How to Prepare a Chronic Kidney Disease Patient for Dialysis

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Before You Start: Facts You Need to Know

- Preparation for dialysis must be patient centered.
- The goals of preparation include an informed selection of dialysis modality, preemptive transplant when possible, timely placement of appropriate dialysis access, timely initiation of dialysis, reduction of morbidity, and optimal survival.
- Dialysis access should be placed early to preclude the need for temporal venous catheters.
- The decision of when to start dialysis should be individualized based on symptoms and/or the appearance of complications yet should not be delayed until patient reaches a specific value of estimated eGFR or becomes too symptomatic.

36.1 The Importance of Preparation Before Dialysis Initiation

Careful planning before dialysis is required and may prevent many medical and social problems associated with advanced end-stage renal disease (ESRD). Patients with ESRD have exceedingly high morbidity and mortality rates, particularly in the first year after dialysis initiation, when annual mortality rate may exceed 25 %. All-cause mortality peaks in the second to third months on hemodialysis (HD) and then falls significantly and even more after the first year. For example, incident HD patients in 2009 had an all-cause mortality of 435 deaths per 1,000 patient years at risk in month 2 and then fell to 206 at month 12; cardiovascular mortality peaked at 169 at month 2 and decreased to 78 at month 12. Mortality due to infection peaks at months 2 and 3 with 40–43 per 1,000 patient deaths [1]. In some reports nearly 35 % of HD patients died within the first 90 days. A retrospective cohort study using data from the Dialysis Outcomes and Practice Patterns Study (DOPPS; 1996 through 2004) found a mortality risk highest during the first 120 days after HD initiation (27.5 deaths per 100 person-years) compared with risk from days 121 to 365 after initiation (21.9 deaths per 100 person-years; p: 0.002) [2]. All these studies suggest that inadequate predialysis nephrology care may be strongly associated with mortality, highlighting the potential benefits of a careful preparation plan before dialysis.

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Table 36.1 Adjusted hazard ratios (AHR) and 95 % confidence interval between patients' characteristics and death <120 days after initiation of HD among incident HD patients (n = 4,802), DOPPS 1996–2004

Variable	AHR, 95 % CI
Age, per 10 years	
65–74	1.65, 1.22–2.22
≥75	2.49, 1.86–3.31
White race versus nonwhite	1.40, 1.07–1.80
Catheter versus AV fistula or AV graft	1.62, 1.05–2.51
Serum albumin <3.5 g/dl	1.57, 1.18–2.09
Serum phosphorus <3.5 mg/dL	1.47, 1.02–2.10
Comorbid conditions (yes versus no)	
Cancer, other than skin	1.41, 1.07–1.85
Congestive heart failure	1.71, 1.35–2.17
HIV/AIDS	2.85, 1.34–6.06
Lung disease	1.33, 1.04–1.69
Psychiatric disorders	1.35, 1.09–1.68
Nephrology pre-ESRD care (yes versus no)	0.65, 0.51–0.83

Source: Data from Bradbury et al. [2]

Some factors associated with an increased risk of mortality (Table 36.1) at dialysis initiation are not modifiable, including age >75 years, cancer history, lung disease, neurologic disease, HIV/AIDS, or psychiatric disorders, among many others. Nevertheless, there are other patients' features associated with mortality, such as temporary access use at the beginning of HD, serum albumin levels <3.5 g/dl, or serum phosphorus levels <3.5 mg/dl that can be modifiable with clinical care [2]. An optimal preparation for dialysis allows proper patient education, modality selection, and creation of a permanent access.

Adequate preparation for dialysis can improve survival. There is no study that has tested an intervention strategy focused in preparing patients before chronic dialysis; nevertheless, there is strong evidence that a targeted program of medical and teaching intervention at the beginning of HD results in improved morbidity and mortality during the first 90 days, and this improvement is sustained during the following 120 days [3]. A longer duration of predialysis nephrology care is associated with a graded survival benefit, especially when evidence-based KDOQI guidelines goals are accomplished [4]. According to KDIGO guidelines [5], patients with progressive chronic kidney disease (CKD) in whom the risk of kidney failure within 1 year is 10–20 % or higher, as determined by validated risk prediction tools, should be managed in a multidisciplinary care setting. In counterpart, suboptimal HD or peritoneal dialysis (PD) initiation (defined as initiation as an inpatient and/or with a central venous catheter (CVC) in the case of HD) is associated with an increased mortality in the following 6 months [6].

In this chapter, we discuss the goals of an adequate preparation for dialysis and present a practical step-by-step approach to help bridge the gap in care and reduce the high mortality seen in the first few months after initiation.

36.2 Objectives of Adequate Preparation for Dialysis

The goals of an adequate preparation for dialysis are:

- Patients must not require hospitalization for the management of untreated acute or chronic complications of uremia.
- Patients must have a thorough understanding of the different treatment options.
- Patients must have a functioning permanent access for the dialysis therapy decided jointly between the patient and the nephrologist.

36.3 Selection of the Patient

The first step is to properly identify CKD patients who may progress in the near future to a more advanced stage and require renal replacement therapy. It is inappropriate to consider only one element such as an estimated glomerular filtration rate (eGFR) below a certain threshold (v.gr. according to what was agreed in previous reviews you told us it would be e.g. <30 ml/min/1.73 m^2; e*GFR KDOQI Stage 4*) for renal replacement therapy preparation, as specific conditions vary among patients. For example, many elderly individuals with CKD are unlikely to exhibit sufficient progressive renal function decline to require dialysis, or the likelihood of dying prior to initiating dialysis far exceeds the likelihood of starting dialysis therapy. In addition, patients with certain nephropathies, in

Box 36.1. Characteristics Associated with Progression to ESRD

- eGFR <30 ml/min/1.73 m^2 and young age, high blood pressure, underlying renal disease (diabetes, APKD, primary glomerular disease), and development of CKD complications (such as increased serum phosphorus and/or decline in hemoglobin levels)
- Rapid decline in kidney function over time (slope of eGFR against time)
- Persistent albuminuria (albuminuria category 3 KDIGO [A3]=albumin excretion rate >300 mg/day or albumin/creatinine ratio >30 g/g)
- History of acute kidney injury and requirement of transient dialysis

Source: Data from Kidney Disease: Improving Global Outcomes (KDIGO) CKD Work Group [5]

particular tubulointerstitial, display a slower progression pattern, which may justify an individualized delay in the preparation for dialysis.

No single characteristic can reliably identify which individuals and at what rate are to progress to ESRD. In Box 36.1, we focus on at least one additional evaluation tool, associated with a high probability of reaching ESRD, in addition to an isolated low eGFR, which could aid to identify those who would benefit from preparation for future dialysis. The slope of decline of the eGFR against time allows us to recognize those patients whose renal function is deteriorating at a rate that predicts they will require dialysis in the next 1–2 years and who therefore should be referred to the multidisciplinary team. Age alone should not be used as a barrier for referral and treatment; dialysis decision should be made on a composite assessment of the health and functional status of the individual. In every consultation with a patient likely to reach ESRD, the nephrologists must work in the process of information and therefore timely preparation for dialysis. Moreover, all patients with advanced CKD could benefit from education tailored to each individual's probability of need of future dialysis.

36.4 Selection of Dialysis Modality

Preparation for dialysis should begin early enough in the course of CKD to allow time for patients to consider different treatment options and to establish a permanent functioning access for the dialysis modality of choice. Patient education in those with CKD is shown to be highly effective when focused on health promotion, shared decision-making, and discussion of treatment options (Chap. 33). Depending on multiple factors including patients' personal will, style of life, age, presence of comorbidities, and availability of local dialysis facilities, among many others, patient's/physician's choice can include three options: non-dialytic maximum conservative management (Chap. 34), preemptive kidney transplantation (Chap. 35), and dialysis.

36.4.1 Hemodialysis Versus Peritoneal Dialysis

We summarize the general characteristics of two major modalities of renal replacement therapy: HD and PD in Table 36.2. The preferred choice of dialysis modality in patients with ESRD differs between countries, within countries between communities, and due to a multiplicity of reasons: availability of the technologies, economic capabilities of the health system and in some instances of the individuals themselves, economic incentives to provide specific modes of treatment, the experience of the physicians in particular and in general of the dialysis center, the appropriate training of health-care professionals to provide home dialysis therapies, and many others [7].

The available epidemiological evidence of published survival studies is not strong enough to guide patients'/physicians' selection of a specific dialysis modality. Previous studies described that the relative risk of death between the HD and PD appears to change over time after dialysis initiation. Several studies in the last decades indicated that PD is associated with better survival during the first 1–2 years of renal replacement treatment, whereas HD is associated with better survival thereafter. Explanations for this shift have been

Table 36.2 Hemodialysis and peritoneal dialysis

Modality of renal replacement therapy	Hemodialysis	Peritoneal dialysis
Technique	Blood is exposed to dialysate across a semipermeable membrane. Small solutes and electrolytes diffuse down a gradient due to concentration differences	The peritoneum is a semipermeable membrane and is exposed to high intraperitoneal osmotic or oncotic gradients (glucose or glucose polymers)
	Water can be driven through the membrane by hydrostatic force	Small solutes diffuse through small pores and macromolecules diffuse through large pores by convection
Dialysate characteristics	A solution containing predefined concentrations of electrolytes	A solution containing high glucose or glucose polymers and a predefined concentration of electrolytes
Patients' characteristics favored by method	1. Patients' desire of dialysis-free days	1. Infants or very young children
	2. Functional dialysis access	2. Difficult vascular access
	3. Possibility to attend a dialysis center	3. Desire to avoid attending a dialysis center
Advantages	Patients are free of other dialysis responsibilities between sessions	PD may be less expensive in most environments
		PD may allow patients more independence and freedom to travel
Consider	Home HD, performed in some centers (nocturnal or short HD), has shown a relatively better survival as compared with in-center conventional HD	PD may not be the best option for patients who do not have social stability and family support, in particular if elderly

proposed, including a reduced rate of loss of residual renal function in PD patients, and a greater level of comorbidity among HD patients at initiation [8] seems to benefit early PD survival, whereas technique failure due to recurrent peritonitis and loss of ultrafiltration with an increase in peritoneal membrane transport [9] and less frequent monitoring of PD patients by their nephrologists might be factors becoming adversely relevant after the first few years on PD. The other explanation was that patients with little or no predialysis nephrology care invariably started HD with a central venous catheter. In this case, the absence of predialysis nephrology care and of course the use of a hemodialysis catheter instead of a well-planned permanent access were strong factors that made the death risk of HD to appear higher, early in the course of renal replacement treatment.

On the other hand, at present, there is no consistent evidence of higher long-term death risk in PD patients in the USA. The adjusted survival of PD and HD is almost identical in recent studies [10]. Furthermore, the 10-year survival of patients who started treatment with any of the two therapies in 1999 was remarkably similar (HD and PD 12 %) [1]. Conclusion from old studies suggests that these survival differences are not attributable to the dialysis therapy itself. Instead, they either reflect biases arising from where geographically patients were treated with HD and PD or point opportunities for improvements in patient management.

In addition to general differences between treatment modalities, survival is also dependent on other patient-specific influential factors such as age, gender, race, body weight, and educational status. Understanding these subgroup differences and mortality trends is essential for optimizing patient outcomes. In Table 36.3 absolute and relative contraindications to HD and PD are listed. The majority of patients with ESRD are suitable for treatment with either PD or HD.

Patients selected to HD or PD must know and understand the following points:

1. *Preservation of veins and avoidance of unnecessary catheters*. Most patients undergoing HD will require several arteriovenous fistulae

Table 36.3 Contraindications to PD or hemodialysis

	Peritoneal dialysis	Hemodialysis
Absolute	Peritoneal adhesions, fibrosis, or abdominal malignancy which precludes use of the peritoneal cavity	Impossibility to have an appropriate vascular access
	Non-correctable hernia, abdominal wall stoma, or diaphragmatic fluid leak	
Relative	Recent abdominal aortic graft	Coagulopathy
	Ventriculoperitoneal shunt	Difficult vascular access
	Body mass index ≥40 kg/m^2	Needle phobia
	Skin infection	
	Inflammatory bowel disease (e.g., Crohn's, ulcerative colitis)	

or grafts in both upper extremities in particular if they are not subjected to early kidney transplantation. Patients selected to PD also must preserve their veins, considering the potential failure of the PD technique during the course of treatment. Cannulation of veins above the wrist in either upper extremity should be avoided in as much as possible [11]. Every effort should be made to limit phlebotomy and intravenous catheters to veins in the hand. Peripherally inserted central catheters (commonly known as PICC lines) must not be used because they can cause thrombosis of the upper arm veins precluding future vascular access in the entire ipsilateral upper extremity. PICC lines in patients with prior venous thrombosis and use of double-lumen 5-F or triple-lumen 6-F PICCs are risk factors for deep venous thrombosis. If the patient needs a temporary central venous access during surgery or hospitalization, internal jugular access must be the preferable site. Subclavian site for catheter placement should be considered as a last resort given the significant risk of subclavian vein stenosis, which may compromise the construction of a permanent access.

2. *Timely construction of a vascular access*. Sufficient time should be allocated for placement and maturation of a permanent dialysis access. Education about CKD, dialysis therapies, and dialysis access should be initiated in individuals with an eGFR 20–30 ml/min/1.73 m^2. Furthermore, vascular access should be placed in patients with an eGFR 15–20 ml/min/1.73 m^2, in whom progression to ESRD seems likely (Fig. 36.1).

36.4.1.1 Hemodialysis

The first permanent vascular access, either arteriovenous (AV) fistula or arteriovenous vascular (AV) graft, should be placed early enough to allow, if needed, the time to either revise the initial access or second access to be placed, mature, and adequate for cannulation prior to initiation of dialysis. The only justification not to place an AV fistula or an AV graft is the technical or mechanical impossibility to place them; in these cases, a cuffed catheter may be the appropriate vascular access. In Table 36.4 the advantages and disadvantages of vascular accesses, including AV fistulae, AV grafts, and cuffed catheters, are summarized. If the patient is going to be on HD, the first option must always be AV fistula and an AV graft as a second-line option. For new HD patients initiating with an AV fistula, median time to first cannulation varies greatly between countries: Japan and Italy (25 and 27 days), Germany (42 days), Spain and France (80 and 86 days), and the UK and USA (96 and 98 days). Cannulation of an AV fistula within the first 2–3 weeks of creation is associated with reduced long-term fistula survival. AV grafts ideally should be left to mature for at least 14 days before the first cannulation.

36.4.1.2 Peritoneal Dialysis

Peritoneal catheters may be categorized as acute (without subcutaneous cuff) or chronic (with subcutaneous cuff, commonly known as Tenckhoff catheter due to the fact that this model is the one most extensively used). A chronic catheter should be placed initially in all cases, as acute catheters are rigid and imply an increased risk of perforation,

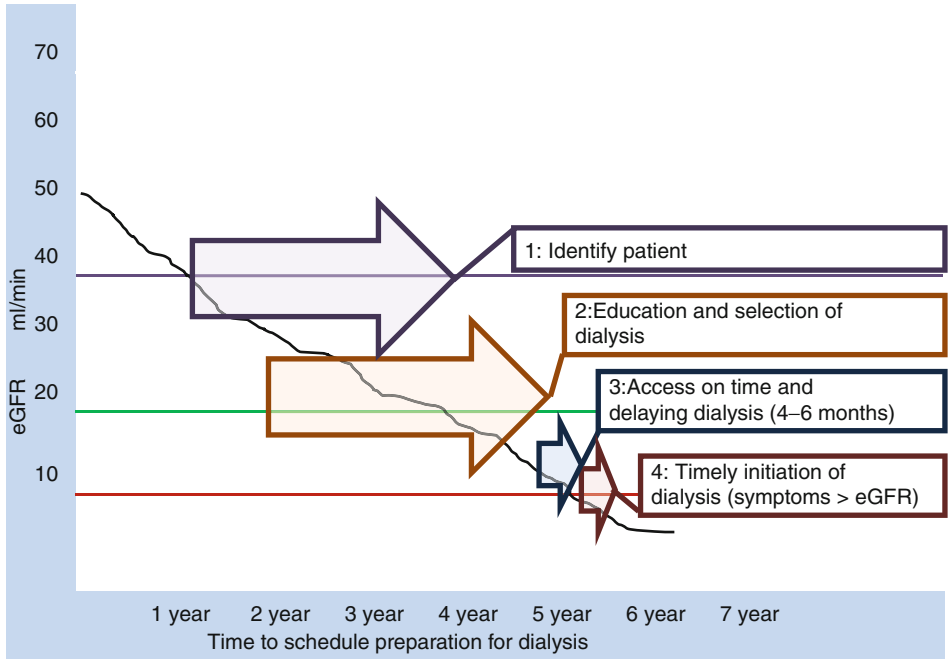

Fig. 36.1 Preparation for dialysis. The figure shows a hypothetical case progressing from CKD stage 3b to ESRD (stage 5) with a relentless and time-dependent decline in kidney function along 6 years of follow-up. In this hypothetical case, the identification of progression from stage 3b to 4 (*purple arrow*) should indicate the right time to start patient education and selection of dialysis modality, when GFR is around 30–20 ml/min/1.73 m^2 (*brown arrow*). Once modality is selected, construction of a vascular access or placing of a peritoneal catheter must be done according to clinical criteria and institutional facilities, months (HD) or weeks (PD) before planned initiation of dialysis (*blue arrow*). The initiation of HD or PD must happen according to clinical judgment, not only by an isolated eGFR value. Almost all patients should start dialysis when eGFR is above 7 ml/min/1.73 m^2. Some authors have suggested that the majority of patients do not show this progressive and predictable decline in kidney function, and this scheme must be adapted according to different clinical scenarios

Table 36.4 Vascular access

Vascular access	Advantages	Disadvantages	Commentary
AV fistula	Can last many years Lower frequency of stenosis, thrombosis, and infection, as compared to AV grafts	Early failure (failing to mature) Longer time to first cannulation than AV graft	Preferred vascular access
AV Graft	Lower risk of early failure than AV fistula Early cannulation	Requires more frequent intervention for maintaining patency	Useful in elderly patients with limited life expectancy May be selected in patients with history of AV fistula failure to mature
Cuffed venous catheter	No "waiting time" after placement	Patients with catheters develop infections more often, have higher levels of inflammatory markers and higher mortality	Effective flow >350 ml per minute can rarely be obtained, which results in lower dialysis efficiency
	Can be used as a long-term vascular access for patients in whom an AV access cannot be created	High rate of vascular stenosis and potential development of superior vena cava syndrome	Increased recirculation which lowers dialysis efficiency

Source: Data from Saggi et al. [12]

do not have cuffs to protect against bacterial migration from the skin site to the subcutaneous tract so incidence of peritonitis increases beyond 3 days of use, and need to be replaced in short periods of time. In addition, acute catheters commonly present early dysfunction and hernia formation. Acute catheters were extensively employed in the past, yet nowadays there is no justification for their use in clinical practice unless this is the only available option.

In patients who have been selected or chosen to perform PD, the optimal interval between chronic catheter placement and the start of PD is approximately 2 weeks (known as the break-in period), which allows sufficient time for the catheter track to heal and minimizes the chance of a leak when dialysate is instilled in the peritoneal cavity [13]. During the break-in period, at least once per week and preferably up to 3 times per week during the break-in period, heparinized saline or 1.5 % dialysate is infused into the abdomen and drained. When PD has to be started within a week of catheter placement or even immediately after placement, the abdomen is drained and left dry for part of each day, the volume of infusion may be reduced to half of its total usual volume, and patient activity is initially restricted when peritoneal fluid is preset to minimize intraperitoneal pressure increase.

While chronic PD catheters are typically implanted by surgical dissection in the operating room, effective and safe techniques for placement at the bedside or in an ambulatory surgical suite, utilizing guidewire and dilators or peritoneoscopy, also exist. It has often been argued that PD can be used for patients who are referred late, as in most patients PD can be started within 24–96 h of placement of a PD catheter, as long as care is taken to instill low volumes of fluid with the patient lying supine. Implementation of a "PD first" program, as a policy or as a preferable system, has been argued by some as of benefit, yet it is clear that this may depend on local resources and expertise and should also ideally depend on patient's participation on the decision process [14]. In some centers, the use of the embedded PD catheter technique is associated with low rates of surgical, mechanical, and infectious complications. In this technique, the free end of the catheter is embedded in a tunnel under the abdominal subcutaneous fat for a period of 4–6 weeks.

36.5 Timely Initiation of Dialysis

As stated above, among patients with advanced CKD, the decision to start dialysis should not be solely based upon the value of serum creatinine or eGFR. We should not postpone dialysis until the kidney function reaches a prespecified eGFR, especially in patients who develop uremic symptoms, volume overload, hyperkalemia refractory to medical therapy, or significant protein energy wasting syndrome. In the last decade, guidelines recommended that starting dialysis should be considered when a certain eGFR value was reached ($\leq$10 ml/min/1.73 m^2 or even higher in diabetic patients) [11]. One of the problems with this recommendation is that the calculation of eGFR based on serum creatinine may be quite inaccurate when kidney function is extremely reduced. Although a low serum creatinine concentration generally indicates a better GFR, a low creatinine concentration may also be caused by decreased muscle mass due to malnutrition or may be increased by overhydration. Furthermore, there is data that indicates that among patients with advanced CKD, serum creatinine is more dependent on muscle mass than kidney function itself. In the only trial that has consistently explored the outcome of advanced CKD patients in relation to the actual kidney function at which they initiated renal replacement treatment, the IDEAL study [15], there was no difference in survival between patients randomly assigned to begin dialysis early (creatinine clearance of 10–14 ml/min) or late (at a creatinine clearance of 5–7 ml/min). It was remarkable that 76 % of patients randomized to the late start group developed uremic symptoms before creatinine clearance reached 7 ml/min and there was a 6-month separation between the groups in the start time of dialysis. An important conclusion of the study is that waiting to initiate dialysis until signs of uremia appear does not necessarily jeopardize the patient and that starting renal replacement therapy

Box 36.2. What Guidelines Say You Should Do: Timing the Initiation of Dialysis

- Dialysis should be initiated when one or more of the following are present: symptoms or signs attributable to kidney failure, inability to control volume status or blood pressure, a progressive deterioration in nutritional status refractory to dietary intervention, or cognitive impairment. This often but not invariably occurs in the GFR range between 5 and 10 ml/min/1.73 m^2.

Source: Kidney Disease: Improving Global Outcomes (KDIGO) CKD Work Group [5]

Box 36.3. What the Guidelines Say You Should Do: Retarding CKD Progression

- Define CKD progression based on one of more of the following: Decline in GFR category (a certain drop in eGFR is defined as a drop in GFR category accompanied by a 25 % or greater drop in eGFR from baseline).
- Rapid progression is defined as a sustained decline in eGFR of more than 5 ml/min/1.73 m^2/year.
- The confidence in assessing progression is increased with increasing number of serum creatinine measurements and duration of follow-up.

Source: Kidney Disease: Improving Global Outcomes (KDIGO) CKD Work Group [5]

on the basis of a predefined estimated GFR value does not improve the outcome (Box 36.2).

36.6 Retarding Initiation of Dialysis

Preparation for dialysis should begin about 4–12 months prior to the anticipated dialysis need if one takes in consideration 1–6 months of iterative CKD education for patients to accept potential need for dialysis and 3–6 months for placement and maturation of dialysis access [12] (Box 36.3). Of note, CKD progression rates can change over time, making it challenging to precisely anticipate the need for dialysis. Complications of advanced CKD such as fluid overload, anemia, hyperkalemia, and acidosis must be approached and treated according to what is written in other chapters of this book.

In certain patients with advanced CKD, the following strategies can defer dialysis initiation:

1. *Prevent drug-induced nephrotoxicity*. Abrupt onset and irreversible acute kidney injury that precipitates end-stage renal disease can occur with the use of nephrotoxic drugs such as nonsteroidal anti-inflammatory drugs (NSAIDs), aminoglycosides, contrast dye, diuretics, or others, especially in patients with risk factors (age>60 years, CKD, volume depletion, heart failure, or sepsis). Selective cyclooxygenase-2 inhibitors have a similar adverse kidney effect in glomerular autoregulation to other NSAIDs. Acetaminophen can be associated with chronic interstitial nephropathy. CKD patients with chronic pain should use alternate agents for pain and avoid NSAIDs as much as possible [16].
2. *Stop inhibitors of the renin-angiotensin system*. In patients with proteinuria <1 g/g and eGFR <20 ml/min/1.73 m^2, stopping angiotensin-converting enzyme inhibitors (ACEi) and/or angiotensin receptor blockers (ARB) may increase eGFR and postpone dialysis initiation for several months. In some patients, this maneuver may increase eGFR up to >50 % from the value at the time of discontinuation of ACEi/ARB, especially in patients >65 years old or those whose kidney function was declining in spite of ACEi/ARB treatment.
3. *Correction of metabolic acidosis*. Patients with serum bicarbonate 16–20 mmol/l on two consecutive measures and controlled blood pressure (<150/90) must receive oral sodium bicarbonate tablets 600 mg thrice daily increased as necessary to achieve and maintain HCO_3 level ≥23 mmol/l. Absence of a deleterious effect on BP despite increased sodium intake has been observed suggesting that sodium salts other than sodium chloride have a negligible effect on BP [17].
4. *Diet*. The benefits of dietary protein restriction to approximately 0.6–0.8 g/kg per day on the

progression of CKD in humans remain controversial, and there is a lack of controlled and randomized studies to support extensive protein restriction. In addition, the use of nutritional supplements with low amounts of protein, phosphorous, and potassium; ketoanalog-supplemented very-low-protein diets; or vegetarian diet might prove to be useful, yet, there is a lack of scientific validated and controlled information supporting them. Dietary restrictions should be considered on an individual case-by-case basis. 2012 KDIGO guidelines suggest the use of a lower, high-quality protein diet of 0.8 g/kg per day among select predialysis patients who are highly motivated to follow such a diet [5]. Patients who are on a protein-restricted diet should be closely monitored, preferably by a dietitian, with follow-up every 2–3 months for adequate caloric intake and evidence of protein malnutrition, which in itself may provide a deleterious environment and an increased risk at dialysis initiation [18]. Given that it has been strongly demonstrated that initiating dialysis with a poor nutritional status is associated with inflammation and higher mortality, it may be questionable to try to delay progression to ESRD for a few months with excessive protein restriction [19].

36.7 Problems in Preventing Urgent Dialysis

The aim of KDIGO 2012 CKD guidelines is to avoid late referral, defined as referral to specialized services less than 1 year before the start of renal replacement therapy. Late referral to a nephrologist is associated with higher morbidity and higher death risk [20]. However, *early referral to a nephrologist is not synonymous of optimal dialysis initiation*. Many patients still initiate dialysis late or suboptimally prepared, despite early referral and care for >12 months by factors such as patient-related delays, acute-on-chronic kidney disease, surgical delays, and late decision-making, among others (Box 36.4). An important limitation to timely referral for proper preparation of a patient before dialysis is the unpredictable, nonlinear, and rapid progression to ESRD triggered by the occurrence of an AKI episode, when it occurs in patients with CKD. This situation may be common among older patients [21]

Box 36.4. What Guidelines Say You Should Do: Early Referral

- Timely referral for planning renal replacement therapy in people with progressive CKD in whom the risk of kidney failure within 1 year is 10–20 % or higher, as determined by validated risk prediction tools, and avoidance of late referral, defined as referral to specialist less than 1 year before start of RRT.
- Patients with progressive CKD should be managed in a multidisciplinary care setting team that should have access to dietary counseling and education and counseling about different renal replacement treatment modalities, transplant options, vascular access surgery, and ethical, psychological, and social care.

Source: Kidney Disease: Improving Global Outcomes (KDIGO) CKD Work Group [5]

36.8 Myths Associated with Dialysis

First PD, after HD. Due to the differences in early and late survival, some have suggested using a "dual-modality" or "integrative-care" approach with initiation of PD, followed by timely transfer to HD. One study showed a survival advantage in a matched-pair analysis of patients who started on PD and were transferred to HD versus patients who started and remained on HD. Yet, another study reported that initial dialysis modality was not a significant predictor of survival after adjusting for age, sex, and primary renal diagnosis. Thus, in the absence of randomized controlled studies, definite recommendations regarding the dialysis modality based on mortality rates cannot be made, even when some data seem to suggest that starting patients on PD might be beneficial. A non-planned change from PD to HD is

associated with an increased risk of hospitalization and mortality.

PD is more appropriate for patients with cardiovascular comorbidities providing hemodynamic stability and avoiding rapid fluid shifts that may be harmful to the cardiovascular system. There is evidence provided by some studies that the risk of death is significantly greater in patients on PD, in particular in elderly patients with diabetes, coronary artery disease, and congestive heart failure. We have to consider that some of the previous results could be due at least in part to biased selection. Another explanation is that fluid control is potentially more difficult in PD and fluid overload may be the main cause of death in some of these reports. Nevertheless, it certainly contradicts the expressed opinion that PD is more appropriate for patients with preexisting significant cardiovascular disease.

PD is the preferred dialysis modality in diabetic patients. Initial reports suggested that PD improve survival in diabetic ESRD patients. At present, most studies have concluded that both HD and PD appear to have similar survival in diabetic patients after adjustment of multiple variables [9]. PD has advantages in diabetic patients such as fewer episodes of hypotension during dialysis, avoidance of vascular access complications, home setting, fewer episodes of blood-borne diseases, and fewer episodes of hemorrhagic retinopathy; nevertheless it also has disadvantages that include an increased risk of fluid overload, gain of weight precipitated by continuous glucose absorption (100–300 g of glucose in a conventional DP), and large insulin requirements when hypertonic solutions are used, among others. The majority of these disadvantages can be overcome by adequate care.

Before You Finish: Practice Pearls for the Clinician

- In each clinical visit, a CKD patient should be assessed for progression and risk of dialysis, in particular looking closely to those with eGFR <30 ml/min/1.73 m^2, high blood pressure, type of underlying renal disease (diabetes, APKD, primary glomerular disease), and development of CKD complications.
- The slope of eGFR against time is useful to predict those CKD patients that require dialysis in the next 1–2 years.
- The decision to start dialysis should also include a careful evaluation of symptoms and signs of uremia and other clinical conditions, and not solely eGFR.
- Patients in preparation for dialysis must preserve their veins, and cannulation of veins above the wrist in either upper extremity should be avoided.
- Vascular access should be placed in patients with an eGFR 15–20 ml/min/1.73 m^2 or before, in whom progression to ESRD seems likely. In HD the first option must be AV fistula created 1–4 months before dialysis; in peritoneal dialysis a chronic catheter should be placed approximately 2 weeks before dialysis.
- Retarding initiation of dialysis while a vascular access is created and, before, may be accomplished with appropriate medical care that would include optimal blood pressure control, avoidance of NSAIDs, and other measures, including discontinuing inhibitors of the renin-angiotensin system, correcting metabolic acidosis, and appropriate diet restrictions.
- In spite of early nephrology referral, many patients are not efficiently prepared for a programmed dialysis initiation as multiple factors such as patient-related delays, acute-on-chronic kidney disease, surgical delays, and late decision-making could take place.
- Once renal replacement is needed, most patients can be treated with either PD or HD. The selection of dialysis modality is influenced by a number of considerations, and results of survival studies between HD and PD should not guide patient/physician selection of dialysis modality.

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