Creatine supplementation in hemodialysis: A futile exercise?

Written by The Life Science Feed Editorial Team · Published 11 August 2026 · Edited by Mara Voss

Patients undergoing hemodialysis frequently experience creatine deficiency, a condition linked to diminished health-related quality of life and increased mortality. This deficiency stems from impaired endogenous synthesis and significant losses during the dialysis process itself. The question of whether direct supplementation can mitigate these issues has long been a point of clinical interest.

A pilot study published in PLoS One investigated the feasibility, tolerability, and safety of intradialytic creatine supplementation, aiming to establish a foundation for future, larger trials. The study sought to determine if this approach could be a viable strategy for addressing creatine depletion in this vulnerable population.1

KEY TAKEAWAYS

- The Pivot: Intradialytic creatine supplementation is feasible and well-tolerated in hemodialysis patients.
- The Data: The pilot study did not report efficacy data for clinical outcomes, focusing instead on safety and feasibility.
- The Action: Clinicians should await larger, adequately powered trials before considering creatine supplementation for routine use in hemodialysis patients.

Patients receiving hemodialysis face a unique metabolic challenge: a persistent state of creatine deficiency. This is not merely an academic observation; it directly correlates with tangible patient burdens, including a lower health-related quality of life and, more critically, a higher mortality rate.1 The underlying mechanisms involve both the compromised endogenous synthesis common in chronic kidney disease and the direct removal of creatine during the hemodialysis procedure itself.

The current pilot study, led by Doorenbos and colleagues, aimed to explore a straightforward intervention: intradialytic creatine supplementation.1 This double-blind, randomized, placebo-controlled trial focused on establishing the feasibility, tolerability, and safety of administering creatine directly during hemodialysis sessions. While the abstract does not specify the exact number of participants, the study design indicates a controlled environment to assess initial parameters before moving to larger efficacy trials. The investigators sought to understand if this method of delivery could be a practical and safe way to replenish creatine stores in this specific patient group.

Assessing the Intervention's Practicality

The primary objective of the Doorenbos study was to determine if intradialytic creatine supplementation was feasible and well-tolerated.1 This involved evaluating the practical aspects of administering creatine during dialysis, such as the ease of integration into existing protocols and any immediate adverse reactions. The researchers designed the study as a pilot,

a first step in evaluating novel interventions, particularly in a complex patient population like those on hemodialysis, to inform the design and safety profile for subsequent, larger investigations. Pilot studies are not typically powered to detect statistically significant differences in clinical outcomes, but rather to inform the design and safety profile for subsequent, larger investigations.

The study employed a double-blind, randomized, placebo-controlled design, which is the gold standard for minimizing bias.1 Patients were randomly assigned to receive either creatine or a placebo during their hemodialysis sessions, ensuring that neither the patients nor the treating clinicians knew which intervention was being administered. This methodological rigor is essential for obtaining reliable data on tolerability and safety, even in a pilot setting. The duration of the supplementation and the specific creatine dosage are not detailed in the abstract, but these parameters would have been critical components of the study protocol.

Tolerability was assessed by monitoring for any discomfort, gastrointestinal issues, or other patient-reported adverse events during and after creatine administration.1 Safety evaluations included routine laboratory tests to detect any potential renal, hepatic, or hematological abnormalities that might arise from the supplementation. The study's focus on these initial parameters is a pragmatic approach, recognizing that an intervention must first be safe and practical before its efficacy can be meaningfully explored in a broader clinical context. The abstract confirms that the intervention demonstrated both feasibility and tolerability, suggesting that the administration method itself did not pose significant immediate challenges or adverse effects for the patients.

The Absence of Efficacy Data

While the Doorenbos study established the feasibility and tolerability of intradialytic creatine supplementation, it did not report on improvements in health-related quality of life or mortality.1 This is a critical distinction. The study's design as a pilot meant its scope was intentionally limited to safety and practical implementation. Therefore, clinicians should not interpret the absence of reported adverse events as evidence of clinical benefit. The study simply did not measure those outcomes in a way that would yield definitive efficacy data.

The abstract highlights that creatine deficiency is associated with lower health-related quality of life and higher mortality, providing the rationale for the intervention.1 But the pilot study itself did not provide any numbers (e.g., HR, p-value, NNT) to suggest that creatine supplementation actually mitigated these associations. This gap means that while the intervention appears safe to deliver, its impact on the very problems it aims to address remains an open question. Larger trials, specifically designed and powered to assess these clinical endpoints, are necessary to determine if intradialytic creatine supplementation offers any tangible benefit to hemodialysis patients.

The lack of efficacy data in this pilot study highlights a common challenge in early-phase research. Investigators must first ensure an intervention is safe and practical before committing significant resources to large-scale efficacy trials. The positive findings on feasibility and tolerability are therefore a necessary, but not sufficient, step towards clinical adoption. They merely confirm that the path to investigating efficacy is clear, not that efficacy has been achieved. Clinicians must remain mindful of this distinction when evaluating such preliminary data.

Broader Context and Unanswered Questions

The concept of supplementing essential compounds lost during dialysis is not new. Hemodialysis, while life-sustaining, is an inherently catabolic process that can deplete various micronutrients, amino acids, and other vital substances. The

rationale for creatine supplementation fits within this broader understanding of dialysis-related deficiencies. But simply replacing a lost substance does not automatically translate into improved patient outcomes, especially in a population with such complex comorbidities.

The study did not detail the specific patient characteristics beyond their status as hemodialysis recipients.1 Factors such as age, duration of dialysis, underlying causes of renal failure, and nutritional status could all influence the impact of creatine supplementation. Future trials will need to consider these variables, potentially exploring whether certain subgroups of hemodialysis patients might derive greater benefit from the intervention. The optimal dosage and frequency of intradialytic creatine administration also remain to be definitively established, as these were likely explored only within a narrow range in this pilot study.

The long-term safety profile of creatine supplementation in this population also warrants further investigation. While short-term tolerability was demonstrated, the effects of chronic administration over months or years, particularly on kidney function (even in an anuric population) or cardiovascular health, have not been elucidated by this pilot study. Any potential interactions with other medications commonly prescribed to hemodialysis patients would also need careful assessment. The Oxford Handbook of Nephrology and Hypertension provides a comprehensive overview of the complexities in managing this patient group, highlighting the need for robust evidence before introducing new therapies.

The study's abstract also mentions other research, such as a qualitative study on long-term warfarin use in prosthetic heart valve patients and a systematic review on intratympanic steroids for cisplatin-induced hearing loss.2,3 These are distinct areas of research, but their inclusion in the abstract of the creatine study appears to be an editorial error in the provided source material, as they are entirely unrelated to creatine or hemodialysis. This highlights the importance of scrutinizing the full text of papers to ensure relevance and avoid misinterpretation.

The next logical step following this pilot study would be a larger, multi-center randomized controlled trial. This trial would need to be adequately powered to detect statistically significant differences in clinically meaningful endpoints, such as health-related quality of life scores, muscle strength, functional capacity, and potentially even hard outcomes like hospitalization rates or mortality. Without such data, intradialytic creatine supplementation remains an interesting concept with demonstrated feasibility, but no proven clinical utility for the hemodialysis population.

CLINICAL IMPLICATIONS

Clinicians should view the findings on intradialytic creatine supplementation with appropriate caution. While the pilot study confirmed feasibility and tolerability, it offered no evidence of clinical benefit for hemodialysis patients. Integrating a new intervention into complex dialysis regimens requires more than just a clean safety profile; it demands clear, quantifiable improvements in patient outcomes.

The current data does not support routine creatine supplementation in this population. GPs and specialists managing hemodialysis patients must prioritize interventions with established efficacy in improving quality of life or survival. Until larger, adequately powered trials demonstrate a tangible clinical advantage, creatine supplementation remains an investigational therapy.

Any enthusiasm for this approach must be tempered by the reality that many interventions that appear to be a good theoretical fit for a problem fail to deliver meaningful benefits in practice. The burden of proof for adding another therapy to an already polypharmacy-heavy patient group is high. We need to see hard numbers on improved patient function or reduced mortality before considering a change in practice.

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