

Fowler's syndrome and posterior fornix syndrome play a similar dysfunction. A systematic review

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Abstract: Introduction. In the present review, based on the literature data search, we suggest that urinary retention or obstructed micturition in Fowler's syndrome (FS) and posterior fornix syndrome (PFS) could be functionally related disorders, consistent with both syndromes being a consequence of laxity in the uterosacral ligaments (USLs). **Methods.** This review was conducted by screening and gathering results of research papers from PubMed and Web of Science databases. External sources were not used. Relevant studies were searched by using keywords algorithm: 'posterior fornix syndrome of the bladder' [All Fields], 'urinary retention' [All Fields] AND 'Fowler's syndrome' [All Fields]. **Results.** After searching 'posterior fornix syndrome of the bladder', and 'urinary retention and Fowler's syndrome' keywords, in Pubmed we have found 45 articles from which 21 were abstracts and from Web of Science, we have found 48 articles from which 37 were abstracts. After including 9 articles from Pubmed and 7 from Web of Science, 4 similar articles were excluded regarding FS but with other causes than urinary retention. In the end, we gather only 7 full-articles from Pubmed and 5 from Web of Science. From the total of 12 full-text articles included from both databases, 4 were common articles in both databases and the final number of eligibility articles was 8. **Conclusions.** Finally, based on literature screening, and hand searches of results from USL repair papers, confined to the discussion section of the paper, we sustain the fact that both FS and PFS could have similar underlying abnormalities in terms of ligamentous dysfunction and, based on these similarities, both were potentially curable by repairing the USLs (i.e. posterior intravaginal sling).

Keywords: Urinary retention; Posterior fornix syndrome; Fowler's syndrome; Uterosacral ligaments; Urge incontinence; Chronic pelvic pain; Nocturia.

INTRODUCTION

Fowler's syndrome (FS) is a disorder described by Clare Fowler in 1988¹. Its essential features were urinary retention in young women with polycystic ovaries and aberrant electrical activity in the rhabdosphincter (RS). The condition was first assumed to develop from urinary RS spasm due to aberrant electrical activity, presenting complex repetitive discharges and repetitive motor unit bursts². However, it was demonstrated that electromyography (EMG) activity occurs also in healthy women³. This finding invalidated one fundamental aspect of traditional FS. From the anatomical point of view, RS is a small and weak muscle from the middle 1/3 of the urethra, which doesn't encircle all the urethra⁴. In this respect, we concluded that this muscle was not capable of closing alone the urethra, especially when it becomes severely atrophied with age, as demonstrated by Huisman⁵. Huisman placed electrodes in the pelvic floor and dorsal striated urethral RS muscle. In this way, he assessed EMG activity during standing, straining, using unilateral and bilateral pudental nerve blockade. After unilateral pudental nerve blockade, he showed that EMG activity in RS still continued, maintaining the intraurethral pressure⁵. However, with bilateral blockade, there was a fall in urethral pressure and massive urine loss, despite a 500% increase in RS EMG activity⁵. This experiment demonstrated that the RS was responsible for maintaining urethral pressure, but not continence⁵.

More recently Petros and contributors used previous urodynamic data in 24 patients who had symptoms of urinary retention and post-void residual of 100ml and other symptoms fitting a diagnosis of posterior fornix syndrome (PFS)⁶. PFS was first reported in 1993 and was attributed to uterosacral ligament laxity⁶. PFS consists of 4 main symptoms, urinary retention (and high post-void residuals), nocturia, urgency, chronic pelvic pain. Petros and contributors were able to check every reported characteristic of FS save RS EMG which was not performed. They demonstrated marked similarities between FS and PFS⁶.

METHODS

Literature Search

This systematic review was conducted by screening and gathering results of research papers from literature search in PubMed and Web of Science databases. External sources were not used except in the discussion section at the end to further validate the conclusions reached from the results of the systematic review. Relevant studies were searched by using keywords algorithm: 'posterior fornix syndrome of the bladder' [All Fields], 'urinary retention' [All Fields] AND 'Fowler's syndrome' [All Fields].

Inclusion and Exclusion Criteria

The articles from the database with the keywords input were screened and analyzed: by using 'urinary retention and Fowler's syndrome' in PubMed were 44 articles and from Web of Sciences 48 articles. By using 'posterior fornix syndrome of the bladder' we have found only 1 full-article in PubMed. Another 2 abstracts in PubMed and 3 abstracts in Web of Science were found and were excluded.

By using PRISMA guidelines⁷ we have followed the next criteria: (i) original articles; (ii) published in English language; (iii) published within year 2000-2018; (iv) obstructed micturition/urinary retention; (v) overactive bladder; and (vi) surgical revision. We excluded conference abstracts, letters, and review articles.

Data Extraction

We gathered all of the full-text articles that met the inclusion criteria. The results from 8 research articles that were relevant to this review were extracted and analyzed. The outcomes of the studies were comprehensively analyzed.

RESULTS

Study characteristics

Since by searching the words like 'posterior fornix syndrome of the bladder', we found only 1 full-text article

from PubMed database (besides 2 abstracts which were common in PubMed and Web of Science and 1 abstract found only in Web of Science), we restricted further to the words implying 'urinary retention and Fowler's syndrome'. Therefore, from PubMed we found 45 articles from which 21 were abstracts and 1 without any abstract. From 23 full-text articles, we excluded 10 articles (i.e. 3 review articles and 5 case reports, 1 which was a correspondence and 1 as reply article). After remaining 13 full-text articles we excluded 4 articles (i.e. 1 article written in Portuguese, 1 in German language, 1 book of the Effective Health Care Program and 1 article with other causes). The number of eligibility articles from PubMed was 9. Searching from Web of Science, we found 48 articles from which 37 were abstract (i.e. 31 only abstracts, and 6 conference abstracts). From 11 free full-text from publisher, we

excluded 4 articles (i.e. 1 review, 1 case report, 1 Editorial, and 1 Correspondence). The number of eligibility articles from Web of Science was 7. After including 9 articles from PubMed and 7 from Web of Science, 4 similar articles were excluded regarding FS but with other causes than urinary retention (i.e. menstrual cycle and onabotulinumtoxinA treatment). In the end, we gather only 7 full-text articles from PubMed and 5 from Web of Science. Furthermore, we did not find any conference abstracts. From the total 12 full-text articles included from both databases, 4 were common articles in both databases and the final number of included articles was 8 (Figure 1 and Table 1). Studies that were used in this review were focused on the common features of PFS, urinary retention and FS. Moreover, the studies used in this review have a low to moderate level of certainty.

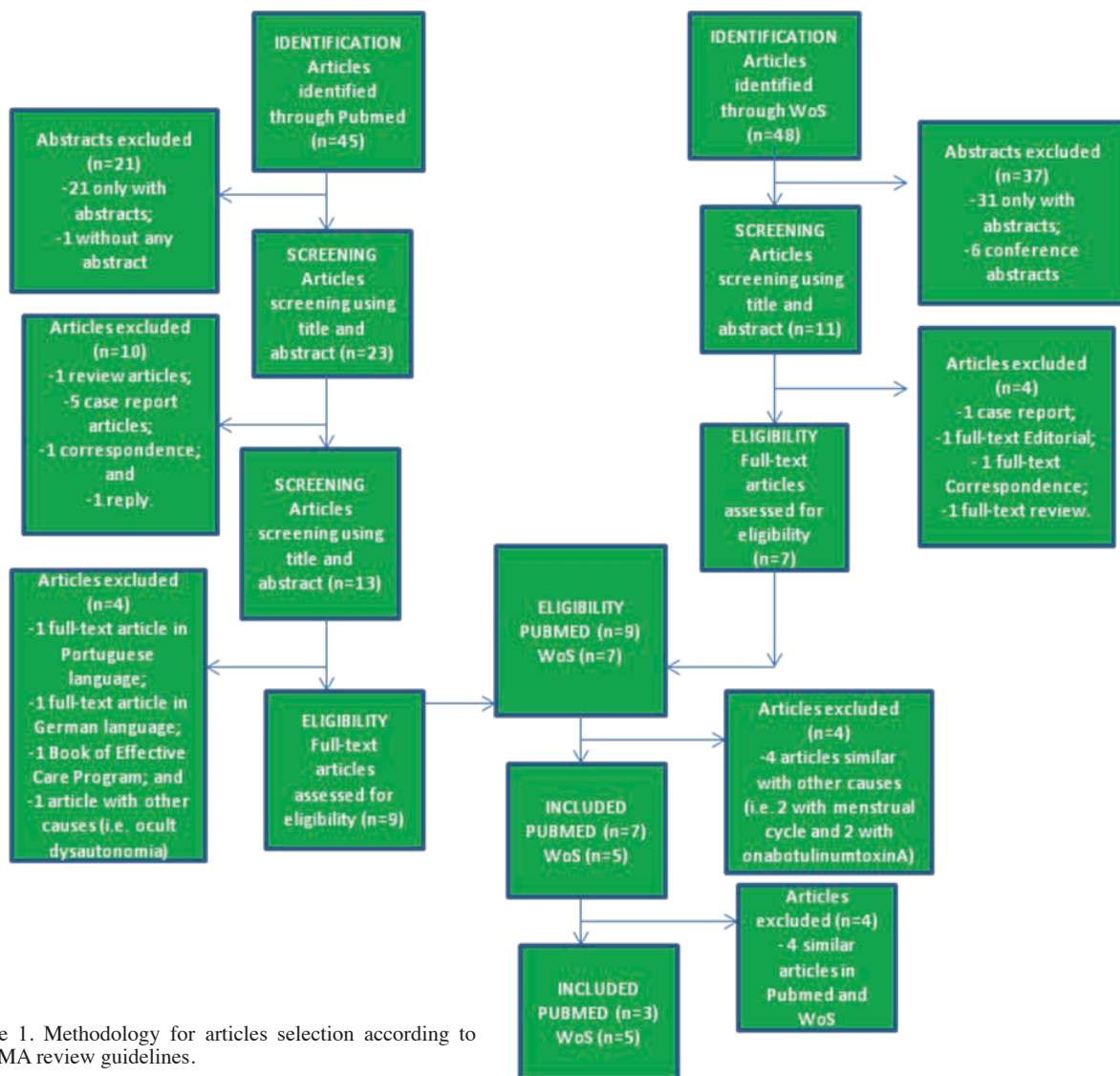


Figure 1. Methodology for articles selection according to PRISMA review guidelines.

In the paper of Mehmood & Altawell, it was showed the safety and efficacy of sacral neuromodulation (SNM) in patients with idiopathic nonobstructive urinary retention on 27 patients. The results showed that 88.8% of the patients presented a 50% improvement in symptoms and underwent permanent device implanted. From the total patients, 17 patients presented adverse effect during follow-up (i.e. box site infection, box site pain, leg pain, implant migration, stroke, urinary tract infection, pelvic/urethral pain and undesirable sensation)⁸.

Kavia and contributors⁹ examined brain responses to bladder filling in 6 women with FS treated with SNM. The data collected from patients showed that brain responses to bladder filling are abnormal in FS. This could be due to the primary abnormality of the overactive urethra and shows strong inhibitory afferent signals, blocking bladder afferent activity. The consequences were loss of the bladder sensation and ability to void. SNM showed to act by blocking inhibition by urethral afferents⁹.

References	Obstructed micturition/urinary retention	Overactive bladder	The main complication: surgical revision
(8)	27 patients with urinary retention after SNM* treatment	-	24 patients
(9)	6 patients with FS** and SNM treatment	Having overactive bladder	Without complications: Small no of patients
(10)	60 patients with urinary retention of FS and SNM treatment	-	53% of the patients
(11)	247 patients with urinary retention, which 44 had test for SNM treatment	Having overactive bladder	45% of the patients
(12)	217 patient with urinary retention and SNM treatment		41% of the patients
(13)	26 patients with urinary retention and SNM treatment		54% of the patients
(14)	8 patients with urinary retention and SNM treatment		Without any complication data
(6)	24 patients with urinary retention, FS or PFS***	Having unbalanced bladder neck	Without any complication data

*SNM= sacral neuromodulation; **FS= Fowler's syndrome; ***PFS= posterior fornix syndrome.

Table 1. Comparison of the included full-text articles.

Another study reported a 10-year experience of sacral neurostimulation (SNS) in 60 patients with urinary retention. About 53% of the women required a surgical revision. The authors showed that SNS could sustain for long term efficacy, but the procedure has a significance complication rate¹⁰. Into another study, 247 women with complete or partial retention were referred to different investigations like urethral pressure profilometry, transvaginal ultrasonographic measurement of the sphincter volume or sphincter EMG. These investigations help authors to classify the cause of retention. The common diagnosis was FS in which SNS was the only intervention that restores voiding¹¹.

Peeters et al. studies 217 patients who received an implantable pulse generator between 1996 till 2010. The success and cure rates were almost 70% and 20% for urgency incontinence. SNM appears effective in the long-term application, although the re-intervention rate was higher with most occurring in less than 2 years after implantation¹².

Dasgupta and contributors analysed 26 patients with urinary retention and treated by using implantation of a sacral nerve stimulator. Fourteen patients (54%) required revision surgery and the most complications included loss of efficacy, and implant-related discomfort. The authors concluded that SNM is effective for up to 5 years implantation having a significant complication rate¹³.

Another study analysed 8 patients with FS and 8 healthy controls which underwent brain imaging with positron emission tomography in order to identify regions of brain activity relating to the perception of bladder fullness and their modulation by SNM. The neuroimaging data showed the existence of abnormal interaction between brainstem and cortical centers in women with urinary retention. Therefore, the authors showed evidence that the therapeutic effect of SNM is achieved through restoration of activity associated with brainstem autoregulation and attenuation of cingulate activity¹⁴.

In the study of Petros and contributors, idiopathic urinary retention and other known FS descriptions in 24 women treated for PFS were evaluated by applying the reinforcement of the USL using tissue fixation system. The authors showed that functional disorders typical of FS, which is also presented in PFS, especially urinary retention can be cured by USLs sling repair⁶.

From all this data presented, although SNM represent the single available treatment especially for urinary retention, after long-term follow-up, the recurrence rate showed to be higher, requiring another procedure to be developed.

DISCUSSION

Since obstructed micturition, pelvic pain, and overactive bladder constitute 3 of the 4 core features of the PFS and also 3 of the major features of FS, this suggests that urinary retention or obstructed micturition in FS and PFS are highly likely to be functionally related disorders, dependent on the incompetence of the USLs. Therefore it could be predicted, that treatment with reinforcement of USLs would most likely cure these FS symptoms, exactly as it cures PFS symptoms. We believe the evidence of clinical similarity⁶ is such as to recommend USL repair in young women, even by native tissue ligament repair prior to using a far more expensive and invasive option, like SNM technique.

We suggest that, since the urethral RS spasm theory for FS has invalidated⁸, the two syndromes may have similar underlying abnormalities in terms of USLs dysfunction or incompetence. Furthermore, by using a posterior intravaginal sling (PIVS) (infracoccygeal sacropexy) or tissue fixation system (TFS) USL repair (in older women), or even, native tissue cardinal ligament (CL)/USLs plication (in young women), it can be confidently expected, that a positive cure rate can be achieved for the symptoms.

The sympathetic fibers in the structure of the hypogastric nerves as well as the parasympathetic fibers from the S2-S3 level explain the symptoms of FS and PVS. Depending on the irritated fibers proportion, symptomatic or parasympathetic - urine retention (sympathetic nervous nerve irritation) or urinary imperiality (parasympathetic fibers) predominates.

The symptom of urinary imperiality caused by irritation of the parasympathetic threads (S2-S4) is different from the overactive bladder syndrome. In the overactive bladder we can see in urodynamic assessment uninhibited detrusor contraction, but in irritation of parasympathetic fibers we will have the same symptom but without detrusor contraction-named hypersensitivity of the bladder.

Although the symptoms of the two syndromes are common, we must bear in mind that it were described at different age groups, women with different pathologies - FS (in young women) and PVS (in women with prolapse). This was possible because these symptoms occur by irritating sympathetic and parasympathetic fibers in the hypogastric plexus. The irritation of sympathetic and parasympathetic threads can be determined by different pathologies that produced damage or laxity of the CL and USL support system. Thus, both ligaments can be affected by infiltrative processes (i.e. endometriosis) or the process of laxity of their conjunctive

tissues. Regardless of the pathogenic mechanism that affects USLs, the pelvic nerve structures found in the vicinity of these ligaments are chronically irritated, causing symptoms such as urinary imperiality, chronic pelvic pain, or difficulty in bladder evacuation.

As a result, the release of these nerves from the periligamentar adhesion syndrome in endometriosis or the reinforcement of weak ligaments that stabilize the constant irritation of the nerve threads causes the cure of the symptoms included in the 2 syndromes.

Considering these aspects, it is explicable why SNM treatment does not have very good results, modulating the activity of the S1-S3 thread, without influencing the sympathetic threads of the lower hypogastric plexus, threads originating from T12-L5.

PIVS in USL reinforcement for FS and PFS

In order to treat symptoms like chronic pelvic pain, emptying problems, or nocturia which could often appear in PFS, it can be creating a neo-sacroterine ligaments bridge. This technique can be achieved by using PIVS or CL/USL TFS ligament repair, creating a new collagen for long term sustaining the pelvis^{15,16}.

Some authors using PIVS posterior sling repair method on 40 patients (i.e. 20 younger than 60 years and 20 older than 60 years) with vaginal vault prolapse, demonstrated that significant improvements in symptoms of nocturia, urgency, fecal incontinence and chronic pelvic pain¹⁵. The incidence of mesh erosion varied between 0 and 13% after applying the PIVS method¹⁷.

Balsak and contributors¹⁸ showed a 100% surgical success rate by applying PIVS technique on 21 patients with 2, 3 or 4 pelvic organ prolapsed. It was also showed a 33.3% rate of dyspareunia and 14.2% rate of mesh erosion with an improvement in vaginal symptoms and quality of life scores in the postoperative period.

Caliskan et al.¹⁹ used both the original and modified PIVS technique on 368 patients with symptomatic pelvic organ prolapsed in various grade. By using both methods, the authors showed a 97 and 96% apical success rate.

Another study made on fifty-two patients with vault prolapsed symptoms, using the PIVS technique, showed an incidence of 2.1% of mesh erosion in approximately 20 weeks²⁰.

Limitations and Future Research Suggestions

The limitation of our study consisted in a very low number of full-text articles referring to 'posterior syndrome of the bladder', and indeed FS also, from both databases. Furthermore, we did not find many articles which could include the management of FS and PFS disorders and the outcomes complications after achieving the surgical complications.

CONCLUSIONS

In the present review, we sustain the fact that similar FS and PFS symptoms like urinary retention, pelvic pain and/or bladder fullness could have similar underlying abnormalities in terms of ligamentous dysfunction or incompetence. In this respect, PIVS treatment can be achieved, being a minimally invasive procedure for repairing the USLs.

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FINANCIAL STATEMENT

The authors of the publication did not received any financial support by any grant/research sponsor.

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