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DETRUSOR OVERACTIVITY AND ATHEROSCLEROSIS, ARE THEY LINKED? ATHEROSCLEROSIS SCREENING USING ANKLE BRACHIAL INDEX AND PULSE WAVE VELOCITY IN WOMEN WITH DETRUSOR OVERACTIVITY.

Hypothesis / aims of study

In animal studies, induced atherosclerosis of the pelvic vessels is associated with the development of urodynamic proven detrusor overactivity (DO). The mechanisms appear to be increased collagen deposition, upregulation of proinflammatory markers, cytokines and decreased nitric oxide synthase expression(1). The aim of the study was to evaluate signs of atherosclerosis in women with detrusor overactivity, using the Ankle Brachial Index (ABI), a simple, non-invasive predictor of atherosclerosis and peripheral vascular disease, as well as the Brachial-ankle Pulse Wave Velocity (Ba-PWV), a predictor of aortic vessel stiffness and how they are able to expand and contract with cardiac pulsation and relaxation.

Our hypothesis was that postmenopausal women with DO will have a significant decrease in their ABI and/or an increase in Ba-PWV when compared to postmenopausal control women (without any overactive bladder symptoms). Thus supporting the atherosclerotic changes are more likely in patients with DO.

Study design, materials and methods

This is a prospective cohort study of women aged over 50, who are post-menopausal, with urodynamically proven non-neurogenic DO with or without a voiding dysfunction. Controls comprised women with no symptoms of an overactive bladder (i.e. those recurrent UTI, haematuria, prolapse or pure stress incontinence).

Women were recruited from a Tertiary Urogynaecology Unit. New patients, as well as patients presenting for review, urodynamics, or pre-operative assessment, were asked to participate in the study and have their ABI and Ba-PWV assessed using the OMRON 1000 machine. The ABI is a ratio of the systolic blood pressure in the tibial artery systolic blood pressure (SBP) compared to the brachial artery. A normal value is between 0.90 and 1.40. A value below 0.90 is considered to indicate significant atherosclerosis, which requires further investigation. An ABI >1.40 indicates that pathological hardening of the arteries has occurred not likely due to atherosclerosis itself. Ba-PWV is a measure of the time it takes a pulse wave to travel from the arm to the ankle. The higher the number, the stiffer the central vessels. This value normally increased with age, hence all women had their age, height, and weight recorded.

ABI and the Ba-PWV were performed in the supine position, after resting for five minutes, using appropriate sized arm cuffs, using an automatic machine, called the OMRON 1000. This is an automated blood pressure machines that measures the BP simultaneously in each limb to calculate the ABI and also measures and calculates the Ba-PWV on each side of the body. This machine is designed to minimize inter-user variability. While some studies have suggested that automated machines are not as sensitive as the hand held Doppler, a study using an earlier model, the OMRON HM 722 showed that it had an excellent sensitivity (92%) and specificity (98%) to detect an abnormal ABI and Ba-PWV when compared to the traditional hand held Doppler measurement in calculating an accurate ABI (2). The left brachial BP was recorded in the traditional manner.

Thus far only one study of PWV in relation to the overactive bladder (OAB) is known (3), which used carotid-femoral PWV. To date, no studies of ABI in relation to OAB have been performed. Therefore no data existed to enable an adequate sample size to be calculated. As a result we collected 20 data sets in DO patients, and 56 Controls (mean PWV values were 1800 and 1660 respectively), from which a sample size was calculated. In order to detect a statistically significant difference with a 80% power in the PWV of 140 between the two groups, with a sd=300 a sample size of 73 will be required in each group. Data collection is on going. Data was analysed using Microsoft SPSS with the departmental statistician.

Exclusion criteria: Women <50 years of age; Women with diabetes, or Chronic Kidney disease, as they are more likely to have falsely elevated ABI due to arterial calcification. Women with severe hypertension (Systolic BP (SBP) >180, Diastolic BP (DBP) >110) were also excluded as this was likely to falsely elevate the PWV due to decreased arterial compliance and increased volume due to arterial dilation. Women with an ABI <0.90 were excluded for analysis of PWV because significant peripheral vascular disease renders the calculation of PWV inaccurate on this equipment.

Patient information such as childhood bed wetting or day wetting, or recurrent cystitis, was noted; along with peripheral artery disease, hypertension, hypercholesteraemia, voiding dysfunction, body mass index (BMI), insulin resistance, were recorded. "Known hypertension" was defined as a pre-existing diagnosis of hypertension (SBP >140, DBP >90) by another clinician, which was largely treated with anti-hypertensives.

Results

Thus far 59 controls and 23 women with DO have been recruited. 6 were excluded due to severe hypertension (5 controls and 1 with DO), and a further 6 women (3 controls and 3 with DO) excluded for analysis of PWV only due to ABI <0.90. The data was normally distributed

Mean age, BMI, rates of hypertension, and BP were similar between groups (see above table). 37/57 (59.6%) in the control group had a background of known hypertension, vs 13/22 (59.1%) in the women with DO. As can be seen in the Table, as yet, there is no statistical difference in the ABI between the DO and Control patients. The PWV appears to be significant elevated in the patients with DO on the left side (with a similar trend on the right).

Abnormal results were followed up with the patients General Practitioner and any serious abnormalities were referred to our collaborating vascular surgeon for further management.

| Group: | Detrusor overactivity (95% CI) | Control (95% CI) | Significance |
|--------------|--------------------------------|-------------------|--------------|
| Mean age | 71.4 (67.3, 75.6) | 72.3 (69.6, 74.9) | NS |
| Mean SBP | 149 (141, 157) | 147 (141, 151) | NS |
| Mean DBP | 82 (77, 87) | 81 (79, 84) | NS |
| Mean BMI | 27.3 (25.5, 29.1) | 27.4 (26.1, 28.7) | NS |
| ABI Right | 1.08 (1.03, 1.13) | 1.15 (1.11, 1.20) | NS |
| ABI Left | 1.08 (1.03, 1.12) | 1.15 (1.12, 1.17) | NS |
| Ba-PWV Right | 1757 (1606, 1909) | 1605 (1515, 1695) | P=0.076 |
| Ba-PWV Left | 1831 (1624, 2038) | 1611 (1537, 1685) | P=0.048 |

Interpretation of results

Our preliminary results show indicates that the PWV measurement is statistically elevated on the patients left hand side (with a similar trend on the right), implicating possibly decreased elasticity of the central vessels such as the aorta and the internal iliac/pelvic vessels. Perhaps these women with DO are more likely to have (as seen in animal studies), decreased vascularization and thus oxygen supply to the bladder wall and the nerves supplying the bladder with resultant overactivity of the detrusor muscle (1).

While $p < 0.05$ in the left Ba-PWV, the current small sample size could mean that this is a type two error. However, more women are recruited to achieve adequate statistical power.

Concluding message

Detrusor overactivity is the second most common cause of urinary incontinence in women, but the aetiology remains unclear. Our overall goal is to amass a very large data set of arterial vascular studies in women with DO, so that we can perform subset analysis in women who have the known bad prognostic features of bed wetting/day wetting/recurrent cystitis. Thus it may be possible to identify different aetiological subgroups amongst the common urodynamic diagnosis of Detrusor overactivity – perhaps those with vascular impairment may be “truly idiopathic” group.

References

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Disclosures

Funding: Pelvic Floor Research Fund **Clinical Trial:** No **Subjects:** HUMAN **Ethics Committee:** South Eastern Sydney Area Health Authority Ethics Committee **Helsinki:** Yes **Informed Consent:** Yes