Editorial

Continous renal replacement therapy and intermittent hemodialysis in acute kidney injury: equivalent or complementary?

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Nearly 60% of patients admitted to intensive care units have evidence of acute kidney injury (AKI). In the recent AKI EPI study, 13.5% of patients admitted to ICUs were treated with renal replacement therapy (RRT) and 23.5% of patients with AKI required RRT (1).

Although peritoneal dialysis is still used widely in developing countries and in neonates, often with excellent outcomes, it has limitations in efficiency of solute clearance and in patients following abdominal surgery (2,3). Intermittent hemodialysis (IHD) is highly effective in achieving solute removal by solute clearance and fluid removal by ultrafiltration. However, IHD achieves this over a short period of time, typically 3–5 hours. However, IHD induced rapid fluid removal and solute changes may result in further hemodynamic instability in critically ill patients and may result in disequilibrium syndrome in patients with pre-existing cerebral edema or severe uremia. Continuous renal replacement therapy (CRRT) provides for fluid removal and solute clearance continuously, 24 hours a day, potentially allowing for less hemodynamic instability. Some studies have shown significant hemodynamic instability in critically ill patients during IHD and even during slow low efficiency dialysis (SLED) which uses a lower blood and dialysate flow rate and extends dialysis to 8 or more hours (4,5). However, others have not, especially from centers where the initial blood pump speed is slow, the duration of IHD is extended to 5 or 6 hours and is performed daily so to minimize solute shifts and the amount of fluid removal required (6,7).

Over the last two decades, many studies have sought to determine the optimal modality for RRT treatment of critically ill patients with AKI. The results of observational studies, randomized clinical trials, and meta-analyses comparing these techniques have failed to demonstrate superiority of either CRRT or IHD in terms of mortality (6-14). However, a number of observational studies have suggested that initial use of CRRT is associated with lower subsequent dialysis dependency, possibly due to less hemodynamic instability (15-18).

Truche and colleagues recently published another study comparing intermittent IHD and CRRT in the management of critically ill patients with AKI. They studied data from 1,360 critically ill patients from 19 ICUs in France who had AKI treated by either CRRT or IHD between 2004 and 2010 whose clinical data had been entered in an observational prospective multicenter cohort (19).

Treatment groups were defined as the modality used for the longest time within the first 7 days after RRT initiation. The primary outcome was a composite criterion composed of mortality or dialysis dependency 30 days after the beginning of RRT. The secondary outcome was the 30-day mortality comparatively between the two groups. Six-month prognosis of patients alive and still requiring RRT at ICU discharge was compared between the two modalities with a composite criterion of mortality and persistent renal dysfunction.

As with other studies comparing CRRT and IHD in this population, there was no difference in mortality or 30-day dialysis dependency between groups. Interestingly, however, survival was better in the CRRT group in patients with fluid overload and worse in patients who were hemodynamically stable.

Examination of the study data however, reveals a number of limitations in the methodology and significant differences between the groups. There was a change in initial therapy in over 40% of the patients making it difficult to clearly

attribute therapies. In addition, data on long-term renal recovery was missing in over 25% of patients and there were significantly more patients with septic shock in the CRRT group (41.5%) than the IHD group (22.2%).

The authors employed a marginal structural model (MSM), which has been proposed as a method to infer a causal relationship between a time-dependent treatment and outcome in the presence of a time-dependent confounder. However, MSM assumes that the treatment regime is fixed over time. This is a problem in this study which spanned nearly 10 years and where there were significant changes in clinical practice in some of the 19 study centers with some moving from almost complete use of CRRT in 2004 to almost total use of IHD in 2010.

While interesting, this study does not provide new answers to the now, largely outdated, question of whether critically ill patients with AKI should be treated with IHD or CRRT. There is increasing acceptance that patients should be treated with the modality most appropriate for their clinical condition at that point in time. I would suggest that the question which needs to be answered is not whether IHD or CRRT are superior, but in which patient and when should each mode be used? For many patients that means providing the initial RRT with CRRT in a dose appropriate to control acid-base derangements followed by a reduction in dose and subsequently with IHD as they become hemodynamically stable and require mobilization. As an intensivist, used to using many different modes of ventilation selected based on the patient's changing needs, I find the viewpoint that all critically ill patients with AKI should be treated with the same mode (and dose) simplistic.

Until recently, vendors built most RRT machines so that they could only provide either IHD or CRRT but not both. More recently, however, some manufacturers are now providing RRT machines, which are built primarily for use in the ICU and allow for the provision of a spectrum of RRT modes including IHD, SLED and the variations of CRRT.

Future studies of RRT in the ICU should address the question of which modality should be used in which patients and when.

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Footnote

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