**386**

Bower W[1]
***1.*** *Institute of Clinical Medicine, Aarhus University*

# USING DIRECTED ACYCLIC GRAPHS (DAGS) TO UNDERSTAND CAUSALITY OF DYSFUNCTIONAL VOIDING IN WOMEN.

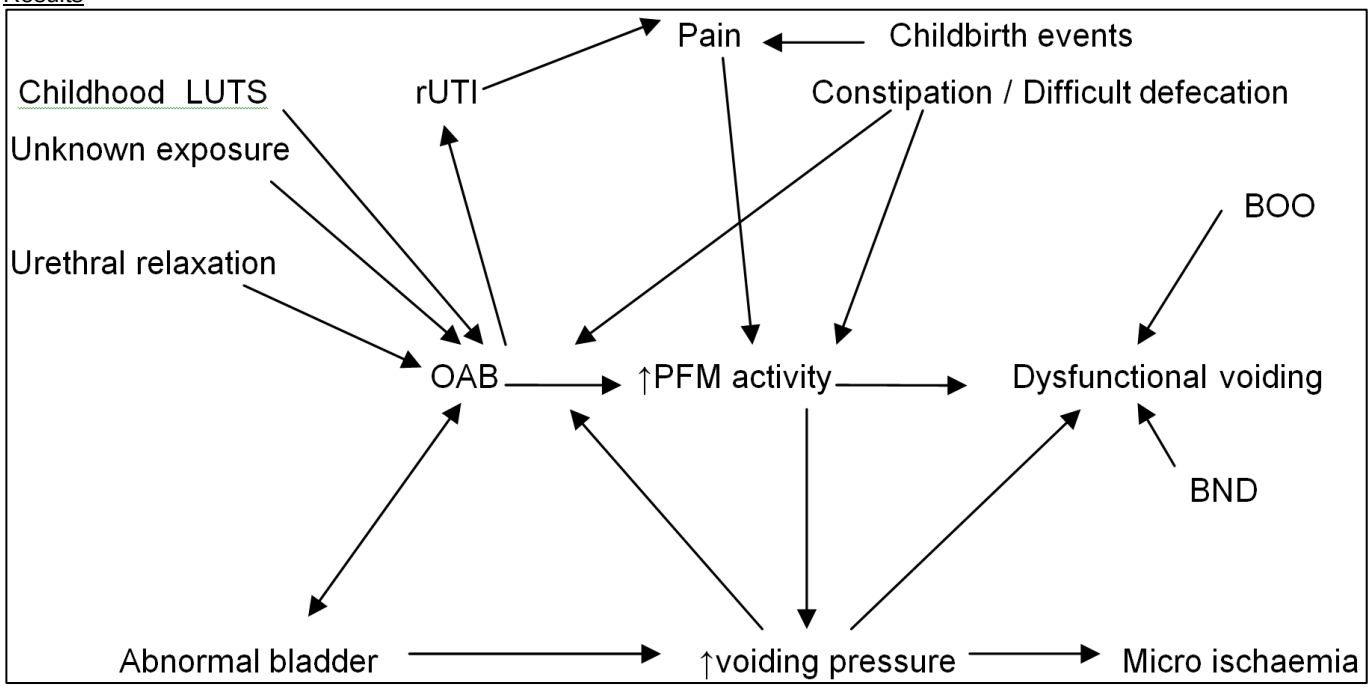
Hypothesis / aims of study

Functional obstruction to voiding by involuntary intermittent contractions of the peri-urethral skeletal muscles generates a transient reduced lumen mid urethra. Flow of urine is slowed and as a response voiding pressure increases, yet significant urine remains in the bladder post-void. This altered voiding may be driven by pain, be idiopathic or a compensatory response to urethral relaxation that permits urine to leave the bladder. Specific correlates of functional obstruction in women include cystitis or proven urinary tract infections, constipation or difficult defecation, urethral relaxation and childbirth events [1-3]. The aim of this study was to explore causality of dysfunctional voiding in women by using Directed Acyclic Graphs to manage confounding.

Study design, materials and methods

Factors known to have an association with the outcome of dysfunctional voiding in women were incorporated into a DAGS. Possible direct and indirect pathways from each exposure were identified. Specific rules were applied to mediators and confounders. Statistical analysis strategies to generate unbiased estimate of exposures were derived.

Results




[rUTI: recurrent urinary tract infections; BOO: bladder outlet obstruction; BND: bladder neck dysfunction; OAB: overactive bladder; PFM: pelvic floor muscle; LUTS: lower urinary tract symptoms]

Direct pathways to the outcome of dysfunctional voiding from covariates: 1) rUTI via the mediators of OAB, abnormal bladder and change in voiding pressure. 2) urethral relaxation and childhood LUTS have common pathways via both OAB and abnormal bladder. 3) pain via the mediator of ↑PFM activity. 5) constipation mediated by ↑PFM activity. Indirect pathways from: 5) constipation via OAB, rUTI, pain and ↑PFM activity. 6) childhood LUTS mediated by OAB, rUTI or constipation.

Given the hypothesis that OAB causes dysfunctional voiding, the covariates childhood LUTS and urethral relaxation need not be included in the analysis. The presence of increased pelvic floor activity cannot be considered a mediator given that it is blocked by constipation and pain. If it were adjusted for, the direction of arrowheads would be removed and the paths between pain, constipation, rUTI and dysfunctional voiding opened. To test the initial hypothesis related to OAB, increased pelvic floor activity should be left as a collider to block the direct path to dysfunctional voiding allowing the pathway through abnormal bladder to be examined.

Given the hypothesis that abnormal bladder morphology causes dysfunctional voiding one can see that if ↑PFM activity is not conditioned on and blocks the pathway to dysfunctional voiding then Change in voiding pressure mediates the effect of bladder change on dysfunctional voiding. Similarly if PFM activity is conditioned on, but OAB is not, then the hypothesis between constipation and dysfunctional voiding can be tested.

Interpretation of results

The etiology of dysfunctional voiding in women can be explored by considering each possible cause (i.e. exposure) and subjecting it to a DAGS to identify covariates that may bias an estimate of effect. We have identified 4 direct and 2 indirect pathways from exposures known to have some association with functionally obstructed voiding in women

Concluding message

A DAG illustrates the complexity of dysfunctional voiding due to functional obstruction in women. It offers mathematical rules that direct inclusion of variables in the analysis of causation without requiring complex statistical programs. By controlling for variables that violate the rules one can minimize bias and confounding in analysis and development of causal models.

References

1. Coyne KS, Kaplan SA, Chapple CR et al. BJU Int. 2009 Apr;103 Suppl 3:24-32.
2. Abrams P, Cardozo L, Fall M et al. Neurourol Urodyn. 2002;21(2):167-78
3. Zhang W, Song Y, He X et al. Eur Urol. 2005 Aug;48(2):309-13

Disclosures

**Funding:** Nil **Clinical Trial:** No **Subjects:** NONE