INPLASY

A Meta-Analysis on Inflammatory Marker Variations among Patients with End-Stage Renal Disease: Peritoneal Dialysis vs. Conventional

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ADMINISTRATIVE INFORMATION

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Review Stage at time of this submission - Data analysis.

Conflicts of interest - None declared.

INPLASY registration number: INPLASY202630084

Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 23 March 2026 and was last updated on 23 March 2026.

INTRODUCTION

Review question / Objective This study aims to systematically examine the effects of peritoneal dialysis (PD) versus conventional hemodialysis (HD) on inflammatory markers in end-stage renal disease (ESRD) patients, providing evidence-based guidance for optimal dialysis selection.

Condition being studied Objective: This study aims to systematically examine the effects of peritoneal dialysis (PD) versus conventional hemodialysis (HD) on inflammatory markers in end-stage renal disease (ESRD) patients, providing evidence-based guidance for optimal dialysis selection.

Methods: Comprehensive database searches were conducted in CNKI, VIP, Wanfang, Web of Science, PubMed, Embase, and Cochrane Library, covering studies from inception to December 2025. The analysis focused on randomized controlled trials comparing PD and HD effects on inflammatory markers in ESRD patients. Two researchers independently screened studies, extracted data, and assessed bias risk. Meta-analysis was performed using RevMan 5.4 and Stata 17.0. Primary outcomes included tumor necrosis factor-alpha (TNF-α), interleukin-6 (IL-6), and C-reactive protein (CRP) levels.

Results: This analysis included 22 trials with 3,176 patients. TNF-α levels were significantly lower in the PD group compared to HD (MD = -3.26, 95% CI: -3.65 to -2.87). CRP (SMD = -1.35, 95% CI: -1.46 to -1.23) and IL-6 levels (SMD = -1.04, 95% CI: -1.16 to -0.92) also showed significant reductions (all $p < 0.0001$). Subgroup analysis indicated that ESRD patients with diabetic nephropathy had the greatest IL-6 reduction (SMD = -2.40). Egger's test showed no significant publication bias.

Conclusion: PD is more effective than HD in reducing inflammatory markers in ESRD patients, especially those with diabetic nephropathy,

offering valuable insights for dialysis modality selection.

METHODS

Participant or population Study participants: Patients with chronic renal failure who were clearly diagnosed as requiring PD or HD.

Intervention No applicable.

Comparator No applicable.

Study designs to be included Comprehensive database searches were conducted in CNKI, VIP, Wanfang, Web of Science, PubMed, Embase, and Cochrane Library, covering studies from inception to December 2025. The analysis focused on randomized controlled trials comparing PD and HD effects on inflammatory markers in ESRD patients. Two researchers independently screened studies, extracted data, and assessed bias risk. Meta-analysis was performed using RevMan 5.4 and Stata 17.0. Primary outcomes included tumor necrosis factor-alpha (TNF-α), interleukin-6 (IL-6), and C-reactive protein (CRP) levels.

Eligibility criteria
Inclusion Criteria
(1) Study types: Well-designed retrospective studies, prospective studies, or randomized controlled trials, whether blinded or not, should involve comparisons of data between two groups.
(2) Study participants: Patients with chronic renal failure who were clearly diagnosed as requiring PD or HD.
(3) Intervention: The experimental group was treated with PD, whereas the control group underwent conventional HD.
(4) Outcome indicators should include at least one of TNF-α, CRP, or IL-6.
Exclusion Criteria
The exclusion criteria include the following:
(1) Irrelevant topics, reviews, or meta;
(2) Incorrect article type; or
(3) Incorrect interventions, missing outcomes, or inaccessible articles.

Information sources Comprehensive database searches were conducted in CNKI, VIP, Wanfang, Web of Science, PubMed, Embase, and Cochrane Library, covering studies from inception to December 2025.

Main outcome(s) This analysis included 22 trials with 3,176 patients. TNF-α levels were significantly lower in the PD group compared to HD (MD = -3.26, 95% CI: -3.65 to -2.87). CRP (SMD = -1.35, 95% CI: -1.46 to -1.23) and IL-6 levels (SMD = -1.04, 95% CI: -1.16 to -0.92) also showed significant reductions (all $p < 0.0001$). Subgroup analysis indicated that ESRD patients with diabetic nephropathy had the greatest IL-6 reduction (SMD = -2.40). Egger's test showed no significant publication bias.

Quality assessment / Risk of bias analysis
Assessment of Bias and Study
Quality Critical domains including randomization, blinding, and control of confounding factors were assessed by utilizing Cochrane RoB 2.0 tool. This assessment was independently completed by two researchers. Discrepancies were resolved through discussion or with the assistance of a third-party. The studies were classified into high, moderate, or low according to their risk of bias levels. The assessment results were presented as traffic light plots and barcharts.

Strategy of data synthesis Statistical Analysis
The meta-analysis was carried out to evaluate the results utilizing RevMan 5.4 and Stata 17.0 for data analysis and statistical computations, respectively. For the marker TNF-α, Mean Difference (MD) was applied as the effect size, as measurement units were consistent across studies. For markers CRP and IL-6, Standardized Mean Difference (SMD) was used due to differences in measurement methods and units. Effect sizes were calculated along with 95% confidence intervals (CI) to provide a clearer assessmsent of the results.
Heterogeneity accross studies was evaluated by utilizing Cochran's Q test and the I^2 statistic. To identify whether the observed variation in effect sizes could be attributed to factors beyond random chance, a significance threshold was set at $\alpha = 0.10$ for analysis. When I^2 was below 50% and p value exceeded 0.10, heterogeneity was considered at a low level, and a fixed-effects model was employed for subsequent analysis. Conversely, once I^2 was 50% or higher, or p value was equal to or less than 0.10, indicating significant heterogeneity, a random-effects model was applied. In these cases, subgroup analyses and meta-regression were furhter carried out to identify potential sources of the observed variability.
Publication bias was evaluated with Egger's linear regression test, with the values of p less than 0.05 interpreted as a sign of significant bias. These statistical tests were two-tailed, with $p < 0.05$ deemed statistically significant.
Additionally, sensitivity analysis was performed by sequentially removing each individual study from the analysis to evaluate the potential effect on the pooled SMD results, allowing to determine whether

any single study had a disproportionate influence on the overall outcome.

Subgroup analysis Given the high heterogeneity in the overall meta-analysis (I^2 = 92.9%), we conducted a subgroup analysis to investigate possible sources of variability and assess whether treatment effects differed across patient populations and dialysis protocols.

Sensitivity analysis sensitivity analysis was performed by sequentially removing each individual study from the analysis to evaluate the potential effect on the pooled SMD results, allowing to determine whether any single study had a disproportionate influence on the overall outcome.

Country(ies) involved China.

Keywords Search keywords used both Chinese characters for "PD," "HD," "end-stage renal disease," "inflammation," "TNF-α," "CRP," and IL-6 and English terms.

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