Mode of dialysis at initiation

Date written: September 2004
Final submission: February 2005

GUIDELINES

No recommendations possible based on Level I or II evidence

SUGGESTIONS FOR CLINICAL CARE

(Suggestions are based on Level III and IV evidence)

- **Primary determinants of mode of initial dialysis include the preference of a fully-informed patient, absence of medical and surgical contraindications, and resource availability. (Level IV evidence) (See Appendix A for contraindications to peritoneal dialysis [PD] or haemodialysis [HD])**

- **When dialysis modality is not determined by preference of a fully-informed patient, absence of medical and surgical contraindications and resource availability, consider using continuous ambulatory peritoneal dialysis (CAPD) (not automated peritoneal dialysis [APD]) in preference to haemodialysis to better preserve residual renal function (RRF) and allow graded introduction of dialysis. (Level III evidence)**

- **If using haemodialysis, use biocompatible rather than bioincompatible membranes to better preserve RRF. (Level III evidence)**

Background

This section examines the possibility that choice of dialysis modality (PD versus HD) or details of dialysis prescription at initiation of dialysis for end-stage kidney disease (ESKD) influence outcome.

Search strategy

Databases searched: Medline (1966 to April Week 2 2004). MeSH terms and text words for kidney transplantation and dialysis were combined with MeSH terms and text words for decision making. The results were then combined with the Cochrane highly sensitive search strategy for cohort and other prognostic studies.

Date of search: 28 April 2004.

What is the evidence?

No randomised controlled trials (RCTs) are available which address this issue.

Choice of modality: general comments

There are no controlled trials which prove any advantage of one mode of initial dialysis over another.

The major determinants of modality choice are patient preference, absence of medical and surgical contraindications, and resource availability. Medical and surgical contraindications to PD or HD are listed in *Appendix A*.

Education can influence the patient's choice of dialysis modality. Unpublished studies from both Europe and the US have shown an increase in the number of patients choosing PD following education about dialysis.

Residual renal function

Residual renal function may be better preserved with CAPD than with HD (Lysaght et al 1991, Feber et al 1994, Jansen et al 2002, Lang et al 2001)) and in HD patients with biocompatible membranes (Lang et al 2001, McCarthy et al 1997). Lysaght and coworkers (1991) in a retrospective comparison of 55 patients on CAPD and 57 on HD showed that the rate of decline of GFR was slower with CAPD (5.8% vs 2.9% per month, $p < 0.01$). Feber et al (1994) showed a better preservation of diuresis (but not GFR) in children treated with CAPD (n = 31) versus HD (n = 28). In a prospective study of 522 incident dialysis patients (Jansen et al 2002) RRF declined more rapidly among HD than PD patients. However, the authors proposed that decline was potentially preventable in both groups, by avoiding hypotension in HD patients and dehydration in PD patients.

Residual function may decline more rapidly with APD than CAPD. In a small prospective cohort study (Hufnagel et al 1999) of matched APD and CAPD patients (n = 18 each), residual creatinine clearance (C_{Cr}) declined more rapidly during the first year in patients on APD.

Rate of loss of RRF was slower (0.14 vs 0.27 mL/min/month, $p < 0.06$ log rank), especially among patients with renal parenchymal disease, preservation of renal function longer (23 vs 11 months, $p < 0.001$, Kaplan-Meier analysis) and delivered Kt/V higher in HD patients treated for at least 6 months with polysulfone dialysers compared with a retrospective matched group treated with cellulose acetate dialysers (McCarthy et al 1997). In a small prospective cohort study of 45 incident dialysis patients (Lang et al 2001), not only was residual function better preserved in patients on PD rather than HD, but also among the 30 HD patients in those using high-flux polysulphone as opposed to cuprophane membranes. In another cohort study (McKane et al 2002), decline in RRF was no different between incident patients on CAPD (n = 175) and those on HD with high-flux polysulphone dialysers and ultrapure water (n = 300).

However, published comparisons of rate of loss of RRF with different modalities may have been compromised by informative censoring (Misra et al 2000). Moreover, residual function may decline more rapidly in PD patients who commence dialysis with a higher GFR (Johnson et al 2003).

Mortality

Some studies have reported a survival advantage for PD over HD during the first one to two years of dialysis (Heaf et al 2002, Fenton et al 1997), but beyond that period mortality is lower in HD patients (Termorshuizen et al 2003). In a small retrospective study (Van Biesen et al 2000a), Van Biesen and colleagues showed that survival was greater in patients who started on PD and later transferred to HD (integrated care) rather than those who started and remained on HD. However, interpretation of these studies may be clouded by differences in study methodology, differences in survival between nations (e.g. the better survival with PD in Canada than the US, as shown in the CANUSA study) and in case-mix differences (e.g. the lower comorbidity among patients choosing PD rather than HD in some studies (Termorshuizen et al 2003, Ganesh et al 2003).

In patients with cardiac disease, survival appears to be better in those on HD than PD. Data from the USRDS (Ganesh et al 2003, Stack et al 2003) in more than 100,000 patients starting dialysis in the 2-year period from mid-1995, showed a better 2-year survival for HD over PD for those with coronary heart disease (whether diabetic or non-diabetic) and for diabetics (but not non-diabetics) with congestive cardiac failure. In a retrospective analysis of 3648 Spanish patients (Antolin et al 2002), survival up to 32 months was no different between incident PD and HD patients, but survival was higher for HD than PD, among patients older than 70 years.

Other endpoints

Few studies have examined the effect of modality choice on hospitalisation. One study from Canada involving 822 patients, showed a minor advantage for HD, using a treatment-received analysis (Murphy et al 2000).

Home-based dialysis costs less than hospital and probably satellite HD, including after adjustment for comorbidities.

Other arguments for commencing with PD rather than HD include a lower risk of hepatitis, less delayed graft function after renal transplantation (Van Biesen et al 2000b) and preservation of vascular access sites for later HD.

Incremental dialysis

There are no randomised, controlled comparisons of incremental versus full dialysis for initiation. Empirical (Burkart 1998, Golper 1998) and theoretical (derived from urea kinetic modelling) (Keshaviah et al 1999) approaches have been proposed for introduction of dialysis by increments, to maintain total (residual and dialysis) weekly Kt/V at 2.0.

Burkart (1998) has proposed an empirical dosing for the incremental introduction of PD, with volume determined by patient body surface area, and number of exchanges by residual GFR, commencing at one exchange per night for GFR 10–12 mL/min.

Golper (1998) has proposed one overnight 2.5 L exchange for GFR 8–11 mL/min, two overnight 2.5 L exchanges (with an exchange device) for GFR 6–7 and full PD for GFR 5. Alternatively, nocturnal APD can be commenced 2–3 nights per week.

For HD, once-weekly treatment is impracticable because of large swings in solute concentration, and the need for single treatment Kt/V of 2.0 to achieve target weekly Kt/V (2.0) when residual Kt/V is 1.6 (McKane et al 2002).

Potential advantages of incremental dialysis over full dialysis include cost savings, reduced glucose exposure and protein loss, less membrane 'fatigue' and greater patient acceptance. Potential disadvantages of incremental dialysis include the need for close monitoring of residual GFR, frequent prescription changes, the fact that middle molecule clearance is dependent on total dwell time (Kim et al 2001) and uncertainty about the effect on outcome (given the results of the CANUSA study which suggest a positive association between survival and total Kt/V up to at least 2.3, without any plateau in the relationship). Delaying initiation until full dialysis is required has the disadvantages of the increased time on dialysis and the complications associated with dialysis.

Summary of the evidence

There are no RCTs on this topic and so there is no Level I or Level II evidence on which to base a CARI guideline.

What do the other guidelines say?

There are no differences of substance between the above Suggestions for Clinical Care and the few published guidelines addressing this issue.

Kidney Disease Outcomes Quality Initiative: Incremental or full PD, to keep weekly total Kt/V > 2.0. Twice- or thrice-weekly HD, with biocompatible membrane.

British Renal Association: Depends on patient choice, and absence of medical or surgical complications.

Canadian Society of Nephrology: No recommendation.

European Best Practice Guidelines: No recommendation.

International Guidelines: No recommendation.

Implementation and audit

Current ANZDATA reporting.

Suggestions for future research

Conduct an RCT of the effect of incremental versus full initial dialysis on patient outcome, including the rate of loss of RRF.

References

Antolin A, Miguel A, Perez J et al. Analysis of survival in dialysis: hemodialysis versus peritoneal dialysis and the significance of comorbidity. Nefrologia 2002; 22: 253–61.

Burkart JM. Clinical experience: how much earlier should patients really start renal replacement therapy? J Am Soc Nephrol 1998; 9(12 Suppl): S118–S123.

Feber J, Scharer K, Schaefer F et al. Residual renal function in children on haemodialysis and peritoneal dialysis therapy. Pediatr Nephrol 1994; 8: 579–83.

Fenton SS, Schaubel DE, Desmeules M et al. Hemodialysis versus peritoneal dialysis: a comparison of adjusted mortality rates. Am J Kidney Dis 1997; 30: 334–42.

Ganesh SK, Hulbert-Shearon T, Port FK et al. Mortality differences by dialysis modality among incident ESRD patients with and without coronary artery disease. J Am Soc Nephrol 2003; 14: 415–24.

Golper TA. Incremental dialysis. J Am Soc Nephrol 1998; 9(12 Suppl): S107–S111.

Heaf JG, Lokkegaard H, Madsen M. Initial survival advantage of peritoneal dialysis relative to haemodialysis. Nephrol Dial Transplant 2002; 17: 112–17.

Hufnagel G, Michel C, Queffeulou G et al. The influence of automated peritoneal dialysis on the decrease in residual renal function. Nephrol Dial Transplant 1999; 14: 1224–28.

Jansen MA, Hart AA, Korevaar JC et al. Predictors of the rate of decline of residual renal function in incident dialysis patients. Kidney Int 2002; 62: 1046–53.

Johnson DW, Mudge DW, Sturtevant JM et al. Predictors of decline of residual renal function in new peritoneal dialysis patients. Perit Dial Int 2003; 23: 276–83.

Keshaviah PR, Emerson PF, Nolph KD. Timely initiation of dialysis: a urea kinetic approach. Am J Kidney Dis 1999; 33: 344–48.

Kim DJ, Do JH, Huh W et al. Dissociation between clearances of small and middle molecules in incremental peritoneal dialysis. Perit Dial Int 2001; 21: 462–66.

Lang SM, Bergner A, Topfer M et al. Preservation of residual renal function in dialysis patients: effects of dialysis-technique-related factors. Perit Dial Int 2001; 21: 52–57.

Lysaght MJ, Vonesh EF, Gotch F et al. The influence of dialysis treatment modality on the decline of remaining renal function. ASAIO Trans 1991; 37: 598–604.

McCarthy JT, Jenson BM, Squillace DP et al. Improved preservation of residual renal function in chronic hemodialysis patients using polysulfone dialyzers. Am J Kidney Dis 1997; 29: 576–83.

McKane W, Chandna SM, Tattersall JE et al. Identical decline of residual renal function in high-flux biocompatible hemodialysis and CAPD. Kidney Int 2002; 61: 256–65.

Misra M, Vonesh E, Churchill DN et al. Preservation of glomerular filtration rate on dialysis when adjusted for patient dropout. Kidney Int 2000; 57: 691–96.

Murphy SW, Foley RN, Barrett BJ et al. Comparative hospitalization of hemodialysis and peritoneal dialysis patients in Canada. Kidney Int 2000; 57: 2557–63.

Stack AG, Molony DA, Rahman NS et al. Impact of dialysis modality on survival of new ESRD patients with congestive heart failure in the United States. Kidney Int 2003; 64: 1071–79.

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: 2851–60.

Van Biesen W, Vanholder RC, Veys N et al. An evaluation of an integrative care approach for end-stage renal disease patients. J Am Soc Nephrol 2000a; 11: 116–25.

Van Biesen W, Vanholder R, Van Loo A et al. Peritoneal dialysis favorably influences early graft function after renal transplantation compared to hemodialysis. Transplantation 2000b; 69: 508–14.

Appendix A:
Relative and absolute medical and surgical contraindications to PD or HD

Peritoneal dialysis:

- previous abdominal surgery with adhesions
- unrepaired hernia
- pleuro-peritoneal communication
- bowel problems (e.g. chronic constipation, diverticulitis)
- severe respiratory insufficiency
- ileal conduit or colostomy
- abdominal obesity
- large muscle mass.

Haemodialysis:

- vasculature unsuitable for AV fistula
- cardiovascular instability
- needle phobia.