Overview on Surgical Management of Overactive Bladder

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Abstract:

Overactive bladder syndrome is a persistent and incapacitating disorder that has profound medical, psychological, and social implications, greatly impacting the well-being of countless individuals globally. A significant number of individuals experience urine urgency, which can be extremely bothersome. The primary indicator of overactive bladder (OAB) is a sense of urgency, often accompanied by increased urine frequency and nocturia. After ruling out other medical conditions with similar

symptoms, the initial approach to managing OAB is providing guidance on fluid consumption and bladder training. If needed, antimuscarinic medicines may be added as a supplement. If patients have significant distress from OAB symptoms even after maximizing medicinal treatment, they may choose to undergo invasive procedures. There is currently a limited understanding of the hierarchical structure of central nervous system control. However, the use of functional imaging is starting to reveal the difficulties that need to be addressed in this area. Current research is exploring the use of botulinum neurotoxin-A injection, oral β3-adrenergic agonists, and innovative methods for nerve stimulation as potential therapies. The inherent subjectivity of urine urgency, the absence of animal models, and the complex pathophysiology of overactive bladder (OAB) pose substantial obstacles to achieving effective clinical therapy.

Keywords: OAB, Overactive bladder syndrome, Surgical, Management

Introduction:

The International Continence Society (ICS) defines Overactive Bladder Syndrome (OABS) as a collection of symptoms related to dysfunction in the lower urinary tract [1]. The lower urinary tract symptoms associated with Overactive bladder (OAB) are widespread in the population and remain a frequent reason for urological referrals globally [2]. The International Continence Society (ICS) defines the OAB symptom complex as a condition characterized by a strong and sudden need to urinate, with or without involuntary leakage of urine, sometimes accompanied by frequent urination and waking up at night to urinate [3].

OAB impacts both males and females, resulting in a significant decline in the overall well-being of the patients [4]. While it is more prevalent among adults over the age of 40, it can also impact children and young individuals [5]. A 2011 study, conducted in Europe with a sample size of 10,000 persons, revealed that around 36% of men and 43% of women aged 40 and above exhibited signs of OAB [6]. Research has confirmed a strong association between the age of the patient and the degree of symptoms, with older individuals experiencing more severe symptoms [7]. The National Overactive Bladder Evaluation Program (NOBLE) revealed that there are more than 33 million individuals in the US population who have OAB [8].

A telephone study conducted in the USA found that the total occurrence of OAB wet in women aged 18 years and older was 9.6%, with a gradual increase from 5% in the 18-44 age group to 18% in those over the age of 65 [8]. The Leicestershire Medical Research Council (MRC) incontinence research conducted in the UK revealed that the prevalence of OAB in women aged 40 and above is 21.4% [9]. Although patients with OAB may not actively seek a consultation with an urologist for their symptoms, it is estimated that 20.4% of the population aged 40 years and above have a healthcare need related to this condition.

The OABS frequently leads to impaired bladder control, which in turn gives rise to many consequences including heightened susceptibility to falls/fractures among the elderly, depression, skin infections, and vulvovaginitis [10]. The presence of concurrent problems associated with OABS, such as urinary tract infections (UTI), leads to elevated healthcare expenses for patients undergoing therapy [11]. The annual health-related cost of controlling OABS in the USA is estimated to be around $9 billion. The developing cost patterns suggest that promptly and decisively managing patients with the OABS could enhance patient care and reduce the total utilization of healthcare resources [12].

To clinically evaluate the patient and diagnose OAB, it is necessary to rule out other medical disorders that present similar symptoms, such as UTI and pelvic cancer. Behavioral adjustment and antimuscarinic medications can be initiated as conservative treatment in either a primary or secondary care environment. In

numerous cases, the initial treatment response is insufficient, thus requiring additional medical attention for urodynamic diagnosis and more invasive therapy. The outcomes of all therapy methods continue to be unsatisfactory for certain patients. The progress of new methodologies is impeded by the challenge of establishing unbiased indicators of results and the significant placebo effect observed in research involving antimuscarinic drugs [13].

A study published in 2019 to review the primary clinical evaluation and treatment of women presenting with OAB, encompassing non-invasive interventions and pharmacotherapy and will prioritize the examination of the function of estrogen, found that overactive bladder is a prevalent and troubling illness that has a substantial impact on Health-Related Quality of Life (HRQoL). The clinical diagnosis of OAB is often made by ruling out other possible conditions. However, urodynamic tests can be beneficial for women who have persistent or atypical symptoms. Most women will initially benefit from conservative approaches; however a significant number may later need pharmacological therapy. The existing research indicates that systemic estrogen does not have a therapeutic effect on OAB. However, vaginal estrogen may be beneficial and can potentially enhance the effectiveness of antimuscarinic medicines. Patients with refractory OAB who do not respond to pharmacological treatment may find relief from intravesical administration of Botulinum Toxin or neuromodulation [14].

A study published in 2021 to review the updates on the management of overactive bladder, and found that there is an abundance of therapy options accessible for OAB. Both physicians and patients should acknowledge that OAB is a syndrome without a cure, rather than a disease. Most individuals with OAB will experience persistent symptoms, with remission rates ranging from 3% to 40%. Individuals with the most severe urge urinary incontinence (UUI), a high body mass index (BMI), and poor levels of physical exercise have a higher likelihood of experiencing progression. OAB is a persistent medical illness, and while the treatment choices that are now available can help alleviate symptoms, they cannot completely eliminate them. As a result, many individuals may feel dissatisfied with the treatment outcomes and thus choose to discontinue all available therapies. Given the option, the majority of patients tend to choose minimally invasive surgery, which involves preoperative planning and has been linked to enhanced patient outcomes [15].

Epidemiology and etiology:

Lower urinary tract symptoms (LUTS) are very common and become more frequent as people become older. Most older adults experience at least one lower urinary tract symptom (LUTS), however OAB is a distinct subgroup of LUTS that occur during the storage phase. Hence, individuals who have urine urgency are

categorized as having OAB, but those who only have nocturia or frequency should not be encompassed under this classification. Extensive research has been conducted to determine the frequency and level of distress associated with OAB, as defined by the current International Continence Society (ICS) standards. According to the population-based EPIC study, the overall occurrence of OAB in Europe is 11.8%. The study also revealed a noticeable pattern of higher occurrence as individuals age. An analogous investigation demonstrated a total occurrence rate of 12.2% among the Korean populace. These studies indicate that the general occurrence of OAB is comparable across males and females. However, in younger age groups, OAB is slightly more common in women than in men, but this trend reverses in older age groups (beyond 60 years of age). Significantly, the variations in the configuration and operation of the bladder outflow in males and females result in significant disparities in the related characteristics of OAB. Females have a significantly higher probability of experiencing UUI or mixed urine incontinence (MUI), which refers to the simultaneous presence of UUI and stress incontinence. Men have a higher likelihood of experiencing OAB dry, although this can also happen in older males who have bladder outlet obstruction (BOO) [16-18].

Distinct causative risk factors for OAB have been identified. The previous text makes reference to the process of aging and the distinctions between genders. The impact of nutrition has also been discussed, specifically the intake of carbonated soft drinks [19]. However, it is probable that these drinks worsen symptoms in individuals who are already prone to OAB, rather than being the root cause. Individuals afflicted with many neurological disorders are susceptible to experiencing storage-type LUTS. However, the absence of urgency may occur when there is a deficiency in sensory innervation or central nervous system (CNS) processing. BOO might increase the likelihood of patients developing OAB and detrusor overactivity (DO). In fact, earlier terminology categorized DO as idiopathic, obstructive, or neurogenic. Nevertheless, the limited occurrence of OAB in men experiencing significant difficulties with urination due to urethral stricture, and the continued presence of DO in men who have not undergone prostate surgery, suggests that the connection between these conditions is not direct. As a result, OAB and DO are currently categorized as either idiopathic or neurogenic [20].

Diagnosis:

OAB is diagnosed clinically by assessing the patient's symptoms of increased frequency and urgency during the day, with or without UUI. Patients frequently endure these symptoms for extended durations before seeking medical attention, typically when the symptoms become troublesome to them or their caregivers [21].

An in-depth examination of the patient's medical background is crucial for identifying OAB. It is crucial to evaluate the beginning of symptoms, as well as the variables that worsen or relieve them, and the amount of pad usage during a 24-hour period. A comprehensive physical examination should encompass an evaluation of the genitourinary system, including a digital rectal examination and assessment of the prostate in males, as well as a vaginal examination in females. Performing a first urinalysis with a dipstick is necessary to exclude the presence of blood in the urine and any signs of infection [22].

Questionnaires that have been verified for accuracy are accessible for evaluating both the impact on quality of life and the presence of symptoms. Bladder diaries or frequency–volume charts offer a precise and dependable assessment of voiding patterns. Urinary tract imaging is not necessary for diagnosis; however it can be utilized as an additional tool in individuals who are thought to have bladder outflow obstruction. The European Association of Urology (EAU) guidelines advise against the routine use of imaging for the evaluation of OAB to assess the upper or lower urinary tract. Cystoscopy is only advantageous when there is a suspicion of cancer [23].

The utilization of urodynamics in the diagnosis of OAB continues to be a subject of debate and disagreement. While the gold standard diagnostic test for detrusor overactivity, it is an intrusive procedure and should only be used for individuals with treatment-resistant overactive bladder. Nevertheless, the course of treatment should be determined by the patient's symptoms, as standard urodynamic tests do not definitively exclude the possibility of OAB. Urodynamic testing has shown that detrusor overactivity is more prevalent in men, with 69% of men experiencing dry overactive bladder compared to 44% of women. Additionally, 90% of men with overactive bladder experience wet symptoms, while this is the case for just 58% of women [24]. The National Institute for Health and Care Excellence (NICE) recommends conducting urodynamics tests before initiating third-line therapy. The European Association of Urology (EAU) suggests performing urodynamics only if the results are likely to impact the treatment plan. The American Urological Association (AUA) advises urodynamics for patients with complicated OAB, such as those with concurrent urethral dysfunction or those in whom the diagnosis is uncertain [15].

Management and treatment:

Treatment of OAB encompasses different approaches, ranging from first line to fourth line treatment.

- *Non-pharmacological intervention/ Behavioral therapy (first line treatment)*

The primary function of the therapy is to educate patients about OAB and help them recognize solutions for managing symptoms. Patients should be informed from the outset that they will undertake a prolonged course of treatment, requiring them to maintain motivation and, most importantly, tolerance [4].

Behavioural therapies seek to extend the duration between voiding, decrease instances of urgency and nocturia, and avoid incontinence by instructing patients to interrupt or suppress detrusor contractions through pelvic floor muscle training. For committed patients, this treatment can be highly effective in lowering leakage by 50–80% and achieving dryness in up to 30% of cases. It is recommended to restrict fluid consumption to 1–1.5 L per day. Patients can effectively alleviate symptoms of Overactive Bladder (OAB) by implementing a 25% reduction in fluid consumption. Nevertheless, there is insufficient evidence to support this claim, as there is no notable enhancement in symptoms upon ceasing the consumption of caffeinated beverages. Diuretics are recognized as a potential factor contributing to incontinence and should be minimized, especially among older individuals [25-27].

- *Pharmacology and medications (second-line treatment)*

The initial category of pharmacological medications consists of antimuscarinic pharmaceuticals, also known as anticholinergic drugs, which are utilized to achieve partial relaxation of the detrusor muscle. Through extensive usage and clinical research, these treatments have demonstrated their safety, relatively high tolerance, and efficacy, resulting in notable enhancements in symptoms and subsequent quality of life. The primary issue with these medications is that they target muscarinic receptors, which are present in multiple organs throughout the body. As a result, a wide range of common side effects can arise, including dryness of the mucous membranes (such as dry mouth, dry eyes, and dry vagina), constipation, heart palpitations, arrhythmia, tachycardia, cognitive impairment (such as drowsiness, hallucinations, confusion, delirium, blurred vision, and memory problems), as well as urinary retention [28].

Anticholinergic medicine has demonstrated efficacy in alleviating symptoms, as evidenced by multiple trials. Nevertheless, a significant number of individuals discontinue their medicine. The primary reasons for people discontinuing medicine are constipation, which affects over 50% of patients, and dry mouth, which affects around 30% of patients [29].

The antimuscarinics most frequently utilized include oxybutynin, tolterodine, fesoterodine, trospium, propiverine, and solifenacin. However, following research have not been able to establish the superiority of one over the others in terms of effectiveness. Extended-release (ER) medications are deemed to be equally efficacious as immediate-release (IR) medications, but possess an enhanced safety profile, resulting in less adverse effects. If both forms of treatment are accessible, it

is advisable to prioritize the prescription of ER meds. Another alternative to consider is transdermal oxybutynin or oxybutynin topical gel. This option is advantageous since it bypasses the liver's initial metabolism, resulting in reduced systemic adverse effects and a low incidence of dry mouth. Prolonged treatment is challenging in this scenario due to the occurrence of unfavorable skin reactions [30].

Surgical management:

- *The refractory overactive bladder (third line treatment)*

Patients who do not show a response to anticholinergic therapy or β3-agonists are classified as refractory. This category encompasses people who have undergone treatment with a minimum of two different anticholinergic medications or combination therapies, but have not experienced any positive outcomes. It also includes individuals who are unable to endure the adverse effects of these treatments or have medical conditions that make them unsuitable candidates for first-line or second-line therapies. When faced with such situations, it is necessary to turn to third-line therapy. The temporary suppression of bladder detrusor muscle activity using pharmacological means, peripheral tibial nerve stimulation (PTNS), or neuromodulation [28]. The primary concepts for additional surgical intervention in patients with refractory OAB involve employing treatments that have the ability to decrease bladder pressure, stabilize overactivity, and enhance bladder capacity. Present therapies encompass the utilization of intradetrusor botulinum toxin-A (BTX-A) injections and sacral neuromodulation (SNM). If the previous treatments indicated above do not effectively alleviate symptoms, patients may receive counseling regarding bladder reconstructive surgery options, such as urinary diversion, augmentation cystoplasty, or detrusor myomectomy [31].

- *Botulinum toxin A*

The efficacy of botulinum toxin A has been proven in several randomized placebo-controlled trials, showing a statistically significant 60% improvement in symptoms for a median period of 373 days. The only authorized formulation in Europe for treating wet OAB and as a third-line therapy in the USA is currently 100 units of onabotulinum toxin A dissolved in 10 ml of saline and injected into 20 points of the bladder wall above the trigone. Patients may discontinue treatment due to the need for repeat injections every 6-9 months, the risk of UTIs, and the increased need for clean intermittent catheterization (CIC) due to higher post-void residuals. Therefore, it is crucial to select patients who are willing to undergo post-void residual evaluation and engage in CIC. Dysport and Xeomin, alternative formulations of botulinum toxin, are not authorized for the treatment of refractory OAB, although being utilized for

that purpose. Botox is authorized for the treatment of neurogenic detrusor overactivity. It is administered as 200 units diluted in 30 ml of saline and given through 30 injections [32-33].

- *Sacral neuromodulation*

SNM requires a two-stage approach in which a percutaneous electrode is placed under fluoroscopic guidance into the sacral foramen to stimulate the S3 or S4 nerve roots. Subsequently patients undergo a test phase, and a permanent device is implanted if there is >50% improvement in symptoms. Therapeutic success rates are reported at 69.3% over a 23-year follow up, with no life threatening or irreversible adverse events (implant site pain and undesirable change in stimulation being the most reported). Lower success rates are seen in men. SNM and onabotA are comparable in terms of efficacy and safety, with no difference in reduction of UUI episodes over 24 months [34].

The need for removal of SNM devices in those patients requiring body magnetic resonance imaging (MRI) remains a concern in those who had implants prior to 2020. The standard Medtronic (Dublin, Ireland) SNM device, prior to 2020, was both non-rechargeable and only head MRI compatible (1.5T). Since 2020, Medtronic's Interstim II recharge-free system is full body MRI compatible up to 3T. Axonics® (Irvine, CA, USA) SNM System and Medtronic InterStim™ Micro are new devices with FDA approval for the treatment of urinary incontinence and are both rechargeable and full body MRI compatible (up to 3T). Rechargeable devices are usually smaller, with a battery life expectancy of 15 years compared with 3–5 years with standard SNM devices. However, the additional need for weekly recharging by the patient, requiring dexterity and good cognition, may limit its use and compliance [35].

- *Posterior tibial nerve stimulation*

Posterior tibial nerve stimulation (PTNS) administers electrical stimulation to the sacral micturition centers by a thin needle positioned slightly above the inner part of the ankle. The treatment protocol entails 12 consecutive outpatient sessions, each lasting 30 minutes. Typically, these sessions are scheduled once a week, although in certain cases, they may occur up to three times a week. Long-lasting effects can be maintained through regular therapy sessions every 2-3 weeks, for a maximum duration of 3 years. PTNS has demonstrated a patient-reported response rate of 71-79.5% after treatment. However, there is no statistically significant advantage of PTNS over tolterodine. Recent implantable PTNS devices, which enable uninterrupted tibial nerve stimulation, seem to be well tolerated. Initial findings indicate a notable enhancement in UUI and a comparable effectiveness to SNM. Currently, only statistics for a short-term period of 6 months are available [36].

There is currently no agreement among guidelines regulating the utilization of PTNS. NICE recommends against the use of PTNS, in contrast to the EAU's suggestion of using it as a second-line treatment when the side effects of antimuscarinics are considered intolerable. PTNS is recommended by the AUA as a therapy option to be used as a third-line approach. These recommendations are based on the limited evidence supporting the effectiveness of PTNS, especially considering that the placebo effect can account for up to 21% of the observed benefits. Additionally, the need for frequent visits and weekly attention from healthcare professionals to address patient symptoms, as well as the cost-effectiveness compared to antimuscarinics, also influenced these recommendations. Furthermore, it is important to highlight that there is a lack of evidence supporting the utilization of PTNS in males [37].

- *Augmentation cystoplasty*

Augmentation cystoplasty is considered a final choice for people with OAB who have not responded to medication or less invasive treatments. Laparoscopic and robotic augmentation cystoplasty are now being performed with low complications due to advancements in surgical technique. Patients should get counseling regarding the necessity of performing CIC after the treatment. However, it is important to acknowledge that for many patients, experiencing urine retention and requiring CIC may be more favorable than dealing with severe, uncontrollable frequency, urgency, and urgency incontinence. For individuals who are unable or unable to undergo CIC, urine diversion might be considered as an alternative. This can be done through the creation of an ileal conduit/stoma. The results continue to be outstanding, with a 93% rate of continence observed in individuals with OAB, in comparison to a 78% rate in individuals with neuropathic bladders. The literature extensively documents the occurrence of long-term problems following augmentation, including as recurring urinary tract infections, bladder stones, and potential cancer. The use of long-term monitoring cystoscopy is a subject of debate and disagreement. There is a suggestion that asymptomatic patients may not need to have annual surveillance cystoscopy, as there is no indication of cancer occurring during the first 10 years after augmentation cystoplasty. The average insurance reimbursement over a span of 5 years is anticipated to be roughly US$25,041, making it a pretty cost-effective option. By contrast, the anticipated cost of SNM amounts to US$64,111 over a span of 15 years. Nevertheless, Botox proves to be economically advantageous within the initial 5-year period, with each injection costing US$2946.83, provided that the benefits persist for at least 5.1 months before the next injection [38,39].

Conclusion:

OABS, or age-related obstructive airway syndrome, impacts a significant number of individuals globally, with a higher occurrence of symptoms observed as the population ages. Standard treatment for OABS involves implementing behavioral changes and administering anticholinergic medicines. Some patients may experience a prolonged and severe symptom complex that can greatly impact their overall quality of life. The management of patients with refractory OAB can present clinical challenges and necessitates meticulous consideration of each patient's unique needs and circumstances. In recent years, several minimally invasive techniques, such as SNM and intravesical botulinum toxin injection, have been developed and shown promising outcomes in patients with refractory OABS. Our personal experience with these operations has also been highly favorable and clearly demonstrates the cautious application of these approaches in specific individuals with unresponsive OABS before resorting to irreversible major surgical measures.

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