
Comparison of hemodialysis, hemofiltration, and acetate-free biofiltration for ESRD: systematic review

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CRD summary

This review compared haemodialysis, haemofiltration, haemodiafiltration and acetate-free biofiltration for patients with end-stage renal disease. The authors concluded that there was insufficient evidence to determine the most effective method of extracorporeal renal replacement. This was generally a well-conducted review and the authors' conclusions are likely to be robust.

Authors' objectives

To compare the clinical effectiveness of haemodialysis (HD), haemofiltration (HF), haemodiafiltration (HDF) and acetate-free biofiltration (AFB) for the treatment of patients with end-stage renal disease (ESRD).

Searching

MEDLINE (1966 to 2003), EMBASE (1980 to 2003), the Cochrane CENTRAL Register, the American College of Physician's Database, DARE and CINAHL were searched using reported terms. In addition, the Cochrane Renal Group's Specialised Register and reference lists were searched.

Study selection

Study designs of evaluations included in the review

Randomised controlled trials (RCTs) were eligible for inclusion. The duration of follow-up ranged from after only one session to 48 months.

Specific interventions included in the review

Studies that compared the following were eligible for inclusion: HF, HDF or AFB with HD; HDF with AFB; or HF with HDF. The included studies compared HDF with HD, AFB with HD, HDF with AFB and HF with HD. One of the included studies reported cointervention with erythropoietin and intravenous iron; the other studies did not mention whether or not cointerventions were used.

Participants included in the review

Studies of patients with ESRD were eligible for inclusion. The mean age of the participants in the included studies ranged from 36.5 to 76 years. The participants in all but one of the studies were predominantly white.

Outcomes assessed in the review

Inclusion criteria for the outcomes were not explicitly reported. The review assessed all-cause mortality, hypotension and blood-pressure (pre-dialysis, intra-dialysis and end-of-dialysis), dialysis associated symptoms (headache, nausea and vomiting), hospitalisations, dialysis adequacy (Kt/V values or urea reduction ratio), beta2-microglobulin levels and amyloid-related complications, and quality of life.

How were decisions on the relevance of primary studies made?

Two reviewers screened identified titles and abstracts and two reviewers independently selected studies from full reports. Any differences were resolved through discussion with a third reviewer.

Assessment of study quality

The studies were assessed for method of randomisation and allocation concealment, blinding of the participants, investigators and outcome assessors, use of intention-to-treat analysis and completeness of follow-up.

Two reviewers independently assessed validity, while a third reviewer checked for consistency. Authors of the primary

studies were contacted for clarification of data if required.

Data extraction

Two reviewers independently extracted the data, while a third reviewer checked for consistency. For each study, relative risks (RRs) with 95% confidence intervals (CIs) were obtained for dichotomous data and the mean difference with 95% CI were obtained for continuous data.

Methods of synthesis

How were the studies combined?

Pooled RRs with 95% CIs were calculated for dichotomous data using the random-effects model of DerSimonian and Laird. Pooled weighted mean differences (WMDs) and 95% CIs were calculated for continuous data.

How were differences between studies investigated?

Statistical heterogeneity was assessed using the Q statistic and the I-squared statistic. Pooled RRs with 95% CIs were also calculated using the fixed-effect Mantel-Haenszel method. A subgroup analysis was planned to explore potential sources of heterogeneity including study quality, risk status of the patients and membrane flux.

Results of the review

Eighteen RCTs (n=588) were included.

The studies varied in their quality. All studies reported randomisation but none reported the methods used to conceal allocation. One study reported blinding of the investigators, 3 studies reported blinded outcome assessment and none reported patient blinding. Seven studies used intention-to-treat analysis. The drop-out rates ranged from 0 to 35%; the overall drop-out rate was 16.7% (98 out of 588), with more than 50% of drop-outs coming from one study.

All-cause mortality.

HD versus HF: no deaths were reported in studies comparing HD with HF.

HDF versus HD: mortality was statistically significantly greater in patients receiving HDF compared with HD (RR 3.52, 95% CI: 1.31, 9.47), based on 2 studies with 249 patients. No statistically significant heterogeneity was found (P=0.87).

AFB versus HD and HDF versus AFB: there was no statistically significant difference in mortality between AFB versus HD (1 RCT with 41 patients) or for HDF versus AFB (1 RCT with 12 patients).

Hypotension and blood-pressure.

HD versus HF: 1 study (n=9) reported no statistically significant difference between HF and HD in the number of patients with hypotension. HDF versus AFB: 1 study (11 patients undergoing 144 dialysis sessions) reported no statistically significant difference between HDF and AFB in the number of dialysis sessions with hypotension.

AFB versus HD: 1 study (n=20) reported no statistically significant difference between AFB and HD in the percentage of dialysis sessions with hypotension.

There were no significant differences in predialysis, intradialysis and end-of-dialysis systolic, diastolic and mean arterial blood-pressure.

Dialysis associated symptoms (headache, nausea and vomiting).

HDF versus AFB: 1 study (n=11) reported no statistically significant difference between HDF and AFB in dialysis-associated symptoms.

HDF versus AFB: 1 study (n=9) reported no statistically significant difference between HDF and AFB on an

interdialysis symptom score.

Hospitalisations.

HDF versus HD: there were no statistically significant differences between HDF and HD in the number of hospitalisations (1 study, n=45) or the number of days spent in hospital (1 study, n=45).

AFB versus HD: 1 study (n=41) reported fewer hospitalisations with AFB compared with HD (17 with HD versus 8 with AFB).

HDF versus AFB: there was no statistically significant difference between HDF and AFB in the number of hospitalisations per patients (1 study, n=12) or the length of hospitalisation (1 study).

Measures of dialysis adequacy.

HF versus HD: dialysis adequacy was not reported.

HDF versus HD: Kt/V values were statistically significantly greater in patients receiving HDF compared with HD (WMD 0.14, 95% CI: 0.05, 0.22), based on 3 studies (n reported as 124 in the text and 180 in the forest plot). No statistically significant heterogeneity was found.

AFB versus HD: there was no statistically significant difference between AFB and HD in the end-of-treatment Kt/V values, based on 5 studies (n reported as 77 in the text and 85 in the forest plot). No statistically significant heterogeneity was found.

HDF versus AFB: 1 study (n=12) reported no statistically significant difference between HDF and AFB in end-of-treatment Kt/V values.

Beta2-microglobulin levels and amyloid-related complications.

HF versus HD: values of beta2-microglobulin clearance in dialysate at the end of treatment were statistically significantly greater in patients receiving HF than those receiving HD (WMD 133, 95% CI: 71.46, 194.54), based on 1 study with 20 patients.

HDF versus HD: there was no statistically significant difference between HDF and HD in predialysis beta2-microglobulin values (2 studies with 76 patients) or amyloid-related carpal tunnel syndrome (1 study with 67 patients).

HDF versus AFB: there was no statistically significant difference between HDF and AFB in predialysis beta2-microglobulin values, based on 1 study with 9 patients.

Quality of life.

HDF versus HD: 2 studies assessed quality of life. One study (n=67) found significantly increased quality of life with HDF using an unvalidated tool, while the other (n=45) found no significant difference between treatments using the validated Kidney Disease Questionnaire.

The results for the other outcomes were also reported.

Authors' conclusions

There was insufficient evidence to determine the most effective method of extracorporeal renal replacement for individuals with ESRD.

CRD commentary

The review addressed a clear question that was defined in terms of the participants, intervention and study design;

inclusion criteria for the outcomes were not defined. Several relevant sources were searched and attempts were made to minimise publication bias. It was unclear whether any language restrictions had been applied. Two reviewers independently selected studies, assessed validity and extracted the data, thus reducing the potential for reviewer bias and errors. Validity was assessed using specified criteria and results of the assessment were reported.

The data were appropriately combined using a meta-analysis and statistical heterogeneity was assessed. A small number of patients was used in the comparisons, consequently some analyses are likely to have been underpowered. Overall, this was a well-conducted review and the authors' conclusions are likely to be robust.

Implications of the review for practice and research

Practice: The authors stated that, given the paucity of evidence, it is not possible to recommend one type of extracorporeal renal replacement over any others.

Research: The authors stated that future RCTs should be longer term (at least 1 year), should focus on clinically important outcomes such as mortality and hospitalisations, should clearly define outcomes, and should report results in the CONSORT (Consolidated Standards of Reporting Trials) recommended format. They also suggested that future studies should include patients at high-risk and that economic analyses would be useful.

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