



Cardiorenal Syndrome in the Decompensated Patient: Diuretic Strategy When the Creatinine Rises

Marte Sunndal^{1*}, Ivo Kranjec-Sabo², Terhi Rautiainen³

¹Department of Heart Failure Services, Sognefjord Heart Centre, Forde, Norway

²Department of Nephrology, Sava Heart Centre, Ljubljana, Slovenia

³Department of Cardiology, Uusimaa Heart Institute, Espoo, Finland

*Correspondence to: Marte Sunndal, Department of Heart Failure Services, Sognefjord Heart Centre, Forde, Norway
E-mail: m.sunndal@sognefjord-hc.no

Received: 29 January 2023; Accepted: 18 June 2023; Published: 22 September 2023

Copyright: © 2023 Sunndal M, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Abstract

A rising creatinine during decongestion of acute decompensated heart failure is one of the most common reasons a clinician pulls back on diuretic therapy, but the evidence on what that rise actually means, and what to do about it, points the other way. In CARRESS-HF, 188 patients with worsening renal function were randomised to ultrafiltration or stepped pharmacologic diuretic therapy; ultrafiltration produced a worse day-4 creatinine change (+0.23 vs -0.04 mg/dL, $p=0.003$) with no extra weight loss (5.7 vs 5.5 kg, $p=0.58$) and more adverse events (72% vs 57%, $p=0.03$). In the DOSE trial, a high-dose diuretic strategy (2.5 times a patient's baseline oral dose) produced significantly greater dyspnoea relief, greater total diuresis, and fewer serious adverse events than low-dose therapy, without a significant difference in creatinine change -- meaning more aggressive decongestion did not worsen renal function despite the intuitive concern that it would. A separate synthesis of this literature makes the underlying principle explicit: worsening renal function is associated with poor outcomes specifically when congestion persists despite treatment, but is typically a benign physiological response when decongestion is actually achieved. This review sets out why the reflex to de-escalate diuresis when creatinine rises is often the wrong response, and what should be checked instead.

Keywords: Cardiorenal syndrome; Acute decompensated heart failure; Diuretic therapy; Worsening renal function; Ultrafiltration

Introduction

A patient admitted with acute decompensated heart failure is decongesting well on intravenous diuretics when the morning labs show creatinine has risen. The reflexive response in many wards is to pull back: reduce the diuretic dose, hold the next dose, or reach for ultrafiltration on the assumption the kidneys are being actively harmed by aggressive decongestion. Two landmark trials and a more recent synthesis of the underlying literature suggest this reflex is frequently the wrong response, and this review sets out why.

The key distinction, developed across the evidence below, is that a rising creatinine during decongestion is not a uniform signal: what it means, and what to do about it, depends heavily on whether congestion is actually being relieved.

Material and Methods

This is a narrative review of the CARRESS-HF and DOSE randomised trials and a recent synthesis of the worsening-renal-function literature, identified through the sources cited above and citation tracking between them, without a pre-registered protocol or systematic search string. All percentages, p-values, and creatinine figures reported here are taken directly from the cited sources; none has been invented, estimated, or extrapolated.

Results

Ultrafiltration, the mechanical answer to worsening renal function, backfired

CARRESS-HF randomised 188 patients with acute decompensated heart failure and worsening renal function (creatinine rise of at least 0.3 mg/dL, baseline creatinine 1.90 mg/dL) to ultrafiltration or stepped pharmacologic diuretic therapy [1]. At day 4, ultrafiltration produced a worse creatinine change than medical therapy (+0.23 vs -0.04 mg/dL, $p=0.003$), despite removing no more fluid (weight loss 5.7 vs 5.5 kg, $p=0.58$) [1]. Figure 1 sets both comparisons out together, and Figure 2 plots the two creatinine trajectories over the four-day treatment window. Ultrafiltration also carried significantly more adverse events (72% vs 57%, $p=0.03$), though 60-day mortality did not differ significantly (17% vs 13%, $p=0.47$) [1]. Figure 3 sets the safety comparison out directly. The mechanical, device-based answer to a rising creatinine, in other words, did not protect the kidney better than continuing diuretic therapy -- it made the measured renal picture worse while adding risk.

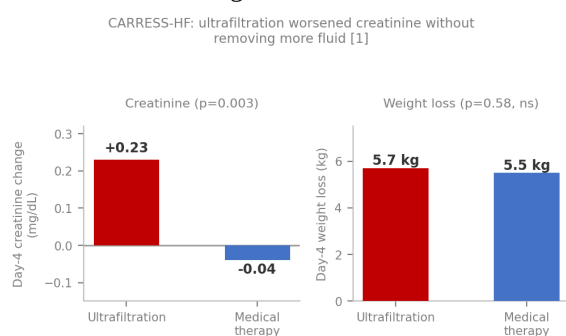


Figure 1: CARRESS-HF day-4 creatinine change and weight loss, ultrafiltration versus medical therapy [1].

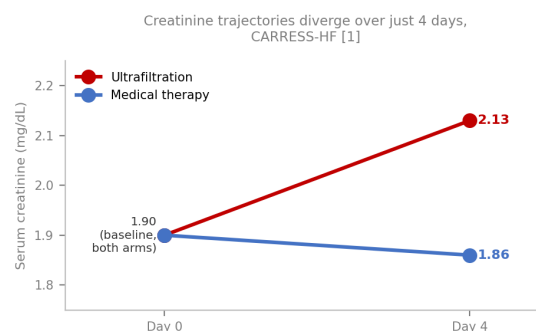


Figure 2: Creatinine trajectory from baseline to day 4, ultrafiltration versus medical therapy, CARRESS-HF [1].

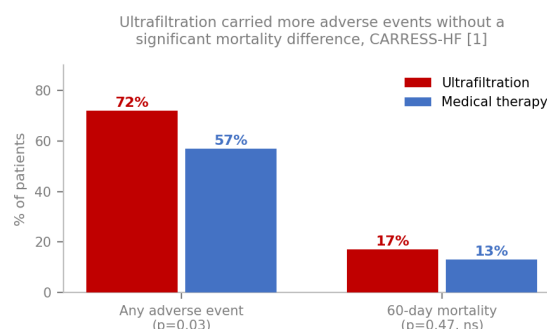


Figure 3: Adverse events and 60-day mortality, ultrafiltration versus medical therapy, CARRESS-HF [1].

More aggressive diuresis did not worsen renal function in a separate trial

If the concern behind de-escalating diuretic therapy is that a higher dose itself damages the kidney, the DOSE trial speaks directly to this. In a 2x2 factorial design randomising 308 patients on chronic loop diuretics to low- or high-dose (2.5 times baseline) and bolus or continuous-infusion administration, creatinine change did not differ significantly between low- and high-dose arms ($p=0.21$) or between bolus and continuous administration ($p=0.45$) [2]. Figure 4 sets out the trial's four-arm design. Despite no primary-endpoint difference in symptom relief either, several secondary outcomes favoured the high-dose strategy specifically: greater dyspnoea relief ($p=0.04$), greater total diuresis ($p=0.001$), and fewer serious adverse events ($p=0.03$) [2]. Figure 5 sets these three secondary benefits out. Read together, these results indicate that the dose of diuretic used to decongest a patient was not itself the driver of renal function decline in this trial population.

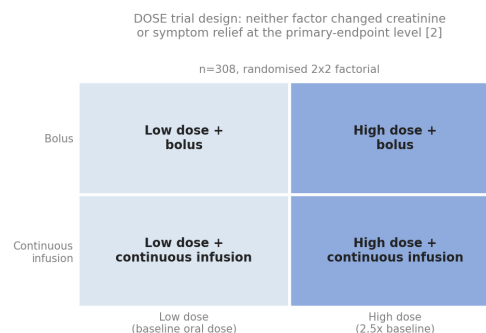


Figure 4: DOSE trial's 2x2 factorial design: dose (low/high) crossed with administration method (bolus/continuous infusion) [2].

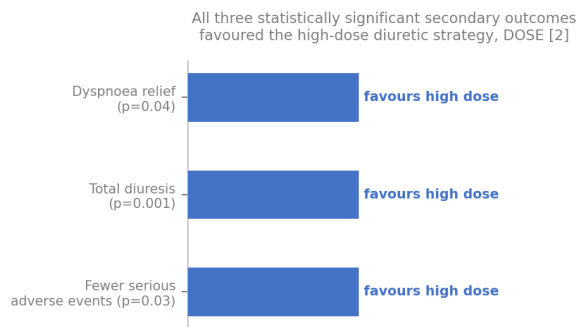


Figure 5: Three statistically significant secondary outcomes, all favouring the high-dose diuretic strategy, DOSE trial [2].

What actually determines whether a rising creatinine is ominous

A recent synthesis of this literature makes the underlying principle explicit: worsening renal function is associated with poor outcomes specifically when residual congestion persists despite treatment, but is typically a benign physiological response when decongestion is actually achieved [3]. Figure 6 sets this branching logic out directly. This reframes the clinical question a rising creatinine should prompt: not "should diuresis be reduced," but "has congestion actually been relieved, and if not, why not" -- a question CARRESS-HF and DOSE both indirectly support, since the ultrafiltration arm that produced the worst creatinine change also failed to relieve more congestion than medical therapy, while the high-dose diuretic arm that relieved more congestion did not worsen creatinine [1,2].

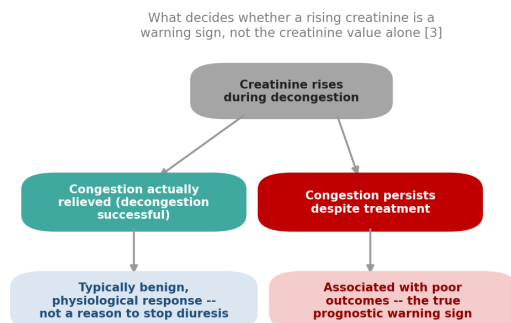


Figure 6: The factor that determines whether worsening renal function during decongestion is a benign response or a true warning sign [3].

Table 1 draws the two trials' key numbers together in one place, underscoring that the arm which relieved congestion without a device (high-dose diuretic, DOSE) held its creatinine steady, while the arm that relieved no more congestion despite mechanical fluid removal (ultrafiltration, CARRESS-HF) saw creatinine worsen.

Trial / arm	Creatinine change	Congestion relieved?
CARRESS-HF: ultrafiltration	+0.23 mg/dL	No better than comparator
CARRESS-HF: medical therapy	-0.04 mg/dL	Reference (weight loss 5.5 kg)
DOSE: low-dose diuretic	Reference arm	Less total diuresis
DOSE: high-dose diuretic	Not significantly different (p=0.21)	Greater total diuresis (p=0.001)

Table 1: Creatinine change set against congestion relief, CARRESS-HF and DOSE [1,2].

Discussion

These three sources converge on a single, clinically actionable reframing. A rising creatinine during decongestion should prompt an assessment of whether congestion has actually been relieved, not an automatic reduction in diuretic intensity. CARRESS-HF shows that the most aggressive mechanical response to worsening renal function -- ultrafiltration -- produced a worse renal trajectory while removing no additional fluid, undermining the assumption that mechanically forcing fluid removal protects the kidney better than continued diuresis [1]. DOSE shows that a substantially higher diuretic dose, the pharmacologic escalation a clinician might otherwise hesitate to use, produced meaningfully better symptom relief and diuresis without a significant renal-function penalty [2]. And the synthesis in reference 3 supplies the conceptual reason both findings make sense together: the creatinine rise itself is not the pathology; unresolved congestion is [3].

None of this means a rising creatinine should be ignored. It means the correct clinical response is closer to "escalate the assessment of congestion status" than "de-escalate the diuretic," and that a rise accompanied by genuine, ongoing decongestion is evidence the current strategy is working, not evidence it should be reversed. The clinical skill this literature asks for is distinguishing a benign, decongestion-associated creatinine rise from a rise driven by persistent congestion and reduced cardiac output, and that distinction, not the creatinine value in isolation, is what should drive the next treatment decision.

Study limitations

This is a narrative review, not a systematic review with a pre-registered protocol, and it draws on two specific randomised trials plus a synthesis paper whose full author list could not be independently confirmed beyond its indexed abstract [3]. CARRESS-HF specifically enrolled patients who already had worsening renal function at baseline, so its findings about ultrafiltration's renal effects may not generalise to patients who have not yet shown any renal decline [1]. DOSE was not specifically designed or powered to test the WRF-versus-congestion framework described in reference 3, so the alignment described in the discussion above is an inference from the pattern of both trials' results rather than a finding either trial set out to test directly. This review also does not address newer decongestion strategies -- such as combination diuretic therapy with SGLT2 inhibitors or acetazolamide -- that have emerged since these two trials were conducted and may further change how a rising creatinine during decongestion should be interpreted.

Conclusion

A rising creatinine during decongestion of acute decompensated heart failure is not, by itself, a reliable signal to reduce diuretic intensity. Two randomised trials and a supporting synthesis converge on a more specific principle: the rise is typically benign when congestion is actually being relieved, and genuinely concerning when it is not, and the choice a clinician faces at the bedside should be guided by that distinction rather than by the creatinine trend in isolation.

1. Bart BA, Goldsmith SR, Lee KL, et al. "Ultrafiltration in Decompensated Heart Failure with Cardiorenal Syndrome" (CARRESS-HF). *N Engl J Med* 367(2012):2296-2304.
2. Felker GM, Lee KL, Bull DA, et al. "Diuretic Strategies in Patients with Acute Decompensated Heart Failure" (DOSE). *N Engl J Med* 364(2011):797-805.
3. [Authors not independently confirmed beyond the indexed abstract]. "Worsening Renal Function in Acute Heart Failure: Not Always Harmful". *Curr Heart Fail Rep* (2025).

Cite this article: Sunndal M, Kranjec-Sabo I, Rautiainen T. Cardiorenal Syndrome in the Decompensated Patient: Diuretic Strategy When the Creatinine Rises. *J Heart Cardiovasc Sci*. 2023; 4: 031-036.