

Acute Kidney Injury Occurring in the First Year After Transplantation - Its Causes and Influences on Graft Function

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Background

Acute kidney injury (AKI) of native kidneys is a well known risk factor for chronic kidney disease and end-stage kidney failure.

Objectives

The aim of our retrospective study was to analyze the incidence, causes and impact of AKI on renal graft function one year after kidney transplantation.

Methods

Kidney transplant recipients with AKI in the period of one year after kidney transplantation were included in our retrospective analysis. AKI was defined in line with the KDIGO guidelines.

Results

In the period from November 2008 to September 2014, 342 patients were transplanted and 77 patients with AKI in the first year after kidney transplantation were included in our study. Baseline patient characteristics, causes of AKI and kidney graft function are presented in table 1.

The median time to the first episode of AKI was 8 (IQR 5–14) weeks and was significantly different according to the cause of AKI ($p=0.002$): in case of vascular complications it was 4.5 (IQR 3.5–9.5) weeks, in case of acute pyelonephritis 7.5 (IQR 5.5–9.5) weeks, in case of renal graft obstruction 8 (IQR 5.0–16.5) weeks, in case of acute rejection 12 (IQR 8.0–20.0) weeks and in case of other reasons 5.0 (IQR 3.5–9.5) weeks.

The median serum creatinine after 1 year was 121 (IQR 95–139) $\mu\text{mol/L}$. There was no difference in kidney graft function after 1 year of follow-up in patients with only one AKI regardless of the cause ($p=0.260$).

Urinary tract infection at the time of transplantation was related to the higher incidence of AKI due to acute pyelonephritis of renal graft in the first post-transplant year (7/15 (46.7%) vs 7/62 (11.3%), $p=0.015$).

Delayed graft function (DGF) had no influence on the cause and outcome of the first AKI ($p=0.202$), but patients with DGF had more often more than one episode of AKI (65% vs 46%, $p=0.039$).

A single episode of AKI occurred in 55 (71.4%) patients, 2 episodes of AKI in 13 (16.9%) patients and 3 episodes of AKI in 9 (11.7%) patients.

The reasons for the second and third episode of AKI were not significantly different from the reasons for the first episode of AKI.

Multiple episodes of AKI resulted in a significantly worse renal graft function at 1-year follow-up with a median creatinine 124 (IQR 117–166) $\mu\text{mol/L}$ vs. 111 (IQR 90–133) $\mu\text{mol/L}$ observed in patients with a single episode of AKI ($p=0.012$).

Each successive episode of AKI resulted in progressive worsening of renal function. The estimated glomerular filtration rate (IQR) at one-year of follow-up after the first, second and third episode of AKI was 61 (50–77), 52 (40–64), 50 (35–61) ml/min/1.73m^2 , respectively ($p=0.037$).

Table 1. Baseline patient characteristics, causes of AKI and kidney graft function

	All	Rejection	Pyelonephritis	Obstruction	Other*	<i>p</i>
N (%)	77 (100)	25 (33)	14 (18)	17 (22)	21 (27)	
% female[#]	25	28	21	24	24	0.969
Age* [years]	50 (40–57)	49 (37–57)	52 (40–57)	50 (46–59)	49 (40–58)	0.845
At the time of transplantation						
% DGF[#] (N)	43 (33)	40 (10)	57 (8)	23 (4)	52 (11)	0.202
% UTI[#] (N)	19 (15)	16 (4)	50 (7)	12 (2)	10 (2)	0.015
Baseline kidney graft function						
Creatinine* [$\mu\text{mol/L}$]	130 (108–168)	129 (106–163)	130 (116–165)	108 (99–137)	141 (121–185)	0.117
eGFR* [ml/min/1.73m^2]	53 (39–62)	51 (41–64)	52 (38–63)	59 (50–71)	48 (37–55)	0.134
First AKI and kidney graft function						
Weeks to AKI*	8 (5.0–14.5)	12 (8.0–20.0)	7.5 (5.5–9.5)	8 (5.0–16.5)	5 (3.0–9.5)	0.001
% Early AKI[#]	17	0	21	12	38	0.006
% with KB[#]	45	100	7	6	38	0.000
Creatinine* [$\mu\text{mol/L}$]						
at admission	177 (144–236)	190 (141–242)	156 (145–183)	162 (141–256)	193 (151–248)	0.697
at 1 year	121 (95–138)	118 (92–165)	123 (109–140)	111 (84–123)	122 (101–146)	0.194
% ΔCreatinine from baseline* [$\mu\text{mol/L}$]						
at admission	26 (13.2–42.1)	29 (20–61)	21 (11–33)	32 (12–70)	19 (12–38)	0.133
at 1 year	-13 (-27– -2.7)	-13 (-29–3.1)	-10 (-22–0.1)	-15 (-30– -4.0)	-17 (-32– -3.0)	0.688
eGFR* [ml/min/1.73m^2]						
at admission	36 (27–46)	36 (27–44)	42 (31–47)	39 (22–51)	34 (25–42)	0.671
at 1 year	59 (48–72)	58 (37–77)	55 (43–68)	66 (55–77)	54 (46–74)	0.252
% ΔeGFR from baseline* [ml/min/1.73m^2]						
at admission	-25 (-36– -14)	-26 (-43– -19)	-21 (-30– -12)	-28 (-47– -13)	-18 (-33– -13)	0.186
at 1 year	17 (2.2–41)	17 (-3.6–50)	14 (-0.3–33)	17 (4.2–40)	25 (2.2–53)	0.800
% with proteinuria at > 0.5g/day[#]						
at admission	38	25	67	33	40	0.110
at 1 year	19	26	18	8	20	0.625

Legend: *Median (IQR), Kruskal-Wallis test; #Pearson Chi-square test; AKI, acute kidney injury; DGF, delayed graft function; UTI, urinary tract infection; KB, kidney biopsy; eGFR, estimated glomerular filtration rate (CKD-EPI);

*Other: renal artery stenosis 4, acute tubular necrosis 3, cytomegalovirus infection 2, hypertensive nephrosclerosis of the transplanted kidney 2, hypovolaemia 2, acute interstitial nephritis 1, calcineurin nephrotoxicity 1, bisphosphonate nephrotoxicity 1, unspecified systemic infection, urinary reflux 1, external iliac artery stenosis 1.

Conclusions

- AKI is common in the first year after kidney transplantation.
- The time of first AKI occurrence depends on the reason for AKI, with surgical complications and kidney graft infection appearing earlier as acute rejection.
- Single AKI has no important influence on one year kidney graft function outcome.
- Repetitive episodes of AKI in kidney graft recipients result in a significantly worse renal graft function after 1 year of follow-up.
- Careful screening and patient care is encouraged to prevent AKI and preserve kidney graft function.

