

'Application of two pelvic floor muscle function tests in men following radical prostatectomy relationship to urinary incontinence'

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Abstract

This study examines the impact of posture and measures of urinary incontinence relating to two non-invasive real time ultrasound-based tests. Using real time ultrasound with transperineal and transabdominal approaches, we assessed pelvic floor muscle function in men and found the rapid response and sustained endurance tests possessed strong reliability in both supine and standing postures, and for both ultrasound approaches. However, questions remain pertaining to the relationship of the tests to other outcome variables, including measures of urinary incontinence. Participants (n=95) undergoing radical prostatectomy were assessed to determine the relationship between incontinence and pelvic floor muscle function, as seen on ultrasound. The presence and severity of incontinence was measured via 24-hour pad weight. When related to pad weight, the transabdominal protocol produced statistically significant correlations between the rapid response test in standing ($r=0.430$, $p<0.001$) and supine ($r=0.456$, $p<0.001$), and the sustained endurance test in standing ($r=-0.560$, $p<0.001$) and supine ($r=-0.560$, $p<0.001$). Similar results were found using the transperineal approach. All Bland-Altman analyses showed no significant difference ($p>0.05$) between the two postures, for either test or scan approach. While the plots also demonstrate no heteroscedasticity or proportional bias, with the bias being close to 0, the magnitude of variation in difference scores suggests different outcomes for tests performed in standing compared to supine postures. We present two simple bedside tests that provide objective, non-invasive, and reproducible assessment of pelvic floor muscle function in men that relate to clinical outcomes including urinary leakage.

Introduction:

- Urinary Incontinence (UI) is often associated with compromised function of the pelvic floor muscles, especially in men after radical prostatectomy for Prostate Cancer of which there are 1.4 million new cases diagnosed annually.
- Current strategies for enhancing PFM function in men are not well supported by research.
- It is expected most men will report UI and ED following RP, due to damage sustained to the internal urethral sphincter (bladder neck), coupled with increased demand on PFM with removal of prostate.
- Post RP- most men suffer UI in upright postures, with changes in intra-abdominal pressures such as during sit to stand/cough/sneeze/ lifting typically causing leakage. Worsening leakage occurs over the day, with PFM fatigue and increased activity levels
- Men are generally dry in supine positions after the initial post-RP catheter- adjustment time.
- The use of two newly pioneered RTUS-based tests- the Rapid Response Test (RRT) and Sustained endurance Test (SET)- are specific to the physiological make up and demands of the PFM in relation to sustained and rapid actions, my measurement of PFM contractions over time

- These tests aimed to minimise the need for per rectal assessments, which are unrelated to urinary sphincteric function in UI
- Application of RRT and SET in different postures (supine vs standing) and their relationship to 24-hour pad weights were analysed, in an effort to match clinical presentations seen in post-RP patients.

Methods:

- TransAbdominal (TrA) & TransPerineal(TrP) RTUS PFM tests were utilised to assess correct PFM technique in both supine and standing positions. RRT (Perform 10 maximal PFM contractions and relaxations as rapidly as possible) and SET (Hold a maximal contraction for as long as possible and continue to breath to a maximum of one minute'). Elapsed time was recorded in both tests as per Paper 1.
- 24 -hour Pad weights recorded as described.
- TrA and TrP testing positions described as for paper 1

Statistical Analysis

- SPSS utilised , significance accepted for all analyses $p < 0.5$
- Strength correlations used Pearson's correlation and linear regression with:
 $r = 0.25-0.5$ weak to moderate, $r = 0.5 -0.75$ moderate to good > 0.75 good to excellent

Results:

- 95 participants, post-RP

Relationship between RTUS tests and pad weight

- Statistically significant correlations were observed between 24-hour pad weight and both RRT and SET in all combinations of posture and either TrP or TrA probe positions. All correlations moderate to good in RRT and SET assessments.

Relationship between supine versus standing

- No significant difference was seen between RRT and SET performed in either standing or supine using TrA or TrP approaches- Bland Altman plots.

Discussion:

- PFM function utilising RRT and SET scores were compared to 24-hour pad weights to measure severity of UI.
- Moderate correlations were achieved between 24-hour pad weight and SET and RRT assessment.
- Lower RRT scores, indicative of fast twitch PFM fibre function related to better PFM function and milder incontinence. Higher RRT scores reflected worse UI.
- For endurance, higher SET scores related to better PFM function and less UI. Lower SET scores related to higher pad weights and worse UI.

- Similar scores were achieved for RRT and SET when comparing supine vs standing postures between participants, with the supine position reflecting less PFM fatigue and less UI. I.e. we were able to show that posture does have an impact on PFM function.
- We recommend testing PFM function in standing to better reflect clinical presentation of UI in post-RP patients.
- RRT and SET scores can be used as a baseline for assessment and rehabilitation strategies

Limitations:

- Other factors may influence UI and pad weight that we did not account for e.g. surgical experience, damage to IUS/ bladder neck/degree of nerve sparing.
- Edge detection may enable RRT and SET tests to be more highly reproducible
- 3-day pad weights may have offered a broader view of patient UI variability

Conclusions :

- RRT and SET scores were associated with 24-hour pad weight and severity of UI.
- Pad weight and PFM RRT and SET varied according to posture, but not TrA or TrP approaches
- Standing is the best default position to assess this population, either TrP or TrA appropriate, but can be personalized depending on patient presentation.