International Journal of Life Sciences Biotechnology and Pharma Research

Research Paper

ISSN 2250-3137 www.ijlbpr.com
Vol. 1, No. 4, October 2012

STUDY OF AKI AMONG CHILDREN ADMITTED TO PAEDIATRIC ICU

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ABSTRACT

Background: To study AKI among children admitted in ICU. **Materials & methods:** A total of 150 subjects were enrolled. The subjects were divided as two groups AKI as 50 in number and non- AKI as 100 subjects. The relevant risk factors or outcomes of AKI: age at PICU admission, gender, requirement for mechanical ventilation during PICU admission, admission diagnosis of trauma, duration of mechanical ventilation, and PICU mortality. **Results:** A total of 150 subjects were enrolled. The subjects were divided into two groups as AKI and Non- AKI patients. Patients with AKI had approximately double the duration of PICU and of mechanical ventilation compared to non-AKI patients. **Conclusion:** AKI is associated with increased mortality and morbidity in critically ill children.

Keywords: Acute kidney injury, intensive care unit, mortality.

INTRODUCTION

Acute kidney injury (AKI) is well known to be associated with longer hospital length of stay (LOS), morbidity and mortality in adults. [1,2] In recent years, it has become apparent that even very small increases in serum creatinine (SCr) levels in hospitalized adults and in children undergoing cardiac surgery are associated with poor hospital outcomes. [3,4] Most previous research in pediatric AKI was focused on patients requiring acute dialysis. Recently derived AKI definitions now allow us to comprehensively evaluate risk factors for and outcomes of AKI, which is a necessary first step to perform prior to initiating clinical trials to reduce AKI incidence and improve AKI outcomes. [5,6] The steep oxygen gradient from cortex to glomeruli places the renal tubular beds at significant risk of hypoxic and oxidative injury as well.[7] Both ischemia and hypoxemia are hallmarks of the dysregulation that occur during the systemic inflammatory response syndrome (SIRS), the first stage of the sepsis syndrome. [8] Sepsis is one of the leading causes of AKI in children, which may be secondary to inflammatory mediator effects on renal vascular endothelium and aberrations in the microvascular perfusion of the glomerulus from derangements in the coagulation system. Nutrition in adult AKI is important and minding macro and micro nutrient requirements is vital to outcome. [9] Optimizing nutrition in pediatric AKI patients can be challenging and Bunchman recommends using a metabolic cart to determine the amount of nutrition necessary.[10] CRRT may reduce fluid concerns when optimal nutrition, using reno-protective and anabolic formulas, is desired.

Recent large prospective randomized control trials suggest that tight glucose control increases overall mortality, also showing no difference in the number of adult patients requiring RRT based on glycemic control strategy.11 A prospective pediatric study demonstrated morbidity improvements in children receiving intensive insulin therapy, but no effects on outcomes with AKI or dialysis were seen. 12 Hence, this study was conducted to study AKI among children admitted in icu.

MATERIALS & METHODS

A total of 150 subjects were enrolled. The subjects were divided as two groups AKI as 50 in number and non- AKI as 100 subjects. The age group included was 3 days to 8 years. The consent from parents was taken. Complete history was taken. The relevant risk factors or outcomes of AKI: age at PICU admission, gender, requirement for mechanical ventilation during PICU admission, admission diagnosis of trauma, duration of mechanical ventilation, and PICU mortality. The paired t-tests were used to compare continuous variables. The results were analysed using SPSS software.

RESULTS

A total of 150 subjects were enrolled. The subjects were divided into two groups as AKI and Non- AKI patients. Patients with AKI had approximately double the duration of PICU and of mechanical ventilation compared to non-AKI patients. The mean length of mechanical ventilation days in AKI group was 4.5 and non-AKI group was 2.1. The mortality in pediatric intensive care unit for AKI was 8% and non- AKI was 2%.

Table 1: Patient characteristics by AKI status and variable associations with AKI

Characteristics	AKI (50) mean)	Non – AKI (100)	P - value
Age	5	6	0.003
Outcomes			
Length of mechanical ventilation, days	4.5	2.1	<0.001
PICU length of stay, days	8.2	3.5	<0.001
PICU mortality	4 (8%)	2 (2%)	<0.001

AKI = acute kidney injury; PICU = pediatric intensive care unit

DISCUSSION

Severe and acute impairment in vital organ function is the hallmark of critical illness and indeed the purpose of intensive care is to provide support for, and protection of, vital organs. However, comprehensive kidney support would be difficult to achieve, as the kidneys perform many complex homeostatic functions.[13,14] For instance, regulation of extracellular fluid volume, concentration of osmotically active substances, plasma pH, excretion of unwanted products of metabolism, and catabolism of hormones are all impaired during AKI. In addition, homeostasis of blood pressure, platelet function, and electrolytes are also dysregulated. Given the wide range of dysfunction that occurs during AKI, our ability to define and quantify impairment of the kidneys in a single definition that captures all of the functional domains is limited. Hence, this study was conducted to study AKI among children admitted in icu.

In the present study, a total of 150 subjects were enrolled. The subjects were divided into two groups as AKI and Non- AKI patients. Patients with AKI had approximately double the duration of PICU and of mechanical ventilation compared to non-AKI patients. A study by Andreoli SP et al, studied that acute kidney injury (AKI) (previously called acute renal failure) is characterized by a reversible increase in the blood concentration of creatinine and nitrogenous waste products and by the inability of the kidney to regulate fluid and electrolyte homeostasis appropriately. The incidence of AKI in children appears to be increasing, and the etiology of AKI over the past decades has shifted from primary renal disease to multifactorial causes, particularly in hospitalized children. The pathophysiology of hypoxia/ischemia-induced AKI is not well understood, but significant progress in elucidating the cellular, biochemical and molecular events has been made over the past several years. The history, physical examination, and laboratory studies, including urinalysis and radiographic studies, can establish the likely cause(s) of AKI. Children who have suffered AKI from any cause are at risk for late development of kidney disease several years after the initial insult. Therapeutic interventions in AKI have been largely disappointing, likely due to the complex nature of the pathophysiology of AKI, the fact that the serum creatinine concentration is an insensitive measure of kidney function, and because of co-morbid factors in treated patients. Improved understanding of the pathophysiology of AKI, early biomarkers of AKI, and better classification of AKI are needed for the development of successful therapeutic strategies for the treatment of AKI. [15]

In the present study, the mean length of mechanical ventilation days in AKI group was 4.5 and non- AKI group was 2.1. The mortality in pediatric intensive care unit for AKI was 8% and non- AKI was 2%. Another study by Hou et al., in 1983, found that 4.9% of hospitalized patients developed AKI [defined as a relative increase in serum creatinine (SCr) of 0.5, 1.0 or 1.5 mg/dl, depending on the baseline SCr]. The major causes of hospital-acquired AKI were decreased renal perfusion (42%), major surgery (18%), contrast nephropathy (12%) and aminoglycoside antibiotics (7%). The crude in-hospital mortality rate was 25% and was higher in those with more significant degrees of AKI. [16] Nash et al. updated their initial study of hospital-acquired AKI almost two decades later. They reported that 7.2% of patients developed AKI – higher than the 4.9% in the original study performed at a different institution, although the in-hospital mortality rate (19.4%) was slightly lower. The most common causes of AKI in the follow-up study were decreased renal perfusion (39%; defined broadly to include congestive heart failure, cardiac arrest, and volume contraction), nephrotoxin administration (16%), contrast administration (11%) and major surgery (9%). [17] AKI increases overall mortality, independent of disease severity. In some reports, adult mortality increases to nearly 80%, specifically in conjunction with sepsis, trauma, burns, transplant, and acute respiratory distress syndrome (ARDS). [18,19] AKI is an independent risk factor for mortality, with odds ratios as high as 4.8, and independently increases hospital costs, length of stay, and ventilator days. [20] AKI also leads to end stage renal disease in a significant proportion of adults. [21] In a study of nearly 4000 critically ill children, AKI increased mortality and lengthened intensive care stay four-fold. [22]

CONCLUSION

AKI is associated with increased mortality and morbidity in critically ill children.

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