Peritoneal Dialysis in the Elderly Patient

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Dialysis in the Elderly Population

The general population is getting older, and dialysis patients are ageing too. In the United States, end-stage renal disease (ESRD) prevalence per million is highest in the 65–74-year age group and the highest incidence rate is found in patients aged 75 and over [1] (Figs. 12.1 and 12.2). In short, the elderly are the largest group of patients on dialysis. This is a trend seen throughout the developed world. Indeed, in some European regions, the median age of the dialysis population is now over 70 [2].

The decision whether to commence renal replacement therapy (RRT) or to pursue a conservative nondialytic management path in elderly patients is complex. The

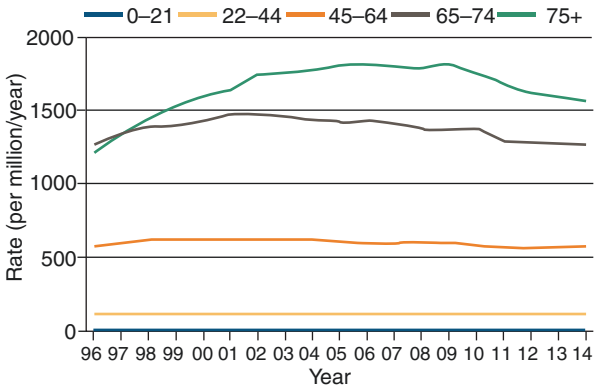

Fig. 12.1 Trends in adjusted ESRD incidence rate (per million/year, of ESRD, by age group, in the US population [1]

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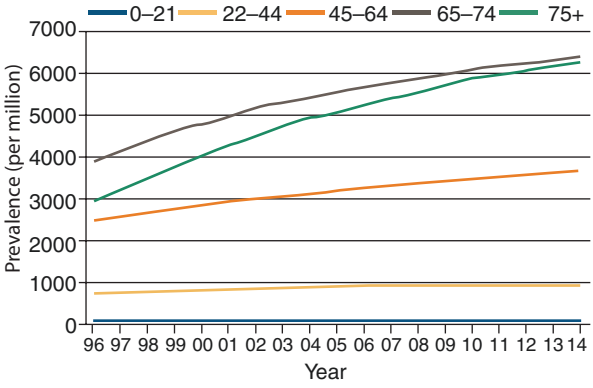

Fig. 12.2 Trends in the adjusted prevalence (per million) of ESRD, by age group, in the US population [1]

(often) competing factors of poor long-term prognosis coupled with the desire to control symptoms while maintaining quality of life can create a challenging discussion with the patient and family. As clinicians, we should always strive to maintain patient autonomy while being mindful of individual family dynamics and cultural backgrounds.

Where Are We Now?

A longitudinal study by Jain et al. reviewed data from 130 countries from 1996 to 2008 and reported that 11% of chronic dialysis patients around the world are treated with peritoneal dialysis, with increasing prevalence of utilization in developing countries [3]. However, the proportion of dialysis patients managed with PD is declining in the developed world. Health care financing and delivery play an important role in determining dialysis modality. Countries with private dialysis providers tend to use PD for a smaller proportion of patients compared to countries where publicly-funded providers predominate.

In most countries, elderly patients who commence RRT are much more likely to be commenced on hemodialysis (HD) than peritoneal dialysis (PD) [2]. This is despite PD offering comparable medical outcomes and potentially a better quality of life than hemodialysis, as will be discussed. In the United States, the prevalence of PD use is relatively low in the general dialysis population. However, this situation is further exacerbated in the elderly. USRDS data reveals that only 6.3% of the 65–74 age group and 5.6% of the over 75 age group are on PD as their mode of RRT [1].

In countries where PD is utilized more widely, such as in Canada, Australia, and parts of Europe, the trend of lower PD use in the elderly population persists. For example, in Denmark, Belgium, and Holland, 13–25% of dialysis patients aged 65–74 years and 9–13% of those aged over 75 start on PD compared to 20–41% of patients aged between 45 and 64 (Fig. 12.3) [4].

In contrast, France has a well-developed PD program for older patients where assisted peritoneal dialysis (usually CAPD) is frequently employed. Community

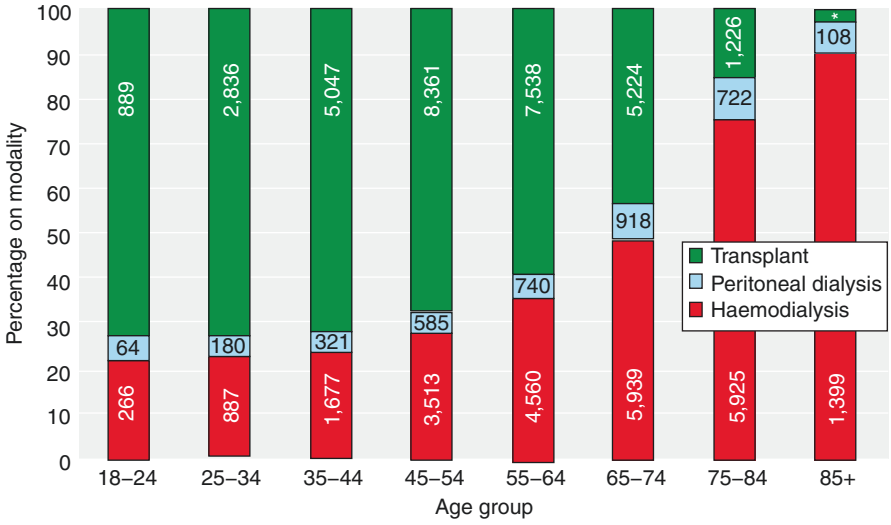

Fig. 12.3 Treatment modality distribution by age in prevalent RRT patients on 31/12/2014. (UK Renal Registry [5])

nurses utilize a "non-disconnect" UV flash system as it shortens the time needed for the nursing visit. The nurse can call the patient or relative to start the drain procedure so that on arrival, the nurse can remove the old bag and connect the new one leaving the fluid to drain in and the patient to fold up the bag [6]. In 2006, 54% of males and 59% of females on PD in France were over the age of 70. Other countries such as Hong Kong have adopted a "PD first" policy where PD is the default first-line RRT modality unless there is a contraindication or the patient wishes to pay for hemodialysis. As a consequence, PD is the modality used by 75.6% of the dialysis population. In Hong Kong, this policy has been in effect since 1985 and has proven to be cost-effective. Paradoxically, in other countries this *may* be the case from a payer's perspective but the use of PD may offer lower revenue or income margins for the provider [7].

Why Is PD Generally Underutilized in the Elderly?

PD has advantages for the elderly patient, not least the fact that it can be undertaken at home and is a gentle, continuous therapy. However, its relative low use compared to hemodialysis in this demographic is not congruent with these potential benefits.

How Are the Elderly Different?

The elderly patient with end-stage renal disease (ESRD) almost invariably has considerable co-morbidity—in part related to their renal disease and increased

cardiovascular burden, but also secondary to the conditions affecting many older people, such as arthritic and mobility issues, cognitive impairment, and hearing or visual impairment [4].

The elderly are more likely to be prescribed multiple medications, often suffering the effects of polypharmacy, drug interactions, and adverse effects. To compound matters, psychosocial issues such as housing problems, financial compromise, social isolation, and depression are often particularly prevalent in the older population.

In addition, the elderly are more likely to be *frail*. The concept of frailty far exceeds its colloquial constraints of "weak and delicate" and is an important medical description which encompasses a state of increased vulnerability with reduced physical reserve and loss of function [8]. It is a strong predictor of morbidity and mortality and is known to be more common in the CKD population. Recognizing frailty is key to improving patient care and helps ensure patients and their families feel confident about the care their loved ones receive.

The NECOSAD study was a large prospective cohort study carried out in the Netherlands. The relationship between dialysis modality and health-related quality of life was explored. It reported that 50% of dialysis patients would choose PD if given a chance. However, patients over 70 were six times more likely to choose HD compared to patients aged 18–40. The factors that were associated with not choosing PD were older age, being female and living alone. The study also highlighted that patients who had received predialysis care were more likely to choose PD [9].

The use of PD in the elderly is likely limited by numerous factors. These include:

Health Policy

This varies among countries but greatly impacts dialysis trends. As previously discussed, high use of PD is found in countries such as Hong Kong where a "PD first policy" exists, whereas in the United States, peritoneal dialysis is reimbursed differently than hemodialysis [7].

Physician Bias

In many parts of the world, physicians have minimal experience with peritoneal dialysis which can significantly impact utilization. This factor is exemplified by the wide variation of PD uptake between different units even within the same country and payor system. Nephrologists with more training and experience with PD are more likely to effectively manage peritoneal catheter insertion and malfunction, volume status, infectious complications, and cardiovascular disease.

Patient Contraindications

Medical contraindications (although seldom absolute contraindications) include previous lower abdominal surgery, severe obesity, dexterity problems, and significant sensory impairment without a willing partner (although the latter could be overcome by the use of assisted PD) [10].

Psychosocial concerns include poor housing with limited storage space, anxiety regarding the ability to learn a new technique, the fear of undertaking dialysis at home and cognitive impairment.

There is some suggestion that the elderly are more likely to "crash land" onto dialysis. In other words, they present to a nephrologist late in the course of their disease affording minimal time for prognostic discussions and management planning. Roderick et al. conducted a retrospective study of 361 patients accepted for renal replacement therapy. Thirty-five percent were referred within 4 months of their needing to start dialysis and 23% within 1 month. These patients were found to be older and with more co-morbidity and had a high 6-month mortality rate [11]. Unfortunately, this group of patients is almost invariably commenced on hemodialysis and is likely to remain on this modality indefinitely.

Is Peritoneal Dialysis "Better"?

Over the past 30 years, numerous retrospective survival studies have been published comparing in-centre hemodialysis to peritoneal dialysis with variable and often conflicting results. Suffice to say; in the modern era survival is very comparable between the two modalities. However, we could, in this era of an ageing co-morbid population where prognosis in the elderly on ESRD is extremely poor, provocatively ask the question, who cares about length of survival [12]?

A large epidemiological study by Bloembergen et al. in 1995 paved the way for an overwhelming preference for hemodialysis as the dialysis modality of choice, particularly in the US population [13]. It was based on USRDS data and showed higher mortality rates in the PD population, particularly in older diabetics. Later work by Heaf et al. suggested that PD may confer an initial survival advantage which then resumes equality with hemodialysis after 2 years [14]. This has been explained by the preservation of residual renal function for longer in patients on peritoneal dialysis which in itself is known to confer survival benefits. Additional theories have stated that a "sicker" cohort of patients tend to be cordoned onto hemodialysis from the beginning. In other words, the initial survival advantage of PD is really the result of an accelerated early mortality on hemodialysis, especially in those starting with a venous catheter [15, 16].

These and other similar studies suffer from inherent methodological issues; conclusions are frequently based on complex statistics, subgroup analysis and are guilty of selection bias. It is considered impossible to conduct a randomized study on such an issue, and appropriately so. Patients value their autonomy and a decision regarding dialysis modality is clearly a personal and subjective one.

More recent work has focused specifically on elderly patients and attempts have been made to incorporate complex issues such as quality of life factors and examination of frailty. The North Thames dialysis study (NTDS) was the first prospective study looking at incident and prevalent elderly patients (over the age of 70) on dialysis. Mortality was not affected by dialysis modality and

adjusted analyses also showed no significant differences in quality of life between PD and HD patients [17].

In the Broadening Options for Long-term Dialysis in the Elderly (BOLDE) study, 140 prevalent dialysis patients aged 65 and over were recruited with the intention of determining quality of life (amongst other variables) in patients on peritoneal dialysis compared to hemodialysis. Fifty percent of the cross-sectional cohort was on peritoneal dialysis. Illness intrusion rating scores (IIRS) were significantly *lower* in the peritoneal dialysis group. The IIRS assesses the impact of chronic illness on 13 life domains including health, diet, active recreation, relationship with partner and family relations [4].

How Important Is Survival?

As we have transitioned into the next millennium, our attitudes regarding medical care have, rightly, become more patient-focused. This ethos is particularly apt in the context of our ageing and co-morbid population. One could question why survival in terms of mortality rates on dialysis matters and it is becoming evident that patients themselves often do not care about this metric at all. If a survival advantage *does* exist for hemodialysis, any extended survival is likely to be spent in the hemodialysis unit.

Contrary to what may historically have been important to physicians with regard to their patients, a study by Manns et al. in Canada sought to identify concerns and unanswered questions important to patients nearing or on dialysis and to their families. The top 10 questions included issues such as access to transplantation and how intractable itch can be treated. There was only one question pertaining to survival in relation to modality but this only made it to the top 30 and was in the context of quality of life improvements [18].

Ahmed et al. demonstrated that independence is greatly valued in the elderly population. Patients are willing to initiate dialysis therapy as long as independence is sustained and symptoms are alleviated [19].

What Are the Benefits of PD in the Elderly?

Arguably PD is the superior dialysis therapy for both the "fit" and the "frail" elderly patient. At the fitter end of the spectrum, PD enables easier travel and encourages independence whereas for frailer patients, assistance is becoming increasingly available. As described above, PD appears to have, at least, comparable survival rates compared to hemodialysis and offers quality of life benefits. Other potential benefits are discussed below.

No Dependence on Vascular Access

Vascular access is the Achilles heel of hemodialysis. There is a high rate of fistula maturation failure in the elderly. Consequently, there is a higher rate of central

venous catheter use which incurs issues with high infection risk and subsequent mortality [20]. A study by Perl et al. looked at mortality rates in hemodialysis versus peritoneal dialysis and found that mortality on hemodialysis was significantly worse in the 1st year when the patient had a central line as vascular access [15]. On the other hand, the frequently quoted mantra of "fistula first" may not always be appropriate in the elderly, and decisions regarding vascular access should be made on an individual patient basis.

Reduced Myocardial Stunning

Although cardiovascular related morbidity and mortality appear to be similar in hemodialysis and PD, there is evidence that PD is not associated with myocardial stunning [21]. In hemodialysis, hemodynamic changes can precipitate subclinical myocardial ischemia which negatively impacts morbidity. There is no evidence that this positively affects outcomes in PD as studies have been small and there are likely multiple conflicting and converging factors. However, at least in the elderly, the lack of regional wall motion abnormalities identified during PD may at least suggest that it is a more tolerable therapy for our frail elderly. The large swings in blood pressure and hemodynamic instability that are frequently experienced during a hemodialysis session are not usually an issue during the continuous and gentler nature of PD treatment.

This may also tie in to the evidence that "recovery time" after a conventional hemodialysis session (even for younger patients) may be as long as 6 h [22]. If travelling time to and from the hemodialysis unit 3 days a week is taken into consideration, it is understandable why conventional hemodialysis is associated with a greater degree of illness intrusion compared to PD.

Lower Incidence of De Novo Dementia

Similarly to cardiovascular disease, cerebrovascular disease and cognitive impairment is also more prevalent in the ESRD population compared to the general population. A large retrospective US cohort study by Wolfgram et al. evaluated the effect of initial dialysis modality on incidence of dementia. They found that patients who started RRT on PD had a 25% lower risk of acquiring a diagnosis of dementia compared to those on HD, despite adjusting for other risk factors/contributors such as age and diabetes [23]. Similarly to theories explaining myocardial stunning in hemodialysis, it has been postulated that the fluctuations in volume status and blood pressure that occur during HD can result in repeated episodes of cerebral ischemic injury.

There is also evidence that the incidence of subdural hematoma is higher in patients on hemodialysis which contributes to cerebrovascular morbidity and mortality [24].

Logistical Benefits

PD is a home-based therapy, meaning that there are few transportation costs. Additionally, for the elderly patient, travelling is frequently uncomfortable and time consuming.

Nutritional Benefits?

Nutrition is a vital component of a patient's well-being, particularly in the elderly dialysis patient. Malnutrition is common in dialysis patients and PD has some potential benefits with regard to this. Depending on the type of PD undertaken, the patient may absorb between 300 and 450 kcal per day via their dialysis. However, this may also be an undesirable effect for some resulting in unwanted weight gain [25].

A competing risk with the potential nutritional gain is the loss of protein that can occur via the dialysate. For example, APD has been shown to result in 10 g of protein loss each day [26]. Consequently, patients on PD are generally found to have lower serum albumin levels compared to patients on hemodialysis. Hypoalbuminemia has a striking correlation with mortality. However, a large cross-sectional study showed that the equivalent mortality risk in people on PD compared with HD occurred at different albumin thresholds; albumin levels were 0.2–0.3 g/dl lower in the PD patients [27].

PD solutions using amino acids instead of dextrose have been proposed as a treatment for protein malnutrition in PD patients. It is a 1.1% amino acid containing dialysate and has similar effective tonicity to a 1.5% glucose dialysis solution. It is most appropriately used for a 4–6 h dwell so could be used as part of a CAPD regimen or for the last fill/day dwell in APD. It has been shown to improve some nutritional markers but is most effective if the patient consumes calories whilst the fluid is indwelling. Since most malnutrition is the result of inflammation and not insufficient access to nutrients, the results have been disappointing. In addition, metabolic acidosis can supervene with potential catabolic effects [28].

Promoting PD in the Elderly

Many nephrology centres now pursue a multidisciplinary approach to patients who are predialysis but have progressively worsening renal function. This enables nonbiased information to be provided and patients given the opportunity to consider and decide upon dialysis versus nondialytic care and, if dialysis, home dialysis versus in-centre, and finally the dialysis modality. Peer support is also offered in some programs. The cognitive abilities of patients should be borne in mind during such discussions as well as the possible influence of uremia.

A retrospective study by Goovaerts et al. evaluated the influence of a predialysis education program on the mode of renal replacement therapy. This comprised talks from experienced nurses and the use of audiovisual tapes [29]. They found that a high percentage of patients opted for a self-care RRT modality following the education program [29].

Another study by Chanouzas et al. questioned 118 patients regarding the factors contributing to their choice of dialysis modality. It also highlighted that predialysis education encourages patients to choose self-care therapies. Furthermore, there was an overwhelming association of having a strong social support network and being functionally able, with choosing PD, emphasizing the need for assisted PD. The study helped to elucidate important factors for a dialysis education program

including good quality information provision, written and easy to understand information, an education day and sufficient time for decision making. The study also focused on the importance of lifestyle preservation and coping skills [30].

As discussed previously, "crash-landers" are invariably commenced onto hemodialysis. However, in centres with willing surgeons or nephrologists capable of inserting PD catheters, initiating emergency PD in these circumstances should not be discounted.

Training and Assessment of Older Patients

Careful assessment of the potential PD candidate is essential and includes psychological, social and cognitive assessment in addition to consideration of medical issues. The utilization of the multidisciplinary team is key and may include the skills and knowledge of a social worker, geriatrician and psychiatrist.

Psychosocial Barriers

Accommodation issues including limited storage space, financial problems, transport limitations and functional impairment such as impaired dexterity can all significantly impact choice of modality. It is important to appreciate how involved families are likely to be in the care of the patient.

Cognitive Barriers

This is a particularly important as it may impact on an individual's ability to perform PD independently and safely, to comply with therapy and also whether they will even tolerate dialysis at all.

A MOCA (Montreal Cognitive Assessment) is a simple tool that can be performed in 10 minutes and can provide a quick initial screening method [31].

Medical Barriers

Have been discussed previously in "patient contraindications."

Training the elderly patient may take more time than for younger patients. Trainers should aim to be flexible; shorter more frequent training sessions may be appropriate. Educational materials may require adaptation such as the use of larger fonts or pictures to explain procedures. Aids such as clamp adaptors for those with dexterity problems can prove helpful.

MATCH-D

The Method to Assess Treatment Choices for Home Dialysis (MATCH-D) was developed by the Medical Education Institute, Inc., for Home Dialysis Central (www.HomeDialysis.org) to help nephrologists and dialysis staffs identify and assess candidates for home dialysis therapies. It is a useful "checklist" or aide memoire to refer to when assessing a predialysis patient.

Method to Assess Treatment Choices for Home Dialysis (MATCH-D)

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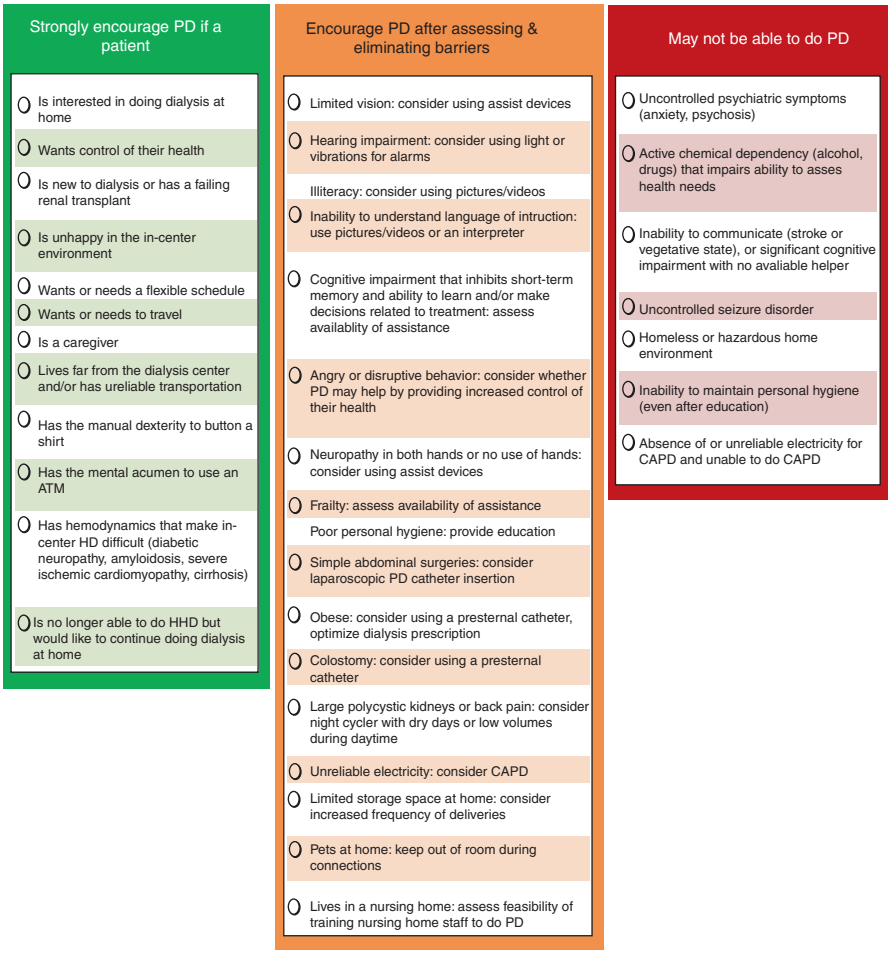

PD Catheter Insertion

In recent times, the options for peritoneal dialysis catheter placement have broadened. Depending on the centre, open surgical, peritoneoscopic, laparoscopic, fluoroscopic, or the percutaneous Seldinger approach of peritoneal catheter insertion may be employed.

In the elderly patient, PD catheter insertion is not an insignificant undertaking. The patient may be on antiplatelet medications or anticoagulants and is less likely to tolerate the often heavy duty bowel preparation.

Percutaneous approaches obviate the use of general anesthesia and the risks that this entails, particularly for the elderly morbid patient. In some centres, nephrologists are undertaking these procedures at the bedside which can markedly reduce wait times for catheter insertion. Clearly, a percutaneous bedside approach may not be suitable for all patients. For example, those with a history of lower abdominal surgery or significant obesity would be better served with catheter insertion under direct visualization.

Laparoscopic surgery affords additional benefits. It permits the ability for simultaneous omentopexy, rectus sheath tunneling and adhesiolysis for those patients with prior abdominal surgery to maximize catheter function potential.

A meta-analysis by Boujelbane reviewed 13 peritoneal dialysis access studies comparing surgical and percutaneous placement of PD catheters and found no significant difference between rates of catheter dysfunction or in 1-year catheter survival rates [33].

Additionally, the concept of buried PD catheters may be appropriately utilized in the elderly. This is a concept whereby the PD catheter is inserted in advance of clinical need and the external tubing is embedded under the skin in the subcutaneous space. This helps to minimize the risk of a last-minute hemodialysis catheter being placed in the event of a sudden and unexpected change in renal function. It also means that the patient does not necessarily have to commence PD using low volumes as is often the case if the catheter has only just been inserted. However, especially in the elderly population, there may be a measurable number of futile placements, where the patient dies before ever needing dialysis [34].

Specific Considerations in the Elderly: Dialysis Modifications

Unfortunately, an elderly patient with ESRD on dialysis has a fairly dismal prognosis with USRDS data showing that the adjusted survival rate for patients greater than 75 years is 62.5% at 1 year and 17.1% at 5 years [1].

The Aim of PD in the Elderly Should Be Within the Remit of the Individual Patient's Goals of Care

Many of the dialysis guidelines and protocols we work towards in general may not be appropriate for the elderly patient. Parameters such as blood pressure recommendations and dialysis adequacy markers such as Kt/V_{urea} were formulated based on younger cohorts and their relevance and applicability for the elderly is questionable.

Dialysis modifications to consider in the elderly include:

Delayed Start of Dialysis Initiation

There is no good evidence to dictate the optimal dialysis initiation time in the elderly.

Anemia, volume overload and metabolic acidosis can be managed with erythropoietin stimulating agents (ESA's), judicious use of diuretics, salt restriction and sodium bicarbonate before dialysis is commenced.

A prospective study from the NECOSAD group looked at the association between the timing of dialysis initiation and the effect on survival [35]. Thirty-seven percent of the 253 patients started dialysis later than US guidelines advise. Timely starters had a small survival benefit after 3 years on dialysis; however, this was thought to be a reflection of lead time bias rather than a clear survival advantage.

Continuous Automated Peritoneal Dialysis (CAPD) v Automated Peritoneal Dialysis (APD)

The decision regarding whether to opt for CAPD or APD is ultimately patient preference. However, the decision may also be reliant on what assistance is available in the community (see Table 12.1).

Minimizing the Dialysis Prescription

The concept of incremental peritoneal dialysis is gaining momentum in the general dialysis population. It describes the gradual up titration of the dialysis prescription as residual kidney function (RKF) declines over time.

In a not dissimilar fashion, the elderly frail patient may often "get away" with a fairly minimal PD prescription. The elderly may be nutritionally challenged, of low muscle mass and have minimal energy expenditure. Their urea removal and ultrafiltration requirements may not be high and the patient can therefore achieve symptom benefit with fewer hours on dialysis and/or fewer exchanges but with some preservation of quality of life [36].

Table 12.1 Summary Table [32]

	PD advantages	PD disadvantages
Medical	Better preservation of residual kidney function Gentle treatment modality—avoids hemodynamic compromise → potentially less myocardial and cerebral stunning Vascular access not required	Risk of peritonitis, exit site infection, membrane failure Requires surgical procedure to insert PD catheter Inability to "fine tune" fluid removal, particularly in the anuric patient Risk of technique failure
Psychosocial	Performed at home—by patient, family member or nursing staff Less disruption to day-to-day life; particularly for frail patients with cognitive impairment Can continue to travel and engage in social activities Enables treatment flexibility—incremental dialysis, CAPD v APD, days off can be negotiated Avoids long, expensive, uncomfortable travel Fewer hospital visits	Reliance on family, caregivers or nurses to perform dialysis in many cases Treatment burden Less contact with medical staff Home storage space required May promote social isolation and dependence

Indeed as time goes by and the patient ages further, there may be the possibility of reducing dialysis complexity and hours further. The over-riding intention should be effective symptom control rather than a desire to achieve a certain Kt/V_{urea}.

For example, the elderly patient with cardio renal syndrome and resistance to large diuretic doses may benefit from CAPD with two exchanges of icodextrin over each 24 h period. There may also be a case for scheduling a "day off" intermittently in order to provide respite.

Assisted PD

Many older patients are simply not candidates for self-care or autonomous home-based dialysis and multiple studies have highlighted the benefits and successes of assisted peritoneal dialysis.

Assisted PD is available in parts of Europe, Canada and Australasia using health-care workers and also in the Middle East and Asian countries where help is provided by family members. In Canada, assisted APD or CCPD is generally offered and in France, the modality is usually CAPD. In the United States, assisted PD is not reimbursed.

In France, the elderly have been treated with assisted PD for more than a decade. The recent Frail Elderly Patient Outcomes on Dialysis (FEPOD) study suggested that quality of life is similar on assisted PD and in-centre hemodialysis although treatment satisfaction was higher on assisted PD [37]. The French experience also suggests that the cost of assisted PD is equal or even less expensive to that of in-centre hemodialysis. In France, registry data shows that in patients over the age of 75, the median survival for those requiring nursing assistance was 24 months which is similar to that in many parts of the world (the majority of whom would be on hemodialysis) [38].

APD is the most suited PD modality for the elderly requiring assistance as the home care nurse will need to attend the home just once or twice per day. Adequate training is clearly crucial and 24 h back-up from a medical centre is needed.

In France, private nurses provide care for those patients on assisted PD and they are seen by a nephrologist in a clinic every 8 weeks where the PD prescription is reviewed. The private nurses can send patients to the nephrologist on duty whenever necessary. Assisted CAPD is the norm but more places are beginning to offer assisted APD. In the 2010 report from the French Peritoneal Dialysis Registry (RDPLF), 76% of French PD patients over the age of 75 were on assisted PD. The median patient survival was 27.1 months, the median technique survival was 21.4 months and the median peritonitis free survival was 32.1 months [6].

Telemedicine is a growing area that could prove particularly useful in the management of elderly patients. More sophisticated systems including video conferencing and the ability to monitor patients' blood pressure, weight and ultrafiltration rate have been developed. Certain PD machines have programmable data cards—prescribed treatment details can be programmed onto this and data from each

dialysis session can be captured. A health professional can access this remotely by modem/broadband; alternatively, the data can be accessed via a disc.

PD in the Nursing Home

PD is particularly appropriate for nursing home patients. The overnight cycler can be utilized and the patient then has time free in the day to partake in activities.

Potential Complications of PD

Peritonitis

Peritonitis is a serious complication of PD. However, it carries less morbidity compared to hemodialysis related central line infections. Studies regarding PD peritonitis in the elderly have revealed mixed findings. Overall, the risk of peritonitis does not appear to be increased in the elderly. For example, RDPLF data shows that the overall risk of peritonitis was not increased in the elderly and actually even lower in older patients compared to younger counterparts in those who have nursing assistance. However, there is evidence that elderly patients have higher short-term mortality rates and, in some cases, higher rates of relapsing peritonitis [39, 40].

Data was analyzed by Nessim et al. from the Baxter POET (Peritonitis Organism Exit Sites Tunnel Infections) database. Age was not associated with peritonitis among patients initiating PD between 2001 and 2005 [41].

Treatment should follow the International Society for Peritoneal Dialysis (ISPD) guidelines. However, antibiotic dosing may require specific attention particularly in frail elderly patients and a conscious observation for antibiotic-related side effects which may be more prevalent and more problematic in this population.

Of note, there is an association between peritonitis due to enteric organisms and severe constipation which is particularly common in older patients.

Exit Site Infections

This is another recognized complication that should be monitored and treated. However, a study by Szeto found that there appears to be a lower risk of exit site infections in the elderly than in younger patients. Whether this is related to fewer PD exchanges and therefore fewer connections and disconnections each day, or the result of reduced physical activity, is unclear [42].

Technique Survival

Observational studies vary in their assessment of this; some work has suggested an increased risk of transfer to hemodialysis in older adults whereas other studies found a reduced risk with increasing age [43]. On the one hand, one could theorize that the elderly are more likely to incur a change in health status necessitating a switch whereas on the other hand, arguably, the elderly are less likely to run into issues such as membrane failure due to their shorter expected duration on dialysis.

However, for patients who do require transfer to hemodialysis, there is evidence that this carries significant risk. The transfer may be due to modality related issues such as refractory peritonitis or patient factors such as change in health or social circumstance such as loss of housing. Additionally, transfer to HD as an emergency will likely involve hospitalization and central venous access and the risk that this entails.

Nutrition

Gastrointestinal symptoms are particularly prevalent in PD patients in comparison to age matched controls and also compared to patients on hemodialysis. This can further impact on the inability to reach nutrition targets. For example, they experience more dyspepsia, bloating and early satiety.

Contributing to the nutritional concerns for the elderly on PD are socioeconomic factors which may impede access to food and food preparation. However, in this scenario the absorbed calories from the PD solutions may be beneficial.

A significant proportion of the elderly on PD also have diabetes. The dextrose containing dialysis solutions frequently lead to increased blood glucose concentrations. To complicate this issue the action of hypoglycemic agents and insulin is likely to be prolonged in patients on dialysis [25].

Palliative Care in Peritoneal Dialysis

As expressed by Kidney Disease Improving Global Outcomes (KDIGO); (Controversies Conference on palliative care in Chronic Kidney Disease Populations): “the need for supportive care for kidney patients is equal to that for cancer patients and should be available based on need, not prognosis for patients at any stage of kidney disease” [44].

This statement is probably particularly pertinent for the elderly patient on dialysis who is more likely to experience multisymptom burden.

The BOLDE study showed that the median number of symptoms for patients on PD over the age of 65 was almost 9 [4]. Dialysis physicians should be particularly mindful of this and routinely enquire about symptoms [4].

Goals of care discussions and prognostication with patients and their families are critical to ensure optimal care for the elderly patient. This enables realistic and sensible decision making for the future. Prognostic scores are available to aid these frequently challenging consultations.

It is paramount for physicians to appreciate that one size does not fit all; each individual comes with their own collection of experiences, religious, and cultural beliefs. Much of the palliative care literature focuses on patient autonomy; shared decision making and honesty. There are many parts of the world where families take the burden of bad news, thus protecting their family member/patient from the grim reality. Empathy with these and other such ideals should be strived for. Many prognostication scores have been developed in the hemodialysis population but are likely to hold relevance in peritoneal dialysis too. However, studies have demonstrated that patients generally feel that advanced care planning is important [45, 46].

As the end of life approaches, decisions need to be made regarding continuation of dialysis. If dialysis is chosen to be continued, the focus should centre on symptom control as previously discussed. Other measures that can help alleviate burden for patients are to tolerate hypertension in order to avoid symptoms of low blood pressure and also to prevent the adverse effects of polypharmacy. Laboratory monitoring is not always necessary, particularly if it will not affect therapy and also a removal in dietary restrictions can enhance quality of life.

Conclusion

Our dialysis population is ageing. This fact has opened up new challenges for the nephrologist. In most countries, elderly people who start RRT are more likely to be commenced on hemodialysis rather than peritoneal dialysis. However, PD can offer unique benefits. Crucially, it is a home therapy permitting continued independence and can be "tailored" according to an individual's needs and treatment goals. Additionally, some countries such as France and Canada offer successful assisted PD programs to support even very frail patients at home.

Despite this, the number of elderly patients on PD in general remains low, which may be due to a combination of factors including health policy, physician bias, and perceived medical or psychosocial barriers. However, PD offers similar survival and quality of life benefits compared to HD with no dependence on vascular access. There may also be additional medical benefits such as less myocardial stunning compared to HD and potential nutritional advantages.

The use of multidisciplinary predialysis programs is vital to ensure that patients and their families receive balanced and relevant information in order to make informed choices about their care. It is also imperative that the necessary long-term support is available to enable elderly patients to pursue PD confidently.

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