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**Review**

## *Executive summary*

# Effectiveness and efficiency of methods of dialysis therapy for end-stage renal disease: systematic reviews

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**Health Technology Assessment**
**NHS R&D HTA Programme**

# Executive summary

## Objectives

- To review systematically the literature on six major topics in dialysis therapy for patients with end-stage renal disease (ESRD).
- To link clinical effectiveness with cost (resource use) in an economic analysis to assess efficiency.
- To suggest implications for clinical practice and policy needs.
- To indicate areas for further research.

## Methods

Cochrane Collaboration methods were adopted and are described in detail in the full report.

## Results

About 16,000 abstracts were considered and about 2300 possible randomised controlled trials (RCTs) relevant to ESRD (excluding transplantation) identified; 537 were relevant to the six topics and only 47 actually met the eligibility criteria and were included in the review. A total of 820 papers were used for the economic evaluation.

### 1. Synthetic compared with cellulose-based membranes in haemodialysis treatment for ESRD

The inclusion criteria were met by 22 studies. The incidence of nausea and vomiting was significantly less with synthetic than with cellulose membranes. Predialysis β2 microglobulin concentrations were significantly lower with high-flux synthetic membranes. In a 6-year study, the incidence of amyloid disease was less with high-flux synthetic membranes.

Plasma triglyceride was lower with synthetic high-flux membranes (one study) and serum albumin was higher. Whether the differences were attributable to the membrane material or to the flux is unclear. There was no other significant difference.

When compared with modified cellulose membranes, the incidence of pruritus was less with synthetic membranes. The additional benefits of synthetic membranes were achieved at additional cost.

### 2. Bicarbonate-buffered compared with acetate-buffered dialysate in haemodialysis treatment for ESRD

The inclusion criteria were met by 18 studies. There was a significant reduction with bicarbonate dialysis in the number of haemodialysis treatments complicated by headaches, nausea/vomiting, symptomatic hypotension and non-specific intolerance. There was no clear evidence of improved cardiovascular stability, lipid profile or biochemical indicators of renal bone disease. Economic evaluation showed the cost of the self-mix bicarbonate buffer to be similar to that of acetate.

### 3. Short-duration compared with standard-duration haemodialysis for ESRD

One study with 165 patients was identified. It compared ≤ 3.5 hours dialysis with > 3.5 hours dialysis three times a week. There was no significant difference in mortality. Hospitalisation rates were greater in the short-duration group. There was no conclusive difference in the incidence of intradialytic adverse symptoms between the groups. Blood pressure control was worse in the short-duration group. There was insufficient evidence to judge relative efficiency.

### 4. Continuous ambulatory peritoneal dialysis (CAPD) delivery systems: Y-set/modified Y-set versus standard spike as treatment for ESRD

Six studies met the inclusion criteria. The number of patients with at least one episode of peritonitis was significantly lower in patients using Y-set delivery systems. All but one study demonstrated a significant increase in the number of months per episode of peritonitis with the Y-set delivery systems. All studies showed a significant increase in the time to first episode of peritonitis with the Y-set system. There was no significant reduction in the number of patients who suffered exit-site infections or tunnel infections with the Y-set system. No study addressed technique failure. Benefits are achievable at extra cost.

### 5. Continuous cycler-assisted peritoneal dialysis (CCPD) compared with CAPD as treatment for ESRD

One study of 82 patients met the inclusion criteria. There were no significant differences in the number of patients with peritonitis, catheter exit-site infections or catheter tunnel infections. The mean number of peritonitis episodes per patient per year was significantly

lower with CCPD. There was no significant difference in Kt/V, six-monthly serum creatinine, urea or phosphate. Fewer patients on CCPD needed to change dialysis technique but this was not statistically significant. Patient preference could not be adequately assessed because of the parallel group trial design. The estimated cost per episode of peritonitis avoided is considerable.

### 6. Haemodialysis compared with CAPD as treatment for ESRD

No relevant RCTs were identified. Because of the poor quality of the study designs used to obtain primary data for economic analyses, it is not possible to judge whether any assumed extra benefits provided by haemodialysis are worth any extra costs that may be incurred.

## Conclusions

### Implications for policy

- The moderate benefits of high-flux synthetic membranes are currently achieved at additional cost. For general use, cellulose (particularly modified cellulose) membranes are appropriate. Synthetic membranes may be appropriate for patients experiencing persistent nausea and vomiting and for patients likely to be treated by haemodialysis for many years. The price of high-flux synthetic membranes is likely to fall in the future and policy recommendations should be kept under review.
- Bicarbonate dialysis is preferable to acetate dialysis for the haemodialysis of patients with ESRD, producing fewer unwanted effects at a similar cost.
- There is no evidence that reduced dialysis duration (≤ 3.5 hours three times per week) decreases mortality and it may increase morbidity. If reduced dialysis duration regimens are implemented on the basis of patient preference or assumed lower cost, their unproven safety should be explicitly acknowledged.
- Y-set delivery systems significantly reduce the incidence of peritonitis. Given that recurrent peritonitis is a major cause of technique failure, the additional cost is likely to be justified.
- CCPD showed benefit in one patient outcome but is more expensive than CAPD. It is suggested that CCPD should only be offered as an alternative to CAPD, at present, to patients for whom there is a specific indication.
- Data are not available to allow reliable conclusions to be drawn about the relative effectiveness and efficiency of haemodialysis and CAPD.
- Dialysis for ESRD intrudes greatly into people's daily lives. Informed patient preference, based on evidence of effectiveness and efficiency, should be taken into account when policy is decided.

### Recommendations for research

- Further multicentre pragmatic RCTs with economic evaluations concentrating on primary outcomes of major importance to patients are required to compare the different dialysis membranes available. These should take into account membrane reuse, their properties, including flux and material, and should include modified cellulose and low-flux synthetic membranes which may be less expensive than their high-flux counterparts. The trials should include older patients and those with comorbid illnesses.
- A large multicentre pragmatic RCT comparing haemodialysis treatment duration policies is required. Such a trial should include the longer duration haemodialysis practised in other parts of Europe, have minimum exclusion criteria, a long follow-up period and minimum data collection, concentrating primarily on patient morbidity and mortality.
- More evidence of the effect on patient outcomes and costs of technique failure would further inform the decision about the use of Y-set systems.
- Further RCTs with economic evaluations are required comparing CCPD with CAPD, with particular reference to peritonitis, technique failure rates and patient preference. Studies are also required to compare CCPD with haemodialysis to determine whether it is efficient to provide CCPD for those patients who have a relative contraindication to CAPD and who would otherwise be treated by haemodialysis.
- The issue facing the health services is not whether to have CAPD or haemodialysis but rather the balance of provision between the two modalities. International variations in usage show that a large proportion of patients requiring dialysis for ESRD could be managed initially with either CAPD or haemodialysis. Information is required about the relative costs, benefits and risks of policies of starting with one or other modality. Information on benefits, risks and costs should come from a pragmatic RCT of policies based on starting with CAPD or haemodialysis.
- Further systematic reviews are required in other aspects of dialysis where there are practice options.
- The results of the on-going large American study (HEMO) should be taken into account when the research agenda is decided.

## Publication

MacLeod A, Grant A, Donaldson C, Khan I, Campbell M, Daly C, *et al.* Effectiveness and efficiency of methods of dialysis therapy for end-stage renal disease: systematic reviews. *Health Technol Assessment* 1998; **2**(5).

# NHS R&D HTA Programme

The overall aim of the NHS R&D Health Technology Assessment (HTA) programme is to ensure that high-quality research information on the costs, effectiveness and broader impact of health technologies is produced in the most efficient way for those who use, manage and work in the NHS. Research is undertaken in those areas where the evidence will lead to the greatest benefits to patients, either through improved patient outcomes or the most efficient use of NHS resources.

The Standing Group on Health Technology advises on national priorities for health technology assessment. Six advisory panels assist the Standing Group in identifying and prioritising projects. These priorities are then considered by the HTA Commissioning Board supported by the National Coordinating Centre for HTA (NCCHTA).

This report is one of a series covering acute care, diagnostics and imaging, methodology, pharmaceuticals, population screening, and primary and community care. It was identified as a priority by the Acute Sector Panel.

The views expressed in this publication are those of the authors and not necessarily those of the Standing Group, the Commissioning Board, the Panel members or the Department of Health. The editors wish to emphasise that funding and publication of this research by the NHS should not be taken as implicit support for the recommendations for policy contained herein. In particular, policy options in the area of screening will, in England, be considered by the National Screening Committee. This Committee, chaired by the Chief Medical Officer, will take into account the views expressed here, further available evidence and other relevant considerations.

Reviews in *Health Technology Assessment* are termed 'systematic' when the account of the search, appraisal and synthesis methods (to minimise biases and random errors) would, in theory, permit the replication of the review by others.



The editors have tried to ensure the accuracy of this report but cannot accept responsibility for any errors or omissions. They would like to thank the referees for their constructive comments on the draft document.

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