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Is It Correct to Use a Unique Conventional Dialysis Prescription in the Elderly? Four Alternative Schedules for Dialyzing Elderly Patients

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Abstract

Ageing is a universal asynchronic and heterogeneous process which induces a series of changes in the organisms along the time. In addition, ageing becomes senescence when it induces structural and physiological changes which significantly reduce the body homeostatic capability making the organism vulnerable and frail. Besides, frailty detecting tools have been described such as frailty phenotype score, frailty clinical scale, or gait test. Since elderly population is heterogeneous, it seems that to use a unique conventional dialysis (hemo or peritoneal) prescription would not be adequate in this group. Thus, different sort of dialytic schedules could be proposed for prescribing dialysis to elderly patients, basing these alternatives, on the patient's functional status, residual diuresis and general prognosis. From this perspective at least four sorts of dialytic programs can be delineated for this group: conventional, incremental, functional and palliative dialysis. In conclusion: Frailty phenotype evaluation allows indentifying elderly subgroups, which could be dialyzed by applying different dialytic programs.

Keywords

Dialysis; Elderly; Schedules

Introduction

Ageing is a universal asynchronic and heterogeneous process which induces a series of changes in the organisms along the time. This process is characterized by a functional performance reduction compared to the maximal functionality reached around the second decade of life. The ageing process is universal since it is part of everybody's vital cycle, asynchronic since it has a particular rate on each individual and heterogeneous since it has its particular rate in each individual's organ. As a consequence, the elderly population consists of a heterogeneous group [1]. However, ageing becomes senescence when it induces structural and physiological changes which significantly reduces the body's homeostatic capability, making the organism vulnerable and frail [1,2]. Therefore, geriatricians have elaborated the concept of "frailty" to describe the cumulative declines across multiple physiological systems that occur with ageing and lead individuals to a state of diminished physiological reserve and increased vulnerability to stressors (senescence) [3,4]. In this sense, Fried et al. [5] coined the concept of "frailty phenotype" for clinically identifying the frailty status. Thus, frailty phenotype is based on the evaluation of five clinical domains: shrinking, weakness, poor endurance and energy, slowness and low physical activity, aiming to identify older people who are at risk of disability, fall, institutionalization, hospitalization and death. It is worth mentioning that the characteristic muscles mass and strength reduction secondary to ageing (sarcopenia), is considered by many authors as part of the "shrinking domain" of the frailty phenotype [5,6]. Besides, other frailty detecting tools have been described such as the frailty clinical scale, gait test and handgrip. The prevalence of frailty phenotype in elderly people is of 7% in the general population, 14% in non-dialysis Chronic Kidney Disease (CKD) patients and 42% in chronic dialysis patients [6]. Frailty is the common pathway which leads elderly subjects to suffer from the geriatric syndromes: cognitive impairment, incontinence, gait disorders, falls and immobility syndrome. These syndromes are also known as "geriatric giants" since they affect severely many older individuals in the population [7]. Finally, when senescence combines with a chronic condition, the evolution and prognosis of this condition worsen, requiring the adjustment of the conventional therapeutic targets to the patient's frailty status. Therefore, if a chronic disease suffers from the influence of senescence, it becomes a worse condition known as a *senescent chronic disease*; for instance, when chronic nephropathy suffers the influence of senescence, it becomes a worse condition called *senescent chronic nephropathy* [8].

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CKD is a major public health problem due to its high prevalence, high health cost and poor results obtained by its therapy, being this phenomenon much more marked in elderly patients. The number of end-stage patients older than 75 who require Renal Replacement Therapy (RRT), increases rapidly worldwide [9]. In the United States, this group is the one that grows the most, increasing its proportion since the year 2000 by 12.2% [10]. The same situation occurs in Canada, where its number has doubled in the period 1995-2005 [11] and in Spain, where the number of incident RRT patients is three times higher among those older than 75 [12]. Moreover, it has been demonstrated that early dialysis initiation (eGFR: ≥ 10 ml/min) does not provide a survival benefit in the elderly and it may even promote negative influence on their quality of life [13]. As a consequence, it is currently recommended to defer dialysis initiation (eGFR: ≤ 6 ml/min) in asymptomatic elderly patients. Even though, it was reported that elderly patients who refused to start dialysis and were on conservative treatment, survived for shorter (with lower hospital days), this is debatable since there is also evidence to the contrary [14]. The results obtained in these patients are of concern, especially for those on hemodialysis where mortality in the first year is very high and sometimes exceeds the one associated with conservative treatment [15,16]. It is worth mentioning that despite the undeniable benefits that an adequately prescribed chronic dialysis has, particularly in robust elderly patients; several dialysis related disadvantages have been pointed out, such as residual diuresis loss, intradialytic complications, etc., (Table 1) [14,15]. Moreover, elderly patients who suffer from geriatric syndromes (geriatric giants) usually have less tolerance to dialysis due to their propensity to intradialytic hypotension (dysautonomy), mesenteric ischemia, arrhythmia (increased susceptibility to electrolyte disequilibrium), etc. Additionally, chronic dialysis can also worsen the geriatric syndrome evolution, installing a spiral of deterioration between dialysis and the geriatric syndromes. This phenomenon could explain the reported poor patient's survival in those on dialytic treatment respect to those on conservative treatment, unless an adequate dialytic strategy for the frail elderly patient is prescribed [16]. Regarding the dialysis adequacy evaluation, the Kt/V is the only currently validated and generally accepted parameter, however the

same Kt/V target is used independently of the patient's age: eKt/V ≥ 1.2 session (three times per week) in hemodialysis, or weekly Kt/V ≥ 1.7 in peritoneal dialysis. It is worth pointing out that no benefit has been documented with increasing Kt/V the above standard dose, even HEMO study has found no beneficial out-come with eKt/V between 1.05 and 1.4 [17,18]. Besides, elderly dialysis patients are prone to suffering from malnutrition (senile hyporexia) and/or underdialysis (vascular access dysfunction, incomplete dialysis sessions secondary to intradialytic complications), thus Kt/V monitoring can be useful to avoid these complications. However, it should be taken into account that Kt/V (Gotch equation) is based on many parameters which suffer significant changes in the elderly, particularly in the frail ones, such as the reduction in metabolic rate, body water content, body surface area, etc., (Table 2) [15]. Although, these changes could theoretically influence the Kt/V target value, probably reducing it, surprisingly this is not currently taken into account [19].

In this sense, parameters different from Kt/V has been proposed and some of them are even currently used for evaluating dialysis patients (Table 3). Among these proposed parameters some are especially important in frailty elderly individuals such as body water volume content, nutritional status, hemoglobin levels, body functionality, etc., [19].

Since the elderly population is heterogeneous, it seems that to use a unique conventional dialysis (hemo or peritoneal) prescription would not be adequate in the elderly. Thus, based on the above mentioned concepts and in the literature, different sort of dialytic schedules could be proposed for prescribing dialysis to these patients.

From this perspective at least four sorts of dialytic programs can be outlined (Table 4, Figure 1) [20-24]:

Conventional dialysis

This is the current hemodialysis prescription based on 3 to 5 hours, three weekly sessions which seek to achieve a target single pool Kt/V (spKt/V) de 1.4 per HD session, with a minimum delivered spKt/V of 1.2, or peritoneal dialysis seeking a weekly Kt/V ≥ 1.7 . Conventional dialysis would be ideal for treating robust anuric-oliguric elderly patients.

Advantages	Disadvantages
Longer survival	Residual renal function loss
Improve appetite	Multiple painful access procedures - infections
Increase social contact	Fatigue hypotension, cardiac, cerebral or intestinal ischemia
Reduce fluid overload	Time loss to dialysis and hospitalizations
--	Functional decline - inflammation induction

Table 1: Advantages and disadvantages of dialysis in the elderly

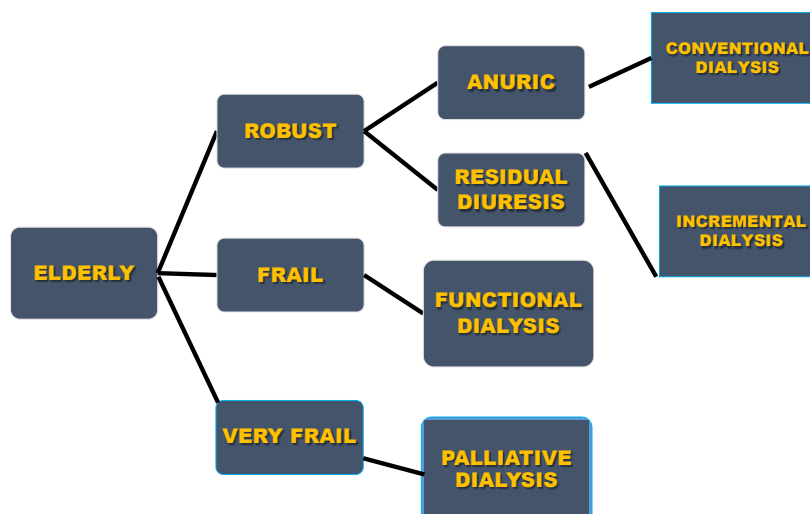
Dialytic parameters	Ageing related Changes
Urea generation rate	Low protein diet (< 20%) Reduced basal metabolism (< 20%)
Urea sensitivity	Increased
Urea volume distribution	Reduced total body water
Lean body mass	Sarcopenia
Body surface area	Reduced body surface area

Table 2: Kt/V dialytic parameters and ageing related changes

Non-urea toxins levels (eg: β_2 microglobulin, etc.)
Nutritional status
Volume status - interdialytic fluid gain
Hemoglobin level
Calcium-phosphorus metabolism
Body functional test (eg: gait test, etc)

Table 3: Non-Kt/V dialysis adequacy parameters

	Conventional Dialysis	Incremental Dialysis	Functional Dialysis	Palliative Dialysis
Medical approach	Nephrologic	Nephrologic	Nephro-geriatric	Geriatric
Elderly population	Robust - prefrail anuric	Robust - prefrail no anuric	Frail anuric/ no anuric	very frail anuric/ no anuric
Prognosis	Depends on the patient's renal disease Residual diuresis	Depends on the patient's renal disease residual diuresis	Depends on the patient's frailty and comorbidities	Terminal patient who refuse dialysis withdraw
Guide parameter	Kt/V ideal target	Standard Kt/V ideal target	Functional test minimal useful Kt/V	Quality of life

Table 4: Proposed alternative dialytic schedules in the elderly**Figure 1:** Algorithm for dialysis prescription in the elderly

Incremental dialysis

This regimen was first used in patients on Peritoneal Dialysis (PD), but has recently gained attention especially in developing countries. It consists of adjusting the dialysis dose based on Residual Renal Function (RRF) to achieve adequate dialysis. The KDOQI guidelines suggest a standard Kt/V target (stdKt/V) of 2.3 volumes per week with a minimum delivered dose of 2.1 for Hemodialysis (HD) schedules different from thrice weekly. Recent observational research has shown that incremental HD may be more beneficial than conventional HD (three sessions per week), particularly in preserving RRF. Regarding incremental peritoneal dialysis, the target is to achieve an adequate Kt/V target (≥ 1.7) between the patient's peritoneal dialysis and residual diuresis. Incremental dialysis could be ideal for robust and/or vulnerable (prefrail) elderly patients who have an adequate residual diuresis.

Functional dialysis

This dialysis prescription consists of a dialytic treatment which seeks to keep a validated minimally useful dialysis dose ($Kt/V: \geq 1.05$) and patient's clinical functionality evaluated by clinical geriatrics tests such as gait test. In this modality residual diuresis (if exists) is taken into account and non-Kt/V dialysis adequacy parameters are mainly used for guiding the dialysis prescription (Table 3). Functional dialysis could be ideal for treating different degrees of frail elderly patients where prognosis is determined not by their renal disease but their frailty status.

Palliative dialysis

This dialysis prescription seeks only to relief uremic and volume overload symptoms and Kt/V value is not taken into account. Palliative dialysis is ideal for treating lucid, anuric-oliguric terminal

patients who have decided neither to stop dialysis nor receive classical palliative treatment (without dialysis).

It is worth pointing out that a clinical geriatric test, such as frailty phenotype, frail clinical scale, gait test, handgrip evaluation are useful for dividing the heterogeneous elderly group in: robust, prefrail, frail (different degrees) and terminal individuals.

Frailty treatment

The treatment of frailty requires interdisciplinary interventions, including team member nurses, occupational therapists, physiotherapists, physicians, psychologists, pharmacists, speech therapists and social workers [6,25]. Frailty therapeutic strategies are based on the prescription of rehabilitation, low-intensity resistance and aerobic exercise, adequate caloric and protein intake, vitamin supplementation and avoidance of polypharmacy [6,25].

Rehabilitation is a process by which form and function are restored following injury or illness, such that life can be lived to the fullest capacity compatible with the degree of abilities and disabilities. Rehabilitation can be performed in the home, as an outpatient or as an inpatient, depending on patient needs and resources [25]. Exercise has a positive effect on brain, skeletal muscles, immune and endocrine systems, as well as it improves patient's mobility and functional ability. Exercise can be safely implemented in end-stage renal disease patients and combined aerobic and resistance exercise, administered in the dialysis facility or outside of dialysis, have resulted in improvements in physical function [25,26]. However, the extent to which this greater degree of improvement in aerobic capacity translates to survival benefit is unclear. Besides, intradialytic exercise programs have usually higher adherence than home-based or extradialytic programs [26].

Finally, it is worth mentioning that due to the heterogeneity of the different clinical components of the frailty phenotype in each patient, a personalized therapeutic approach instead of a general one is likely to achieve success in this vulnerable population [6].

Conclusion

Dialysis prescription should be individualized, particularly in the elderly. Frailty phenotype evaluation allows indentifying elderly subgroups and different dialytic strategies should be prescribed to different elderly subgroups.

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