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Indications of continuous renal replacement therapy in critically ill pediatric patients

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Abstract--Background: Despite the increasing role of continuous renal replacement therapy (CRRT) in management of acutely ill patients requiring dialysis, the procedure remains demanding in terms of human resources and cost. Aim of the work: identification of the indications of CRRT in critically ill pediatric patients. Methods: A descriptive study of 35 pediatric patients requiring CRRT. Data regarding patients' conditions and indications of CRRT were reported. Results: metabolic acidosis and volume overload were the most common indication of CRRT. Conclusion: CRRT is a useful therapy in critically ill children. The most frequent indications are metabolic acidosis and hypervolemia.

Keywords--CRRT, indications, renal replacement therapy.

Introduction

Continuous renal replacement therapy (CRRT) is considered the gold standard for management of critically ill pediatric patients with acute kidney injury (AKI) (Riley

et al, 2018). In addition to those patients with AKI and hemodynamic instability, patients with end stage renal disease (ESRD) are at high risk for developing critical illness that may cause hemodynamic instability as complications of ESRD itself (De Rosa et al., 2017), or caused by intermittent hemodialysis (Blagg, 2001). Many of ESRD patients suffered from cardiovascular abnormalities as a complication of ESRD which can compromise hemodynamic stability, so CRRT is the modality of renal replacement (Srisawat et al., 2010), but its cost remains the main limitation especially in limited resource centers (Farese et al., 2009).

Despite advances in CRRT techniques over the last several years, the mortality rate of patients undergoing CRRT remains high, and some patients die within few days of CRRT initiation, causing physicians to often doubt the benefits of such an invasive procedure on patient survival and/or renal preservation. Unfortunately, there are few studies to determine which factors are associated with increased early mortality in critically ill pediatric patients undergoing CRRT (Al-Ayed et al., 2018).

Methods

The current study was a descriptive study that took place in tertiary hospital intensive care units (ICUs) from January 2020 to September 2021. It included thirty-five pediatric patients with renal impairment admitted to intensive care units (ICUs). We collected clinical data from patients, such as the reason for ICU admission, and indications for CRRT initiation were recorded.

Statistical Analysis

Data were coded and entered using the statistical package for the Social Sciences (SPSS) version 26. Data were summarized using mean, standard deviation, median, minimum, and maximum in quantitative data and using frequency (count) and relative frequency (percentage) for categorical data. Comparisons between quantitative variables were done using the non-parametric Kruskal-Wallis and Mann-Whitney tests. For comparing categorical data, Chi-square (χ^2) test was performed. The exact test was used instead when the expected frequency is less than 5. Correlations between quantitative variables were done using the Spearman correlation coefficient (Chan, 2003). P-values less than 0.05 were considered statistically significant.

Results

In the patients studied, the most common reasons for starting CRRT were volume overload (54.3 %), intractable metabolic acidosis (65.7 %), hyperkalemia (31.4 %), hyponatremia (14.3 %), and uremic manifestations (8.6%) (table 1) (figure 1).

Table 1 indications of CRRT initiation

Indications		N	%
Overload	No	16	45.7%
	Yes	19	54.3%
Acidosis	No	12	34.3%
	Yes	23	65.7%
Hyperkalemia	No	24	68.6%
	Yes	11	31.4%
Hypernatremia	No	30	85.7%
	Yes	5	14.3%
Uremia	No	32	91.4%
	Yes	3	8.6%

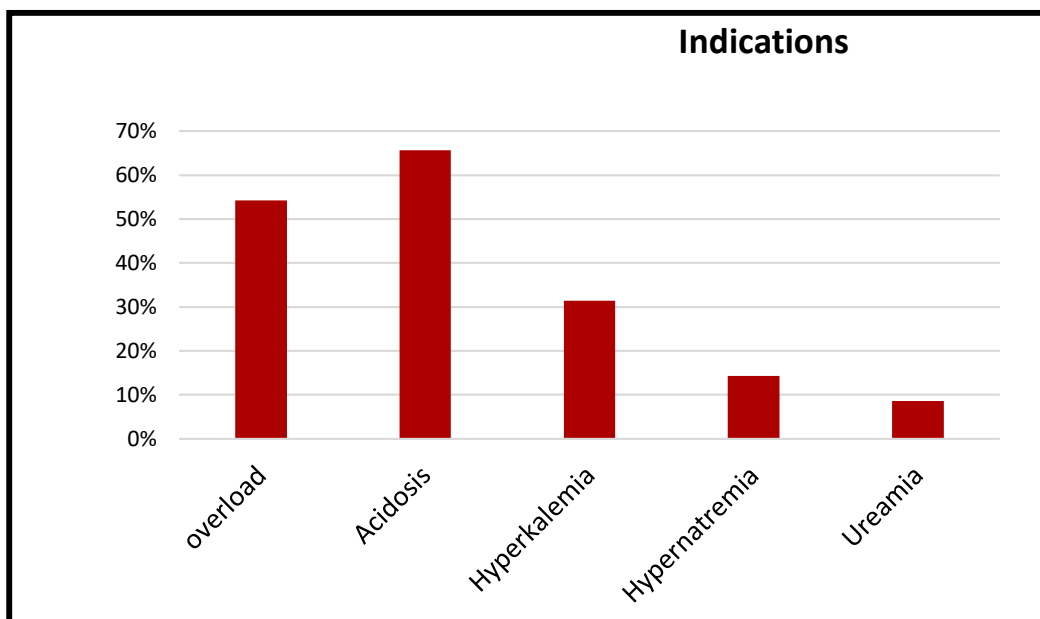


Figure (1): Indications for CRRT

Discussion

In the current study, the most frequent indications for CRRT were volume overload and refractory metabolic acidosis regardless the etiology of acidosis (renal acidosis, tissue hypoperfusion and lactic acidosis due to shock or metabolic acidosis associated with diabetic ketoacidosis and affecting kidney function). Volume overload has a positive link with higher mortality in critically ill children and can lead to several problems, including heart failure, pulmonary edema, poor wound healing, tissue breakdown, and bowel dysfunction. As a result, determining volume status is vital in the early management of severely unwell children. Although diuretics are routinely used as a first line of defense, their effectiveness is limited. As a result, in PICUs, CRRT is frequently the treatment of choice for fluid overload especially in hemodynamically unstable patients (Claire-Del Granado and Mehta, 2016).

In addition, metabolic acidosis is the most commonly observed acid-base disorder in critically ill patients, with 46 % of all children admitted to a PICU suffering from it. Correction of metabolic acidosis is a must because organ dysfunction, changed oxygen delivery, higher respiratory strain in spontaneously breathing individuals, decreased adenosine triphosphate (ATP) generation, and immune response impairment are all linked to metabolic acidosis (Ishaque et al., 2020).

Conclusion

metabolic acidosis and volume overload are the most frequent indications in critically ill patients receiving CRRT.

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