

## IS ISCHAEMIA PRESENT IN THE DETRUSOR MUSCLE DURING DETRUSOR OVERACTIVITY CONTRACTIONS?

### Hypothesis / aims of study

Bladder ischaemia has been shown to lead to detrusor overactivity in animal models (1). Near infra red spectroscopy (NIRS) is a non invasive optical technique which monitors changes in tissue oxygenation and haemodynamics. NIRS uses wavelengths of low intensity infra-red light transmitted to the bladder through the skin via a fibre optic bundle and detected with a photodiode array mounted on the skin's surface. The ratio of light intensity emitted and detected is used to derive absolute changes in haemoglobin concentration. Studies using NIRS during bladder filling and voiding cystometry have shown that it is a non invasive method of evaluating males with voiding dysfunction(2)(3). The aim of this study was to use NIRS to measure oxygenation of detrusor muscle during filling and voiding cystometry and to assess whether there is a reduction in oxygenation during detrusor contractions during voiding and overactivity.

### Study design, materials and methods

Twenty women were recruited from the urodynamics clinic in a tertiary referral centre. Women with a body mass index of greater than 30 were excluded from the study to enable optimal NIRS acquisition. Women with voiding difficulties were also excluded from the study so that the detrusor contractions during unobstructed voiding could be assessed. Informed consent was obtained from the women. The TETRA bladder monitor system was used for the NIRS study to measure the oxygenated haemoglobin (HbO<sub>2</sub>); deoxygenated haemoglobin (Hb) and sum of oxygenated haemoglobin and deoxygenated haemoglobin (HbSum) simultaneously while the women underwent filling and voiding cystometry. This was achieved by using two optrodes, one was an infra red emitter and other was a detector. The optrodes were positioned to lie 2cm above the symphysis pubis. The bladder was filled at the rate of 100ml/min and the first desire to void, normal desire to void, strong desire to void and maximum cystometric capacity were noted. Annotations were also made on the trace when the woman complained of urgency or had an uninhibited detrusor contraction. Using NIRS, HbO<sub>2</sub>, Hb and HbSum was recorded continuously and simultaneously during filling and voiding cystometry. Urodynamic diagnosis was made according to ICS guidelines.SPSS version 14 was used for statistical analysis.

### Results

The urodynamic diagnoses were detrusor overactivity (DO) in 6, urodynamic stress incontinence (USI) in 6, both DO and USI in 6, and normal urodynamics in 2 cases. There was a significant rise in deoxygenated haemoglobin during involuntary detrusor contractions (Table 1) where there was no significant change in oxygenation during voluntary voiding (Table 2).

There was no significant difference between the peak detrusor pressure measured during involuntary detrusor contractions and the peak detrusor pressure during voiding (Mann Whitney U test p>0.05).

Table 1: Mean deoxygenated, oxygenated and total haemoglobin and 95% confidence intervals of the mean during detrusor contraction and when the detrusor was stable

	Deoxygenated Hb mean (95%C.I.)	Oxygenated Hb Mean (95%C.I.)	HbSum Mean (95% C.I.)
When detrusor stable	<b>0.135</b> (-.7 to .97)	-.575(-2.29 to 1.14 )	-.665(-2.58 to 1.25)
During involuntary detrusor contraction	<b>5.700</b> (-.07 to 11.47)	4.900(-2.65 to 12.45)	10.527(-1.90 to 22.95)
P value (Mann –Whitney test)	<b>&lt; 0.05</b>	>0.05	>0.05

Table 2: Mean deoxygenated, oxygenated and total haemoglobin and 95% confidence intervals of the mean during opening detrusor pressure and peak flow rate during voiding.

	Deoxygenated Haemoglobin mean (95% C.I.)	Oxygenated Haemoglobin mean (95%C.I.)	Total HbSum Mean (95%C.I.)
Opening detrusor pressure	1.616(-2.83 to 6.06)	-.842(-6.31 to 4.62)	.842(-8.82 to 10.50)
Peak flow rate	1.495 (-2.60 to 5.59 )	.368 (-4.64 to 5.38)	1.705 (-6.98 to 10.39)
P value	>0.05	>0.05	>0.05



Figure 1: Episode of detrusor overactivity

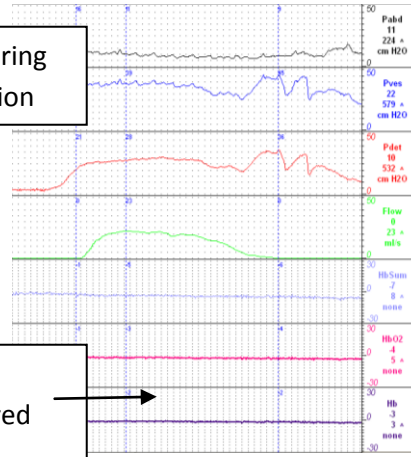


Figure 2: Urodynamic pressure flow study

**Interpretation of results**

During involuntary detrusor contractions there was a statistically significant rise in deoxygenated haemoglobin when compared to stable detrusors. There were no statistically significant differences in oxygenated or total haemoglobin. There were no statistically significant changes in the oxygenation parameters during voiding even though these were at similar pressures to the episodes of the involuntary detrusor contractions. This indicates that during an involuntary detrusor contraction there is ischaemia which does not occur during voiding. Ischaemia may be a pathological mechanism for the development of detrusor overactivity in women.

**Concluding message**

There are changes in oxygenation of the detrusor during involuntary contractions in women which are not seen in voiding

**References**

1. Scand J Urol Nephrol Suppl. 2004;(215):84-92
2. Can J Urol. 2008 Dec;15(6):4399-409
3. Can J Urol. 2008 Oct;15(5):4241-8

<b>Specify source of funding or grant</b>	none
<b>Is this a clinical trial?</b>	No
<b>What were the subjects in the study?</b>	HUMAN
<b>Was this study approved by an ethics committee?</b>	Yes
<b>Specify Name of Ethics Committee</b>	Camden & Islington Community REC
<b>Was the Declaration of Helsinki followed?</b>	Yes
<b>Was informed consent obtained from the patients?</b>	Yes