

Evaluation of continuous renal replacement therapy results applied in the intensive care unit

Yoğun bakım ünitesinde uygulanan sürekli renal replasman tedavisi sonuçlarının değerlendirilmesi

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Posted date:02.11.2022

Acceptance date:22.11.2022

Abstract

Purpose: Acute kidney injury diagnosed patients are in need of renal replacement therapy (RRT). Continuous RRT is believed to be safer because the rates of fluid and solute removal are slower than with intermittent hemodialysis. In many centers, CRRT is preferred in special conditions such as increased cranial pressure, sepsis, burns, heart and liver failure. In our study, we present one year data of CRRT usage in our ICU.

Materials and methods: This study included the patients who admitted to the Internal Medicine Intensive Care Unit of our university between January 2019 and June 2020. Among these patients, those over 18 years of age and those who had acute renal failure during their hospitalization and received continuous renal replacement therapy were included in the study.

Results: Mean SOFA scores at admission were 2.7 which is an indication for severe disease. Lengths of ICU stay were long and approximately 77 percent of these patients died in ICU. When the comorbid conditions of the patients were examined, it was seen that oncological diseases were the most common. It was followed by hypertension, diabetes mellitus and heart diseases. Considering the KDIGO scores of the patients diagnosed with AKI, it was seen that 60 percent of them were grade 5. Treatment could be applied for an average of 25 hours.

Conclusion: Indications, timing and benefits of CRRT are the questions that need to be research and yet remained unsolved. With evolving of technology, CRRT will be our most useful helper in ICUs.

Key words: CRRT, acute kidney injury, renal replacement therapy.

Akbudak İH, Erdoğan C, Akbudak İH. Evaluation of continuous renal replacement therapy results applied in the intensive care unit. Pam Med J 2023;16:67-71.

Öz

Amaç: Akut böbrek hasarı teşhisi konan hastaların renal replasman tedavisine (RRT) ihtiyacı vardır. Sürekli RRT'nin daha güvenli olduğuna inanılmaktadır çünkü sıvı ve çözünen uzaklaştırma oranları aralıklı hemodiyalizden daha yavaştır. Birçok merkezde kraniyal basınç artışı, sepsis, yanıklar, kalp ve karaciğer yetmezliği gibi özel durumlarda CRRT tercih edilmektedir. Çalışmamızda yoğun bakım ünitemizde CRRT kullanımının bir yıllık verilerini sunuyoruz.

Gereç ve yöntem: Bu çalışmaya Ocak 2019-Haziran 2020 tarihleri arasında üniversitemiz Dahiliye Yoğun Bakım Ünitesi'ne başvuran hastalar dahil edilmiştir. Bu hastalardan 18 yaş üstü ve yatışı sırasında akut böbrek yetmezliği gelişen ve sürekli renal replasman tedavisi alanlar çalışmaya dahil edildi.

Bulgular: Başvuru anında ortalama SOFA skoru 2.7 idi ve bu ciddi hastalık göstergesiydi. Yoğun bakımda kalış süreleri uzundu ve bu hastaların yaklaşık yüzde 77'si yoğun bakımda öldü. Hastaların komorbid durumları incelendiğinde en sık onkolojik hastalıkların olduğu görüldü. Bunu hipertansiyon, diabetes mellitus ve kalp hastalıkları izledi. ABH tanısı alan hastaların KDIGO puanlarına bakıldığında yüzde 60'ının derece 5 olduğu görüldü. Ortalama 25 saat tedavi uygulanabildi.

Sonuç: CRRT'nin endikasyonları, zamanlaması ve faydaları, araştırılması gereken ve henüz çözülmemiş sorulardır. Gelişen teknoloji ile birlikte CRRT, yoğun bakım ünitelerinde en faydalı yardımcımız olacaktır.

Anahtar kelimeler: CRRT, akut böbrek hasarı, renal replasman hasarı.

Akbudak İH, Erdoğan Ç, Akbudak İH. Yoğun bakım ünitesinde uygulanan sürekli renal replasman tedavisi sonuçlarının değerlendirilmesi. Pam Tıp Derg 2023;16:67-71.

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Introduction

Acute kidney injury (AKI) is seen in 5–45 % of patients who admitted to intensive care units (ICU), and renal replacement therapy (RRT) is one of the treatments that have been used. 4-10% of AKI diagnose patients are in need of RRT [1]. AKI has been treated with hemodialysis and peritoneal dialysis but in critically ill patients, cardiovascular instability is a major contraindication for these modalities. Continuous RRT is a safer and well tolerated option in ICU [2].

Usages of RRT, timing and choice of modalities in ICU have been investigated and there are several trials published about these questions. Some trials suggested that CRRT and intermittent RRT have similar outcomes tolerance [3, 4]. Based on clinical practice, hypotension is the most common reason for CRRT. CRRT is believed to be safer because the rates of fluid and solute removal are slower than with intermittent hemodialysis [5]. In many centers, CRRT is preferred in special conditions such as increased cranial pressure, sepsis, burns, heart and liver failure [6].

In this study, we are presenting the data of CRRT which had been used in our ICU. We will try to explain about our indications, timing and discuss the result of these treatments.

Material and methods

This retrospective study was performed at the Pamukkale University Hospital. The permission for this study had taken from Ethics Committee of the Pamukkale University, Medical School.

This study included the patients who admitted to the Internal Medicine Intensive Care Unit of our university between January 2019 and June 2020. Among these patients, those over 18 years of age and those who had acute renal failure during their hospitalization and received continuous renal replacement therapy were included in the study. Patient's data was obtained from electronic data stored in software in the hospital computers.

Data collection

Demographic data, clinical symptoms reason for the necessity of follow-up in the intensive care unit, laboratory findings and comorbidities were recorded. Acute Physiology

and Chronic Health Assessment II (APACHE II), Sequential Organ Failure Assessment (SOFA), and The Simplified Acute Physiology Score II (SAPS II) score calculated and noted. Acute kidney injury had evaluated according to 'Kidney Disease Improving Global Outcomes' According to (KDIGO) guidelines [7]. CRRT onset time, duration time, modalities and the preferred anticoagulation method had recorded. The patients discharge status (dead, alive), and length of stay in the ICU were also recorded and acute clinical situations were examined.

Statistical analysis

All statistics were considered descriptive only. Descriptive statistics were used and median, mean and standard deviations were calculated. Continuous variables were defined by the mean \pm standard deviation and categorical variables were defined by number and percent. To test whether numerical measurements satisfy the assumption of normal distribution Kolmogorov Smirnov test had been used.

Results

Patients who received CRRT treatment on the specified dates were added to the study. 60 patients were identified and their demographic characteristics were analyzed. It was observed that the majority of the patients were male and over 60 years of age (Table 1).

Mean SOFA scores at admission were 2.7 which is an indication for severe disease. Lengths of ICU stay were long and approximately 77 percent of these patients died in ICU (Table 1).

When the comorbid conditions of the patients were examined, it was seen that oncological diseases were the most common. It was followed by hypertension, diabetes mellitus and heart diseases. Hematological diseases were seen in ten patients. Most of the patients were in septic conditions. Procalcitonin, CRP and ferritin levels were noted. They were higher than other patients in our ICU. The levels of these parameters can be seen at Table 1.

Considering the KDIGO scores of the patients diagnosed with AKI, it was seen that 60 percent of them were grade 5. Grade 4 and 5 patients underwent CRRT. The time to start CRRT after diagnosis was variable, but it could be started

within an average of 3 hours. CRRT duration was variable due to hemodynamic instability or device-related difficulties. Treatment could be applied for an average of 25 hours. Considering

the scores of the 14 surviving patients at discharge, a great improvement was seen (Table 2).

Table 1. Demographics and clinical characteristics of patients

Age (Mean ± S.D)	68.97±12.16
Sex (M/F)	42 (70%) /18 (30%)
SOFA score (Mean ± S.D)	2.71±1.32
Length of ICU stay (day) (Mean ± S.D)	15.87±11.57
Exitus	46 (76.6%)
Comorbidities	
Oncological Diseases	47 (78.3%)
Hypertension	41 (68.3%)
Diabetes Mellitus	38 (63.3%)
Coronary Artery Disease	29 (48.3%)
Cardiac Failure	12 (20%)
Hematological Disease	10 (16.6%)
Laboratory Findings at Admission	
Procalcitonin (Mean ± S.D)	2.9±10.51
C-reactive Protein (CRP) (Mean ± S.D)	123.83±86
Ferritin (Mean ± S.D)	1023.33±1335.09

S.D: Standard Deviation

Table 2. Treatment properties of patients

Scores at Beginning of CRRT	
KDIGO Grade 4	24 (40%)
KDIGO Grade 5	36 (60%)
CRRT	
Time of onset (minutes)	3.5±1.8
Duration time (hours)	25.8±12.7
Modalities	Continuous venovenous hemodialysis (CVVHD) – all patients
Preferred Anticoagulation	Heparin – all patients
Scores at Discharge (number of patients)	
KDIGO Grade 2	7 (11.6%)
KDIGO Grade 3	6 (10%)
KDIGO Grade 4	1 (1.6%)

S.D: Standard Deviation

Discussion

The use of CRRT in critically- ill patients has been increasing in recent years. Many ICUs have this option of treatment for AKI. In this study, we investigated the data of CRRT used in patients in our ICU. We chose this method against routine hemodialysis because of many reasons. The most common reason was hemodynamic instability due to sepsis. Being an internal diseases intensive care unit causes that our patients mostly admitted from oncology

and hematology wards. This explains the high percent of these comorbidities in our patients.

Our initiation time was earlier than most of the studies about CRRT. The STARRT-AKI, is a large study that had 3019 patients and included many different patients from ICUs. Patients were selected to the accelerated RRT protocol group or standard RRT group randomly. There was no statistical difference in mortality between these group and between subgroups (sepsis, KDIGO grading, type of admission) [8].

Mortality rate was high in our patients. Most of the patients were immunosuppressed due to malignancies and chemotherapies. They were admitted to ICU because of sepsis and septic shock. This situation may explain high rates of mortalities.

In a prospective cohort study that investigates outcomes of cancer and non-cancer patients with acute kidney injury and need of renal replacement therapy admitted to general intensive care units found that higher mortality rate in patients can be attributed to severity of organ dysfunctions as shown by higher SOFA scores. They studied 773 patients who needs RRT and their mortality rate was %70 overall. 78 percent of these deaths were cancer patients [9].

Fourteen patients had survived AKI and could discharged. There was significant improvement in their KDIGO grading. KDIGO grade 2, 3 and 4 were noted. Mostly, the injuries were mild and patients needed follow-ups for renal functions. In a study which investigated Korean critically-ill patients in ICU, the data showed that %25 patients of solid diseases and %33.3 patients of hematologic diseases were RRT independent. This showed that we can maybe raise their survival rates but some of these patients have permanent renal injury [10]. In the cohort study, >85% of surviving patients were not dependent on RRT at hospital discharge [9]. In the study of Soares et al. [11] renal function recovered in 82% of patients at 6 months of follow-up.

CRRT has some technical limitation as seen in our cases. Such problems like filter clotting, intravascular device problems cause short treatment time. CRRT needs educated staff including doctors and nurses. When technical problems are encountered, it is necessary to find and solve the problem. Education is essential in this regard.

In a review about CRRT complications, possible complications and interventions discussed. Mechanical complications such as vascular access related complications and extracorporeal circuit complications were major limitations for the therapy. Complications related to catheters include development of arrhythmias, hemothorax, pneumothorax, pericardial tamponade, and sepsis due to catheter infection. Premature filter clotting

encountered in some patients contributes to substantial down time compromising dialysis [12].

Our study has multiple limitations. Patients are from internal medicine wards and they have multiple comorbidities that have high mortalities. This fact may raise our mortality rates. Patient variability is low due to the same fact.

As result; indications, timing and benefits of CRRT are the questions that need to be researched and yet remained unsolved. With evolving of technology, CRRT will be our most useful helper in ICUs.

Conflict of interest: No conflict of interest was declared by the authors.

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Ethics committee approval: Permission for the study was obtained from Pamukkale University, Non-Interventional Clinical Research Ethics Committee (date: 08/07/2020 and number: 60116787-020/41134).

Authors' contributions to the article

I.H.A., C.E., I.H.A. have constructed the main idea and hypothesis of the study.

I.H.A., C.E. developed the theory and arranged the material and method section.

I.H.A., C.E., I.H.A. have done the evaluation of the data in the Results section.

Discussion section of the article is written by I.H.A., C.E.

I.H.A., C.E., I.H.A. reviewed, corrected and approved.

In addition, all authors discussed the entire study and approved the final version.