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Peritoneal dialysis: an underutilized modality

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Purpose of review

There have been differential changes in outcomes of patients treated with in-center hemodialysis and peritoneal dialysis. In light of these changes, providers and practices should reevaluate the utilization of peritoneal dialysis.

Recent findings

Accumulating evidence confirms that the present distribution of dialysis modality in the United States does not reflect patient choice. Furthermore, in most recent cohorts, the 5-year adjusted survival of patients treated with hemodialysis and peritoneal dialysis is remarkably similar (35 and 33% respectively). Similar results have been reported from Canada, Australia, and New Zealand. Moreover, health-related quality of life of peritoneal dialysis patients are no different from that reported by those treated with nocturnal hemodialysis. Finally, an expansion of use of peritoneal dialysis for the treatment of end-stage renal disease makes economic sense for the taxpayers – the payors for dialysis services.

Summary

The improvement in outcomes of peritoneal dialysis patients makes a compelling argument for the expansion of the use of the therapy for the treatment of end-stage renal disease in the United States. We think that 20–40% of patients can be treated with peritoneal dialysis. However, any expansion in use should be done gradually and should include training healthcare providers while continuously monitoring patient outcomes.

Keywords

end-stage renal disease, hemodialysis, mortality, peritoneal dialysis, renal replacement therapy, utilization

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Introduction

Even though the incidence rate of end-stage renal disease (ESRD) in the United States has plateaued, ongoing population growth is anticipated to result in an ever-increasing number of Americans with ESRD [1]. Furthermore, the availability of organ donors has not kept pace with the growth of the ESRD population. Hence, a larger number of even patients medically eligible for renal transplantation will need to be treated with dialysis for longer periods of time. Furthermore, a significant proportion of patients are not medically eligible to undergo renal transplantation; these patients will undergo dialysis therapy for their remaining lifetime. At this time, over 90% of dialysis patients in the United States are treated with in-center hemodialysis; the overwhelming majority of the remainder are treated with home peritoneal dialysis [1]. The utilization of peritoneal dialysis in the United States is substantially lower than in other countries in North America (Canada and Mexico), western Europe (viz. United Kingdom, Netherlands, Belgium, Sweden,

Denmark, Finland, Iceland), and Oceania (Australia and New Zealand) [1]. In this review, we will present recently available data that support expanding the use of peritoneal dialysis for the treatment of ESRD in the United States.

Current take-up of peritoneal dialysis in the United States does not reflect patient choice

It is often argued that the dialysis population in the United States has become simply too old and sick to dialyze at home [2]. However, the average age of new dialysis patients in the United States in 2002–2003 was only 1.5 years older than in 1996–1997, the proportion of diabetics was unchanged (45.5 vs. 45.0%), as was the prevalence of other coexisting illnesses [3]. Yet, peritoneal dialysis take-up decreased by almost 35% [3]. Consistent with these observations, several studies from different parts of the world have shown that more than three-quarters of new patients starting dialysis do not have any medical or social contraindications to peritoneal

dialysis. These findings have been confirmed by a recent study that examined medical and psychosocial eligibility of 1303 patients in seven North American centers at an average estimated glomerular filtration rate of 24 ml/min/1.73 m² [4[•]]. On the basis of the assessment of different members of the healthcare team, 87% of these patients had no medical contraindications, 83% had no psychosocial contraindications, and 78% had neither medical nor psychosocial contraindications for peritoneal dialysis [4[•]].

The argument that often follows is that even though patients can dialyze at home they simply do not want to. However, this is also not supported by patient surveys. In a survey of 428 patients new to dialysis in ESRD Network 18 over a 2-month period, two-thirds reported that peritoneal dialysis was not offered as a method of treatment [5]. There was no relationship between the medical conditions of the patients and the probability of peritoneal dialysis being offered; among patients who had been seeing a nephrologist for over a year, less than one-half reported that peritoneal dialysis was offered as a method of renal replacement therapy [5]. A recent report confirms that 81–87% of patients with advanced chronic kidney disease in the United States are simply unaware of the possibility of dialyzing at home [6].

There is a large body of data, some of which has been discussed earlier, that allows one to reach the conclusion that the barriers to peritoneal dialysis are nonmedical. Furthermore, these barriers lie within the healthcare system, and the peritoneal dialysis take-up rate does not reflect patient choice. As eloquently opined recently by Blake 'It seems reasonable to conclude, therefore, that the asymmetric modality distributions seen in many countries reflect an absence of true patient free choice. Peritoneal dialysis utilization rates over 40%, and under 15% are both suggestive of such a situation [7].'

Five-year survival of dialysis patients is similar for in-center hemodialysis and peritoneal dialysis in most recent cohorts

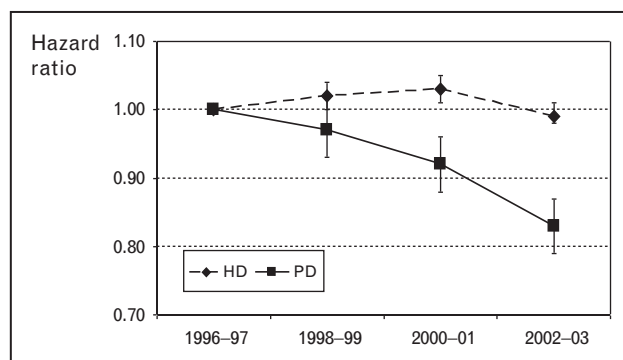
Ever since peritoneal dialysis was introduced as a viable therapy for long-term replacement of renal function, researchers have been interested in comparing the survival achieved with this therapy with that achieved with in-center hemodialysis. In the 1990s and early 2000s, single center studies were supplanted either by prospective, cohort studies or comparisons using data from national registries [8]. Even though the results of individual studies varied, it allowed us to conclude the following – the relative risk for death for patients treated with hemodialysis and peritoneal dialysis varies over time, and the difference in outcomes is determined by patient age, diabetic status, and coexisting illnesses [8]. Thus, patients treated with peritoneal dialysis have lower

risk for death early during the course of ESRD; the healthier the patient, the greater the apparent survival advantage [8]. However, several studies have raised concern of a higher long-term risk for death for patients treated with peritoneal dialysis [9,10].

However, the outcomes have not remained static over time. Analysis of the data from the United States Renal Data System shows that over an 8-year period starting from 1996, there has been no significant change in the 1-year mortality of patients treated with hemodialysis. In contrast, among patients who started peritoneal dialysis in 2002–2003, the risk for death or transfer to hemodialysis during the first year decreased by 17%, compared with 1996–1997 (Fig. 1) [3]. Subsequent studies have shown significant improvements in long-term outcomes of peritoneal dialysis patients as well [11^{••}]. This observation of differential changes in outcomes of two therapies suggests that most of the published intermodality comparisons may not be relevant to today's practice. Only six studies have included patients who were new to dialysis after 2000 (Yeates K, personal communication) [12,13^{••},14[•],15,16] – only four of these either examined secular trends or reported results from most recent cohorts and will be briefly discussed herein [12,13^{••},14[•]].

As would be expected from the differential change in outcomes over time for patients treated with hemodialysis and peritoneal dialysis, the difference in the 5-year survival for patients treated with the two modalities in the United States has gradually narrowed [12]. Indeed, for patients who started dialysis in 2002–2004, there was no

Figure 1 Hazard ratios for incident hemodialysis and peritoneal dialysis patients either to die or to transfer to hemodialysis during the first 12 months



Using 1996 to 1997 as the reference period and adjusting for demographics, case-mix, and laboratory data, the hazard ratios (confidence interval) for patients who started hemodialysis were 1.02 (1.00 to 1.04) from 1998 to 1999; 1.03 (1.01 to 1.05) from 2000 to 2001; and 0.99 (0.98 to 1.01) from 2002 to 2003. The corresponding hazards ratio for patients who started peritoneal dialysis were 0.97 (0.93 to 1.02) from 1998 to 1999; 0.92 (0.88 to 0.96) from 2000 to 2001; and 0.83 (0.79 to 0.87) from 2002 to 2003. HD, hemodialysis; PD, peritoneal dialysis. Reproduced with permission from [8].

significant difference in the 5-year adjusted survival of hemodialysis and peritoneal dialysis patients (35 and 33% respectively) [12]. Put differently, during this period, there was no difference in the median life expectancy of patients treated with hemodialysis or peritoneal dialysis (38.4 and 36.6 months respectively) [12]. Consistent with these observations, there was no significant difference in the mortality of 6337 pairs of propensity-score matched patients in the United States who started treatment with hemodialysis and peritoneal dialysis in 2003 [adjusted hazard ratio, 1.05 (0.96, 1.16)] [13^{••}]; there was no difference in the adjusted 4-year mortality of patients treated with either dialysis modality. These observations are not unique to the United States. Similar trends have also been reported from Canada – there is no difference in adjusted 5-year survival of patients who started treatment there between 2001 and 2004 (Yeates K, personal communication). Finally, similar results have been reported from Australia and New Zealand [14[•]]. This may appear to contradict the conclusions of the three recent publications from Oceania wherein the investigators reported a higher risk for all-cause mortality, infection-related, and cardiovascular mortality for patients treated with peritoneal dialysis [14[•],17,18]. However, the authors did not take into account the differential change in outcomes with the two therapies. The analysis of all-cause mortality included patients from 1991–2005, of infection-related mortality included patients from 1995–2005, and of cardiovascular mortality included patients from 1997–2007. When the outcomes were compared by the year of incidence, there was no difference in the all-cause mortality of hemodialysis and peritoneal dialysis patients who started treatment in 2004 [14[•]].

Thus, in the most recent cohorts, the longer term outcomes of hemodialysis and peritoneal dialysis patients are remarkably similar. It is often argued that this is a result of more selective assignment of patients to peritoneal dialysis than was done in the 1990s. Epidemiologic studies cannot exclude this possibility. However, it is our opinion it is unlikely to be the case for two reasons. First, more care in selecting patients for peritoneal dialysis presupposes that the therapy is considered and offered to over three-quarter of patients who are deemed medically and psychosocially eligible for peritoneal dialysis. It is evident that this is not the case – an overwhelming majority of patients are not aware of the possibility of using peritoneal dialysis. Second, the similarity in outcomes with the two dialysis therapies is seen in populations with three different take-up rates for peritoneal dialysis – United States (7%), Canada (18%), and Australia and New Zealand (24%). The similarity in risk for death between patients treated with the two therapies makes a strong case for expanding the use of peritoneal dialysis in the United States.

Home hemodialysis and peritoneal dialysis patients report similar health-related quality of life

ESRD is a chronic illness with a profound impact on the health-related quality of life. The quality of life is as important as the quantity of life and, hence, how dialysis modalities affect health-related quality of life is as relevant. A patient's report of quality of life is determined by their expectations and it is not surprising that most studies have been unable to demonstrate any difference in the health-related quality of life of in-center hemodialysis and peritoneal dialysis patients. In recent years, home hemodialysis has attracted a lot of attention and in a recent study investigators from Toronto compared the health-related quality of life of patients treated with peritoneal dialysis and nocturnal hemodialysis. There was no significant difference in the kidney disease component summary, physical component summary, mental component summary and depression between the two groups. However, the peritoneal dialysis patients experienced more social support than home hemodialysis [19]. Although we await the results of the Frequent Hemodialysis Network trial on the effects of more frequent hemodialysis on physical health of patients, data to date suggests that the dialysis modality (peritoneal dialysis or nocturnal hemodialysis) does not seem to affect the health-related quality of life of patients who dialyze at home.

Use of peritoneal dialysis can be expanded by assisted peritoneal dialysis

Even though the decline in peritoneal dialysis take-up cannot be explained by the ageing of the dialysis population, the absolute number of older patients continues to grow. Older individuals are more likely to be frail and have medical and social conditions that are potential barriers to self-care peritoneal dialysis [20]. It is not surprising then that peritoneal dialysis take-up declines significantly with advancing age of patient. Several reports from around the world (Denmark, Canada, and France) have reported their experience with assisted peritoneal dialysis – where the therapy was performed with the assistance of either a visiting nurse or a family member [20–22]. In studies from Canada, family support was associated with an increase in peritoneal dialysis eligibility from 63 to 80%, and an increase in peritoneal dialysis utilization from 23 to 39% among patients who had a barrier to self-care peritoneal dialysis [23]. Furthermore, assisted peritoneal dialysis can be used safely in elderly patients referred late and in whom the start of dialysis was unplanned [21]. A significant minority of patients who started assisted peritoneal dialysis graduated to self-care peritoneal dialysis after the first few months [20].

France may be the only country in the world where peritoneal dialysis patients are older and sicker than those treated with hemodialysis. This is a result of the availability of reimbursement for visiting nurses to support assisted peritoneal dialysis, independent of the reimbursement for dialysis services [22]. It is not surprising then that between 2000 and 2004, 22% of peritoneal dialysis was assisted – 14% assisted by a visiting nurse and 8% by family members [22]. The adjusted peritonitis rate was significantly higher when assistance was provided by a visiting nurse – however, additional training of the nurses mitigated this difference [22].

These reports suggest that eligibility of peritoneal dialysis can be expanded by the use of assisted peritoneal dialysis. It is possible that changes in the reimbursement schemes in the United States, with the advent of bundling, may make assisted peritoneal dialysis financially viable in the United States. However, it is unlikely to find widespread application but might still be appropriate in some integrated healthcare systems.

In developed countries, a greater use of peritoneal dialysis makes economic sense

The initial capital investment and ongoing manpower costs contribute significantly to the overall costs of providing in-center hemodialysis [24]. On the contrary, the manpower costs are lower for peritoneal dialysis; the costs of the therapy are driven by the need to provide sterile solutions. In developed countries, where manpower costs are high, the total costs of hemodialysis have consistently been shown to be significantly higher than for peritoneal dialysis [24]. In a systematic review, the cost-ratio of hemodialysis to peritoneal dialysis in the United States has been estimated to range between 1.20 and 1.52 [24]. In contrast, in many developing countries, manpower costs are considerably lower and the cost of importing peritoneal dialysis fluids is significantly greater. This makes peritoneal dialysis more expensive in many developing countries [24].

In the United States, ESRD patients constitute a little over 1% of the Medicare population in 2007 but accounted for 5.8% of the total expenditure [1]. Despite the lower costs of peritoneal dialysis, the Centers for Medicare and Medicaid Services (CMS) provide identical reimbursement for provision of both hemodialysis and peritoneal dialysis. Lower costs for peritoneal dialysis but similar reimbursement as for hemodialysis is a way that CMS has sought to incentivize a greater use of peritoneal dialysis by increasing the potential profitability of the therapy for providers. However, to date, injectables have been reimbursed for separately and are used

substantially more in hemodialysis patients. This higher revenue for hemodialysis patients more than compensates the larger profitability from lower dialysis costs for peritoneal dialysis. In 2007, the annual Medicare payments for hemodialysis patients are about \$20 000 higher than for peritoneal dialysis patients. Even when considering the higher risk of peritoneal dialysis patients to change dialysis modality, the per patient per year Medicare payments are considerably lower for patients who begin treatment with peritoneal dialysis [25]. With that as background, we are on the cusp of a major change in reimbursement patterns in the United States. The new ‘bundling’ rules are anticipated to provide similar total reimbursement for hemodialysis and peritoneal dialysis patients for the provision of dialysis as well as injectables. Hence, lower direct costs of the therapy as well as lower injectable use may make peritoneal dialysis more profitable.

Conclusion

We have provided evidence to support the argument that the current peritoneal dialysis take-up rates do not reflect patient choice and are likely to be a result of breakdown in the systems of care around the time of initiation of dialysis. A greater use of peritoneal dialysis for the treatment of ESRD makes economic sense both for the tax payers – the payors of healthcare – and with upcoming changes in reimbursement patterns, for healthcare providers. In the most recent cohorts, the 5-year adjusted survival of hemodialysis and peritoneal dialysis patients are remarkably similar. These and other arguments presented herein make a case for a more balanced, uniform, and, most importantly, consistent approach to the dialysis modality education for patients with advanced chronic kidney disease. If high-quality dialysis modality education is made more widely and universally available, an increase in use of home dialysis, including peritoneal dialysis, will inevitably follow. In our opinion, with this approach, peritoneal dialysis use could be safely expanded for the care of 20–40% of all dialysis patients in the United States. Achieving this would result in considerable savings for the taxpayers without compromising patient outcomes. However, this expansion in peritoneal dialysis use should be accompanied by adequate training of the nephrology task force and careful monitoring of patient outcomes.

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References and recommended reading

Papers of particular interest, published within the annual period of review, have been highlighted as:

- of special interest
- of outstanding interest

Additional references related to this topic can also be found in the Current World Literature section in this issue (pp. 607–608).

- 1 U.S. Renal Data System, USRDS 2009 Annual Data Report: Atlas of Chronic Kidney Disease and End-Stage Renal Disease in the United States. Bethesda, Maryland: National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases. 2009.
- 2 Blake PG, Finkelstein FO. Why is the proportion of patients doing peritoneal dialysis declining in North America? *Perit Dial Int* 2001; 21:107–114.
- 3 Mehrotra R, Kermah D, Fried L, *et al.* Chronic peritoneal dialysis in the United States: declining utilization despite improving outcomes. *J Am Soc Nephrol* 2007; 18:2781–2788.
- 4 Mendelssohn DC, Mujais SK, Soroka SD, *et al.* A prospective evaluation of renal replacement therapy modality eligibility. *Nephrol Dial Transplant* 2009; 24:555–561.

In this study, attending nephrologists and other members of the healthcare team in seven practices in United States and Canada were asked to assess the eligibility for each of the three major modalities for renal replacement therapy (hemodialysis, peritoneal dialysis, and renal transplantation) for predialysis patients with stage 3 to 5 chronic kidney disease. A total of 1303 patients were assessed for their medical and psychosocial eligibility – 78% of these patients had neither medical nor psychosocial contraindications to peritoneal dialysis.

5 Mehrotra R, Marsh D, Vonesh E, *et al.* Patient education and access of ESRD patients to renal replacement therapies beyond in-center hemodialysis. *Kidney Int* 2005; 68:378–390.

6 Finkelstein FO, Story K, Firanek C, *et al.* Perceived knowledge among patients cared for by nephrologists about chronic kidney disease and end-stage renal disease therapies. *Kidney Int* 2008; 74:1178–1184.

7 Blake PG. Free modality choice: aspiration or illusion? Introduction. *Perit Dial Int* 2009; 29:133–134.

8 Khawar O, Kalantar-Zadeh K, Lo WK, *et al.* Is the declining use of long-term peritoneal dialysis justified by outcome data? *Clin J Am Soc Nephrol* 2007; 2:1317–1328.

9 Termorshuizen F, Korevaar JC, Dekker FW, *et al.* Hemodialysis and peritoneal dialysis: comparison of adjusted mortality rates according to the duration of dialysis: analysis of The Netherlands Cooperative Study on the Adequacy of Dialysis 2. *J Am Soc Nephrol* 2003; 14:2851–2860.

10 Jaar BG, Coresh J, Plantinga LC, *et al.* Comparing the risk for death with peritoneal dialysis and hemodialysis in a national cohort of patients with chronic kidney disease. *Ann Intern Med* 2005; 143:174–183.

11 Mehrotra R, Chiu YW, Kalantar-Zadeh K, Vonesh E. The outcomes of continuous ambulatory and automated peritoneal dialysis are similar. *Kidney Int* 2009; 76:97–107.

In this study, the outcomes of 66381 patients who were undergoing peritoneal dialysis on day 90 of ESRD in the United States between 1996 and 2004 was evaluated. For patients who started treatment in 2002–2004, the risk for death and transfer to hemodialysis were 45 and 38% lower, respectively, when compared with patients who started treatment between 1996 and 1998.

12 Mehrotra R, Chiu YW, Kalantar-Zadeh K, *et al.* Hemodialysis and peritoneal dialysis are associated with similar outcomes for end-stage renal disease treatment in United States. *Arch Intern Med* (in press).

13 Weinhandl ED, Foley RN, Gilbertson DT, *et al.* Propensity-matched mortality •• comparison of incident hemodialysis and peritoneal dialysis patients. *J Am Soc Nephrol* 2010; 21:499–506.

From among the 98875 adults who first initiated dialysis therapy during 2003, investigators identified 6337 pairs of hemodialysis and peritoneal dialysis patients, matched by propensity scores. Using an intent-to-treat analysis, patients who started with peritoneal dialysis on day 0 of ESRD, had an 8% lower risk for death, compared with those who started treatment with hemodialysis. The adjusted 4-year survival of incident hemodialysis and peritoneal dialysis patients was 48 and 47% respectively ($P=0.50$).

14 McDonald SP, Marshall MR, Johnson DW, Polkinghorne KR. Relationship • between dialysis modality and mortality. *J Am Soc Nephrol* 2009; 20:155–163.

The investigators compare the outcomes of patients treated with hemodialysis or peritoneal dialysis from among the 25287 who started dialysis therapy between 1991 and 2005 and were still undergoing treatment on day 90 of ESRD. They reported a higher 2-year mortality among patients treated with peritoneal dialysis in the entire cohort. However, in a sub-group analysis, a progressive improvement in outcomes with peritoneal dialysis were noted, and for patients who started treatment in 2004 there was no difference in the mortality rates between patients treated with the two dialysis modalities.

15 Liem YS, Wong JB, Hunink MG, *et al.* Comparison of hemodialysis and peritoneal dialysis survival in The Netherlands. *Kidney Int* 2007; 71:153–158.

16 Huang CC, Cheng KF, Wu HD. Survival analysis: comparing peritoneal dialysis and hemodialysis in Taiwan. *Perit Dial Int* 2008; 28 (Suppl 3):S15–S20.

17 Johnson DW, Dent H, Hawley CM, *et al.* Associations of dialysis modality and infectious mortality in incident dialysis patients in Australia and New Zealand. *Am J Kidney Dis* 2009; 53:290–297.

18 Johnson DW, Dent H, Hawley CM, *et al.* Association of dialysis modality and cardiovascular mortality in incident dialysis patients. *Clin J Am Soc Nephrol* 2009; 4:1620–1628.

19 Fong E, Bargman JM, Chan CT. Cross-sectional comparison of quality of life and illness intrusiveness in patients who are treated with nocturnal home hemodialysis versus peritoneal dialysis. *Int J Nurs Stud* 2007; 2:1195–1200.

20 Oliver MJ, Quinn RR, Richardson EP, *et al.* Home care assistance and the utilization of peritoneal dialysis. *Kidney Int* 2007; 71:673–678.

21 Povlsen JV. Unplanned start on assisted peritoneal dialysis. *Contrib Nephrol* 2009; 163:261–263.

22 Verger C, Duman M, Durand PY, *et al.* Influence of autonomy and type of home assistance on the prevention of peritonitis in assisted automated peritoneal dialysis patients. An analysis of data from the French Language Peritoneal Dialysis Registry. *Nephrol Dial Transplant* 2007; 22:1218–1223.

23 Oliver MJ, Garg AX, Blake PG, *et al.* Impact of contraindications, barriers to self-care and support on incident peritoneal dialysis utilization. *Nephrol Dial Transplant* 2010 [Epub ahead of print].

24 Just PM, Riella MC, Tschosik EA, *et al.* Economic evaluations of dialysis treatment modalities. *Health Policy (Amsterdam, Netherlands)* 2008; 86:163–180.

25 Shih YC, Guo A, Just PM, Mujais S. Impact of initial dialysis modality and modality switches on Medicare expenditures of end-stage renal disease patients. *Kidney Int* 2005; 68:319–329.