

THERAPEUTICS

# Continuous hemofiltration at an ultrafiltration rate $\geq 35$ mL/h per kg of body weight improved survival in acute renal failure

Ronco C, Bellomo R, Homel P, et al. Effects of different doses in continuous veno-venous haemofiltration on outcomes of acute renal failure: a prospective randomised trial. *Lancet*. 2000 Jul 1;356:26-30.

**QUESTION**

In critically ill patients with acute renal failure, what are the effects on survival of different ultrafiltration doses in continuous renal replacement therapy?

**DESIGN**

Randomized {allocation concealed\*}†, unblinded,\* controlled trial with 15-day follow-up.

**SETTING**

2 intensive-care units in a hospital in Vicenza, Italy.

**PATIENTS**

425 patients (mean age 61 y, 56% men) in the intensive care unit who had acute renal failure (abnormal concentrations of serum blood urea nitrogen and creatinine, and urine output < 200 mL in the preceding 12 h despite receipt of fluid resuscitation and furosemide) and who were to receive renal replacement therapy. Follow-up was complete.

**INTERVENTION**

Patients were allocated to 1 of 3 rates of ultrafiltration: 20 mL/h per kg of body weight ( $n = 146$ ), 35 mL/h per kg ( $n = 139$ ), or 45 mL/h per kg ( $n = 140$ ).

**MAIN OUTCOME MEASURES**

Survival during full observation period ( $\geq 15$  d after discontinuation of treatment).

**MAIN RESULTS**

Analysis was by intention to treat. At baseline, small but statistically significant differences existed between the groups for age, serum blood urea nitrogen level, and Acute Physiology and Chronic Health Evaluation (APACHE) II score. Survival rates were lower in the 20-mL group than in the other 2 groups ( $P \leq 0.001$ ) (mortality rates in Table). Survival did not differ between the 35-mL and 45-mL groups ( $P = 0.87$ ). After controlling for baseline imbalances between the groups, the survival patterns were not changed. Sepsis, blood urea nitrogen level at the start of hemofiltration, and APACHE II

score were shown to affect mortality. Full renal recovery was attained by 95%, 92%, and 90% of patients who survived to 15 days after stopping continuous hemofiltration in the 20-, 35-, and 45-mL groups, respectively.

**CONCLUSION**

In critically ill patients with acute renal failure, continuous hemofiltration at an ultrafiltration rate  $\geq 35$  mL/h per kg of body weight improved survival.

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\*See Glossary.

†Information provided by author.

**Mortality rates from randomization until 15 days after cessation of treatment with ultrafiltration rate at 35 and 45 mL/h vs 20 mL/h per kg of body weight for acute renal failure‡**

Ultrafiltration rates				RRR (95% CI)	NNT (CI)
35 mL	45 mL	35 + 45 mL	20 mL		
43%	—	—	59%	34% (16 to 49)	5 (3 to 11)
—	42%	—	59%	32% (18 to 48)	5 (4 to 11)
—	—	43%	59%	33% (18 to 47)	5 (4 to 9)

‡Abbreviations defined in Glossary; RRR, NNT, and CI calculated from data provided by author.

**COMMENTARY**

Despite continuous improvement of supportive treatments, acute renal failure remains a life-threatening condition with a mortality rate ranging from 40% to 60% at 30 days, even among patients in the care of experienced medical teams. In this study, Ronco and colleagues report that 75% of cases of acute renal failure occur in surgical circumstances, and the short-term prognosis is worsened by concomitant sepsis. In those patients with substantial metabolic and hemodynamic disturbances, the main benefit of continuous hemofiltration is in ensuring a gentle, continuous removal of uremic toxins and fluid without worsening hemodynamic equilibrium. The complication rate of such methods is remarkably low, allowing the treatment to continue for as long as it takes renal function to recover fully. Renal replacement therapy is often regarded as a supportive measure only because of its relatively low influence on early prognosis, which is determined by the presence of risks related to the initial disease and such intercurrent complications as multiorgan system failure. Few studies have been done to compare the effects of continuous and conventional dialysis techniques on the outcomes of acute renal failure (1).

Ronco and colleagues show that the treatment dose delivered by continuous hemofiltration, as measured by ultrafiltration rate, strongly

influences the outcomes. This is especially true in patients with sepsis whose metabolic disturbances and toxin accumulation tend to increase in proportion to increased catabolism and hemodynamic disequilibrium. From the comparison of survival rates between the 3 groups of ultrafiltration rate, we could infer that the dialysis needs of patients with acute renal failure are often undervalued because the survival rate was significantly lower in patients treated according to routine clinical practice. Thus, another challenge of continuous hemofiltration treatment is to permit an easy increase of ultrafiltration rate up to 40 mL/h per kg. This rate may be limited by vascular access dysfunction, but in this study, it occurred in only 10% of the patients and was not significantly different between groups.

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**Reference**

- Swartz RD, Messana JM, Orzol S, Port FK. Comparing continuous hemofiltration with hemodialysis in patients with severe acute renal failure. *Am J Kidney Dis*. 1999;34:424-32.