



The Role of Physiotherapy in the Rehabilitation of Stroke Patients with Lower Urinary Tract Symptoms

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Abstract

Background: Lower urinary tract symptoms (LUTS) are highly prevalent in both male and female patients after stroke, ranging up to 94%. Physiotherapy has been involved in treatment of LUTS in neurologically healthy patients for decades and, over the past few years, and mostly in research, in patients with neurological diseases.

Objective: The objective of this study is to describe how physiotherapy can be involved in the prevention, diagnostic and treatment during the rehabilitation of stroke patients with LUTS.

Summary: This study introduces basic evidence for LUTS in stroke patients. Identify factors and describe exercise interventions for prevention of LUTS. Followed by validated and reliable specific assessments indicated for physiotherapy, and present treatment programs of pelvic floor muscle at different levels for stroke patients.

Conclusion: It is recommended that physiotherapy can provide valuable contribution in the prevention, diagnostic and treatment during the rehabilitation of stroke patients with LUTS.

Keywords

Lower urinary tract symptoms, Physiotherapy, Rehabilitation, Stroke

Introduction

In developing countries with low and middle income the incidence of stroke increases by more than 100% [1,2]. Whereas, in countries with high income it has decreased due to lifestyle changes and new treatment approaches [1]. Globally, there is both an aging population with an increasing proportion of disabled people [3] and an increasing numbers of stroke survivors requiring rehabilitation services for acquired deficits such as motor disability, cognitive impairment, dysphasia, dysphagia and lower urinary tract symptoms (LUTS) [4-6].

The prevalence of LUTS in post-stroke patients ranges from 15% to 94%, depending on time since stroke [7,8]. The most prevalent post-stroke LUTS are nocturia (76%), followed by urgency (70%) and increased daytime frequency (58%) [7], but urinary incontinence (UI), incomplete bladder emptying [9] and urinary tract infection (UTI) are also prevalent [10]. In addition, several non-neurological LUTS with different causes are frequent in post-stroke patients, especially post micturition dribbling and hesitation in men, and stress urinary incontinence (SUI) in women. The International Conti-

nence Society (ICS) has defined these symptoms [4,5] as shown in Table 1.

LUTS have a significant impact on the quality of life (QoL) of stroke patients [7,11-14], caregivers and relatives [15]. It has been reported that 78% of post-stroke patients have LUTS-related problems in activities of daily living [7] and that the symptoms are associated with poor well-being and depression, especially in women [16].

The economic burden of post-stroke LUTS on the healthcare service is high because the symptoms often require life-long medical care [17]. Indirect cost as pads,

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Table 1: Definitions of some Lower Urinary Tract Symptoms (LUTS).

Symptoms	Definition
Nocturia	• Is the complaint that the individual has to wake at night one or more times to void
Urgency	• Is the complaint of a sudden compelling desire to pass urine, which is difficult to defer
Increased daytime frequency	• Is the complaint by the patient who considers that he/she voids too often by day
Urinary incontinence	• Is the complaint of any involuntary leakage of urine
Types of urinary incontinence	
Stress	• Is the complaint of involuntary leakage on effort or exertion, or on sneezing or on coughing
Urge	• Is the complaint of involuntary leakage accompanied by or immediately preceded by urgency
Mixed stress/urge	• Is the complaint of involuntary leakage associated with urgency and also with exertion, effort, sneezing or coughing
Feeling of incomplete bladder emptying	• Is a self-explanatory term for a feeling experiences by the individual after passing urine
Post micturition dribble	• Is the term when an individual describes the involuntary loss of urine immediately after has finished passing urine, usually after leaving the toilet in men, or after rising from toilet in women

Reference: Abrams, et al. [4]; Abrams, et al. [5].

medicines, washing/clothes and time taken by health professionals are the most expensive elements. Loss of productive time is also important for health professionals, caregivers and relatives. Moreover, for the stroke patients who need constant assistance in bladder activities expensive institutionalisation is necessary [18,19].

Several studies have reported that post-stroke LUTS is most prevalent in the acute phase [20,21]. Most UTIS occur after 48 hours and are hospital-acquired associated with urinary catheterisation (OR = 3.03) [22]. UTI (10), UI [23] and urine retention [24] have significant impacts on stroke rehabilitation due to prolonged hospital stays [25]. Elder, et al. reported that post-stroke patients with UI lost 24% of their rehabilitation time through UI-related problems [26]. According to Pettersen, et al. post-stroke UI is a strong predictor for decreased level of physical recovery [27].

Multidisciplinary teams made up of medical doctors, nurses, physiotherapists (PTs) and occupational therapists perform stroke rehabilitation in all phases and settings such as hospitals, communities and clinics. Jia, et al. showed that physiotherapy and occupational therapy were the most common treatment in stroke rehabilitation in the USA [28].

Traditionally, PTs focus largely on motor function such as sitting, standing and walking, while the nurses and doctors have primary responsibility for LUTS.

The International Continence Society (ICS) guidelines for treating UI in frail older adults' emphasizes the importance of maximising toileting ability by combining conservative training for bladder leakage with activities that improve physical function [29]. Therefore, potential elements of prevention and treatment programmes may include physical activity to maintain or improve toileting

skills and conservative training i.e., pelvic floor muscle training (PFMT).

The aims in terms of LUTS for PT in stroke rehabilitation are to: a) Prevent LUTS, b) Achieve or maintain urinary continence, c) Recover of LUTS and d) Improve QoL. Further considerations are the patient's disability and possible complications.

In the mid-1990s the first randomised controlled trials (RCTs) were published indicating the effect of PFMT in neurologically healthy women and men with LUTS [30,31].

Positive effects have also been identified for PFMT on LUTS in patients with neurological diseases [32-34]. In women with UI after their first stroke. Twelve weeks of PFMT leads to significant reduction in UI leakage and frequency of voiding [34,35]. Likewise, in post-stroke men with LUTS 12 weeks of PFMT indicated benefits for LUTS, erectile dysfunction and QoL [36-38]. No adverse events have been reported during PFMT programmes [36].

Not only are post-stroke LUTS under-diagnosed but there is also evidence suggesting under-treated [39,40]. Reports indicate that among neurologically healthy women with UI fewer than 50% seek care due to a range of barriers including lack of knowledge of treatment possibilities [41]. That proportion is likely to be higher in post-stroke patients with LUTS because neurologically healthy patients demonstrate more resources and knowledge about UI treatment compared with women with neurologic diseases. However, it is unclear if there are additional barriers in post-stroke patients, which contribute to a variation regarding seeking care.

Despite the high prevalence of LUTS in post-stroke patients, its major impact on QoL and increased PT

treatment research, there seems to be little attention paid to, and knowledge gained about what PT can provide in the rehabilitation of post-stroke patients with LUTS [42].

The objective of this study is to describe how PT in rehabilitation can be involved in the prevention, diagnostic and treatment of post-stroke patients with LUTS.

Neuropathology

The bladder performs two functions, storage and emptying. The neural control of these functions is done by neural programs, which are located within the pons. The switch between these functions are influenced by the suprapontine. Micturition frequency in healthy adults with bladder capacity of 500 ml is typically about once every 3-4 hours, depending on fluid intake. Since the act of voiding takes 2-3 minutes, for 98-99% of the time the bladder is in storage mode [43]. In the healthy and continent state when to void is determined by the perceived state of bladder fullness together with an assessment of social appropriateness to do so [43].

To affect both storage and voiding, connections between the pons and the sacral spinal cord must be intact as well as the peripheral innervation arising from the pelvic and the pudendal nerves to innervate the bladder and the internal and external sphincter muscles. Thus, the innervation needed for physiological bladder control is extensive requiring suprapontine inputs. Intact spinal connections between the pons and the sacral cord, as well as intact peripheral nerves [44].

Pathophysiology changes after stroke are complex and only partially understood as suggested by Andrew and Nathan [44]. The authors suggested that the antero-medial region in the frontal lobe was aeriated with the control of micturition [45]. A lesion in the other parts of the brain leads to UI which is probably due to the disruption of the pathways between the higher centres and the pontine micturition centre [46,47].

Interference of these pathways would be expected to lead to loss of higher cerebral inhibition of detrusor reflex activity and hence to an overactive bladder.

Borrie performed systematic tests in 22 acute stroke patients with moderate to severe UI that had persisted for weeks post-stroke [48].

Detrusor instability was present in 85% of those who had been continent pre-stroke and a further two patients showed SUI while two others showed urinary retention [48].

Gelber carried out urodynamic studies in 19 post-stroke patients with UI. Bladder overactivity was persistent in 37% of the group, bladder atonicity in 21%, detrusor-sphincter dyssynergia in 5%, leaving 37% with

normal bladder function [49].

Nazarko reported that stroke survivors whom are aware of bladder fullness but cannot inhibit bladder contraction experience LUTS such as frequency, urgency and possible urge urinary incontinence (UUI) [50].

Petersen, et al. explained that the disruption of neuromicturition pathways can lead to an impaired awareness of the need to void even in cognitively intact stroke patients [27].

Fowler, et al. showed that the human lower urinary tract is controlled by a complex supraspinal network [51]. More recently a growing number of functional neuroimaging studies have investigated supraspinal control of urinary tract control during bladder filling and pelvic floor muscle (PFM) contractions. According to Michels, et al. little is known about the supraspinal areas and dynamic processes involving micturition and the voluntary switch over “that is often impaired in patients with LUTS” [52].

Neuroimaging studies include healthy individuals, whereas no such studies have been done for stroke patients with LUTS.

Prevention

Regarding physical function, several factors may be considered for their role in preventing LUTS during stroke rehabilitation.

Optimal bladder emptying is an important factor in preventing UTI. Therefore, if possible, at each micturition the patients need mobilisation to the sitting or standing position. Neither healthy nor non-healthy people can empty their bladder when lying down [53,54].

Another factor preventing UTI relates to stroke patients who are able to clean themselves after micturition. Some patients have to be educated on the preferred cleaning movement of front to back, to avoid the risk of coli bacteria near the urinary tract opening.

Environmental factors

The PTs, together with the rehabilitation team, may consider prevention factors in the varieties of physical environments the stroke patients live in. Particularly for stroke patients suffering nocturia. A key question is: How can the patient safely get to the toilet at night? Is the toilet sign posted? Is there optimal lighting? Do the patients have safe shoes and clothes suitable for fast dressing? In addition, is there free access without e.g., loose blankets? Is the bathroom floor dry? Are there toilet grab bars and can the height of the toilet seat be adjusted [55]? Further considerations, for post-stroke patients with LUTS includes and impaired vision need special care. Moreover, there is significant association between LUTS and risk of

falls in stroke patients [56-60].

Due to hygiene or cultural issues, some patients, avoid sitting down, when crouching or hovering over the toilet. Consequently, the PFM cannot relax which sometimes leads to incomplete bladder emptying of urine [61,62].

Cognitive impairment may complicate the effect of prevention and treatment in post-stroke patients, as patients may have limited understanding and recall, and have misconceptions about their symptoms. However, it is standard to screen for cognitive impairment in stroke patients.

Epidemiological studies in toileting-related disabilities of stroke patients are needed.

Assessments

LUTS

Bladder scan by ultrasound is used to detect for urine retention, and test of urine for leucocytes, nitrites, glucose and protein, both of which are basic nursing assessments completed within the first 24 hours of admission [63]. During rehabilitation, PTs can use other assessments depending on the stroke severity.

Frequency/volume charts, recorded over at least three days, detect the frequency and volume of fluid intake and urine output. Additionally, a simple bladder diary recording time and frequency of micturition and the number of UI episodes can be useful [34,37].

Previously, a subscale in the Barthel Index has been used as a measure of UI in stroke patients but the Danish Prostate Symptom Score (DAN-PSS-1) questionnaire [64] (Table 2) has been suggested as a more specific instrument [16].

The DAN-PSS-1 questionnaire is a patient-reported measure consisting of 12 items, which detects LUTS, its

severity, and, for each symptom, its impact on daily life. The DAN-PSS-1 questionnaire has acceptable validity and reliability in post-stroke men and women [34,65,66].

For treatment, appropriate assessment is essential. Therefore, assessment of the pelvic floor muscle (PFM) function is important. PTs with specialised education can evaluate the PFM function, strength, and static and dynamic endurance by digital vaginal palpation in women and digital anal palpation in men [67,68].

The assessor evaluates whether the patient can perform an isolated PFM contraction or use associated muscles e.g. abdominal muscles, m. adductor femoris and m. gluteus max.

After feed-back to the patients, the PFM strength can be evaluated using the modified Oxford Scale (0-5 score for women and 0-6 for men). Static contraction is especially important in stroke patients due to cardiovascular disease as stroke and last the dynamic contraction again due to the cardiovascular basic cause. For ethical reasons, it is recommended that patients' sign up for appointment when they want to be PFM evaluated.

Other specific assessments for evaluation of the PFM, such as perineometer and electromyography, have also been reported in female stroke patients [35].

Mobility

Mobilisation is the key factor for independent toilet visits. The term toilet disability, defined as "having difficulty with or requiring human or mechanical assistance with toileting" [69], has mostly been studied as a subscale of activity of daily living (ADL) assessments. Furthermore, the Functional Independence Measure (FIM) is available particularly as a basic physiotherapy assessment regarding a chain of physical functions such as a) Transfers (from/to bed, chair or wheelchair and toilet),

Table 2: The Danish Prostate Symptom Score (DAN-PSS-1) Questionnaire. (Brasso, et al, 1994 (64)).

1. *Hesitancy:* Do you have to wait for urination to start?
2. *Decreased stream:* Is your urinary stream weak or dribbling?
3. *Incomplete emptying:* Do you feel you empty your bladder completely?
4. *Straining:* Do you have to strain to start and/or maintain urination?
5. *Daytime frequency:* What is the longest interval between each urination, from when you wake up until you go to bed?
6. *Nocturnal urination:* How many times do you have to urinate during the night?
7. *Urge:* Do you experience an imperative (strong) urge to urinate?
8. *Urge incontinence:* Is the urge to urinate so strong that urine starts to flow before you reach the toilet?
9. *Dysuria:* Does it hurt or burn when you urinate?
10. *Terminal dribbling:* Do you experience dribbling after voiding, when you feel you have finished urination?
11. *Stress incontinence:* Do you experience leakage of urine when physically active (e.g. lighting, sneezing, coughing)?
12. *Other incontinence:* Do you experience leakage without urge or physical activity?

b) Locomotion (walking or wheelchair), c) Dress on/off lower body, d) Maintaining a proper position, e) Managing bladder outlet and f) Personal hygiene [70].

If possible, it is important to educate post-stroke patients with urgency and UUI to express their desire for micturition as soon as it is felt. More specific assessment of walking distance and speed are essential elements for stroke patients with urgency and UUI aiming to enable them to reach a toilet quickly [7]. A similar assessment is required for stroke patients with impaired upper-extremity for their ability to reach and grasp as part of the cleaning function after micturition.

Treatment

PFMT can be used as first-line conservative treatment for men and women with post-stroke LUTS [34-37,71]. However, the treatment has to be provided at all levels (I-III) depending on the severity of the stroke and on PTs' understanding of LUTS [72].

In level I, the stroke patient can be educated about the prevalence and possible duration of LUTS, the most common LUTS and their definitions or characteristics, and their impact on physical, social and mental health.

Regarding PFM function, information to be important includes PFM localisation, PFM function, PFM extent in women and men, awareness of PFM contraction and relaxation, ending with instruction in PFM exercises. PFM models illustrated all, by models and pictures.

The treatment at level II, based on increase awareness of PFM function, includes information, instruction and training in "the Knack" manoeuvre, which is a voluntarily PFM contraction before and during laughing, coughing, sneezings [73] and functional tasks e.g. standing up, sitting down or walking [36]. When the stroke patient expresses awareness of some PFM contraction he/she is recommended to perform the manoeuvre during each relevant functional task.

At level III, the PFMT has to be planned according to the results of the PFM assessment. The assessment must be performed at least as Pre-test and Post-test, but also during the training period giving feed-back to the patient and following the PFM progression. The PFMT can be performed individually or in small groups, supervised by a specialist PT [34,37]. The supervising PT is important in term of motivation for adherence to the training, increasing the training effort [74], and avoiding activity in the m. abdominals, m. gluteus max and m. adductor femoris, and guiding functional visualisation tasks training.

The PFMT programmer includes theory, PFM function and strength, and particularly the static and dynamic endurance due to cardiovascular diseases such as stroke,

and visualised PFM contraction during functions tasks (the Knack manoeuvre) due to e.g., urgency, in which the stroke patients hurries to a toilet.

The home exercises programme must be progressive implies continuous progressive according to the PFM status with a training frequency of at least three times a week for 12 weeks.

For men with post-micturition urine leakage, instruction in three to four powerful PFM contractions has been reported to be beneficial [75].

Information for relatives

The PTs play an important role in some cases in informing relatives about LUTS: concerning a) What to do in regard to prevention, b) What to do concerning treatment, and c) Where to seek help in the health care system.

Discussion

This study describes how physiotherapy can be involved in the rehabilitation of post-stroke patients with LUTS. Factors for prevention of LUTS are identified, validated and reliable assessments are presented; and treatment of PFM at different levels is reported. However, low numbers of studies and small sample sizes limits the evidence.

Prevention

Urgency and nocturia in older people are strongly associated with falls. The cause has been discussed but, according to Gibson, et al., the reason remains to be explored [60]. The cause of urgency and UUI in post-stroke patients has been explained by brain injury. Whether a risk of cardiovascular events could be associated in older people is unclear [76].

Impaired micturition is defined as "the inability to void, despite having the urge to do so", and in post percutaneous coronary intervention (PCI) patients it has been reported that modified spine position could facilitate bladder emptying. The bed was tilted by 20° with a pillow between the feet. The results indicated that patients in the intervention group had significantly better bladder emptying and shorter time to void post PCI [53].

Whether this intervention facilitates prevention of urinary cauterisation in post-stroke patients with problems of bladder emptying, due to their ethology is unknown. Impaired micturition may also lead to nephropathy.

Assessments

In a study by Stineman, et al. stroke patients undergoing acute rehabilitation preferred early recovery of the

ability to eat and control their bowel and bladder functions over recovery of cognition and communication [77].

A Web-based Toileting Behaviour instrument has been developed and validated, aiming to assess and understand toileting behaviour in women with non-neurological conditions [78]. This instrument might be useful in screening for some post-stroke patients.

Treatment

In a review of therapeutic education for post-stroke patients, Daviet, et al. reported that a nurse-targeted education programme might improve longer term continence [79]. However, the most severe stroke patients may have limited ability to participate in some of the more demanding therapies.

In the study by Shin, et al. the frequency of supervised PFMT was three times per week for six weeks compared with the studies by Tibaek, et al. [34-37,71] once a week for 12 weeks combined with progressive home exercise programme for daily training.

Recently, studies suggest that increase in amount of standard rehabilitation leads to better outcomes for people living with the disabling consequences of strokes [80-82].

During rehabilitation, PTs need to consider the stroke patient. Nevertheless, there seem to be several barriers regarding patients with post-stroke LUTS. Dumoulin, et al. reported, in a study of stroke rehabilitation professionals, a lack of knowledge in the field of UI and the need for UI strategies in the health service organisation [42].

Several other barriers may influence PTs' attitudes such as time and resources are not attitudes, in the intervention, practical and environmental factors.

Methodological considerations

The main limitation in this study is the lack of a systematic review. However, its aims were to describe, not to investigate, how physiotherapy can be involved in the rehabilitation of post-stroke patients with LUTS.

Perspective

PFMT has the potential to benefit post-stroke patients with LUTS. Other non-invasive treatments, such as neuromodulation performed by the posterior tibialis stimulation nerve, have given reported benefits for men [83]. For post-stroke patients with LUTS and impaired mobility, the potential of technical devices such as toilet-assistance machines, aiming to clean and take off and replace trousers, leads to independent toilet behaviour. However, these approaches all have to be based on appropriate as-

essment in terms of LUTS and the patient's ability.

Confidence and great respect are important contributions to beneficial treatment, particularly in post-stroke patients with symptoms as LUTS. Most PTs already have these competences, through experience, careful clinical planning and training in the rehabilitation of individual stroke patients.

Further research should seek to develop specific LUTS assessments, identify preventing factors and improve the effect of treatment.

Conclusions

This paper attempts to contribute more comprehensive knowledge for understanding LUTS and to improve QoL in post-stroke patients with the condition. However, the evidence is still limited by the paucity of studies and small sample sizes.

It is recommended that PTs, through their central role in the rehabilitation of stroke patients, contribute with their specific knowledge to the prevention, diagnostic and treatment of post-stroke patients with LUTS.

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