# Personalized haemodialysis and empowering patients: New approaches to CKD management

Hemodialysis (HD) is currently the most common dialysis treatment for kidney failure. Its origins date back to the mid-twentieth century when Dr. Willem Kolff devised the first artificial kidney, thus marking the dawn of modern dialysis. However, the key to successful long-term dialysis treatment was the creation of the vascular shunt by Belding Scribner and coworkers, followed by the autologous Brescia-Cimino radial-cephalic arteriovenous fistula. The first person in the world to receive repeated HD was Clyde Shields in Seattle, USA, in 1960. In its early years, dialysis was only available to a limited number of carefully selected patients, but access rapidly broadened after procedure coverage was instated. This shift catalysed fundamental changes in the epidemiology, economics and ethical frameworks in treating end-stage kidney disease. An individualized approach to prescribing dialysis and nutrition regimens distinguishes contemporary approach to CKD management.

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## Personalized approach to CKD management: Incremental dialysis

Determining the appropriate amount of dialysis remains a pertinent question. The current conventional HD prescription of 3 weekly 4-hour sessions stems from Cambi et al.'s work in 1975, which aimed to customize the treatment for the rapidly growing patient population. However, dialysis remained a highly imperfect treatment, with cyclic osmotic and electrolytic shifts, potentially associated with patient morbidity, increased cardiovascular risk and mortality. The introduction of the urea kinetic model for defining an adequate dialysis dose followed, and while it was initially meant to personalize treatments within the imposed constraints, it later resulted in a "one size fits all" policy. In contrast, other prescription options were explored in the following years, highlighting the beneficial effects of long nocturnal dialysis or short daily dialysis. A crucial development occurred when Hlaudenwich et al. in 2014 reported that enhanced clearance of uremic toxins with an intensified nocturnal HD regimen improved pregnancy outcomes. As a result, awareness of the limitations of the one-size-fits-all approach has been mounting, even amid remarkable technological advances in HD.

In addition, dialysis initiation remains another controversial point. The former strategy of planned early HD initiation has not been supported in the IDEAL study by Cooper et al., which found no significant difference in the frequency of adverse events between patients starting maintenance HD at GFR between 10 and 14mL/min/1.73m$^2$ or GFR between 5 and 7mL/min/1.73m$^2$. This led the Canadian Society of Nephrology to advocate for an intent-to-defer strategy, emphasizing the need for close monitoring by a nephrologist for patients with an eGFR <15mL/min/1.73m$^2$. Rather than obligatory dialysis initiation based solely on the creatinine-based measures of kidney function, these recommendations place a higher value on uremic clinical symptoms and other complications aiming to avoid unnecessary healthcare burdens without delivering a measurable benefit for the patient. Additionally, an increasing number of recent publications have explored the concept of incremental HD as a practice similar to the one already employed in the peritoneal dialysis (PD) population.

Incremental HD represents a concept of adjusting dialysis dose through less frequent dialysis sessions related to residual kidney function (RKF). This strategy potentially offers benefits such as better preservation of RKF, reduced treatment burden on patients and health care systems, and improvement of patient quality of life. Preserving RKF allows for greater fluid intake, contributes eliminating medium and large uremic molecules, facilitates anaemia correction, reduces inflammation, and improves nutritional status, blood pressure control and quality of life.

Nevertheless, there are also certain disadvantages to this approach, such as the risk of underdialysis, the need for more frequent patient monitoring, the risk of accelerating RKF loss due to intensive ultrafiltration (Figure 1). Also, individual prescriptions of dialysis require organizational flexibility and absence of financial constraints. Current literature on incremental haemodialysis so far is mainly observational and the studies have selection biases. Therefore, more evidence is needed to guide practices effectively.

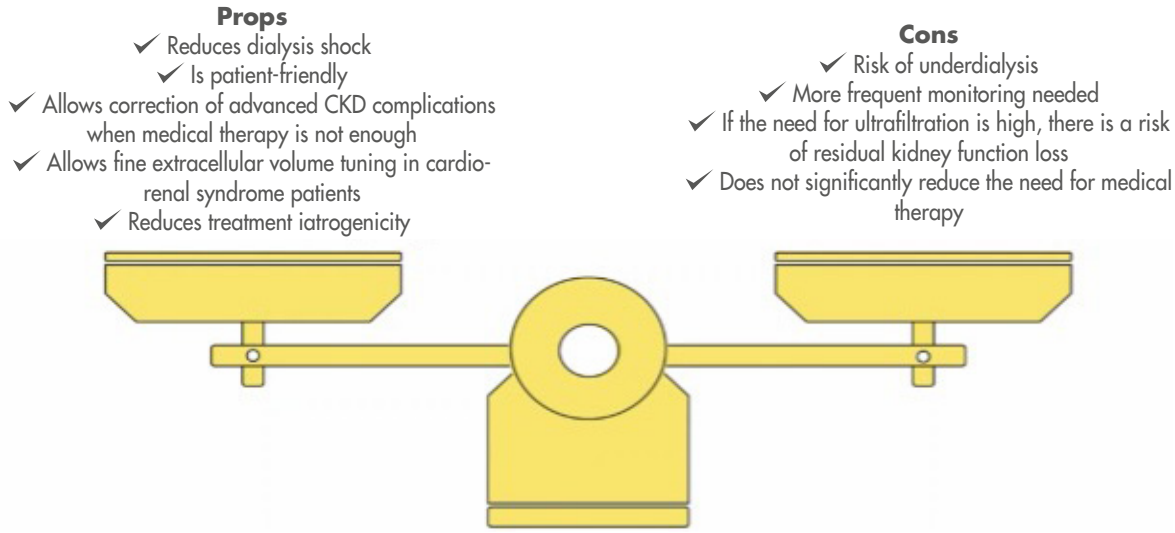


**Figure 1.**
Pros and cons of the incremental dialysis concept

A recent meta-analysis by Takkavatakarn et al., which included nearly 140,000 patients, found no significant difference in the mortality rate, cardiovascular events, vascular access complications, hyperkalemia and volume overload between conventional and incremental HD groups. Hospitalization rates and loss of RKF were significantly lower in patients treated with an incremental approach, thus emphasizing the potential benefits in appropriately selected patients, even in the pediatric population. Some observational studies suggest that over half of incident HD patients have adequate urea clearance to be considered for once or twice-weekly HD. However, this decision cannot be made based on a single criterion. Instead, a combination of biomarkers reflecting small and middle molecule removal, comorbidity and nutritional status should be implemented in an individualized patient assessment. More research is needed to define appropriate parameters and procedures to properly select patients and adequately prescribe optimal incremental HD regimens.

## Empowering patients through personalized nutritional plans

Nutrition is an essential part of CKD treatment. It plays a crucial role in effectively managing fluid, electrolyte, mineral and acid-base balance, as well as uraemia. Patients' compliance with adequate eating regimen helps prevent various nutritional derangements, from malnutrition, which is commonly associated with advanced CKD, to obesity, whose prevalence is rising in this population. This diversity of nutritional issues presents a significant challenge for renal dietitians. Furthermore, current guidelines only offer the general framework for dietary management but lack explicit instructions tailored to different clinical scenarios. Finally, adherence to prolonged dietary regimens is another issue in the CKD population and a universal dietary plan based solely on RKF cannot guarantee patient collaboration. Therefore, only an individualized approach to dietary planning, based on the combination of clinical data, nutritional status, dietary recall, personal preferences, and regular follow-ups, can achieve satisfactory outcomes. In clinical practice, renal dietitians face diverse situations which can be broadly categorized into four groups:

**1.** Patients with satisfactory laboratory parameters who have already established adequate dietary habits and thus only need reassurance to maintain them. This group could benefit from concise reminders about healthy dietary practices, such as: limiting salt use with cooking and eating, avoiding canned and ultra processed food, limiting red meat, and including daily servings of fresh fruits and vegetables. They can also be encouraged to combine pulses with grain products instead of meat. Patients with mild to moderate CKD benefit from the Mediterranean Renal diet which resembles a traditional dietary pattern with predominant plant-based consumption and adjusted protein, sodium and phosphate intake to CKD level (Fig. 2). Close monitoring is essential to detect any metabolic imbalances early on and to implement gradual protein restrictions and limitations on certain food types regarding consumption frequency and serving sizes.


**Figure 2.**
The Mediterranean Renal Diet Pyramid

**2.** Some of the patients who are already following dietary regimens but face specific dietary challenges, such as high phosphorus or potassium levels, targeted intervention and counselling are necessary. Instead of general advice, these individuals should receive tailored guidance that addresses their unique issues including practical recipes for tasty, affordable, and easy-to-prepare meals that meet their nutritional needs.

**3.** Patients at risk of or experiencing malnutrition require enhanced energy intake, best achieved through small servings of foods with high energy content. Suggested high-energy foods include olive oil, vegetable cheese, and even sugar and jams in non-diabetic patients. In some instances, nutritional supplements or even an increase in protein intake may be necessary relative to their usual diet.

**4.** Patients struggling with obesity should be prescribed a diet with reduced energy intake to decrease fat mass, while ensuring that nitrogen balance is maintained to prevent loss of muscle mass. Sarcopenic obesity, characterized by excess fat along with low muscle mass, is increasingly being recognized for its negative influence on important patient-centred outcomes. The diagnosis is considered in at-risk individuals with co-occurring elevated body mass index and waist circumference, and markers of low skeletal muscle mass and function. Patients should then be classified into either stage I, in the absence of clinical complications, or stage II, with the presence of at least one complication attributable to sarcopenic obesity (cardiovascular and respiratory diseases, metabolic diseases, functional disabilities).
Nutrition plays a crucial role in effectively managing patients with end-stage kidney disease. An appropriate approach through timely counselling, themed meetings and informative publications can help secure patient compliance and foster commitment to a proper dietary regimen.

*Written by Jasna Trbojevic-Stankovic.*
*The speaker reviewed and approved the content*

## KEY POINTS

1 The one-size-fits-all approach to HD prescription does not adequately meet the particular needs of all HD end-stage renal disease patients.

2 Incremental hemodialysis might offer a more individualized, kidney-, patient- and environmentally-friendly approach, with better preservation of residual kidney function, less treatment burden and better quality of life.

3 Nutrition is an essential part of treatment in CKD patients. Nutritional strategies must be tailored to meet the patient's specific needs.

4 Nutritional guidance through focused counselling, cooking meetings and kidney-friendly cookbooks contribute to patients' adherence to the necessary dietary regimen.

## Further readings


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