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LETTER TO EDITOR

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Mortality and Recovery of Kidney Function in Kidney Replacement Therapy-Requiring AKI: Data from All Affected In-Hospital Subjects

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Abstract

Acute kidney injury (AKI) affects increasing numbers of hospitalized patients in Central Europe and in the US. Kidney replacement therapy (KRT) becomes mandatory if other strategies fail to prevent patients from systemic intoxication, resistant hyperhydration, or refractory hyperkalemia. The majority of data related to survival rates of AKI subjects that require KRT have been acquired under intensive care conditions. In the current letter to the editor we provide outcome data of all patients with in-hospital diagnosed AKI that received KRT at least once. We retrospectively assessed subjects receiving one or more individual sessions of KRT due to AKI of various etiology. Subjects were partly treated in the ICU or under non-ICU conditions. The in-hospital mortality was 35.4% complete recovery of kidney function occurred in 48.8%. In summary, the mortality of all in-hospital AKI subjects is comparable to the mortality of AKI patients in the ICU. In addition, more than 50% do not recovery completely. Therefore, subjects with hospital-acquired AKI and an incident or prolonged need for KRT require the highest attention of nephrologists in general, no matter whether they received intensive care treatment or not.

Keywords: AKI; Dialysis; Mortality; Recovery of kidney function

Main Text

Acute kidney injury (AKI) affects increasing numbers of hospitalized patients in Central Europe and in the US (up to 30% [1]). Kidney replacement therapy (KRT) becomes mandatory if other strategies [2] fail to prevent patients from systemic intoxication, have resistant hyperhydration, or refractory hyperkalemia. The KRT procedure of choice depends on the patient´s characteristics (e.g. hemodynamic stability, bleeding risk) on one hand, but also on regional or hospital-related preferences (e.g. intermittent hemodialysis or hemodiafiltration, slow extended daily dialysis - SLEDD) on the other hand. Until now, no particular procedure has truly been shown as superior to other procedures in terms of mortality. In recent years, however, it has at least been realized that a so-called extended approach of KRT initiation may be preferred in subjects without the urgent need for KRT initially [3-5]. The majority of data related to survival rates of AKI subjects that require KRT have been acquired under intensive care conditions. Significantly fewer studies have evaluated outcome variables of all in- hospital AKI subjects that undergo KRT either transiently or permanently. In the current brief communication we provide outcome data of all patients with in-hospital diagnosed AKI that received KRT at least once. Two variables were of particular interest: in-hospital mortality and recovery of kidney function.

We retrospectively assessed subjects receiving one or more individual sessions of KRT due to AKI of various etiologies. Subjects were partly treated in the ICU or under non-ICU conditions. The study was formally approved by the ethics committee of the Brandenburg Medical School (E-01-20200701). All patients were recruited from the University Hospital Brandenburg of the Brandenburg Medical School (Germany). The observational period lasted from September 2018 until October 2019. AKI subjects were identified though the in-hospital AKI alert system, which is based on criteria 1 and 2 of the 2012.

KDIGO clinical practice guidelines for AKI [6]. KRT was initiated if one or more of the following criteria was/were fulfilled: anuria for more than 12 hours, hyperkalemia of >6.0 mMol/L despite the use of at least two pharmacological measures, systolic hypertension of >180 mmHg or pulmonary congestion with simultaneous oliguria for at least 12 hours, and one or more symptoms of suspected uremia (decision by the nephrologist in charge). KRT was performed as either intermittent hemodialysis (blood flow rate 200-300 mL/min) for 4-5 hours or as SLEDD (blood flow rate 100-200 mL/min) for 8-10 hours or as continuous veno-venous hemodialysis (blood flow rate 50-50 mL/min) for more than 24 hours. Anticoagulation was exclusively performed with heparin or argatroban if indicated. In subjects with a higher bleeding risk or active bleeding, no anticoagulant was used at all. The ultrafiltration rate was adapted to individual needs. The following endpoints were defined: in-hospital death and recovery of kidney function until discharge. Complete recovery was diagnosed

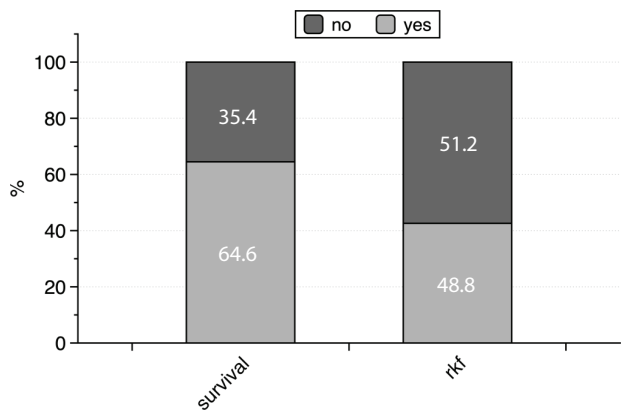

Figure 1: Survival and recovery of kidney function (rkf). 35.5 % of all AKI subjects without pre-existing CKD that required KRT died during the hospital stay. More than 50% did not recover from excretory kidney dysfunction until discharge.

if the last eGFR according to CKD-EPI [7] differed from the highest eGFR by no more than 10 mL/min, and no recovery was diagnosed if the last eGFR was lower by more than 10 mL/min.

During the observational period, a total number of 204 subjects were included in the study. Patients were either diagnosed with AKI (n=100) or with AKI-on-CKD (chronic kidney disease) (n=104). 80 of all individuals were females, 124 were males, and the mean age was 69.4 ± 13.5 years. The mean in-hospital treatment time was 15.2 ± 12.5 days. The respective etiologies were: pre-renal 62.7%, sepsis 10.3%, drug-induced 2.5%, obstruction 2%, other 11.7%, and unknown 10.8%. KRT was initiated for the following reasons: symptoms of suspected uremia 47.5%, refractory hyperhydration with or without refractory hypertension 20.6%, hyperkalemia 19.6%, and other 12.3%. The in-hospital mortality of all subjects 25.7%, the in-hospital mortality of AKI subjects without pre-existing CKD was 35.4% (Figure 1), complete recovery of kidney function occurred in 48.8%, and no recovery in 51.2%.

Twenty years ago, Angus DC, et al. [8] published a retrospective observational study that summarized epidemiological data from >840 US hospital. More than 190,000 subjects fulfilled the criteria for severe sepsis based on the "International Classification of Diseases" (Ninth Revision, Clinical Modification). The authors identified an AKI incidence of 22%, and the mortality of affected individuals exceeded 38%. Vaara ST, et al. [9] reported an incidence of KRT-treated AKI of 6.8% in critically ill subjects, and the in-hospital mortality was 35%. In 2015 finally, Hoste and colleagues published a large scaled retrospective study in which ICU patients from 97 centres were included. The overall mortality of AKI subjects was 26.9 % [1]. There is currently no consensus regarding the definition of recovery of kidney function. Rewa O and Bagshaw SM emphasized that most studies defined non-recovery as persistent dialysis dependence [10]. In this regard, Korkeila M, et al. [11] reported a recovery rate of 82%. Silvester W and colleagues identified a recovery rate of more than 85% [12]. We decided to choose stricter criteria for recovery analysis since prolonged kidney excretory dysfunction in post-AKI patients also affects their prognosis, even if KRT may not be mandatory. In this context, Ronco C, et al. [13] discussed a certain AKI entity, subclinical AKI, which is diagnosed solely through certain types of damage markers such as neutrophil gelatinase-associated lipocalin (NGAL) and kidney injury molecule 1 (KIM-1).

In summary, our study revealed two noticeable findings. The mortality of all in-hospital AKI subjects without pre-existing CKD is comparable to the mortality of AKI patients in the ICU. In addition, more than 50% do not recovery completely. Therefore, subjects with hospital-acquired AKI and an incident or prolonged need for KRT require the highest attention of nephrologists in general, no matter whether they received intensive care treatment or not.

Ethical Approval and Consent to Participate

The local ethics committee of the Brandenburg Medical School formally approved the study (No. E-0120200701). It was not required to obtain written consent due to the retrospective nature of the investigation.

Consent For Publication

All authors agreed to submit the final version of the manuscript.

Availability of Data and Materials

The data supporting the findings of this study are available from the corresponding author upon reasonable request: d.patschan@gmail.com.

Competing Interests

The authors declare that they have no conflicts of interest.

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Authors' Contributions

LS collected all data, performed analyzes and assisted in writing the article or corrected the article. DP designed the study, analyzed data and wrote the manuscript. All authors agreed to publish the final version of the manuscript.

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