

Accepted Manuscript

Primary Bladder Neck Obstruction May be Determined by Postural Imbalances

Tommaso Ciro Camerota, Matteo Zagoa, Stefano Pisu, Daniela Ciprandi,
Chiarella Sforza

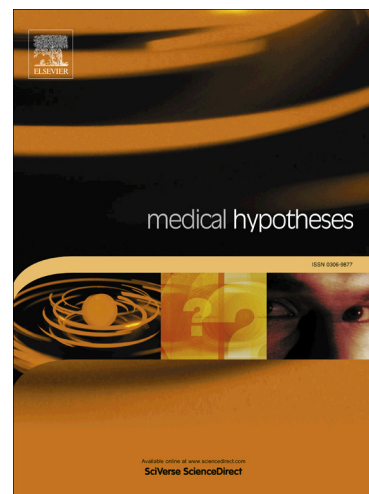
PII: S0306-9877(16)30191-8
DOI: <http://dx.doi.org/10.1016/j.mehy.2016.10.028>
Reference: YMEHY 8404

To appear in: *Medical Hypotheses*

Received Date: 28 May 2016
Revised Date: 26 October 2016
Accepted Date: 27 October 2016

Please cite this article as: T.C. Camerota, M. Zagoa, S. Pisu, D. Ciprandi, C. Sforza, Primary Bladder Neck Obstruction May be Determined by Postural Imbalances, *Medical Hypotheses* (2016), doi: <http://dx.doi.org/10.1016/j.mehy.2016.10.028>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.



PRIMARY BLADDER NECK OBSTRUCTION MAY BE DETERMINED BY POSTURAL IMBALANCES

Tommaso Ciro Camerota*

Dpt. of Biomedical Sciences for Health, Università degli Studi di Milano

via Mangiagalli 31, 20133 Milano – Italy

email: tommaso.camerota@unimi.it

Matteo Zago*

Dpt. of Biomedical Sciences for Health, Università degli Studi di Milano

via Mangiagalli 31, 20133 Milano – Italy

email: matteo.zago@unimi.it

Orcid: 0000-0002-0649-3665

Stefano Pisu

Dpt. of Biomedical Sciences for Health, Università degli Studi di Milano.

via Mangiagalli 31, 20133 Milano – Italy

email: pisu.stefano90@gmail.com

Daniela Ciprandi

Dpt. of Biomedical Sciences for Health, Università degli Studi di Milano

via Mangiagalli 31, 20133 Milano – Italy

email: daniela.ciprandi@unimi.it

Chiarella Sforza

Dpt. of Biomedical Sciences for Health, Università degli Studi di Milano

via Mangiagalli 31, 20133 Milano – Italy

email: chiarella.sforza@unimi.it

Orcid: 0000-0001-6532-6464

** TCC and MZ equally contributed to the present paper.*

Manuscript #YMEHY_2016_72 submitted to Medical Hypotheses on 24 May 2016.

First revision submitted on 26 October 2016.

Word count: 1113

Corresponding author: Chiarella Sforza

Dpt. of Biomedical Sciences for Health, Università degli Studi di Milano

via Mangiagalli 31, 20133 Milano – Italy

Tel: +39-02-503-15407

Fax: +39-02-503-15387

email: chiarella.sforza@unimi.it

SUMMARY

Primary bladder neck obstruction (PBNO) is a frequent under-investigated urological condition in which the bladder neck fails to open adequately during voiding. In the majority of cases no known etiological factor can be found.

In this study we propose a new hypothesis to explain the origin of the disease in young male patients with no neurological disorders. We suggest a possible role of an unbalanced biomechanics of the pelvis on urethral sphincters activity and on functional bladder capacity. To support the proposed hypothesis, we present pilot gait analysis data of young male patients with primary bladder neck obstruction.

Word count: 98.

Key Words: urology; voiding dysfunction; primary bladder neck obstruction; lower urinary tract symptoms; postural control; pelvic imbalances.

1 BACKGROUND

Primary bladder neck obstruction (PBNO) is a urological condition in which the bladder neck fails to open adequately during voiding, resulting in an obstructed urinary flow in the absence of anatomic obstruction (e.g.: increased striated sphincter activity in both sex, benign prostatic enlargement in men or genitourinary prolapse in women). PBNO is a frequent disease in men aged 18 to 45 years, being identified in 47-54% of patients with chronic voiding dysfunction (Kaplan et al., 1996; Nitti et al., 2002). It is a disease of unknown aetiology, thus various etiopathogenetic theories have been presented; among these, we remember structural changes at the bladder neck such as fibrous narrowing or hyperplasia, an abnormal morphologic arrangement of the detrusor/trigonal musculature (Turner-Warwick et al., 1973), and a sympathetic nervous system dysfunction (Awad et al., 1976). To date, the exact cause of PBNO has not been clarified yet (Nitti, 2005).

2 HYPOTHESIS

Young male patients with primary bladder neck obstruction usually refer voiding symptoms, with or without chronic pelvic pain (urogenital or rectal). In these patients peripheral nervous system disorders are ruled out with physical examination, comprehensive medical history, neurological and electrophysiological evaluations.

In some of these patients, we noticed the concomitant presence of non-traumatic biomechanical imbalance of the pelvis. Thus, we propose that PBNO in some cases may be the effect of a postural defect unexplained by a clear orthopaedic entity.

3 EVALUATION OF THE HYPOTHESIS

The relationship between affections in the musculoskeletal system and pelvic dysfunction such as chronic pelvic pain in male patients (Hetrick et al., 2003; Salvati, 1987; Segura et al., 1979) or anal incontinence in both male and female patients (Altomare et al., 2001) has been previously described. In a female population it has been demonstrated that posture have a direct impact on pelvic functions, influencing both the contractility of pelvic floor muscles and the intra-pelvic pressure generated during static postures (Capson et al., 2011; Halski et al., 2014) or dynamic tasks (Sapsford and Hodges, 2001). Moreover, there have been some case reports of symphysis pubis diastasis which resulted in urinary symptoms (Cooperstein et al., 2014; Senechal, 1994; Shippey et al., 2013).

Scientific evidence also exists about the relation between the maladjustment of the lumbo-pelvic area and the development of pelvic dysfunction in females (Bø and Sherburn, 2005; Hungerford et al., 2004; O'Sullivan et al., 2002). Pelvic floor muscles represent part of the abdominal cavity's muscular boundaries, and are thought to have a role in maintaining pelvic stability via force closure (Pool-Goudzwaard et al., 1998; Snijders et al., 1993a, 1993b). In a recent review, Kuo et al. addressed the importance of pelvic floor spasm in the origin of voiding dysfunction in females (Kuo et al., 2015). Moreover, in normal conditions there is an important bladder-to-urethra reflex mediated by sympathetic efferent pathways. It is known that this excitatory reflex (which contracts the urethral smooth muscle) is increased during exercise (Yoshimura and Chancellor, 2004).

We propose a possible correlation between an unbalanced biomechanics of the pelvis and urethral sphincters activity or functional bladder capacity in young male

patients. The urogenital diaphragm occupies the area between the inferior rami of the pubis and the ischium (ischiopubic ramus). Gait abnormalities may result in adjustments at the pelvis level. Pelvic rotation or torsion may cause hypercontraction of the pelvic floor, thus determining bladder neck contraction and interfering with the normal micturition.

To initially test our hypothesis, we searched and collected measurable data. To quantitatively assess the presence of altered locomotion patterns in patients, a pilot gait analysis study was conducted upon two patients with PBNO. PBNO was suspected at bladder diary and uroflowmetry, and was endoscopically confirmed with urethroscopy; urethral strictures and other organic diseases were excluded. Patients underwent neurological clinical evaluation, and no abnormal reflexes were found. Patient's gait was recorded with a motion capture system (BTS Spa, Italy) to obtain three-dimensional joint angles and gait parameters through standard procedures (Lovecchio et al., 2016). None of the patients subjectively perceived motor or postural impairments, and none of them received treatment for BPNO before or during our study. History or complaint of neurological disorders, major injury, lower limbs or back surgery were excluded. An existing database of 32 age- and sex-matched healthy subjects was used as control data. Joint angles evaluated throughout the Gait cycle (GC) in patients with PBNO showed clear discordance in the observations at the ankle and pelvis level relative to normal subjects. In particular, Patient 1's left ankle was excessively inverted (i.e.: joint curve out of the $\text{mean} \pm \text{SD}$ area defined by controls) in the initial contact and loading responses phases (0-10% GC), and in the pre-swing phase (50-60%, Figure 1). The right ankle was excessively inverted in the mid and terminal swing phases (75-95% GC). The right hip was less flexed than in controls during the

stance phase (0-60% GC), while the pelvis was backward tilted and markedly leaned on the left side for almost all the GC.

In patient 2, ankles were more dorsiflexed than normal in the mid-stance (10-30% GC), and the left ankle resulted excessively everted in 40-65% of GC. Left hip was more abducted and extra-rotated than in controls for the entire swing phase. Pelvis excessively dropped on the left side in the terminal swing phase.

These preliminary observations seem to be coherent with both our hypothesis and already published findings. In detail, our data suggest that the relation between maladjustment of the lumbo-pelvic area and development of pelvic dysfunction already demonstrated in a female population (Bø and Sherburn, 2005; Hungerford et al., 2004; O'Sullivan et al., 2002) could also be of interest in male patients.

4 DISCUSSION

Primary bladder neck obstruction in young male patients is a complex non-homogeneous clinical entity. The proposed hypothesis and the current preliminary data suggest that postural imbalances could represent a possible cause of voiding dysfunction. The current hypothesis could also explain the persistence of voiding symptoms in male patients after uncomplicated disobstructive prostatic surgery.

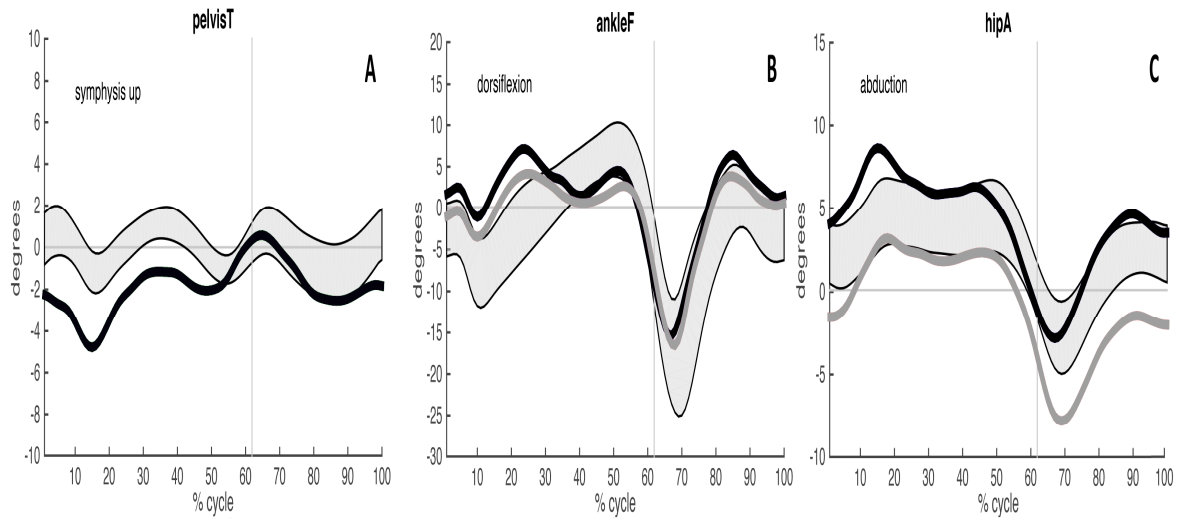
Further research is required to determine the exact role of pelvic imbalances on micturition (bladder contraction and pelvic floor muscles activity), and its possible role in the pathogenesis of PBNO in male patients. Moreover, long-term clinical evaluations are recommended in order to exclude future development of major neurological diseases characterized by PBNO at first observation. There is the need to identify a gold standard in the clinical evaluation of posture and of pelvic

muscles functioning in patients with PBN0, and electromyographic studies are required. Nevertheless, we do believe that tailored postural and osteopathic rehabilitation could positively affect this clinical condition. Thus, to draw conclusive considerations there is the need for randomized clinical trials with larger sample size and direct treatment of the postural impairments highlighted at gait analysis.

5 REFERENCES

- Altomare, D.F., Rinaldi, M., Veglia, A., Guglielmi, A., Sallustio, P.L., Tripoli, G., 2001. Contribution of posture to the maintenance of anal continence. *Int. J. Colorectal Dis.* 16, 51–54. doi:10.1007/s003840000274
- Awad, S.A., Downie, J.W., Lywood, D.W., Young, R.A., Jarzylo, S. V, 1976. Sympathetic activity in the proximal urethra in patients with urinary obstruction. *J. Urol.* 115, 545–547.
- Bø, K., Sherburn, M., 2005. Evaluation of female pelvic-floor muscle function and strength. *Phys. Ther.* 85, 269–282.
- Capson, A.C., Nashed, J., Mclean, L., 2011. The role of lumbopelvic posture in pelvic floor muscle activation in continent women. *J. Electromyogr. Kinesiol.* 21, 166–177. doi:10.1016/j.jelekin.2010.07.017
- Cooperstein, R., Lisi, A., Burd, A., 2014. Chiropractic management of pubic symphysis shear dysfunction in a patient with overactive bladder. *J. Chiropr. Med.* 13, 81–9. doi:10.1016/j.jcm.2014.06.003
- Halski, T., Słupska, L., Dymarek, R., Bartnicki, J., Halska, U., Król, A., Paprocka-Borowicz, M., Dembowski, J., Zdrojowy, R., Ptaszkowski, K., 2014. Evaluation of bioelectrical activity of pelvic floor muscles and synergistic muscles depending on orientation of pelvis in menopausal women with symptoms of stress urinary incontinence: A preliminary observational study. *Biomed Res. Int.* 2014. doi:10.1155/2014/274938
- Hetrick, D.C., Ciol, M.A., Rothman, I., Turner, J.A., Frest, M., Berger, R.E., 2003. Musculoskeletal dysfunction in men with chronic pelvic pain syndrome type III: a case-control study. *J. Urol.* 170, 828–831. doi:10.1097/01.ju.0000080513.13968.56
- Hungerford, B., Gilleard, W., Lee, D., 2004. Altered patterns of pelvic bone motion determined in subjects with posterior pelvic pain using skin markers. *Clin. Biomech.* 19, 456–464. doi:10.1016/j.clinbiomech.2004.02.004
- Kaplan, S.A., Ikeguchi, E.F., Santarosa, R.P., D’Alisera, P.M., Hendricks, J., Te, A.E., Miller, M.I., 1996. Etiology of voiding dysfunction in men less than 50 years of age. *Urology* 47, 836–839. doi:10.1016/S0090-4295(96)00038-6

- Kuo, T., LG, N., Chapple, C., 2015. Pelvic floor spasm as a cause of voiding dysfunction. *Curr. Opin. Urol.* 25, 311–316.
- Lovecchio, N., Sciumè, L., Zago, M., Lopresti, M., Sforza, C., 2016. Lower limbs kinematic assessment of the effect of a gym and hydrotherapy rehabilitation protocol after knee megaprosthesis: a case report. *J. Phys. Ther. Sci.* 29.
- Nitti, V.W., 2005. Primary Bladder Neck Obstruction in Men and Women. *Rev. Urol.* 7, S12–S17.
- Nitti, V.W., Lefkowitz, G., Ficazzola, M., Dixon, C.M., 2002. Lower urinary tract symptoms in young men: videourodynamic findings and correlation with noninvasive measures. *J. Urol.* 168, 135–138. doi:10.1097/00005392-200207000-00030
- O’Sullivan, P.B., Beales, D.J., Beetham, J.A., Cripps, J., Graf, F., Lin, I.B., Tucker, B., Avery, A., 2002. Altered motor control strategies in subjects with sacroiliac joint pain during the active straight-leg-raise test. *Spine (Phila. Pa. 1976)*. 27, 1–8. doi:10.1097/00007632-200201010-00015
- Pool-Goudzwaard, a. L., Vleeming, a., Stoeckart, R., Snijders, C.J., Mens, J.M. a., 1998. Insufficient lumbopelvic stability: a clinical, anatomical and biomechanical approach to “a-specific” low back pain. *Man. Ther.* doi:10.1054/math.1998.0311
- Salvati, E.P., 1987. The levator syndrome and its variant. *Gastroenterol. Clin. North Am.* 16, 71–78. doi:10.1097/00007611-196504000-00026
- Sapsford, R.R., Hodges, P.W., 2001. Contraction of the pelvic floor muscles during abdominal maneuvers. *Arch. Phys. Med. Rehabil.* 82, 1081–1088. doi:10.1053/apmr.2001.24297
- Segura, J.W., Opitz, J.L., Greene, L.F., 1979. Prostatosis, prostatitis or pelvic floor tension myalgia? *J. Urol.* 122, 168–169.
- Senechal, P.K., 1994. Symphysis pubis separation during childbirth., *The Journal of the American Board of Family Practice American Board of Family Practice.*
- Shippey, S., Roth, J., Gaines, R., 2013. Pubic symphysis diastasis with urinary incontinence: Collaborative surgical management. *Int. Urogynecol. J. Pelvic Floor Dysfunct.* doi:10.1007/s00192-013-2120-0
- Snijders, C., Vleeming, A., Stoeckart, R., 1993a. Transfer of lumbosacral load to iliac bones and legs Part 1: Biomechanics of self-bracing of the sacroiliac joints and its significance for treatment and exercise. *Clin. Biomech.* 8, 285–294.
- Snijders, C., Vleeming, A., Stoeckart, R., 1993b. Transfer of lumbosacral load to iliac bones and legs Part 2: Loading of the sacroiliac joints when lifting in a stooped posture. *Clin. Biomech.* 8, 295–301.
- Turner-Warwick, R., Whiteside, C., Worth, P., Milroy, E., Bates, C., 1973. A urodynamic view of the clinical problems associated with bladder neck dysfunction and its treatment by endoscopic incision and transtrigonal posterior prostatectomy. *Br. J. Urol.* 45, 44–59.
- Yoshimura, N., Chancellor, M.B., 2004. Differential diagnosis and treatment of impaired bladder emptying. *Rev. Urol.* 6 Suppl 1, S24–S31.



ACCEPTED MANUSCRIPT