



Use of 2-hour creatinine clearance to guide cessation of continuous renal replacement therapy ☆, ☆ ☆, ☆

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Abstract

Purpose: A simple test that could guide successful cessation of continuous renal replacement therapy (CRRT) in critically ill patients would be clinically useful. This study aimed to investigate whether a 2-hour creatinine clearance (2h-CrCl) measurement could more accurately predict successful cessation of CRRT than serum creatinine or urine output alone.

Materials and Methods: This retrospective study identified all patients admitted to a university teaching hospital intensive care unit who received CRRT and had a 2h-CrCl measurement performed in the 12 hours preceding CRRT cessation. The ability of 2h-CrCl to predict successful discontinuation of CRRT was compared to other renal indices.

Results: Of 85 patients who had 2h-CrCl performed prior to CRRT cessation 53 (62.4%)(success group) remained dialysis free 7 days after CRRT cessation. 2h-CrCl was a better predictor of remaining CRRT free at day 7 (OR, 1.108 [1.05–1.17] per 1 mL/min increase in 2 hours CrCl, $P < .001$) than urine output, serum creatinine or age. A 2h-CrCl value of 23 mL/min had a sensitivity, specificity and positive predictive value for remaining CRRT free at day 7 of 75.5%, 84.4%, and 88.8%, respectively.

Conclusion: 2h-CrCl may be a useful measurement to help guide discontinuation from CRRT.

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☆ Conflicts of Interest: None

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1. Introduction

Approximately 20% of critically ill patients develop severe acute kidney injury (AKI), of whom half will require renal replacement therapy (RRT) [1,2]. Because of hemodynamic stability and steady solute control, continuous RRT (CRRT) is often the preferred choice over intermittent RRT (IRRT) in the intensive care unit (ICU) [3,4].

There are some data regarding optimal commencement and dosing of CRRT. Earlier initiation of CRRT appears to

improve patient outcomes [5,6], and ideal dosing regimens have been established by the ATN (Veteran Affairs/National Institutes of Health Acute Renal Failure Trial Network) and RENAL (Randomized Evaluation of Normal versus Augmented Level Renal Replacement Therapy) trials [7,8]. However there is a paucity of evidence to aid clinician judgment on when exactly CRRT should be discontinued [9]. Were an accurate predictor of successful cessation of CRRT to exist, it may lead to improved success in discontinuing the therapy, a reduction in the duration of treatment and its associated complications and significantly reduced cost [10]. Recent studies examining factors associated with failed discontinuation of CRRT identified urine output, serum creatinine, duration of dialysis, age, and severity of illness as predictors of successful cessation of CRRT [11-13]. Among these factors, urine output and serum creatinine were the strongest predictors.

Creatinine clearance measurements combine both these factors, and as such may represent a useful measurement in predicting return of adequate renal function. Creatinine clearance (CrCl) is the theoretical volume of blood plasma from which all creatinine is removed per minute and represents an indirect measurement of glomerular filtration rate (GFR); the most widely accepted parameter to determine renal function [14]. The measurement of CrCl from timed urine collections and serum creatinine is a simple, relatively inexpensive, and accessible method [15]. Traditionally, 24-hour urine collections were used to determine CrCl. However, it has recently been shown that a two hour urine collection correlates as accurately with GFR as the more cumbersome 24-hour method [16].

Our study aimed to investigate whether a 2-hour creatinine clearance (2h-CrCl) measurement could more accurately predict successful cessation of CRRT than the use of traditional markers such as serum creatinine or urine output. We also aimed to determine the value for 2h-CrCl that provided optimal sensitivity, specificity and accuracy.

2. Methods

Local research ethics committee approval was deemed unnecessary for this study. However, approval was granted by St. Vincent's University Hospital audit research committee. This retrospective study was conducted in a general ICU in a university teaching hospital. All patients admitted from January 1, 2009, to December 31, 2010, were screened, and those who received CRRT and had a 2h-CrCl measurement performed in the 12 hours preceding CRRT cessation (CRRT Day 0) were considered for inclusion. We excluded patients with end-stage renal failure on chronic RRT, patients who received RRT during their hospital stay prior to ICU admission and

patients who had treatment withdrawn or died within 7 days of CRRT cessation.

Demographic and clinical information was obtained retrospectively from written medical records and an electronic clinical information system (Metavision; iMDsoft, Tel Aviv, Israel) using an Excel-based data collection tool.

Included patients were divided into 2 groups according to their RRT requirement within 7 days after the initial discontinuation of CRRT. Patients were placed in the "success" group if they remained free of RRT for 7 days. Patients who required re-initiation of RRT within 7 days of initial discontinuation were placed in the "repeat-RRT" group. The criteria for restarting CRRT were similar between both groups.

Baseline demographics were analyzed using Fisher exact test and Mann-Whitney *U* test. Variables at discontinuation of CRRT were compared using the Mann-Whitney *U* test. To further analyze relevant factors for successful discontinuation of CRRT we conducted a multivariate logistic regression analysis with successful discontinuation of CRRT as the dependent variable. Baseline variables included in the analysis were age, admission serum creatinine and admission Sequential Organ Failure Assessment Score (SOFA) score. Variables analyzed on the day of CRRT cessation were SOFA score, urine output, serum creatinine and 2h-CrCl. Backward stepwise elimination process was used to remove variables if the multivariate *P* value was greater than .05. The prediction ability of creatinine clearance, serum creatinine and urine output for successful discontinuation of CRRT was assessed with the area under the receiver operated characteristic (ROC) curve measurement. Statistical analysis was performed using SPSS (IBM Corporation, New York, NY). A *P* < .05 was considered statistically significant.

3. Results

During the study period, 1127 patients were admitted. Of these, 319 received CRRT, and 151 had 2 hourly creatinine clearance measurements performed within the 12-hour time period preceding CRRT cessation. Of these 151 patients, 41 had treatment withdrawn, 9 died on CRRT, and 16 had insufficient data available for analysis. These patients were excluded from further analysis (Fig.).

Of the remaining 85 CRRT patients, 53 were removed successfully from CRRT and remained RRT free for 7 days post CRRT cessation. These 53 patients were classified as the "success" group, and the other 32 who required re-initiation of RRT within 7 days of cessation were classified as the "repeat-RRT" group. Age and chronic medical conditions between both groups were similar but patients in the success group were less likely to have chronic kidney disease (Table 1). Renal and physiological variables at admission were similar between both groups. However,

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