DOI: https://doi.org/10.53350/pjmhs020231712510

ORIGINAL ARTICLE

Optimizing Pharmacological Management of Lower Urinary Tract Symptoms in Frail Elderly Patients within a Home-Based Primary Care Program

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ABSTRACT

Aim of Study: To evaluate the efficacy of a structured pharmacological protocol for managing lower urinary tract symptoms (LUTS) in frail elderly patients within a home-based primary care program, focusing on symptom reduction, medication safety, and quality-of-life improvement.

Study Duration: January 2022 to March 2023.

Study Place: Rai Foundation Medical College, Sargodha & Niazi Medical & Dental College, Sargodha.

Study Type: Prospective quasi-experimental study (pre-post intervention).

Methodology: 150 frail patients (aged ≥65, Clinical Frailty Scale ≥5) with moderate-to-severe LUTS received a 12-week tailored pharmacological intervention. The protocol included deprescribing high-risk medications (e.g., anticholinergics), initiating guideline-based therapy (e.g., α-blockers, mirabegron), and biweekly telehealth monitoring. Outcomes were assessed using the International Prostate Symptom Score (IPSS), Anticholinergic Cognitive Burden (ACB) scale, and EuroQol-5D (EQ-5D) at baseline, 6 weeks, and 12 weeks.

Results:

- IPSS scores decreased from 20.4 ± 3.1 (baseline) to 11.2 ± 2.8 (12 weeks; *p* < 0.001).
- ACB scores reduced from 3.8 ± 1.2 to 1.5 ± 0.9 (*p* < 0.001).
- EQ-5D improved from 0.52 ± 0.12 to 0.78 ± 0.10 (*p* < 0.001).
- 32% reduction in LUTS-related hospitalizations compared to pre-intervention.

Discussion: Protocol-driven management significantly improved LUTS control while reducing polypharmacy risks. Home-based telehealth enabled real-time dose adjustments, enhancing adherence and safety.

Conclusion: Integrating deprescribing, targeted pharmacotherapy, and telehealth monitoring optimizes LUTS management in frail elderly patients, reducing symptoms and healthcare utilization.

Keywords: Lower urinary tract symptoms, frail elderly, home-based primary care, deprescribing, anticholinergic burden, telehealth, pharmacological management.

INTRODUCTION

Lower urinary tract symptoms (LUTS)—encompassing storage (urgency, frequency, nocturia, incontinence), voiding (hesitancy, weak stream, straining), and post-micturition symptoms (incomplete emptying, dribbling)—represent a pervasive yet underprioritized public health crisis among the global elderly population. Epidemiological studies confirm that over 75% of adults aged ≥65 experience clinically significant LUTS, with prevalence escalating to >90% in those over 85[1]. This symptom complex transcends mere inconvenience, profoundly eroding quality of life (QoL) through sleep fragmentation, falls, social isolation, depression, and catastrophic healthcare expenditures. Frail elderly individuals—defined by diminished physiological reserve, multisystem dysregulation, and heightened vulnerability to stressors—bear a disproportionate burden[2]. Frailty amplifies LUTS severity through intersecting pathways: age-related detrusor overactivity and bladder ischemia; polypharmacy-induced urological toxicity; and functional impairments limiting timely bathroom access[4]. In Pakistan—a low-middle-income country (LMIC) with a rapidly aging population and fragmented geriatric care infrastructure—LUTS prevalence exceeds 80% among community-dwelling elders, yet remains grossly underdiagnosed due to cultural stigma, gender disparities, financial barriers, and a critical shortage of urology specialists (1:3 million ratio)[3,8].

The pharmacological management of LUTS in frailty is a therapeutic tightrope. International guidelines (e.g., AUA/EAU) advocate α-blockers for voiding symptoms and antimuscarinics or β3-agonists for storage symptoms[7]. However, these recommendations rarely address frailty-specific vulnerabilities: altered pharmacokinetics (reduced renal/hepatic clearance, volume distribution shifts); pharmacodynamic hypersensitivity (exaggerated responses to anticholinergics or α-blockers); and the peril of prescribing cascades. Polypharmacy—consuming ≥5 daily medications—afflicts >90% of frail elders in LMICs like Pakistan, where 40% receive potentially inappropriate medications (PIMs) for LUTS, notably tertiary anticholinergics (oxybutynin, tolterodine) with high blood-brain barrier penetration[5]. These agents exacerbate frailty by inducing cognitive decline (OR 1.46), delirium (RR 1.78), falls (HR 1.32), and constipation—often triggering laxative overuse and electrolyte imbalances[5,11]. The 2023 AGS Beers Criteria® explicitly flag such drugs as high-risk in frailty, urging deprescribing in favor of safer alternatives like mirabegron[5]. Yet, real-world implementation is hampered by inadequate monitoring, therapeutic inertia, and fragmented care coordination.

Home-based primary care (HBPC)—a multidisciplinary model delivering comprehensive care to homebound patients—emerges as a promising solution. Studies in high-income settings demonstrate HBPC reduces hospitalizations by 25% and enhances medication adherence through pharmacist-led reviews[6,9]. However, in LMICs like Pakistan, HBPC programs are nascent and understudied, particularly regarding urological pharmacotherapy[8,12]. Existing guidelines lack pragmatic algorithms for HBPC contexts, where diagnostic tools (e.g., uroflowmetry) are unavailable, and comorbidities (hypertension, diabetes) complicate drug selection. Moreover, HBPC's potential synergy with telehealth for real-time dose titration remains unexplored in frailty—a gap with dire consequences, given that 68% of LUTS-related hospitalizations in this cohort stem from adverse drug events (ADEs) like orthostatic hypotension or acute urinary

Received on 11-04-2023
Accepted on 23-12-2023

retention[15].This study bridges three critical domains:Community Medicine: HBPC circumvents access barriers but requires embedded pharmacological expertise to manage polypharmacy [9].Urology: Frailty demands deprescribing high-risk anticholinergics and prioritizing agents with neutral cognitive profiles (e.g., mirabegron, trospium)[10].Pharmacology: Quantifying anticholinergic burden via tools like the ACB scale and deploying telehealth for dynamic monitoring mitigates ADEs[11].

Supported by Jinnah Hospital's HBPC initiative, we pioneered a protocol integrating these elements. We hypothesized that a 12-week intervention featuring systematic deprescribing of ACB≥2 drugs, guideline-based initiation of safer agents, and biweekly telehealth oversight would significantly improve LUTS control, reduce anticholinergic burden, enhance QoL, and decrease hospitalizations in frail elders.

METHODOLOGY

Study Design: Prospective quasi-experimental study (pre-post intervention).

Setting: Rai Foundation Medical College, Sargodha HBPC program.

Participants:

- **Inclusion:** Age ≥65; Clinical Frailty Scale (CFS) ≥5 [13]; IPSS ≥12; stable medical regimen.
- **Exclusion:** Cognitive impairment (MMSE <18); catheter-dependent; urological malignancy.

Sample Size: 150 (calculated using G*Power, α=0.05, β=0.2, effect size=0.35).

Intervention Protocol:

1. **Baseline Assessment:** IPSS, ACB, EQ-5D, renal function, and medication review.
2. **Pharmacological Optimization:**
   - **Deprescribing:** Discontinuation of drugs with ACB ≥2 (e.g., oxybutynin).
   - **Initiating Therapy:** α-blockers (tamsulosin) for voiding symptoms; mirabegron for storage symptoms.
3. **Telehealth Monitoring:** Biweekly calls for symptom tracking, side effects, and dose adjustments.

Outcomes:

- **Primary:** Change in IPSS (0–35 scale).
- **Secondary:** ACB score (0–15), EQ-5D (−0.5–1.0), hospitalization rates.

Statistical Analysis: SPSS v26. Paired t-tests for pre-post comparisons; ANOVA for repeated measures; *p* < 0.05 significant.

RESULTS

Table 1: Baseline Characteristics (n=150)

Characteristic	Value
Age (years)	78.4 ± 6.2
Female	58%
Clinical Frailty Scale	5.8 ± 0.7
IPSS Score	20.4 ± 3.1
ACB Score	3.8 ± 1.2
Polypharmacy (≥5 drugs)	92%

Table 2: Primary Outcomes (Pre vs. Post-Intervention)

Outcome	Baseline	6 Weeks	12 Weeks	p-value
IPSS Score	20.4 ± 3.1	15.1 ± 2.9	11.2 ± 2.8	<0.001
ACB Score	3.8 ± 1.2	2.4 ± 1.0	1.5 ± 0.9	<0.001
EQ-5D Score	0.52 ± 0.12	0.65 ± 0.11	0.78 ± 0.10	<0.001

Table 3: Medication Changes

Intervention	Patients Affected (%)
Deprescribed ACB ≥2	126 (84%)
Initiated α-blocker	89 (59%)
Initiated mirabegron	67 (45%)
Dose reduction	42 (28%)

Table 4: Safety Outcomes

Event	Incidence
Hypotension	12 (8%)
Dry mouth	9 (6%)
LUTS-related hospitalization	5 (3.3%)
Pre-intervention hospitalization rate	7.8%

DISCUSSION

This study demonstrates that a structured pharmacological protocol within HBPC significantly optimizes LUTS management in frail elderly patients. The 45.1% reduction in IPSS scores (20.4±3.1 to 11.2±2.8; *p*<0.001) exceeds outcomes from clinic-based trials (typically 25–30% improvement)[14], underscoring the superiority of home-based, personalized titration. Crucially, this occurred alongside a 60.5% reduction in anticholinergic burden (ACB 3.8±1.2 to 1.5±0.9; *p*<0.001)—a dual achievement challenging to attain in standard care, where symptom relief often comes at the cost of cognitive toxicity. Our protocol's efficacy hinges on three pillars: The discontinuation of ACB≥2 drugs in 84% of participants (notably oxybutynin and tricyclic antidepressants) was pivotal. Anticholinergics amplify frailty by antagonizing central M1 receptors, impairing attention and executive function, and peripherally inducing xerostomia, constipation, and tachycardia[5,11]. Frail patients exhibit heightened sensitivity: even low ACB scores (≥3) correlate with a 32% increased dementia risk[11]. Our ACB reduction to 1.5 aligns with the "target ACB≤1" recommendation for cognitive safety, explaining the parallel QoL surge (EQ-5D 0.52±0.12 to 0.78±0.10; *p*<0.001)[5]. Notably, 45% received mirabegron—a β3-agonist with neutral cognitive effects—validating frailty-adapted urology guidelines[10].

Biweekly monitoring allowed real-time intervention in 28% of patients requiring dose reductions (e.g., tamsulosin-induced hypotension). This prevented ADE escalation—critical in frailty, where orthostatic hypotension precipitates falls (RR 2.1) and fractures[15]. Telehealth also addressed adherence barriers: visual impairment complicating pill identification, or caregivers' misunderstanding of regimens. The 60% reduction in LUTS-related hospitalizations (pre-intervention 7.8% to 3.3%) highlights HBPC's role in decongesting tertiary facilities—a vital benefit for LMICs like Pakistan, where hospital beds are scarce[8].

Pharmacists conducted medication reconciliation, identifying 92% with polypharmacy. Community nurses performed bladder diaries and physical assessments (e.g., post-void residuals via portable ultrasound), while physicians integrated data for tailored prescribing. This contrasts with fragmented traditional care, where urologists prioritize symptoms, overlooking anticholinergic risks, and primary physicians lack LUTS expertise[9].

Intersection of Disciplines:Community Medicine: HBPC's embedded pharmacists overcame deprescribing barriers (e.g., "clinical inertia") via direct patient access[9].Urology: Prioritizing mirabegron over anticholinergics for storage symptoms balanced efficacy and safety—an approach absent in guidelines[7,10]. Pharmacology: ACB quantification proved a feasible safety biomarker, with reductions correlating strongly with fewer ADEs (*r* = 0.72)[11].

Pakistan's healthcare constraints—limited diagnostics, drug costs, and 70% out-of-pocket expenditure—necessitated pragmatic choices. We used IPSS instead of costly urodynamics; selected generic tamsulosin; and employed basic telehealth (phone calls). Despite this, outcomes surpassed high-income settings, proving LMIC-adaptability[8,12].

The single-arm pre-post design limits causal inference. Future RCTs comparing HBPC vs. standard care are warranted. Cognitive outcomes (e.g., MoCA) should be measured to quantify ACB reduction benefits. Sustainability remains uncertain; a 24-week follow-up is ongoing.

CONCLUSION

A 12-week pharmacological protocol—featuring deprescribing, guideline-based therapy, and telehealth monitoring—optimizes

LUTS management in frail elderly patients within HBPC. It reduces symptom severity, anticholinergic burden, and hospitalizations while improving QoL. This model is scalable for LMICs and addresses intersecting priorities in community medicine, urology, and pharmacology.

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This article may be cited as: Khanbhati MM, Ashraf A, Tahir A, Korai NA, Abbas SR, Ali A: Optimizing Pharmacological Management of Lower Urinary Tract Symptoms in Frail Elderly Patients within a Home-Based Primary Care Program. Pak J Med Health Sci, 2023;17(12):510-512.