Meta-analysis: peritoneal membrane transport, mortality, and technique failure in peritoneal dialysis


CRD summary
The review assessed the relationship between peritoneal membrane solute transport rate, measured by peritoneal equilibration test, and mortality and technique failure in peritoneal dialysis patients. It concluded that there is a higher mortality and technique failure risk with higher peritoneal membrane solute transport rates. The results are likely to be reliable, although interpretation is limited by the unknown quality of the included studies.

Authors' objectives
To determine the relationship between peritoneal membrane solute transport rate, as measured by peritoneal equilibration test (PET), and mortality and technique failure in patients who are on peritoneal dialysis (PD).

Searching
MEDLINE was searched from 1987 to January 2006. Search terms were reported. References of relevant reviews and content tables of key nephrology journals, including published abstracts from associated conference proceedings, were also checked. Articles with English abstracts but non-English text were translated where necessary to determine eligibility.

Study selection
Studies of participants on PD or that reported on the impact of PET on mortality and/or technique failure were eligible for inclusion. Participants on continuous ambulatory peritoneal dialysis (CAPD) and/or on continuous cycler peritoneal dialysis (CCPD) were included in the review. Studies that did not report a measure of peritoneal membrane solute transport in their risk analysis and studies with fewer than five participants were excluded from the review.

Most studies utilised a standard PET method, two studies used a modified PET method. Where reported the mean duration of follow-up ranged between 14.4 and 87.4 months. The mean age ranged from 44.6 to 65.5 years, with the percentage of participants with diabetes ranging between 10.4 and 61.

The authors did not state how papers were selected for inclusion in the review or how many reviewers performed the selection.

Assessment of study quality
The authors did not state whether the validity of the included studies was assessed.

Data extraction
Adjusted risk estimates (relative risk (RR) and hazard ratio (HR)) for the associations between mortality or technique failure and the 4-hour D/Pc with standard error (SE) and/or confidence intervals (CI) for the estimates were abstracted or calculated using data reported in the study. Participants were categorised by their ratio of creatinine concentrated in the dialysate compared to plasma after four hours (4-h D/Pc) in a number of studies: high transporters (4-h D/Pc more than 1SD above median value); high-average (4-h D/Pc between the median and 1SD above); low-average (4-h D/Pc between the median and 1SD below); low (4-h D/Pc below 1SD). Attempts were made to contact authors where further information was required.

Two reviewers independently extracted data from the included studies; any disagreements were resolved by consensus.

Methods of synthesis
Studies were pooled in meta-analysis using a random-effects model for the three separate outcomes: patient mortality; technique failure; mortality and/or technique failure (0.1 unit change in D/Pc). Summary estimates were reported as RR
along with their corresponding 95% CI. $\chi^2$ test was used to assess statistical heterogeneity. Meta regression analysis was used to evaluate the impact of PD method; PET method; population type; study design; statistical model; and inclusion of age, diabetes, or albumin in the multivariate model. Publication bias was assessed using Begg and Egger tests and funnel plots.

Results of the review
Twenty studies were included in the review (n=at least 6,648).

An increased risk of mortality in PD patients was found for every 0.1-unit increase in the D/P, RR 1.15 (95% CI: 1.07, 1.23, p<0.001), based on 19 studies. No evidence of statistical heterogeneity was found. A similar result was found when only prospective studies were considered. When categorised by transport status, this related to an increased mortality risk for low-average (21.9%), high-average (45.7%) and high (77.3%) transporters, compared with patients with low transport status. In addition, meta-regression found that the proportion of patients who were on continuous cycler PD was inversely proportional to the mortality risk (p=0.05).

An increase in risk for death-censored technique failure (RR 1.18, 95% CI: 0.96, 1.46, p=0.12) was found for every 0.1-unit increase in the D/P, but this was not statistically significant (seven studies). A similar result was found for the overall pooled RR for 0.1-unit increase in D/P on death or transfer to haemodialysis (RR 1.17, 95% CI: 0.94, 1.44, p=0.16), based on seven studies. No evidence of statistical heterogeneity was found. Sensitivity and regression analysis were not conducted due to the small number of studies. No evidence of publication bias was found.

Authors’ conclusions
A higher peritoneal membrane solute transport rate is associated with a higher risk of mortality and a trend towards higher technique failure.

CRD commentary
The review question was supported by clear inclusion criteria in terms of intervention, population and outcomes. Although several sources were searched, only one electronic database was included. Some attempt was made to counteract language bias and publication bias was assessed. Methods used for data extraction were likely to minimise reviewer error or bias but it is not known whether similar methods were undertaken for study selection. The authors did not appear to assess the validity of the included studies. Studies were pooled using standard meta-analytic techniques and statistical heterogeneity was assessed. The authors also looked at the impact of a number of possible confounding factors. The results are likely to be reliable, although interpretation is limited by the unknown quality of the included studies.

Implications of the review for practice and research
Practice: The authors stated that the use of CCPD appears to offset some of the negative effect on mortality.

Research: The authors stated that the introduction of new PD solutions may influence the review findings and recommend that these are evaluated in randomised controlled trials.

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