Collaborative Pharmacist–physician Medication Management for the Elderly With Chronic Kidney Disease and Polypharmacy

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Research article

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Abstract

Background: Inappropriate polypharmacy is likely in older adults with chronic kidney disease owing to the considerable burden of comorbidities. We aimed to evaluate the impact of a collaborative pharmacist–physician geriatric medication management service on the quality of medication use.

Methods: We retrospectively reviewed the medical records of patients who received the geriatric medication management service in ambulatory care clinic in a single tertiary-care teaching hospital from May 2019 to December 2019. The quality of medication use was evaluated based on the numbers of medications and potentially inappropriate medications. We also evaluated the types of drug-related problems identified during medication management service and pharmacists' interventions.

Results: Drug use quality was assessed in 87 of 95 patients who received the service. After the provision of medication management service, the total numbers of medications and potentially inappropriate medications decreased from 13.5 ± 4.3 to 10.9 ± 3.8 ($p < 0.001$) and from 1.6 ± 1.4 to 1.0 ± 1.2 ($p<0.001$), respectively. Furthermore, the numbers of patients who received three or more central nervous system-active drugs and strong anticholinergic drugs decreased. Among the 354 drug-related problems identified, "missing patient documentation" was the most common, followed by "adverse effect" and "drug not indicated." The most frequent intervention was "therapy stopped" (111, 31.4%).

Conclusions: Polypharmacy and potentially inappropriate medications were prevalent in older adults with chronic kidney disease, and geriatric medication management service involving a collaboration between pharmacists and physicians improved the quality of medication use in this population.

Background

Inappropriate polypharmacy, defined as the use of one or more "medications that have no clear evidence-based indication, or no longer indicated or those carrying a substantially higher risk of adverse effects," presents increasing challenges, especially in older adults [1, 2]. Various strategies have been attempted to manage inappropriate polypharmacy [3]. A medication review and medication management service (MMS), aimed at improving the appropriateness of medication use, reducing medication-related harm, and improving clinical outcomes, are recommended by many guidance documents and their implementation is increasing worldwide to address inappropriate polypharmacy [1, 3, 2].

Medication management via collaboration between pharmacists and physicians was suggested as one of the most effective strategies for reducing medication-related clinical, social, and economic outcomes [4–6].

Although the role of community pharmacy has extended to address inappropriate polypharmacy in community-dwelling older patients globally [7, 8], MMS by non-dispensing pharmacists or pharmacist-led MMS for ambulatory older patients has not been implemented in Korea. Considering patients' preference for hospital-level ambulatory care over clinic-level care in Korea [9] and the feasibility of collaboration

between pharmacists and physicians within the same institution, implementing pharmacist–physician collaborative MMS in tertiary hospitals might be the first step towards extending pharmacist-led MMS.

Older adults with chronic kidney disease, in particular, are at high risk of polypharmacy because they typically have various comorbidities such as diabetes, hypertension, cardiovascular disease, anaemia, and bone and mineral disease [10]. Moreover, patients with renal insufficiency are especially vulnerable to drug-related adverse events, in part due to pharmacokinetic/pharmacodynamics changes as well as the use of multiple medications. Therefore, special precautions are required in terms of drug selection, drug interaction, and dose adjustment [11, 12]. A collaborative pharmacist–physician MMS for older adults visiting the nephrology clinic was established in a tertiary academic medical centre in Korea with the goal of managing polypharmacy and improving the quality of care.

The aim of this study was to evaluate the impact of the newly implemented collaborative pharmacist–physician geriatric MMS for older adults with polypharmacy visiting the nephrology clinic on the quality of medication use.

Methods

Study design and population

This single-centre, retrospective, descriptive study was conducted at SNUH. We evaluated the impact of geriatric MMS provided to patients visiting the nephrology clinic from May 2019 to December 2019 on the quality of medication use by retrospectively reviewing patients' medical records.

Clinical setting and service implementation

SNUH is a 1700-bed tertiary-care teaching hospital that provides medical services to more than 8,900 outpatients daily as well as inpatient care. Outpatient geriatric MMS in SNUH began in 2018 in collaboration with specific practitioners and was targeted at geriatric patients who visit a specific department (rheumatology); the ultimate goal was to extend the service to all geriatric outpatients. After the service was well established for geriatric patients visiting the rheumatology department, it was expanded to geriatric patients visiting the nephrology clinic. This was because, in a preliminary study, the rate of excessive polypharmacy was high among older patients who visited the nephrology clinic and these patients were expected to have many drug-related problems (DRPs) due to the nature of kidney disease.

Before the start of the service, pharmacists and physicians by consensus established a protocol regarding patient selection, criteria for evaluating medication use, patient counselling, and referral and communication procedures. To provide standardized pharmaceutical care for elderly patients with polypharmacy, the pharmacy department developed a computerized pharmacist-led geriatric MMS support program, which enables pharmacists to perform a structured geriatric medication review and document the services provided.

Under this program, designated pharmacists provide weekly patient counselling (one half-day session per week). They have full access to medical records, except psychiatric counselling records. Before the session, pharmacists pre-screened and selected patients with scheduled appointments based on the number of prescribed medications, use of potentially inappropriate medications (PIMs) by the patient, and the number of medical departments visited by the patient. Thereafter, pharmacists obtained primary medical and medication histories and pre-evaluated the appropriateness of the prescribed medication before counselling.

During patient counselling, pharmacists confirmed and updated medication lists to include substances such as medicines prescribed outside SNUH, self-medicated substances, and dietary supplements. After confirming patients' medication history, pharmacist evaluated drug-related issues including medication adherence, effectiveness of medications, current or past adverse drug reactions, drug-drug interactions, patients' dependency on medications that were not indicated at the time of counselling, and the necessity for deprescribing. Finally, pharmacists counselled patients regarding general precautions to be taken during medication use and empowered the patients to ask their prescribing physicians outside the institution about the possibility of deprescribing medications deemed inappropriate or unnecessary. Furthermore, they directly contacted the physician if necessary. They also provided recommendations as written messages to the collaborating physician before and after patient counselling. Pharmaceutical interventions to resolve DRPs were performed through pharmacist–patient and pharmacist–physician interactions.

Evaluation of MMS

We retrieved medical records of patients who visited the nephrology clinic and received geriatric MMS from May 2019 to December 2019. Further, we descriptively analysed pharmacists' intervention records and compared the quality of medication use before and after pharmacists' consultations. The medication use after geriatric MMS was followed up until the end of March 2020. All substances used by the patients were classified using the Anatomical Therapeutics Chemical (ATC) Classification System of the World Health Organization; topical agents were excluded from the analysis.

The quality of medication use and inappropriate polypharmacy were measured based on the number of medications, number of PIMs, and proportion of patients on PIMs according to Beers criteria 2019 [13] and Screening Tool of Older Persons' Prescriptions (STOPP)/Screening Tool to Alert to Right Treatment (START) criteria [14]. Concurrent use of 10 or more medications was defined as excessive polypharmacy. We also evaluated the number of central nervous system (CNS)-active drugs according to Beers criteria 2019 (Ref), strong anticholinergic agents, and anticholinergic burden according to the Korean Anticholinergic Burden Scale (KABS) [15]. Pharmacists' interventions were evaluated based on the frequencies, types of DRPs, and related interventions by using the PharmDISC classification tool [16].

Statistical analysis

Descriptive data were presented as percentages or means values with standard deviations. Comparisons of the quality of medication use before and after intervention were performed with a paired t-test or the

Wilcoxon signed-rank test for continuous variables and McNemar and McNemar-Bowker test of symmetry for categorical variables. All data were considered significant if the p-value was less than 0.05. Analyses were performed using SAS software package version 9.3 (SAS Institute, Inc., Cary, NC, USA).

Results

Patient characteristics

A total of 95 patients who received collaborative geriatric MMS were included in the analysis. More than two counselling sessions were provided to 43.2% of the patients during the study period. The average age of the patients was 74.9 ± 7.3 years, and 58.9% were male. According to the Modification of Diet in Renal Disease estimated glomerular filtration rate (MDRD eGFR), 43.2%, 15.8%, and 24.2% of the patients had stage 3, 4, and 5 chronic kidney disease (CKD), respectively. Approximately 17.9% of the patients were on haemodialysis, with 76.5% of these patients attending out-of-hospital dialysis facilities. The most frequent comorbidities were hypertension (76.8%), diabetes (45.3%), genitourinary disease (27.4%), and ischaemic heart disease (24.2%) (Table 1).

Table 1
Baseline characteristic of patients who received geriatric medication management services (N = 95)

Characteristics	N (%)
Age, years, mean ± SD	74.9 ± 7.3
65–74 years	48 (50.5)
75–84 years	36 (37.9)
≥ 85 years	11 (11.6)
Sex, male, n (%)	56 (58.9)
Chronic kidney disease stages based on MDRD eGFR	
Stage 1 (> 90 ml/min/1.73 m^2)	0 (0)
Stage 2 (60–89 ml/min/1.73 m^2)	16 (16.8)
Stage 3 (30–59 ml/min/1.73 m^2)	41 (43.2)
Stage 4 (15–29 ml/min/1.73 m^2)	15 (15.8)
Stage 5 (< 15 ml/min/1.73 m^2)	23 (24.2)
Patients on hemodialysis	17 (17.9)
Co-morbid disease	
Hypertension	73 (76.8)
Diabetes mellitus	43 (45.3)
Genitourinary disease	26 (27.4)
Ischemic heart disease	23 (24.2)
Dementia	10 (10.5)
Depression or other psychiatric disease	10 (10.5)
Atrial fibrillation	8 (8.4)
Heart failure	6 (6.3)

MDRD eGFR, Modification of Diet in Renal Disease estimated glomerular filtration rate

Quality of medication use before and after geriatric MMS

The quality of medication use was compared in 87 patients whose prescriptions could be followed up until March 2020. The number of overall medications decreased from 13.5 ± 4.3 to 10.9 ± 3.8 ($p < 0.001$), and the proportion of patients with excessive polypharmacy reduced from 85.1–59.8% after geriatric

MMS ($p < 0.001$). The number of PIMs per patient also decreased from 1.6 ± 1.4 to 1.0 ± 1.2 ($p < 0.001$). Reduction of at least one PIM was observed after geriatric MMS in 80.5% of the patients. The proportion of patients who used at least one PIM and three or more PIMs significantly decreased from 77.0–59.8% and 23.0–10.3%, respectively ($p < 0.001$). The number of patients who were taking three or more CNS-active drugs was 21 (24.1%) at baseline and decreased to 15 (17.2%) after receiving MMS ($p = 0.01$). The proportions of patients on any and two or more strong anticholinergic drugs reduced from 34.5–20.7% and 4.6–2.3%, respectively ($p = 0.003$). The anticholinergic burden score, determined using KABS, decreased from 2.7 ± 2.6 at baseline to 1.8 ± 2.2 after geriatric MMS ($p < 0.001$) (Table 2).

Table 2
Changes in quality of medication use in patients undergoing geriatric MMS (N = 87)

	Pre-MMS	Post-MMS	P-value
Number of medications			
Medications including OTCs, dietary supplements*	13.5 ± 4.3	10.9 ± 3.8	< 0.001
Self-medications including OTCs, dietary supplements	1.1 ± 1.3	0.6 ± 1.1	< 0.001
Prescription drugs received outside institution	1.9 ± 3.4	1.4 ± 2.9	< 0.001
Excessive polypharmacy, n (%)	74 (85.1)	52 (59.8)	< 0.001
Number of potentially inappropriate medications	1.6 ± 1.4	1.0 ± 1.2	< 0.001
0	20 (23.0)	35 (40.2)	< 0.001
1–2	47 (54.0)	43 (49.4)	
3 or more	20 (23.0)	9 (10.3)	
Presence of duplicated medications, n (%)	12 (13.8)	5 (5.7)	0.008
Number of CNS active drugs			
0	33 (37.9)	40 (46.0)	0.01
1–2	33 (37.9)	32 (36.8)	
3 or more	21 (24.1)	15 (17.2)	
Number of strong anticholinergics			
0	57 (65.5)	69 (79.3)	0.003
1	26 (29.9)	16 (18.4)	
2 or more	4 (4.6)	2 (2.3)	
Average KABS score	2.7 ± 2.6	1.8 ± 2.2	< 0.001
KABS score ≥ 3, N (%)	40 (46.0)	28 (32.2)	

*exclude the topical agents; CNS, central nervous system; KABS, Korean anticholinergic burden scale; OTC, over the counter medications; MMS, medication management services;

Type of DRPs and pharmacists' interventions

Among the 95 patients who received geriatric MMS, 354 drug-related problems were identified in 94 patients. The most frequent type of DRP was "missing patient documentation" (82 cases in 69 patients), which included an unrecorded medication history of drugs prescribed outside the institution, over-the-counter (OTC) medications, and dietary supplements; followed by "adverse effect" (43 cases in 33 patients); "drug not indicated" (40 cases in 36 patients); "contraindication" (40 cases in 34 patients); and

“insufficient compliance” (33 cases in 32 patients). The most frequent intervention type was “therapy stopped” (111 cases, 31.4%), followed by “clarification/addition of information” (82 cases, 23.2%), “in-depth counselling of patient” (46 cases, 13.0%), and “proposition of therapy monitoring” (42 cases, 11.9%). The overall acceptance rate for recommendations was 81.7%, and the rates for “therapy stopped,” “therapy started,” “dose adjustment,” and “substitution” were 73.8%, 91.7%, 79.2%, and 85.7%, respectively (Table 3).

Table 3
Type of baseline drug related problems and pharmacists' intervention

Types of drug related problems	Cases	Patients
C1.7 Missing patient documentation (medication history)[a]	82 (23.2%)	69 (72.6%)
C1.6 Adverse effect	43 (12.1%)	33 (34.7%)
C1.2 Contraindication	40 (11.3%)	34 (35.8%)
C1.4 Drug not indicated	40 (11.3%)	36 (37.9%)
C5.1 Insufficient compliance	33 (9.3%)	32 (33.7%)
C1.5 Duplication	27 (7.6%)	20 (21.1%)
C1.1 No concordance with guidelines, only suboptimal therapy possible	23 (6.5%)	20 (21.1%)
C5.3 Concerns about the treatment	14 (4.0%)	12 (12.6%)
C3.3 Inappropriate monitoring	11 (3.1%)	11 (11.6%)
C3.2 Overdose	10 (2.8%)	10 (10.5%)
C3.4 Dose not adjusted to organ function	10 (2.8%)	9 (9.5%)
C1.3 Interaction	10 (2.8%)	8 (8.4%)
C4.1 Inappropriate timing or frequency of admin	9 (2.5%)	9 (9.5%)
C2.1 Inappropriate dosage form/administration route	1 (0.3%)	1 (1.1%)
C5.2 Insufficient knowledge	1 (0.3%)	1 (1.1%)
Intervention type	Case	Accepted
D5 Therapy stopped	111 (31.4%)	73.8%*
D10 Clarification / addition of information	82 (23.2%)	-
D7 In-depth counselling of patient (e.g., on adherence)	46 (13.0%)	-
D12 Proposition of therapy monitoring	42 (11.9%)	-
D6 Therapy started	24 (6.8%)	91.7%
D2 Dose adjustment	24 (6.8%)	79.2%
D4 Optimization of administration/route	9 (2.5%)	-
D11 Transmission of information	9 (2.5%)	-

*76/103 due to the data of 8 cases were not available at the end of study period.

[a]include updating medication history of prescription drugs outside the institution, OTC medications, and dietary supplement

Types of drug related problems	Cases	Patients
D1 Substitution	7 (2.0%)	85.7%
*76/103 due to the data of 8 cases were not available at the end of study period.		
[a]include updating medication history of prescription drugs outside the institution, OTC medications, and dietary supplement		

More than 60% of the interventions were delivered only to patients. “Therapy stopped” was the most frequent (40.7%) among these interventions, followed by “in-depth counselling of patient” (21.5%) and “proposition of therapy monitoring” (19.6%) (Additional file 1).

Discussion

This study showed that collaborative pharmacist–physician geriatric MMS for older adults with polypharmacy visiting the nephrology clinic had a significant impact on improving the quality of medication use with regard to reducing polypharmacy, PIM use, CNS-active drug use, and anticholinergic burden. These results were in line with previous findings that showed a positive benefit of a collaborative care approach offering medication review by clinical pharmacists, in that the approach improved the quality of pharmacotherapy [6].

Because we targeted patients for providing geriatric MMS and considered all medications including OTC drugs and nutritional supplements, the high prevalence of excessive polypharmacy and inappropriate polypharmacy was as expected and similar that reported previously in patients with CKD [10]. Approximately 85% of the patients were taking 10 or more medications and 77% of the patients were taking at least one PIM or had therapeutic duplications at baseline. However, the total number of medications and PIMs decreased significantly after geriatric MMS.

The acceptance rate of recommendations was 81.7%, which was higher than that reported in a community setting [7] and similar to that in a hospital setting for patients with CKD [11]. The most frequent DRP in this study was “missing patient documentation,” which in most cases consisted of missed medication history, and could be explained by the ambulatory clinical setting, where documenting a patient’s best possible medication history was impossible due to short durations of consultations with physicians. Performing medication reconciliation (MR) in ambulatory care settings could increase the possibility of safe medication use despite its unknown clinical outcome [17, 18].

The most prevalent pharmacist intervention in this study was drug discontinuation (31.4%). In some cases, this intervention was directly communicated to the physician, whereas in others, it was communicated through patients because prescribing physicians were out of the institution and it was difficult to directly communicate with them. Unlike this study, some previous studies showed that only a small proportion of interventions by clinical pharmacists’ were related to drug discontinuation [6]. This difference might be explained by the difference in the patient population between the studies, because we

selected older patients receiving polypharmacy. In addition, because most of our patients had impaired renal function or were on dialysis, OTC drugs or dietary supplements needed to be discontinued. This type of intervention resulted in a significant reduction in the number of medications.

In this study, we evaluated the effectiveness of geriatric MMS for ambulatory older adults with CKD or at risk of CKD. While previous pharmacy practices focused on the management of CKD complications [11], geriatric MMS in this study focused on the use of PIMs for older adults for whom MR was performed, patient education regarding medication use including the use of OTC drugs and dietary supplements, general precautions about PIMs, duplicated medications from visiting multiple physicians, and strategies to reduce inappropriate polypharmacy.

There are many important limitations of this study, which should be addressed. First, this study had no control group to determine the clinical outcomes of geriatric MMS due to the retrospective nature of the study design. However, this study evaluated the benefit of collaborative geriatric MMS by comparing the quality of medication use among patients before and after geriatric MMS. Second, a certain degree of recall bias might have existed because we did not limit data gathering on medication use to medicines prescribed in our institution and patients may have under-reported the medications taken. Third, all our patients were treated by a specialist nephrologist; therefore, our findings may not be generalizable to community-dwelling geriatric patients. Finally, the number of patients included in this analysis was small and follow-up was not long enough to evaluate the long-term outcome of geriatric MMS.

There is a global trend to involve pharmacists in MMS because of their specific medication-related knowledge. However, pharmacist-led geriatric MMS is not a common practice in Korea or covered by health insurance. The findings of this study offer new insights into the benefits of collaborative geriatric MMS, and this study is one of the first to investigate geriatric MMS for ambulatory patients in Korea.

Conclusions

This study showed that polypharmacy and PIMs were prevalent in older adults visiting the nephrology clinic, and collaborative pharmacist–physician geriatric MMS improved the quality of medication use in this population.

Abbreviations

MMS
medication management services; PIMs:potentially inappropriate medications; CKD:chronic kidney disease; OTC:over-the-counter; DRP:drug related problem; CNS:central nervous system; KABS:Korean anticholinergic burden scale

Declarations

Ethics approval and consent to participate

The Institutional Review Board of Seoul National University Hospital (SNUH; IRB approval no. 1910-079-1070) approved this study. As this study was conducted with the retrospective chart review using anonymized data, waiver of participants' informed consent was approved by IRB.

Consent for publication

Not applicable

Availability of data and materials

The datasets generated during and/or analysed during the present study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests

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Authors' contributions

Each author has made substantial contributions according to the recommendations by The International Committee of Medical Journal Editors (ICMJE). AJK, HL contributed to conception, acquisition, analysis, and preparation of manuscript for this study. EJS, EJC, YSC and HL contributed to conception, analysis, interpretation. JYL contributed to the design and implementation of the research, to the analysis of the results and to the writing of the manuscript. All authors revised the manuscript critically and have read and approved the final manuscript.

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