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Contribution of Posterior Tibial Nerve Stimulation in the management of Urinary Disorders in idiopathic Parkinson's Disease: Experience of the National Hospital Center of Pikine

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Abstract

Introduction: Lower urinary tract symptoms (LUTS) are common during Parkinson's Disease (PD), but their management has not been clearly defined.

Objectifs: Evaluate the efficacy of posterior tibial nerve stimulation in the management of LUTS in patients with PD

Methods: We conducted a prospective and comparative study from January to July 2025 at the Neurology Department of Pikine National Hospital. All patients with PD who complained of LUTS were included in the study. They were divided into two groups: one received posterior tibial nerve stimulation (PTNS), and the other received medical treatment. Patients undergoing stimulation received two 30-minute stimulation sessions per week for a total of six weeks. LUTS were assessed using the International Prostate Symptom Scale (IPSS) at 0, 6, and 12 weeks. Statistical analyses were performed using SPSS version 26.0.

Results: A total of 88 patients with MPI were seen, of whom 37 had LUTS, giving a frequency of 42.5%. The most common urinary symptoms were nocturia and pollakiuria, followed by urgency and incontinence. The IPSS score was higher in patients undergoing stimulation. PTNS resulted in a decrease in the IPSS score in all patients at 6 weeks and in 80% of patients at 12 weeks. The quality of life of patients undergoing stimulation improved at 6 and 12 weeks. There was no significant change in IPSS score and quality of life at 6 and 12 weeks between patients undergoing PTNS and those receiving drug treatment.

Conclusion: LUTS are frequent in Parkinson’s disease and negatively impact quality of life. PTNS improves urinary symptoms and quality of life, showing comparable efficacy to drug therapy, and represents a safe, non-invasive treatment option. Further studies are needed to confirm its long-term benefits.

Keywords: Parkinson's disease, lower urinary tract symptoms, posterior tibial nerve stimulation

Introduction

Parkinson's disease (PD) is a neurodegenerative disorder resulting from the accumulation of alpha-synuclein, which causes degeneration of dopaminergic neurons in the substantia nigra and other parts of the brain. Symptoms of PD can be motor or non-motor. Non-motor symptoms can precede the diagnosis of PD, and include sleep disorders, psychiatric and cognitive disorders, pain, and dysautonomic signs, which include urinary disorders. [1].

The prevalence of lower urinary tract symptoms (LUTS) appears to be higher in patients with Idiopathic Parkinson's disease (IPD) (27-85%) compared to the general population, with a prevalence of approximately 61% [2,3]. This prevalence increases with the severity of PD as defined by the Hoehn and Yahr (H&Y) criteria [1,3,4]. These symptoms are most often related to an overactive bladder (nocturia, urgency, pollakiuria)[1,3,5]. Incontinence occurs later and is present in less than a quarter of patients [3,6]. Obstructive symptoms, such as straining, hesitancy, and an interrupted stream, are less common [1]. The presence of LUTS increases the risk of falls and fractures and impairs patients' quality of life [2].

The treatment options include dopamine, anticholinergics, apomorphine, botulinum toxin, desmopressin, alpha-adrenergic antagonists, bladder training, deep brain stimulation of the subthalamic nuclei, and posterior tibial nerve stimulation [1,7,8]. Some anticholinergics, such as oxybutynin, have side effects that can impair the patient's quality of life through the development of cognitive impairment, confusion, and gastrointestinal disorders [1]. Posterior tibial nerve stimulation (PTNS) is a non-invasive outpatient treatment that has been proven effective in managing neurological and non-neurological bladder hyperactivity [9–11]. It works by modulating the micturition reflex at the medullary and cerebral levels [9]. In a randomized

multicenter study involving 242 participants monitored for OAB, PTNS led to an improvement in the severity of LUTS at 6 weeks. Still, at 12 weeks, this difference was no longer significant [12].

In Senegal, LUTS are present in 16 to 60% of patients treated for IBS and are responsible for a deterioration in their quality of life [13–16]. In a population of 18 patients, LUTS accounted for 55.6% of dysautonomic signs [15]. Despite the high frequency of LUTS in these patients and their impact on quality of life, no study has yet evaluated their management.

Objective

The primary objective of this study was to assess the efficacy of PTNS in managing LUTS in PD patients and to compare it with medical treatment.

1. Methodology

1.1.Study type, period and site

This was a prospective, comparative, interventional clinical study conducted from January to July 2025 at the neurology department of the National Hospital Center of Pikine (CHN). The neurology department is the second neurology department in the Dakar region. Since 2024, it has been recognized by the Movement Disorder Society (MDS) as the focal point for treating abnormal movements in West Africa and offers three- to six-month internships in this area. One consultation day per week is dedicated to movement disorders (including Parkinson's disease).

1.2.Inclusion criteria

- ✓ Patients followed for PD according to MDS criteria, and complaining of LUTS
- ✓ Patients with stable PD for at least two months

1.3.Critères d’exclusion

- ✓ Patients with contraindications to PTNS.

- ✓ Patients who do not consent to participate in the study
- ✓ Uncontrolled diabetes
- ✓ Patients taking diuretics

1.4.Definition of operational terms

Stable PD: no change reported by the patient in physical symptoms such as tremor, bradykinesia, rigidity, posture, or balance disorders [11]. No change in medication for at least two months.

Uncontrolled diabetes: Diabetic patient with a hemoglobin level above 8% at the time of the study.

1.5.Data collected

The data collected included sociodemographic information (age, residency, occupation, marital status), clinical data on Parkinson's disease (age of onset, duration of progression, symptoms, clinical progression, treatment), and urinary symptoms according to the definitions proposed by Haylen et al. [17].

Outcome measures

The International Prostate Symptom Score (IPSS) is a urinary symptom assessment score developed by the American Urological Association. The first seven items assess incomplete emptying, pollakiuria, intermittent urination, urinary urgency, weak stream, dysuria, and nocturia. Each item is scored from 0 to 5, with zero corresponding to the absence of the symptom and 5 to its constant presence. The total score ranges from 0 to 35, and patients can be classified into three categories: 0-7 (mildly symptomatic), 8-19 (moderately symptomatic), and 20-35 (severely symptomatic). Item 8 of the score assesses quality of life and is rated from 0 to 6, with the lowest score indicating a better quality of life. A difference in score greater than 3 suggests an improvement [18,19]. The IPSS has been used numerous times to assess LUTS

in PD and the effectiveness of treatment for urinary symptoms in these patients [6, 12, 20. The IPSS score was recorded at 0, 6, and 12 weeks.

1.6.Procedure

Patients were selected during movement disorder consultations after obtaining their verbal consent. The patients were divided into two groups: patients receiving oral medication (patients remaining on their usual PD treatment) and patients receiving stimulation (patients receiving PTNS in addition to their usual PD treatment). Patients on PTNS received a home visit where the IPSS score was administered and stimulation was initiated. A stimulation program was then established for each patient, consisting of one session at the hospital and a subsequent session at home. Participants were called the day before their stimulation appointment to ensure that they would attend the sessions. Stimulation was performed twice a week for six weeks. Each stimulation session lasted 30 minutes. The stimulation frequency was 10Hz with a pulse duration of 200 μs in continuous mode. The stimulation amplitude varied between 0 and 50 mA, depending on the clinical response, either plantar flexion of the big toe or paresthesia along the nerve pathway. We adopted this protocol from several authors in the literature, with adaptations to suit our local circumstances. [11,12]. They were called back at 12 weeks to undergo the IPSS scoring.

Patients undergoing drug treatment were contacted by telephone at 6 and 12 weeks to collect the data mentioned above.

We delivered stimulation using the UROSTIM-2 transcutaneous stimulation device equipped with two self-adhesive electrodes measuring 5 cm × 5 cm. The first electrode is placed on the back of the inner ankle bone, and the second is 10 cm above the first. A cable then connects these electrodes to the stimulation device, which is pre-set to the stimulation program suitable for urinary disorders (U-03).

1.7.Statistical analysis

Statistical analyses were performed using SPSS version 26.0 software. Qualitative variables were expressed as frequencies and percentages, while quantitative variables were expressed as means and medians. The Mann-Whitney U test was used to compare the means of continuous variables, and the Chi-square test was used for categorical variables. The effect of stimulation on the IPSS score at 06 and 12 weeks was evaluated using the Wilcoxon test. Linear regression was used to identify factors associated with improvement in urinary symptoms. For these tests, a p-value of less than 0.05 was considered statistically significant.

1.8.Ethical consideration

All procedures performed complied with the ethical standards of the Declaration of Helsinki. We obtained informed consent for publication from all individual patients included in this study. We obtained approval from Pikine National Hospital.

2. RESULTS

2.1. Sociodemographic characteristics

We saw 88 patients with MPI, of whom 37 had LUTS (42.5%). Two patients undergoing stimulation withdrew their consent (one due to complete improvement after the second stimulation and the other due to no improvement after the eighth session). Ultimately, 21 patients were included, 11 on oral medication and 10 on stimulation (Figure 1).

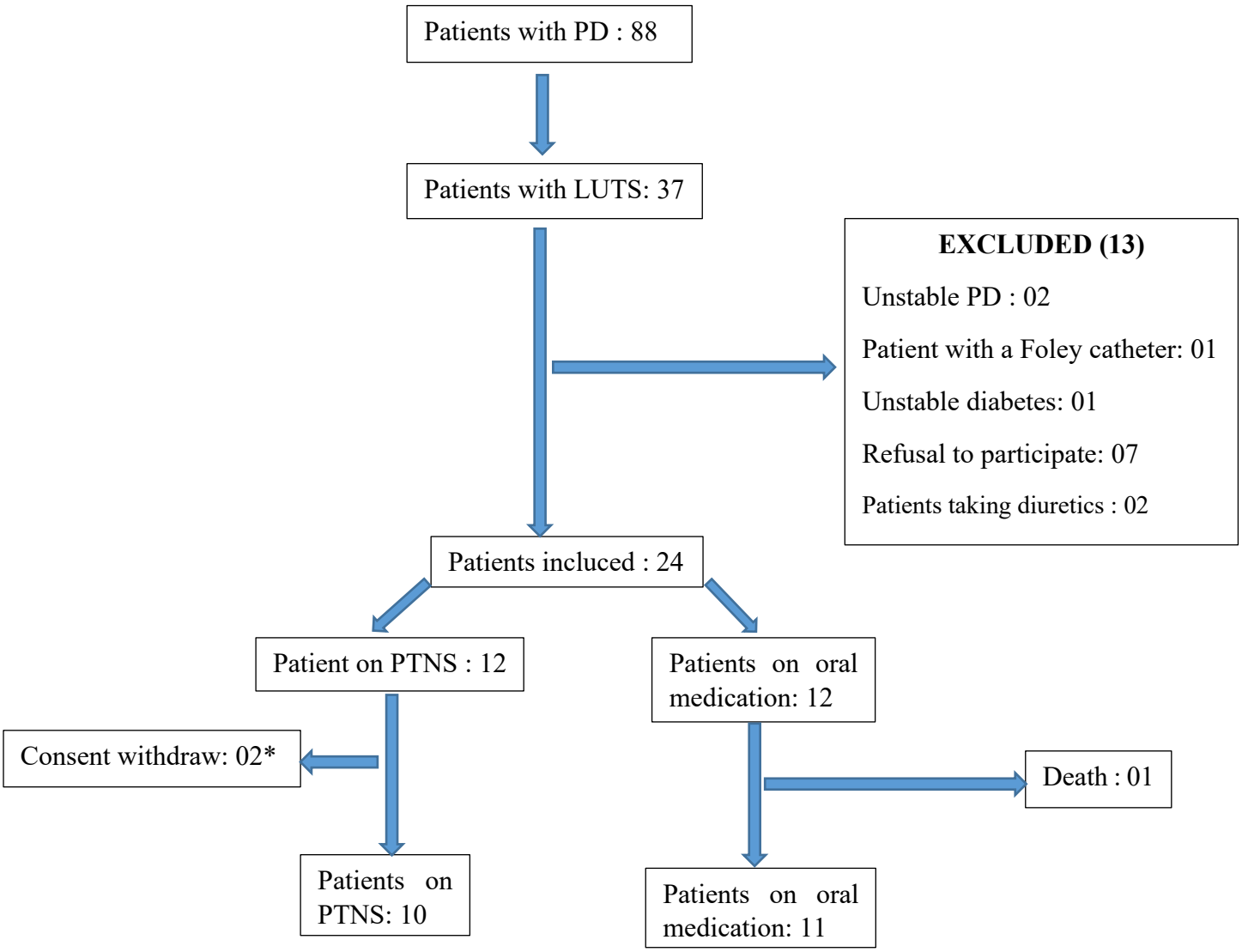


Figure 1: Flow chart of the population

The mean age was 67.90 ± 12.19 years in the stimulation group and 69.72 ± 7.89 years in the oral medication group. Males were the most represented in both groups. Table I shows the remaining sociodemographic characteristics.

Table I: Sociodemographic characteristics of the population

Variable	PTNS (10)		Oral medication (11)	
	Effective	Percentage	Effective	Percentage
Sex				
Male	7	70.0	7	63.6
Female	3	30.0	4	36.6
Profession				

Unemployed	8	80.0	9	81.8
Residency				
Dakar	2	20.0	0	0.0
Suburb	6	60.0	5	45.5
Region	2	20.0	6	54.5
Marital statue				
Single	1	10.0	0	0.0
Monogamous marriage	4	40.0	2	18.2
Polygamous marriage	4	40.0	5	45.5
Windower	1	10.0	4	36.3

2.2. Clinical characteristics

The duration of Parkinson's disease was 5.90 ± 3.72 years in patients receiving PTNS and 3.5 ± 3.44 years in those receiving oral medication, with no significant difference (p = 0.14). Table II shows the clinical characteristics of PD in the population.

Table II: Characteristics of Parkinson's disease in the population

Variable	**Stimulation du nerf tibial postérieur (10)**		**Traitement médicamenteux (11)**		**P value**
	Effectifs	**Pourcentage (%)**	**Effectifs**	**Pourcentage (%)**	
Current symptoms					
Akinesia	8	80.0	3	27.3	**0.03**
Hypertonia	5	50.0	4	36.3	0.67
Sleep disorders	8	80.0	4	36.3	0.08
Working disorders	3	30.0	4	45.5	1,00
Psychiatric disorders	2	20.0	0	0.0	0.21
Tremor	8	80.0	4	36.3	0.08
Constipation	5	50.0	7	63.6	0.67
Anosmia	5	50.0	0	0.0	NA
Current traitement					
Levodopa	8	80.0	10	90.9	0,58
Chlorydrate de trihexyphénidyle	0	0.0	8	72.7	NA

Ropinirole	1	10.0	0	0.0	NA
Péribédil	8	80.0	2	18.2	**0.01**

NA: non-applicable

2.3. Characteristics of LUTS in the population

The most common LUTS were pollakiuria and nocturia (66.7%), followed by incontinence and urgency (57.1%). Figure 2 illustrates the distribution of LUTS across the entire population.

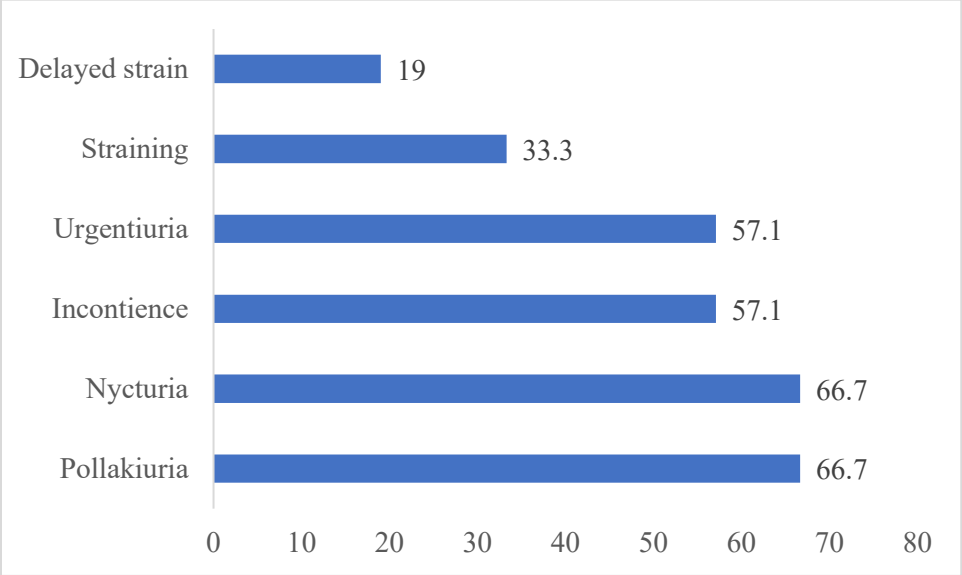


Figure 2: Distribution of lower urinary tract symptoms among the entire population

In subgroup analysis, the median duration in months of LUTS was 12 [1–96] in patients undergoing stimulation and 12 [1–24] in those on oral medication, with no significant difference (p=0.21). The baseline median IPSS score was significantly higher in patients undergoing stimulation (15.50 vs. 8.00, **P = 0.002**). Table III shows urinary disorder characteristics in the two groups.

Table III: Comparison of urinary disorders according to different groups

Variable	PTNS		Oral medication		P value
	Effective	Percentage (%)	Effective	Percentage (%)	
IPSS – severity of LUTS n(%)					
Mild symptoms	0	0.0	6	54.5	NA
Moderate symptoms	8	80.0	5	45.5	0.18
Severe symptoms	2	20.0	0	0.0	NA
IPSS – quality of life (n/%)					
Delighted	0	0.0	0,0	0.0	NA
Pleased	0	0.0	1	9.1	1
Mostly satisfied	0	0.0	2	18.2	0.47
Mixed	1	10.0	4	36.4	0.31
Mostly dissatisfied	1	10.0	3	27.3	0.58
Unhappy	3	30.0	1	9.1	0.31
Terrible	5	50.0	0	0.0	**0.012**
Symptoms					
Pollakiuria	8	80.0	6	54.5	0.36
Incontinence	6	60.0	6	54.5	1.00
Urgenturia	7	70.0	5	45.5	0.38
Nycturia	8	80.0	6	54.5	0.36
Straining	3	30.0	4	36.3	1.00
Delayed strain	1	10.0	3	27.3	0.58

NA: non-applicable

2.4. Effectiveness of posterior tibial nerve stimulation

All patients undergoing PTNS experienced a reduction in LUTS at 6 weeks, with 80% improvement at 12 weeks. The difference in median IPSS scores was greater than 3 points at 6 weeks (P = 0.005) and at 12 weeks (P = 0.016). However, two patients experienced symptom recurrence at week 12. Table IV shows the evolution of the IPSS score.

Tableau IV: Changes in urinary disorders in patients undergoing stimulation

Comparison	median IPSS before	Median IPSS after	Difference of median	Wilcoxon test (p-value)
Baseline vs W6	15.50 [8 – 23]	5 [0 – 15]	-10.5	**0.005**
Baseline vs W12	15.50 [8 – 23]	4,29 [0 – 29]	-11.21	**0.016**

A long duration of LUTS was associated with a greater improvement in symptoms under stimulation (B = 1.26, P = 0.029). No factors were associated with improvement in urinary symptoms at 12 weeks. Tables V and VI show the factors related to improvement under stimulation.

Tableau V: Factors associated with improvement in symptoms at 6 weeks

Variable	B	P value	Confidence interval
Age	0.15	0.29	-0.20 – 0.50
LUTS duration (months)	- 0.18	0.05	-0.37 – 0.01
PD duration (years)	1.26	**0.029**	0.21 – 2.32
Baseline IPSS	0.47	0.15	-0.27 – 1.21
Anosmia	- 4.70	0.11	- 11.28 – 1.86

Tableau VI: Factors associated with significant improvement in symptoms at 12 weeks

Variable	B	P value	Confidence interval
Age	0.47	0.40	-0.60 – 1.28
PD duration (years)	0.29	0.72	-4.30 – 5.68
Anosmia	-0.40	0.46	-28.02 – 16.32
Baseline IPSS	-0.45	0.38	-3.29 – 1.69
Week 6 IPSS	-0.38	0.57	-3.97 – 2.66
LUTS duration (months)	- 0.95	0.35	-1.03 – 0.50

At 6 and 12 weeks of stimulation, there was a significant decrease in the median quality-of-life score among patients undergoing stimulation (Table VII).

Tableau VII: Change in quality of life according to the IPSS at 6 and 12 weeks

Comparison	Median score of quality of life before	Median score of quality of life after	Difference of median	Wilcoxon test (p-value)
Baseline vs W6	5.50 [3 – 6]	1 [0 – 5]	-4.5	**0.028**
Baseline vs W12	5.50 [3 – 6]	0 [0 – 6]	-5.5	**0.008**

2.5. Effectiveness of stimulation versus oral medication

There was no significant difference in median IPSS between the oral medication and stimulation groups at 6 and 12 weeks (Figure 4). At 6 and 12 weeks, there was no statistically significant difference in quality-of-life scores between the two patient populations (Figure 5).

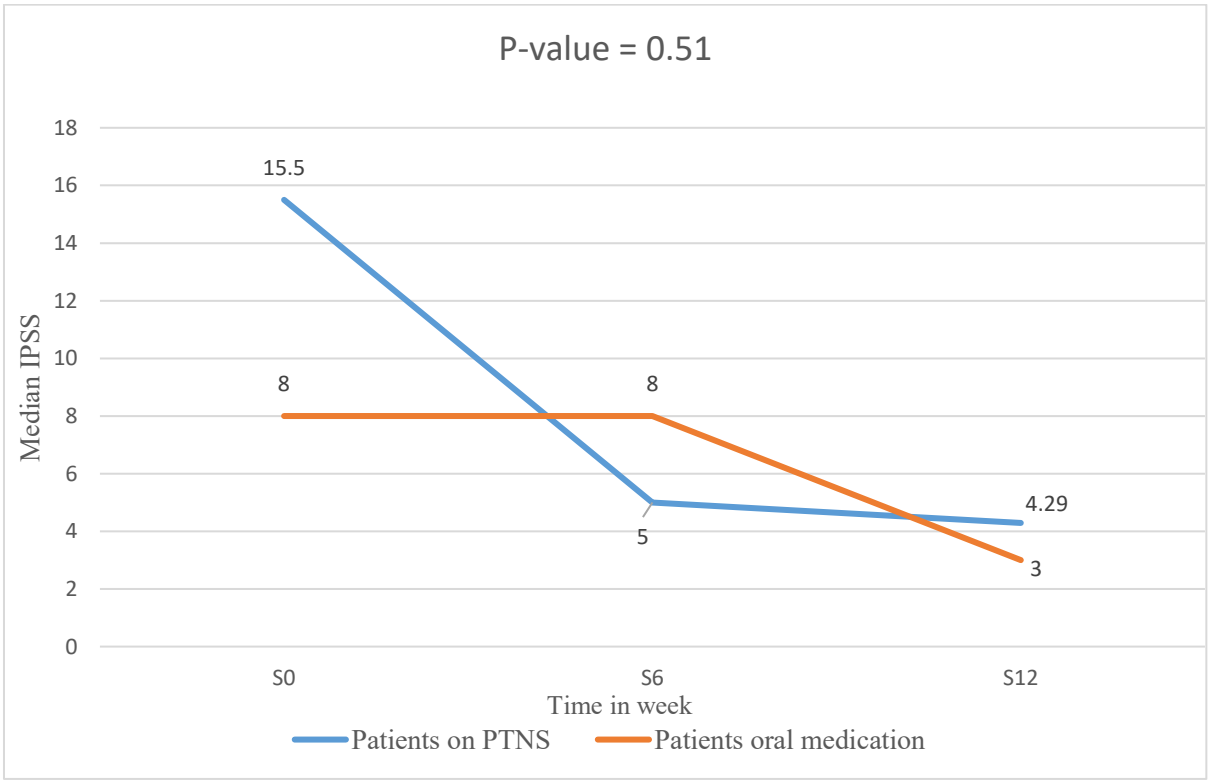


Figure 4: Comparison of the median IPSS change in the two groups

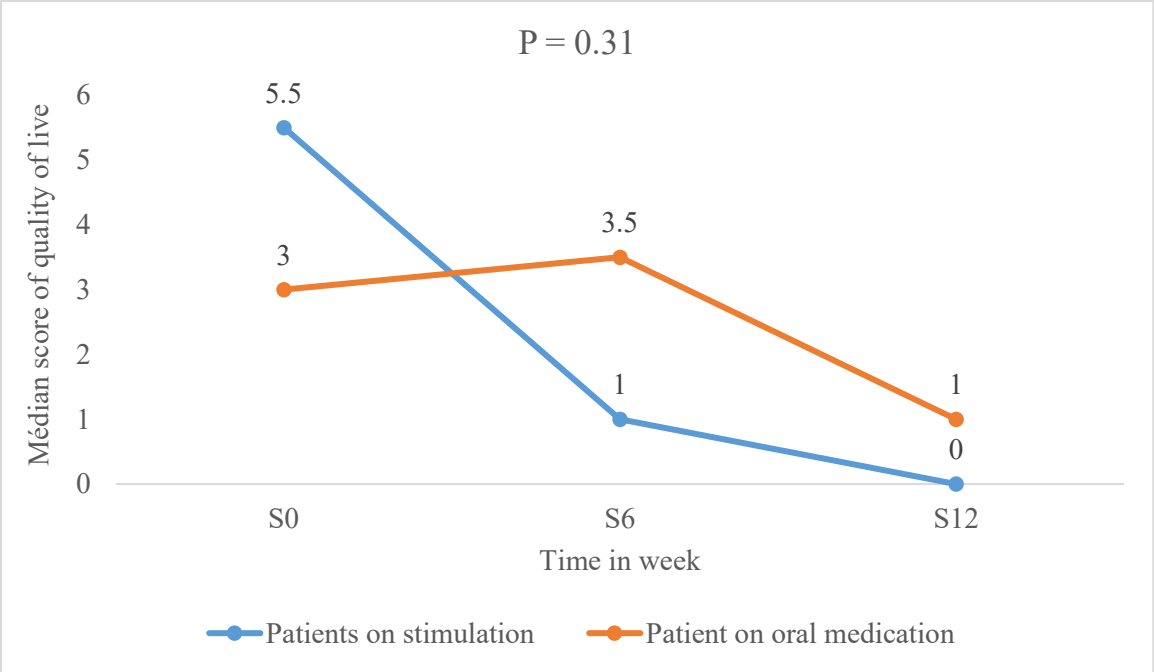


Figure 5 : Comparison of the quality of life score change in the two groups

3. Discussion

Our study aimed to evaluate the effectiveness of posterior tibial nerve stimulation in the treatment of LUTS in Parkinson's disease and to compare it with oral medication. We found that LUTS are present in nearly half of patients with PD, with pollakiuria, urgency, and nocturia being the most common symptoms. PTNS improves urinary disorders and quality of life after 6 and 12 weeks of treatment. However, compared to oral medication, this improvement in urinary disorders with posterior tibial nerve stimulation was not statistically significant.

The proportion of LUTS in PD varies from 27 to 85% [2]. The frequency of LUTS in our population falls within this range, with a rate of 42.5%. Pollakiuria, nocturia, and urgency were the most common urinary symptoms in both groups. These results are similar to those reported by several authors who found a high proportion of urinary symptoms related to overactive bladder [21–23]. As in previous studies, obstructive symptoms (straining and delayed stream) were less common in our study [1]. This could support the hypothesis of the mechanism of urinary disorders in PD, which is most often associated with bladder overactivity. This bladder

overactivity is thought to be due to the lack of inhibition of striatal dopaminergic neurons on the micturition reflex [24].

Furthermore, the baseline IPSS score was significantly higher in patients undergoing stimulation. The long duration of PD in this group could explain the severity of LUTS. LUTS are the non-motor symptoms that appear later in the course of the disease. Ou *et al.* found an increase in the frequency of certain non-motor signs, such as sleep and urinary disorders, in a cohort of 117 patients followed over two years [25]. However, Winge *et al.* (2006) did not find a correlation between the duration of MPI and the onset of urinary disorders [26]. In our study, the patients on oral medication received mainly a combination of levodopa and trihexyphenidyl hydrochloride. The affinity of the latter for the muscarinic M3 receptors present on the detrusor, which explains its side effects such as urinary retention, could contribute to masking certain urinary disorders in patients in the oral medication group.

Posterior tibial nerve stimulation is a non-invasive therapeutic option for managing overactive bladder, with efficacy ranging from 37% to 100%, depending on the study [10]. This efficacy has also been demonstrated in the management of LUTS in PD, showing an improvement in irritative urinary symptoms at six weeks [11,12]. In our study, all patients showed improvement in their urinary symptoms at six weeks, as indicated by the IPSS score ($P = 0.002$). This result is consistent with the literature, which reports the effectiveness of PTNS on LUTS during PD [10]. After 12 weeks, the decrease in the IPSS score was significantly low ($P = 0.016$); however, we observed a wide variability in responses, with two patients becoming symptomatic after this period. This raises other questions, such as the duration of stimulation. In a 2009 study conducted in Egypt, El-Senousy *et al.* performed single weekly stimulation, and all patients reported a recurrence of symptoms three months after stopping stimulation [27]. In the study by Araujo *et al*, where stimulation was performed daily for 12 weeks, improvement persisted in 33% of cases at 90 days [23]. In our study, stimulation resulted in an improvement in patients'

quality of life at both 6 and 12 weeks. The literature also reports an improvement in quality of life in patients undergoing PTNS [11]. Authors found a negative association between urinary disorders and quality of life in patients with PD, as well as a higher number of falls [2,14]. This justifies the implementation of appropriate treatment to reduce the burden of urinary disorders in these patients.

Compared to patients on oral medication, the decrease in IPSS score was not statistically significant at 6 and 12 weeks between those on PTNS and those on oral medication. The literature reports controversy regarding the efficacy of stimulation compared to other therapeutic options. Randomized controlled trials comparing PTNS with placebo did not show a significant difference in the improvement of LUTS or quality of life after six to ten weeks of stimulation [11,12]. In Brazil in 2020, Araujo *et al.* conducted a randomized study involving 30 women, finding that LUTS remained partially improved at both 30 and 90 days [23]. The quality and reliability of the instruments used to assess the effectiveness of PTNS could explain this difference. Scores such as DAN-PSS (Danish PSS), ICIQ (International Consultation for Incontinence Questionnaire), MLUTS (Male Lower Urinary Tract Symptoms), OAB-V8 (Overactive Bladder-V8), and OABSS (OAB Symptom Score) are some of the scores that have met the criteria to be recommended with reservations by the MDS in the assessment of urinary disorders during the PD [28]. Although our results are similar to those of other authors, our study lacks homogeneity; treatment with trihexyphenidyl hydrochloride was used only in patients who did not undergo stimulation, as this treatment can influence urinary disorders. The fact that in our study, a rectal digital examination was not performed in men seeking treatment for prostate enlargement could constitute a selection bias. Nevertheless, authors such as McClurg *et al.* found results similar to ours in a randomized study, even though they did not use prostate pathology as an exclusion criterion [12].

Conclusion

Urinary disorders are non-motor symptoms frequently encountered during the course of Parkinson's disease, with a significant impact on patients' quality of life. Stimulation of the posterior tibial nerve resulted in improvements in urinary disorders and an increase in patients' quality of life at both 6 weeks and 12 weeks. Compared to drug treatment, this improvement in urinary disorders under PTNS is not statistically significant. Nevertheless, PTNS may be a therapeutic option for patients with long-standing PD or severe urinary symptoms.

STRENGTHS AND LIMITATIONS

Our study highlights the role of Posterior Tibial Nerve Stimulation in managing lower urinary tract symptoms in Parkinson's disease. Although there was no difference compared to medication, it is still a safe option for selected patients, such as those who do not respond to medication.

However, our study has a few limitations, including the small sample size, the lack of a valid questionnaire for assessing urinary disorders in Parkinson's disease, the failure to perform urinary tract examinations such as flowmetry or cystometry to characterize the mechanism responsible for LUTS, and the lack of funding, which limited the number of patients who could benefit from stimulation.

ABBREVIATION

IPSS : Internatial Prostate Symptom Scale

LUTS : Lower Urinary Tract Symptoms

MDS : Movement Disorders Society

PD : Parkinson Disease

PTNS : Postérior Tibial Nerf Stimulation

DECLARATIONS

Ethics Statement

All procedures performed complied with the ethical standards of the Declaration of Helsinki. This study was part of a larger study on neurodegenerative diseases in Sénégal, and we obtained approval from Pikine National Hospital (N°066/MSHP/DGES/CHNP/DIR).

Consent to participate

We obtained informed consent to participate from all patients included in the study. Participants could withdraw at any time without consequences.

Consent for publication

Not applicable

Data availability

The datasets analyzed during the current study are available from the corresponding author on reasonable request.

Disclosure statement

The authors report no competing interests.

Funding

Not applicable.

Authors' contributions

F.N.M. and F.M. conceived and designed the study. A.N., M.D.D., M.B., A.G.F., and SAS contributed to data collection. M.O.N., J.K., F.N.M., A.D., and S.K. performed the statistical analysis and interpreted the results. F.N.M., C.K., and C.M.S. drafted the manuscript. C.B.B., M.N., and F.M. critically revised the manuscript for important intellectual content. All authors read and approved the final version of the manuscript

Declaration of generative AI use

The authors report that generative AI was not used in their research or preparation of this manuscript

Clinical trial number: not applicable.

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