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Geriatric Assessment in Elderly Patients with End-Stage Kidney Disease

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Abstract
Background/Aims: Decision-making in elderly patients considering dialysis is highly complex. With the increasing number of elderly with end-stage kidney disease (ESKD), it may be important to assess geriatric impairments in this population. The aim of the Geriatric assessment in OLder patients starting Dialysis (GOLD) study was to assess the prevalence of geriatric impairments and frailty in the elderly ESKD population by means of a geriatric assessment (GA), which is a comprehensive tool for overall health assessment. ***Methods:*** This study included 285 patients ≥65 years: 196 patients at the time of dialysis initiation and 89 patients who chose maximal conservative management (MCM). The GA assessed cognition, mood, nutritional status, (instrumental) activities of daily living (ADL), mobility, comorbidity burden, quality of life and overall frailty. ***Results:*** The mean age of the participants was 78 years and 36% were women. Of the incident dialysis patients, 77% started haemodialysis and 23% started peritoneal dialysis. Geriatric impairments were highly prevalent in both dialysis and MCM patients. Most frequently impaired geriatric domains in the dialysis group were functional performance (ADL 29%, instrumental ADL (iADL) 79%), cognition (67%) and comorbidity (41%). According to the GA, 77% in the dialysis group and 88% in the MCM group had 2 or more geriatric impairments. In the MCM group, functional impairment (ADL 45%, iADL 85%) was highly prevalent. ***Conclusions:*** Geriatric impairments are highly prevalent in the elderly ESKD population. Since impairments can be missed when not searched for in regular (pre)dialysis care, the first step of improving nephrologic care is awareness of the extensiveness of geriatric impairment.

Introduction

The number of elderly patients initiating dialysis has increased considerably over the past decade [1]. This is the result of aging of the population, an increase in the prevalence of chronic kidney disease, earlier initiation of dialysis, and more liberal acceptance of elderly into dialy-

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sis programs [2]. In the elderly ESKD population, frailty is common [3–5]. Frailty is a biologic syndrome of decreased reserve and resistance to stressors, resulting from cumulative declines across multiple physiologic systems, thereby causing vulnerability to adverse outcomes [6].

There is general consensus that a geriatric assessment (GA) is the best approach for the identification of frailty in clinical practice [7]. A GA is a systematic procedure that is designed to assess the health of the elderly population by focusing on somatic, functional, social and psychosomatic domains. It reveals deficits that are not routinely captured in standard history and examination [8] and has been proven to be valuable for improving survival and functional outcomes in different categories of elderly patients [9–11].

The high prevalence of frailty in elderly patients with end-stage kidney disease (ESKD) makes the decision-making process with regard to dialysis highly complex. Many patients experience high disease burden due to dialysis [12, 13] and several studies did not show any benefit on survival and quality of life in the comorbid and elderly population for dialysis compared to conservative management [14, 15]. Nevertheless, elderly patients may benefit from dialysis, and age on itself is not a good selection criterion. Previous studies in the ESKD population showed that frailty is related to mortality, hospitalizations and falls [3, 16]. Therefore, understanding the burden of geriatric impairments could provide an opportunity to direct treatment decisions and to start preventive interventions. However, data on the prevalence of geriatric impairments and frailty in the ESKD population is limited. Also limited data is available on the degree of impairment in elderly at the initiation of dialysis [17–19].

Therefore, the aim of this study is to assess the prevalence of geriatric impairments and frailty through a GA in a population with ESKD at the time of initiating dialysis and in a population choosing maximal conservative management (MCM).

Materials and Methods

Study Participants

To describe the prevalence of geriatric impairments in older ESKD patients, baseline data were used from the Geriatric assessment in OLder patients starting Dialysis (GOLD) study. This is a prospective, multicentre inception cohort study assessing the relationship of GA with outcome in ESKD patients. Participants were enrolled from 17 centres across the Netherlands in the period from August 2014 to September 2017. Patients were recruited from the pre-dialysis outpatients clinics by their treating nephrologists. If inclusion criteria were met, patients were contacted by one of the researchers or research nurses to make an appointment for inclusion. Both dialysis (peritoneal dialysis (PD) and haemodialysis (HD)) and conservative patients who were ≥65 years were included. The aim was to include patients eligible for dialysis between 3 weeks before and 2 weeks after dialysis initiation. Well-informed patients opting for MCM were included when estimated glomerular filtration (eGFR) was ≤15 mL/min per 1.73 m^2. Patients were excluded if informed consent was not provided, if they had insufficient understanding of the Dutch language, or if they were affected by a terminal nonrenal-related condition. The study was conducted in accordance with the declaration of Helsinki and approved by the medical ethics review boards of all participating hospitals. Written informed consent was obtained from all patients before enrolment.

Data Collection

An overview of used test instruments, source of information and cut-off points is shown in online supplementary Appendix 1 (for all online suppl. material, see www.karger.com/doi/10.1159/000494222).

Geriatric Assessment

For the GA, participants were either met at home or in the dialysis centre. For patients who had already started dialysis, assessment was performed on a nondialysis day or just prior to starting a HD session. The assessments were performed by one of the 2 investigators or one of the 2 trained research nurses. For the GA, 7 domains were assessed (online suppl. Appendix 1): comorbidity burden (Cumulative illness rating scale for geriatrics [20]), activities of daily living (ADL; Katz-6 [21]), instrumental ADL (Lawton and Brody [22]), depressive symptoms (GDS-15 [23, 24]), nutrition (Mini nutritional assessment) [25]) mobility (Timed up and Go test, TUG [26]) and cognition. Cognition was assessed with the Mini Mental State Examination ([27]), semantic fluency test [28], clock drawing test [29] and enhanced cued recall test ([30]). An impaired cognition was defined as one or more impaired cognitive tests.

Impairments in cognition, mood, functional performance (ADL and iADL), mobility, comorbidity burden and nutritional status were counted. If data about specific impairments was missing, these specific impairments were not counted.

Caregiver

For all patients, a relevant caregiver was approached (if available) and when participating, informed consent was asked. Questionnaires for caregivers were either obtained during the visit to the patient or sent by mail. Questionnaires for caregivers were preferably filled out within 2 weeks of enrolment of the patient.

Caregivers were asked to fill out 3 questionnaires that are related to cognition; the informant questionnaire on cognitive decline [31], the neuropsychological inventory [32], and the interview of deterioration in daily life dementia [33]. Furthermore, caregiver burden was measured by the EDIZ ("Ervaren druk door informele zorg", Dutch questionnaire) [34].

Additional Data

Baseline demographic data included age, sex, education level, alcohol use, smoking status, living situation, type of dialysis and polypharmacy (defined as the use of 10 or more medications [35]). Clinical characteristics obtained from medical charts included

Table 1. Baseline demographics

	Dialysis (n = 196)	Conservative (n = 89)
Age, years, mean ± SD	75 (7)	82 (6)
Female, n (%)	64 (33)	39 (44)
Single/widow, n (%)	83 (42)	50 (56)
Living at home, n (%)	186 (95)	82 (92)
Higher education level, n (%)*	42 (21)	16 (18)
Intoxications, n (%)		
Smoker**	144 (77)	57 (70)
Current alcohol use	76 (41)	31 (40)
Laboratory values, mean (SD)		
eGFR CKD-EPI in mL/minper 1.73 m^2	8 (3)	11 (4)
Underlying kidney disease, n (%)		
Diabetes	30 (15)	17 (19)
Vascular	99 (51)	45 (51)
Other/unknown	67 (34)	27 (30)
Measurements, mean (SD)		
Systole in mm Hg	150 (22)	151 (26)
Diastole in mm Hg	75 (14)	75 (13)
BMI	27 (5)	26 (5)
Number of medications, median (IQR)	11 (8)	8 (2)
Type of renal replacement therapy, n (%)		
Hemodialysis	150 (77)	–
Peritoneal dialysis	46 (23)	–

* University education, higher professional education.
** Smoker; if the participant has smoked but stopped, or is still smoking.
IQR, interquartile range; eGFR, estimated glomerular filtration rate.
The following variables had missing data: Smoker (5.6%), Current alcohol use (7.4%), Systole (1.1%), Diastole (1.1%), BMI (0.4%).

cause of kidney failure, blood pressure, body mass index and lab results (eGFR). Furthermore, patients were asked about accidental falling in the previous 6 months and the use of a walking aid and an additional balance test (four test balance scale) was performed.

Health-related quality of life was measured by the EuroQol-5D [36], which includes self-rated problems with mobility, self-care, usual activities, pain/discomfort and anxiety and depression.

In addition, 2 frailty screening tools were used: the Fried Frailty Index [6] and Groningen Frailty Index (GFI) [37].

Statistical Analysis

Categorical variables were reported as proportions and continuous variables were reported as means with SDs or medians with interquartile range (IQR) for non-parametric data. Data was analysed using SPSS software (IBM SPSS statistics version 21).

Results

Data is presented for the 196 dialysis (77% HD, 23% peritoneal dialysis) and 89 MCM patients who consented to participate in the GOLD study. Details on recruitment are shown in online supplementary Appendix 2. The majority of the dialysis group was included after start of dialysis (median 8 days, IQR 12 days). Baseline characteristics are shown in Table 1.

The mean age of the population was 78 years (SD 7) and 36% were women. Most patients were living at home (94%). The main cause of ESKD was vascular disease (51%) and diabetes (17%). In the overall group, 63% of the patients had polypharmacy with a median number of 8 medications (IQR 5).

Patients at the Time of Initiating Dialysis

Results for the GA in the incident dialysis population are shown in Table 2. Data provided by caregivers is shown in Table 3. The distribution of geriatric impairments is shown in Figure 1a and b. Most patients had between 1 and 4 geriatric impairments. Only 12 patients (6%) had no geriatric impairments in any of the major domains (cognition, mood, mobility, functional performance (ADL and iADL), comorbidity burden and nu-

Table 2. Results of geriatric assessment in dialysis and patients on conservative management

	Dialysis (*n* = 196)	MCM (*n* = 89)
Cognition		
Cognitive tests, *n* (%)		
Impaired MMSE	27 (14)	16 (18)
Impaired fluency	58 (30)	23 (26)
Impaired enhanced cued recall	34 (18)	15 (17)
Impaired clock drawing test	98 (50)	48 (55)
Impairment of ≥1 cognitive test, *n* (%)	132 (67)	62 (70)
Mood		
Symptoms of depression, GDS, *n* (%)	60 (31)	31 (35)
Nutritional status		
MNA, *n* (%)		
At risk for malnutrition	93 (47)	33 (37)
Malnutrition	10 (5)	1 (1)
Functional performance, *n* (%)		
Dependent in ADL	57 (29)	40 (45)
Dependent in iADL	154 (79)	76 (85)
Mobility, *n* (%)		
Immobile	12 (14)	6 (14)
Impaired Time up and go*		
Mildly impaired	91 (49)	40 (48)
Severely impaired	36 (19)	28 (33)
Comorbidity burden		
Comorbidity severe, *n* (%)	81 (41)	39 (44)
Frailty, *n* (%)		
Frail according to Fried Frailty Index	85 (46)	32 (40)
Frail according to GFI	121 (62)	57 (64)
Other, *n* (%)		
Impaired health related quality of life (EuroQol-5D)	151 (77)	76 (85)
≥1 fall in the past half year	50 (28)	24 (31)
Impaired four balance test*	110 (62)	55 (72)
Polypharmacy	128 (65)	50 (56)

* TUG and four balance test; if immobile test is scored as impaired.

MMSE, mini mental state examination; MNA, mininutritional assessment; GDS, geriatric depression scale; ADL, activities of daily living; iADL, instrumental activities of daily living; GA, Geriatric assessment; GFI, Groningen Frailty Index; NPI, neuropsychological inventory; IDDD, interview of deterioration in daily life dementia; EDIZ, "Ervaren druk door informele zorg".

The following variables had missing data: Enhanced cued recall (3.2%), Clock drawing test (4.6%), Timed Up an Go (5.3%), Fried Frailty Index (6.0%), Fall in the past half year (9.8%), Four balance test (10.5%).

tritional status). According to the GFI and the Fried Frailty Index, 62% and 46% of the patients in the dialysis group were frail respectively. No differences were seen in the prevalence of geriatric impairments in different age categories (online suppl. Appendix 3).

Functional performance was the most commonly affected geriatric domain: iADL was impaired in 79% and ADL in 29%. The most common difficulty in ADL was bathing. For iADL, most patients needed help with cooking, doing groceries and laundry. Almost half of the patients needed help with medication use.

Sixty-seven percent of the patients in the dialysis group had 1 or more impaired cognitive tests. Most frequently impaired was the clock drawing test (50%). Of the 114 included caregivers, more than half reported that their relative had shown deterioration in daily functioning and/or neuropsychological symptoms. Moreover, 17% reported symptoms of cognitive decline. Most common neuropsychological symptoms were a changed appetite (32%), depression/dysphoria (24%) and irritability/lability (19%). The rate of depression/dysphoria experienced by the caregiver corresponds to the GDS filled

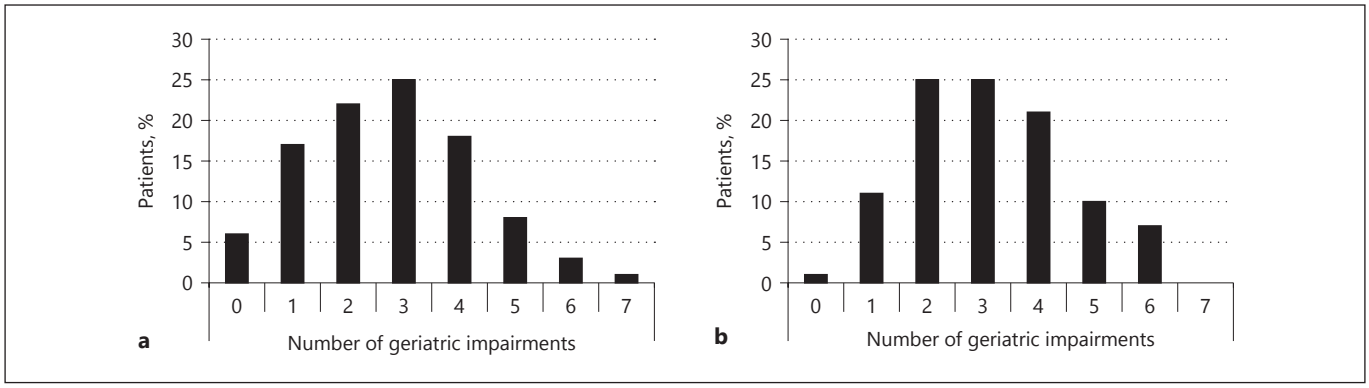

Fig. 1. a Number of geriatric impairments in patients initiating dialysis. **b** Number of geriatric impairments in patients opting for MCM.

out by the patients, in which 31% of the patients had symptoms of depression. Almost one third of the caregivers (28%) experienced the care for the patient with ESKD as burdensome. Of these caregivers, 8% felt overburdened.

A severe comorbidity burden, defined as 2 or more illnesses with a score of 3 or at least 1 score of 4, was seen in 41% of the patients. Most frequently impaired organ systems were the hematopoietic (27%), vascular (23%), heart (22%) and respiratory system (22%).

Mobility was tested by the TUG. This test evaluates the time it takes for the patient to rise from a chair, walk 3 meters, turn around, walk back to the chair and sit down. Only 32% of the patients completed the TUG-test in normal time (<10 s) and 19% of the patients had a severely impaired mobility according to the TUG-test. An impaired balance on the 4 balance test was seen in 62% of the patients; 28% of the patients experienced a fall in the past half year. Moreover, 35% of the patients required a walking aid.

According to the Mini Nutritional Assessment, only 4% of the patients were malnourished. However, almost half (47%) of the patients were at risk for malnutrition. Many patients had weight loss and 45% had weight loss greater than 3 kilograms despite being potentially fluid overloaded. Almost 25% of the patients experienced pressure sores or skin ulcers at time of inclusion.

Seventy-seven percent of the patients had a reduced quality of life according to the EuroQol-5D. Most frequent reported were problems with mobility (58%), problems with daily activities (59%) and pain or other physical complaints (51%). Patients graded their state of health with a mean score of 6 out of 10 (SD 1).

Patients choosing MCM

The 89 patients in the conservative group were mostly included at the beginning of stage 5 kidney failure (when the decision to forego dialysis was made). In contrast, patients in the dialysis group were included at the time of initiating dialysis, and therefore at a more advanced stage 5. Thus, patients in the conservative group had a higher eGFR at inclusion (11 vs. 8 mL/min/1.73 m^2) compared to dialysis patients. Given this difference in the timing of the GA and stage of ESKD, a statistical comparison between these 2 groups was not considered meaningful.

The mean age in the conservative group was 82 (SD 6) years and more than half (56%) of the patients were single/widowed (Table 1). The prevalence of impairment in cognition, symptoms of depression, malnutrition, severe comorbidity and caregiver burden were similar to the dialysis group. Patients in the conservative group were frequently care-dependent (ADL 45%, iADL 85%) and had a reduced mobility: one-third had a severely impaired TUG (33%) and 69% was dependent on the use of a walking aid. According to the GFI and Fried Frailty Index, 64 and 40%, respectively, were frail in the MCM group. Results are shown in Table 2.

Discussion

In this analysis of 196 elderly ESKD patients incident to dialysis, the prevalence of geriatric impairments was very high; 77% of the patients had 2 or more geriatric impairments. Most frequent impairments were seen in functional performance, cognition and severe comorbidity. In the group of 89 patients who chose conservative manage-

Table 3. Results of caregiver questionnaires

	Caregiver dialysis (n = 114, 58%)	Caregiver MCM (n = 64, 73%)
Additional subjective cognition tests, n (%)		
IDDD	64 (56)	40 (63)
IQCODE	19 (17)	14 (22)
NPI	65 (59)	46 (73)
Perceived caregiver burden, n (%)		
Moderate burden caregiver	22 (20)	15 (24)
Overburden caregiver (EDIZ ≥4)	9 (8)	5 (8)

IDDD, Interview for deterioration in daily life dementia; IQCODE, Informant question on cognitive decline; NPI, neuropsychological inventory; EDIZ, "Ervaren druk door informele zorg".

The following variables had missing data: IQCODE (0.6%), NPI (2.2%), EDIZ (2.8%).

ment, the prevalence of geriatric impairments was even higher; 88% had 2 or more geriatric impairments.

To the best of our knowledge, this is one of the largest studies that used a very extensive GA to study multiple geriatric domains in patients with ESKD. The prevalence of geriatric impairment in this study is difficult to compare with other similar studies because every study using a GA in this population addressed a different selection of geriatric domains, using various tests and varying cut-off points. Despite this, all studies reported a high prevalence of different geriatric impairments [38, 19, 18, 39] and the prevalence of individual domains is mostly comparable to our study findings [40, 41]. However, compared to some of these studies, we found a relatively high rate of functional dependency (79% iADL dependency in our study population vs 60% and 26% in other studies [38, 18]) and cognitive impairment (14% impaired Mini Mental State Examination in our study population vs. 7%). A possible explanation could be that in the initiation period of dialysis, patients are in worse metabolic condition compared to patients stable on dialysis. In addition, assessing patients on stable dialysis resulted in a different patient selection compared to incident dialysis patients. As the dialysis initiation period had the highest mortality rate [42], those patients in the poorest condition may already be deceased.

In elderly ESKD patients, a GA is able to reveal a high prevalence of geriatric impairments [18, 19, 38, 39]. The prevalence of impairments across a range of domains is relevant because it provides information about frailty, and therefore the vulnerability of a patient to adverse outcomes. Furthermore, it reveals problems that are frequently unrecognized or inadequately addressed in older adults. Cognitive impairment, for example, is often undiagnosed in HD patients [40]. Creating awareness about how prevalent these geriatric problems are can be the first step for the nephrologist to address these problems timely in their population. Other methods that are frequently used to identify vulnerability are frailty screening tools. In our study population, 62 and 46% of the patients initiating dialysis were considered frail based on the GFI and Fried Frailty Index respectively. Although some frailty screening tools have a high sensitivity and positive predictive value for vulnerability as determined by a full GA, the negative predictive value is not higher than 60% [43]. Therefore, a negative frailty screening cannot be used in a clinical setting to direct treatment decisions, since many vulnerable patients will be missed.

The findings that are obtained by the GA can be used for multiple purposes. First, in studies focusing on one or more geriatric domains in patients on dialysis, a reduced functional performance, cognitive impairment, depression and immobility were all associated with negative outcomes, such as (early) mortality and hospitalizations [16]. Furthermore, frailty in patients with ESKD is associated with worse quality of life, irrespective of dialysis or MCM [44]. Therefore, the recognition of geriatric impairments could potentially help to direct treatment decisions regarding the start of dialysis and can also help to direct treatment goals with patients and family (e.g., decisions concerning the start of strict fluid restriction, start of new medication and diet) [45]. Second, the identification of geriatric impairments may guide preventive interventions. For instance, when functional impairment, malnutrition or accidental falling are present, it could ini-

tiate rehabilitation, nutritional interventions and fall prevention programs, which could potentially improve health outcomes and/or quality of life [46–49]. Furthermore, early recognition of cognitive impairment allows for diagnosis and appropriate treatment, education, and psychosocial support. Third, the recognition of caregiver burden allows for starting or increasing professional care at home.

This study has several limitations. First, the MCM patients were included when eGFR fell below 15 mL/min/1.73 m^2 (mean 11 ± 4), while the actual start dialysis was at a lower eGFR (8 ± 3 mL/min/1.73 m^2). Since the dialysis patients were included at a more advanced stage of kidney failure, this may have negatively affected metabolic state, geriatric impairment and comorbidity burden in dialysis patients. Therefore, these 2 groups are not fully comparable and no statistical analysis was performed. Second, the geriatric domains could have been influenced by uremia and dialysis. This could have led to an overestimation of the number of geriatric problems. For example, previous research showed that patients had a poorer balance right after dialysis [50]. Therefore, the four test balance scale could be performed worse by patients who did the test after dialysis. Furthermore, the setting of the assessment could also have influenced our study results. Third, as patients were referred to our study by their treating nephrologists, it is possible that sicker patients were less likely to be enrolled in the study, or on the other hand, that nephrologists would only include patients when they had doubts during the decision-making process. This could potentially limit the generalizability of our findings. Despite these limitations, major strengths of this study are the use of a large inception cohort of patients at the time of dialysis initiation and the use of a very extensive GA that used multiple sources to assess the different domains.

In conclusion, geriatric impairments and frailty are highly prevalent in the elderly ESKD population. Since impairments can be missed when not searched for in regular (pre)dialysis care, the first step of improving nephrologic care for the elderly patients is awareness of the extensiveness of geriatric impairment. A GA could be implemented to detect and address impairment, thereby improving regular care. Furthermore, understanding the burden of geriatric impairments provides an opportunity to direct treatment decisions for start of dialysis and guide preventive interventions. Further research should focus on geriatric conditions in relation to the decision-making process of starting dialysis, prognostication and improving clinical outcomes such as quality of life, survival and functional decline.

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Disclosure Statement

The authors declare no conflicts of interest.

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