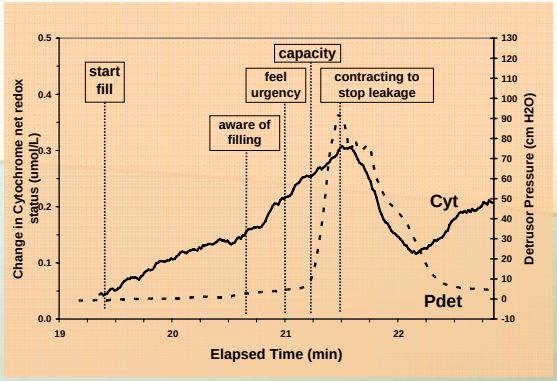
Ten males aged 55 to 82 years and 10 females aged 30 to 67 years presenting with complaints of frequency, urgency, neurogenic bladder, obstruction, and overflow incontinence underwent routine cystometrograms with simultaneous NIRS data collection.

The optodes of a NIRO-300 (Hamamatsu Photonics KK, Hamamatsu City, Japan) were placed at 40mm separation on the intact skin of the abdomen over the transverse midline of the bladder. Measurements of abdominal pressure (Pabd), detrusor pressure (Pdet) and vesical pressure (Pves) together with NIRS Cyt were collected simultaneously at 6Hz intervals. Two filling cystometrograms and pressure flows with EMG were completed per patient.

Data collection began with an empty bladder and continued through both filling with sterile saline, via infusion pump, and voluntary emptying. Event markers recorded the subject's declared moments of first sensation of filling, first urgency, full capacity, and being finished voiding.

RESULTS:

There were highly significant correlations ($p<0.05$ for $r>0.095$) between all NIRS and all standard pressure transducer readings: Cyt a,a3 vs Pabd r=0.62, Cyt a,a3 vs Pves r=0.35, and Cyt a,a3 vs Pdet r=0.23. High urodynamic pressures are related to an increase in oxidized cytochrome c oxidase concentration. There was no statistically significant difference in redox status between genders.



Example of detrusor over activity, urgency incontinence, high contraction pressure, and obstruction in a supine 55 year old male with reduced flow, urinary frequency, and post-void dribbling.

CONCLUSION:

Cyt changes during high detrusor pressure suggest that changes in cell respiratory metabolism are part of bladder cycling. Non-invasive NIRS may be a useful tool in urodynamics.

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