

# Etiology And Outcome Of Acute Renal Failure In 147 Children: A Single Center Experience

<sup>1</sup>Rainer Büscher, <sup>1</sup>Janet Attinga, <sup>1</sup>Anja Büscher, <sup>1</sup>Udo Vester, <sup>2</sup>Christian Dohna-Schwake, <sup>1</sup>Peter F. Hoyer

<sup>1</sup>Pediatrics II, Pediatric Nephrology, University of Duisburg-Essen, Hufelandstr. 55, 45122 Essen, Germany

<sup>2</sup>Pediatrics I, Pediatric Intensive Care Unit, University of Duisburg Essen, Hufelandstr. 55, 45122 Essen, Germany

## Background

Acute renal failure (ARF) is common in critically ill children and characterized by a sudden but reversible increase of serum creatinine and nitrogenous waste products and by the inability of the kidney to regulate fluid and electrolyte homeostasis appropriately. The incidence in children seems to be increasing and the etiology of ARF has shifted from primary renal disease to multifactorial causes. Therapeutic strategies and prognosis depend on the underlying disease.

## Objectives

The aim of this retrospective study was to define etiology and clinical features of ARF in 147 children and to evaluate prognostic factors and the outcome after renal replacement therapy.

## Patients and Methods

**Patients and Methods:** Between 2001 and 2011, 219 paediatric patients were admitted to our Intensive Care Unit (ICU) for ARF. Among those, 72 patients were excluded from the database due to prior existing CKD (n=35), age (n=12) or lack of data (n=25). The remaining 147 pediatric patients (66 females, 81 males), were included in the registry. Out of those, 26 (17.6 %) were newborns (median age 4 days, range 1-22 days) and 121 patients (82.4%) were children older than 1 month (median 3.21 years, range 1 month–18 years). Causes of ARF, accompanying medical conditions, pediatric-modified RIFLE criteria (Figure 1), treatment, indications and mode of dialysis as well as patient outcome were retrospectively analyzed. Stepwise multiple regression analysis was performed to test whether independent predictors of mortality were existing in both age groups.

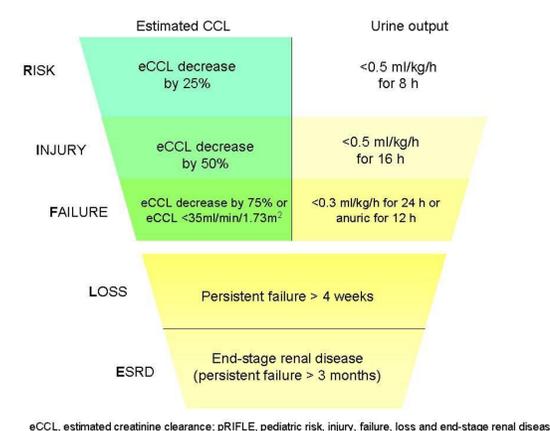
## Results

While haemolytic uremic syndrome (n=42; 35%), sepsis (n=36; 30%) and dehydration (n=34; 28%) were the most common causes of ARF in children older than 1 month, renal vein thrombosis (n=11; 42%) as well as shock and asphyxia (n=10; 38%) were predominant reasons in newborns (Figure 2). Dialysis was performed in 12.5% (n=3, all CVVHD) of newborns and 55% (n=66, 37 CVVHD, 29 CVVHF) of children older than 1 month (Table 1). Overall mortality was 23% (n=34) and was predominantly observed in the group of septic children following bone marrow transplantation (BMT; n=30, 88%, Figure 3). All BMT patients underwent dialysis treatment. Independent predictors of mortality are shown in Table 2. Out of 66 dialysed patients restitution could not be achieved in 15 cases (22.7%) and chronic dialysis treatment became necessary.

## Conclusions

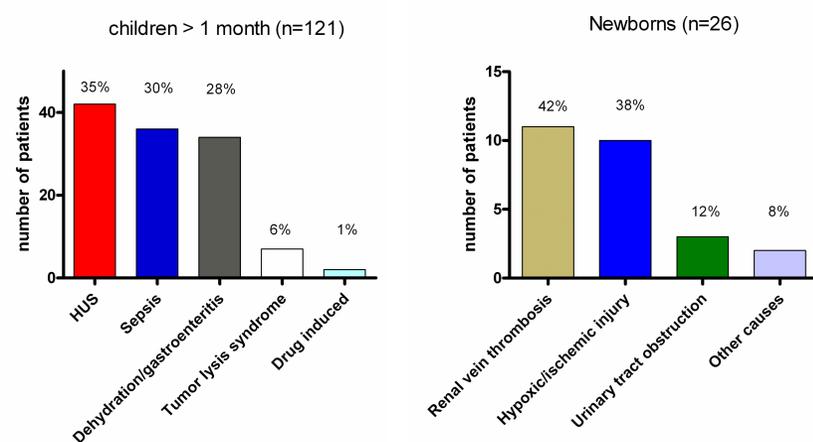
Our overall results suggest a favourable outcome of ARF in children regardless the necessity of dialysis. In contrast, ARF in children following BMT and sepsis is associated with a 100% mortality rate. Improved understanding of the pathophysiology, early biomarkers of AKI, and better classification are required to optimize successful therapeutic efforts.

**Figure 1: Pediatric-modified RIFLE (pRIFLE) criteria**



Adapted from: Akca-Arikan A et al. (2007) Modified RIFLE criteria in critically ill children with acute kidney injury. *Kidney Int* 71:1028-1035.

**Figure 2: Etiology of ARF in the study cohort, stratified by age group**



**Table 1: Patients ICU admission characteristics**

Variables	Newborns < 1 month (n=26)	Children > 1 month (n=121)
Gender (male/female)	11/15	70/51
Age at ARF (days and years)	4 days (1-22)	3.21 years (1 mo. – 18 years)
Weight (kg)	4.3±1.2	41.6±19.2
eGFR (ml/min/1.73m <sup>2</sup> )	24.5±18.3	30.9±10.5
Pediatric RIFLE score		
Risk	2	18
Injury	11	56
Failure	13	47
Need for dialysis (n)	3 CVVHD	66 (37 CCVHD, 29 CVVHF)
Lowest Hemoglobin (g/dl)	8.6±2.2	9.0±1.9
Proteinuria (n)	4	25
Hypervolemia (n)	4 (15%)	68 (54%)
Anuria (n)	15 (58%)	62 (49%)
Ventilation (n)	21 (81%)	91 (75%)
Length of ICU stay (days)	14.8±21.0	12.0±13.1
Length of hospitalization (days)	31±8	28±9
Mortality ICU (n)	1 (4%)	33 (26%)

**Table 2: Predictors of mortality in newborns and children > 1 month by multivariate regression analysis**

Newborns (n=26)		
Predictors	p	Relative risk
Mechanical ventilation	< 0.001	10.314
Hypervolemia	0.003	13.147
Metabolic acidosis	< 0.001	14.247
Septic shock	0.025	3.843
Dialysis	0.083	2.035
Children > 1 month (n=121)		
Predictors	p	Relative risk
Mechanical ventilation	0.042	3.214
Hypervolemia	0.048	5.389
Hypoxia	< 0.001	4.218
Septic shock	0.025	6.245
Dialysis	0.036	4.234
Malignancy	0.065	2.387

**Figure 3: Kaplan-Meier analysis: Occurrence of renal failure after BMT (3A) and duration of dialysis treatment (3B)**

