# Biofeedback for Nonneuropathic Daytime Voiding Disorders in Children: A Systematic Review and Meta-Analysis of Randomized Controlled Trials

Mir Sohail Fazeli, Yiqun Lin, Nooshin Nikoo, Sravan Jaggumantri, Jean-Paul Collet and Kourosh Afshar*

*From the Department of Pediatrics (MSF, SJ, JPC), School of Public and Population Health (YL, NN), and Department of Urology (KA), University of British Columbia, Vancouver, British Columbia, Canada*

**Abbreviations and Acronyms**

NVD = nonneuropathic voiding disorder

PVR = post-void residual

RCT = randomized controlled trial

RD = risk difference

UTI = urinary tract infection

Accepted for publication July 18, 2014.

* Correspondence: Urologic Sciences, BC Children's Hospital, University of British Columbia, K0-4480 Oak St., Vancouver, British Columbia V5Z 4H4, Canada (telephone: 604-875-2734; e-mail: kafshar@cw.bc.ca).

**See Editorial on page 14.**

**Purpose:** Biofeedback has been used to treat children with symptoms of bladder dysfunction not responding to standard therapy alone. However, evidence of the effectiveness of biofeedback is scarce and is based on small studies. We conducted a systematic review of the literature to assess the effects of biofeedback as adjunctive therapy for symptoms of nonneuropathic voiding disorders in children up to age 18 years.

**Materials and Methods:** We searched MEDLINE®, Embase® and CENTRAL on the OvidSP® platform as well as conference proceedings for randomized trials presented at scientific conventions, symposia and workshops through August 13, 2013. Hand searches and review of reference lists of retrieved articles were also performed.

**Results:** Five eligible studies were included in the systematic review, of which 4 (382 participants) were pooled in the meta-analysis based on available outcomes data. The overall proportion of cases with resolved incontinence at month 6 was similar in the biofeedback and control groups (OR 1.37 [95% CI 0.64 to 2.93], RD 0.07 [−0.09, 0.23]). There was also no significant difference in mean maximum urinary flow rate (mean difference 0.50 ml, range −0.56 to 1.55) or likelihood of urinary tract infection (OR 1.30 [95% CI 0.65 to 2.58]).

**Conclusions:** Current evidence does not support the effectiveness of biofeedback in the management of children with nonneuropathic voiding disorders. More high quality, randomized controlled trials are needed to better evaluate the effect of biofeedback.

**Key Words:** child; diurnal enuresis; randomized controlled trials as topic; urinary bladder, neurogenic

VOIDING dysfunction in the pediatric population can be classified as organic with an underlying disease process that can be neurogenic or structural, or without anatomical or neurological lesions,[1] ie nonneuropathic. Nonneuropathic voiding disorders account for a significant number of outpatient referrals to pediatric urologists. Other terms such as dysfunctional elimination syndrome and bladder and bowel dysfunction have been used to describe this condition. The hallmark of nonneuropathic voiding disorders is lower urinary tract symptoms with or without urinary incontinence. In a 6-year period spanning 2002 to 2007



0022-5347/15/1931-0274/0
THE JOURNAL OF UROLOGY®

http://dx.doi.org/10.1016/j.juro.2014.07.097
Vol. 193, 274-280, January 2015
Printed in U.S.A.

almost 2.6 million hospital or physician visits with diagnoses of pediatric urinary incontinence were documented in the Medicare/Medicaid system in the United States.[2] According to cross-sectional studies, the prevalence of daytime wetting for all children at age 7 years is approximately 4.5% (95% CI 3.2 to 6.7) with girls being approximately 1.5 times more likely to have incontinence at age 7 and 5 to 10 times more likely at age 16.[3,4]

NVD consists of a heterogeneous group of syndromes.[1] These syndromes should not be viewed as separate entities because one type of bladder dysfunction may progress to another in the absence of a distinct turning point. Most epidemiological studies have not specifically assessed these subcategories, but rather have investigated only the prevalence of urinary incontinence. It has been shown that children with an overactive bladder as a subtype of NVD may carry this problem into adulthood.[5] This association has been proved via a number of cohort and case-control studies.[6,7]

Typical treatment of NVD starts with urotherapy, which consists of educating, supporting and training the child as well as the family regarding healthy bladder and bowel habits. Typically lifestyle and diet modifications as well as bladder diaries are used. In addition to standard urotherapy, treatment with anticholinergics, alpha-adrenergic blockers, neuromodulation, biofeedback or intravesical botulinum toxin A injection may be used.[8]

Biofeedback is a training method used in various fields to improve academic and athletic performance, as well as health and wellness.[9] Biofeedback aims at increasing awareness and developing better voluntary control over pelvic floor muscles during voiding. During this treatment the patient learns about the physiological activity occurring during the voiding and filling phases through the use of audio and visual aids. The main objective is to maintain a relaxed pelvic floor during voiding.[10]

Our literature search found 2 systematic reviews on the role of biofeedback in pediatric daytime incontinence.[11,12] However, the authors of 1 review were unable to perform a meta-analysis and the other review included only 1 randomized trial. Due to different outcome measurements, there was significant heterogeneity in the studies. Therefore, there is a lack of up-to-date systematic review concerning this important topic.

We assessed the effects of biofeedback, when added to standard urotherapy, on clinical symptoms of NVD in patients up to age 18 years. Outcomes of interest included resolution of incontinence (defined as achieving complete dryness), decreased incidence of UTIs, post-void residual volume, average urinary flow rate, mean maximum urinary flow rate, adverse events and quality of life.

## MATERIALS AND METHODS

A literature search protocol was developed based on the Cochrane recommendations for systematic reviews. Criteria for considering studies for this review were formed in PICO (Participants, Interventions, Comparisons and Outcomes) format. The search included randomized controlled trials (using a RCT search filter adapted from the Scottish Intercollegiate Guidelines Network). The study participants, who were up to 18 years old and diagnosed with NVD, were allocated to receive either "biofeedback as an add-on treatment to standard urotherapy" or "standard urotherapy" (alone or combined with either pharmacotherapy or neuromodulation). Studies published in any language were included.

The search was carried out via OvidSP platform in databases including CENTRAL (1991 to August 13, 2013), MEDLINE (1946 to August 13, 2013) and Embase (1974 to August 13, 2013). We also searched "PapersFirst" and "ProceedingsFirst" for reports presented at symposia, conferences, workshops and meetings received by the British Library Document Supply Centre from 1993 to September 28, 2013.

Bibliographies of all primary studies and review articles were also assessed for additional references. When necessary, authors were contacted.

The search strategy is presented in figure 1. To avoid missing the most recently published articles, we also hand searched the latest 5 issues of *Journal of Pediatric Urology* and *The Journal of Urology®*.

Two reviewers independently examined the titles and abstracts of all studies identified using the search strategy to determine eligibility for inclusion (fig. 1). After exclusion of studies by assessing titles and abstracts, and removal of the duplicates, a full text review was performed and a study selection form was completed to document the reason for exclusion/inclusion.

Data were extracted independently by 2 review authors using a standardized form. Data including details of the studies, characteristics of the participants and results were entered into Review Manager, version 5.2 (Cochrane Collaboration, Oxford, United Kingdom). The quality of evidence for each outcome was assessed by downgrading or upgrading evidence according to the GRADE (Grades of Recommendation, Assessment, Development and Evaluation) criteria.[13,14]

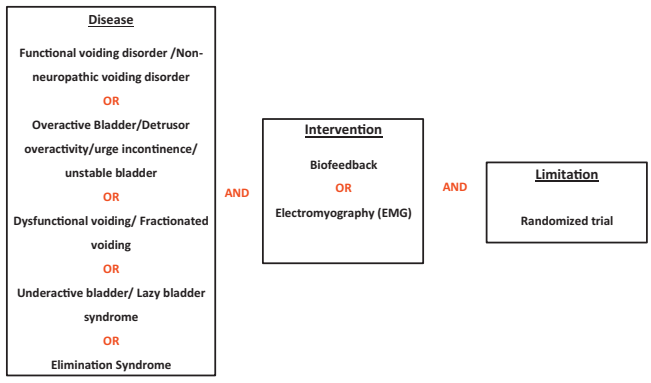


**Figure 1.** Search strategy diagram