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Update on Peritoneal Dialysis: Core Curriculum 2016

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Peritoneal dialysis (PD) is the major established form of renal replacement therapy that is performed primarily at home. Until recently, the prevalent rate of PD patients in the United States was declining, reaching a low of 6.9% in 2009. Since then, there has been a striking increase in PD use, with a prevalence rate of 9.7% in 2014. Consequently, since the original Core Curriculum on PD (from Teitelbaum and Burkart) was published in 2003, there has been a commensurate growth in information on the subject. This update focuses on relevant topics in the field, as outlined in Box 1.

EPIDEMIOLOGY

The number of patients treated with PD in the United States has been on the increase. This is largely due to the bundled payment system, which was introduced in 2011. PD is more cost-effective than in-center hemodialysis (HD), particularly after startup costs are absorbed. Comparing the first quarter of 2010 and the fourth quarter of 2012, prevalent counts of patients treated by PD increased by 24% (see PD prevalence in Fig 1); the corresponding increase in HD patients was only 9.6%. In the 2-year period before this, PD prevalence had remained essentially flat. PD incidence rates have also increased; between December 2010 and 2012, the PD incidence rate increased 22%, whereas the HD incidence rate decreased 2%. Declining overall dialysis rates may be due to improved care for chronic kidney disease, whereas higher PD use may be due to improved efforts in patient and provider education, as well as the mentioned economic incentives.

In 2011, total Medicare expenses for PD and HD patients increased 14.7% and 2.5%, respectively. Despite this, the per-patient expense remained lower for PD than HD, at $71,630 versus $87,945.

Additional Readings

» Collins AJ, Foley RN, Chavers B, et al. US Renal Data System 2013 annual data report. *Am J Kidney Dis.* 2014;63(1)(suppl 1):e1-e420.
» Hirth RA, Turenne MN, Wheeler JR, et al. The initial impact of Medicare's new prospective payment system for kidney dialysis. *Am J Kidney Dis.* 2013;62(4):662-669.
» Saran R, Li Y, Robinson B, et al. US Renal Data System 2014 annual data report: epidemiology of kidney disease in the United States. *Am J Kidney Dis.* 2015;66(1)(suppl 1):S1-S306.
» Teitelbaum I, Burkart J. Peritoneal Dialysis. *Am J Kidney Dis*. 2003;42(5):1082-1096.

OUTCOMES IN PD

PD use in certain areas has markedly increased, and some concerns have risen about the suitability of candidates for PD therapy. One retrospective analysis examined technique survival and patient mortality in practices with high and low PD use. Neither practice setting experienced worse outcomes in technique survival. Larger samples will need to be studied to ensure that this is a fair assessment, but this initial finding is intriguing. In other retrospective cohorts, centers with larger numbers of PD patients under their care had more favorable peritonitis and transplantation rates and lower rates of transfer from PD to HD therapy. A large cohort in Canada of incident PD patients showed improved survival in more recent years (2001-2005 and 2006-2009) than in past years (1995-2000).

During 2012, annual mortality rates in PD and HD were similar, at 1.55 and 1.60 per 1,000 patients treated, respectively. This reflects a substantial improvement from 1993, when the mortality rate in PD (47%) was greater than that in HD (28%). Hospitalizations followed similar trends: PD patients were hospitalized at a rate of 1.61 per patient-year in 2012, a 21% improvement from 1985, and slightly better than HD patients (1.73 hospitalizations per patient-year during the same period). Several reasons have been postulated to explain these improvements, including better infection control and vascular access practices, use of cardioprotective medications and procedures, implementation of quality metrics, and changes in background population mortality rates.

Numerous retrospective studies have examined survival with PD versus in-center HD. It is unclear whether a distinct advantage of one modality truly exists. Canadian registry data from 1991 to 2007 showed a slight survival benefit for PD up to 18 months after dialysis therapy initiation and a benefit of HD after 36 months. A US cohort of incident dialysis patients from 2001 to 2004 showed 48% lower mortality in the PD group. A Finnish study of long-term dialysis patients from 2000 to 2009 demonstrated higher mortality among patients exclusively treated with PD versus HD. Australia and

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Box 1. Update on Peritoneal Dialysis

- Epidemiology
- Outcomes in peritoneal dialysis
- Peritoneal dialysis access
- Peritoneal dialysis solutions
  - Conventional solutions
  - Glucose-sparing solutions
    - Icodextrin
    - Amino acid
  - Neutral-pH, low-GDP solutions
- Adequacy of peritoneal dialysis
  - Concept of adequate dialysis
  - Adequacy
- Prescription options
- Volume management
- Complications
  - Infectious complications
    - Exit-site and tunnel infections
    - Peritonitis
  - Noninfectious complications
    - Peritoneal membrane changes
    - Ultrafiltration failure
    - Encapsulating peritoneal sclerosis
    - Future directions
- New frontiers
  - Urgent-start peritoneal dialysis
  - Peritoneal dialysis for AKI

Abbreviations: AKI, acute kidney injury; GDP, glucose degradation product.

New Zealand registry data showed increased cardiac mortality on Mondays for in-center HD patients, but no variation in patients treated with PD or home HD. Additionally, a Canadian study of more than 38,000 patients starting dialysis therapy between 2001 and 2008 found that in the 5 years after dialysis therapy initiation, risk for death was 20% higher in patients who started HD therapy with a central venous catheter (CVC), compared with those treated with PD. Patients starting HD therapy with an arteriovenous access had similar survival to the PD group. Survival in continuous ambulatory PD (CAPD) and automated PD was similar as well.

Registry data show that heart failure with preserved ejection fraction is common among patients treated with PD and leads to poor outcomes. A recent randomized trial looked at the use of spironolactone in 158 relatively new PD patients who also were receiving angiotensin-converting enzyme (ACE) inhibitors or angiotensin receptor blockers (ARBs). The study, based in Japan, found that left ventricular mass index improved significantly in the spironolactone group versus the nontreatment group.

Based on data from the United States, cardiovascular and all-cause mortality has been found to be worse in patients with very low (<3.5 mEq/L) and very high potassium levels (>5.5 mEq/L). We do not have randomized trials to show that improved potassium levels will decrease mortality, but goals to normalize levels seem fitting.

Patients with diabetes treated with CAPD have worse survival and technique success than age-matched controls without diabetes. It also is very important to preserve residual kidney function (RKF) given its strong association with survival. Small randomized trials in prevalent PD patients using ACE inhibitors or ARBs have been shown to preserve RKF.

Additional Readings

» Haapio M, Helve J, Kyllönen L, Grönhagen-Riska C, Finne P. Modality of chronic renal replacement therapy and

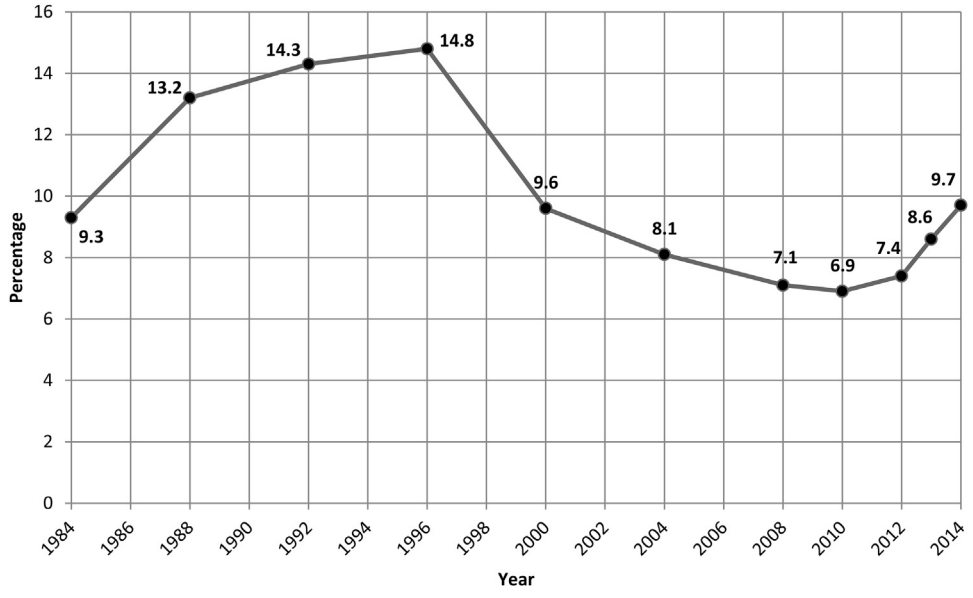

Figure 1. Prevalence of peritoneal dialysis in the United States: 1984-2014. Data from Watnick ("The State of Peritoneal Dialysis in the United States: From Inertia to Resurgence." Nephrology Self-Assessment Program. 2014;13(5):313).