



The Impact of Daily Presence of Nephrology Residents in the Postoperative Cardiac Intensive Care Unit

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Background

Acute kidney injury (AKI) is a significant cause of morbidity and mortality following cardiac surgery. Frequently the nephrologists are not early involved in the care of critically-ill patients, and the consultation occurs until severe AKI has been developed. Early nephrology consultation could result in better outcomes. Recently two studies have addressed this issue, either through evaluating the magnitude of increase of creatinine at the time of nephrology consultation¹, or through a standardized intervention guided by an automatic AKIN/RIFLE criteria detector², both showing positive results. However the potential role of the evaluation by nephrologist previous to AKI has not been explored. The daily presence of nephrologists in the intensive care unit (ICU) could reduce the incidence of AKI, besides its benefits on length of stay and mortality.

Objective

To assess the incidence of AKI, renal recovery, ICU length of stay, and in-hospital mortality following cardiac surgery before and after the daily presence of the nephrology residents as part of the post-cardiac surgery ICU team

Methods

We conducted a retrospective cohort study of 2 consecutive periods of time in adults taken to cardiac surgery in a specialized third level single-center in Mexico City: from March 2009 to February 2010 (nephrologist on-demand period) and from March 2010 to February 2011 (daily presence of nephrologists period). We excluded patients with chronic kidney disease stage V, AKI or renal replacement therapy (RRT) before surgery, and percutaneous procedures. AKI was defined according to RIFLE/AKIN criteria within 7 days since cardiac surgery. We used multivariable linear and logistic regression to adjust for confounding variables.

Results

We included 1096 patients who were taken to cardiac surgery in the Instituto Nacional de Cardiología Ignacio Chávez in Mexico City, 558 patients in the on-demand period and 538 patients in the daily presence of nephrologists period. There was no significant difference in most variables at baseline, including age, gender, NYHA functional class, Euroscore, Thakar score, type of surgery, diabetes, hypertension and other co-morbidities. Estimated GFR by CKD-EPI was significantly lower (88.8±23.6 vs 94.7±21.5 ml/min; P=0.000) in the on-demand period. AKI occurred in 31.9% of patients in the on-demand period and 28.7% in the daily presence of nephrologists period (p=0.019), but no differences were found in the incidence of severe AKI (stage I/2 and F/3); in-hospital mortality was 8.25% and 5.6% (p=0.082) respectively. Figure 1.

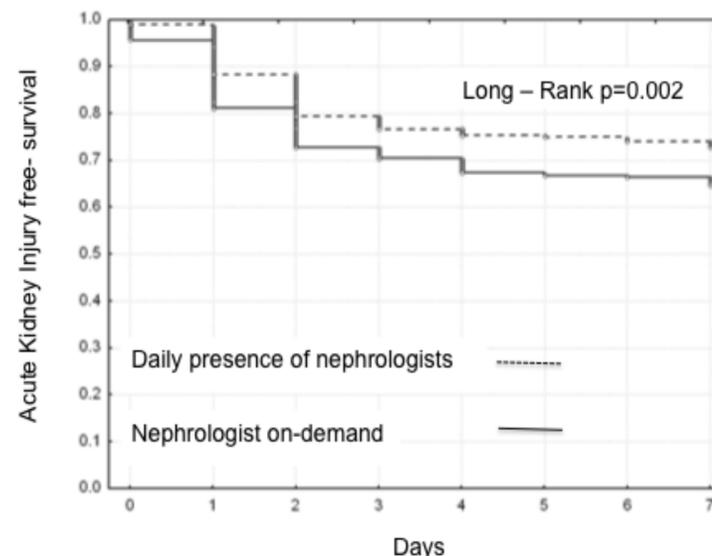


Figure 1. AKI-free survival curve comparing both periods: daily presence of nephrologists and nephrologists on-demand.

In the logistic regression analysis we found that daily presence of nephrologists reduced the incidence of AKI and mortality. Table 1 and 2.

	B	S.E	Wald	OR	CI 95%	P value
Daily presence of nephrologists	-0.336	0.163	4.279	0.714	0.520-0.982	0.039
CKD-EPI mL/min/1.73m ²	-0.021	0.003	45.879	0.979	0.973-0.985	0.000
Weight	-0.014	0.006	5.621	0.986	0.974-0.998	0.018
Thakar Score	0.257	0.055	22.085	1.294	1.162-1.440	0.000
Duration of ventilation	0.107	0.023	22.001	1.113	1.064-1.164	0.000
Age	0.012	0.005	4.927	1.012	1.001-1.022	0.026
Hypertension	0.273	0.180	2.301	1.314	0.923-1.869	0.129
Reoperation	0.242	0.217	1.241	1.274	0.832-1.951	0.265
Previous myocardial infarction	0.122	0.205	0.356	1.130	0.757-1.687	0.551
Cardiopulmonary bypass time	0.001	0.002	0.335	1.001	0.998-1.005	0.563
Bleeding	0.000	0.000	0.085	1.000	1.000-1.000	0.771

Table 1. Multivariate logistic regression for acute kidney injury following cardiac surgery.

	B	S.E.	Wald	OR	CI 95%	P value
Daily presence of nephrologists	-0.757	0.358	6.029	0.469	0.256-0.858	0.014
Euroscore	0.202	0.047	18.641	1.223	1.116-1.340	0.000
Maximum AKIN			11.506			0.009
AKIN 1	0.429	0.345	1.549	1.536	0.781-3.019	0.213
AKIN 2	1.590	0.519	9.387	4.905	1.774-13.567	0.002
AKIN 3	1.450	0.665	4.760	4.265	1.159-15.694	0.029
Weight	-0.039	0.008	21.989	0.961	0.946-0.977	0.000
CKD-EPI mL/min/1.73m ²	-0.016	0.006	8.444	0.984	0.973-0.995	0.004
Severe infection	1.379	0.36	14.637	3.969	1.959-8.043	0.000
Cardiopulmonary bypass time	0.009	0.003	9.768	1.009	1.003-1.015	0.002
Duration of ventilation	0.029	0.019	2.225	1.029	0.991-1.069	0.136
Reoperation	0.266	0.337	0.622	1.305	0.674-2.527	0.430
Bleeding	0.000	0.000	0.113	1.000	1.000-1.000	0.736
Severe heart failure	0.436	0.369	1.394	1.546	0.75-3.188	0.238

Table 2. Multivariate logistic regression for mortality.

We also found that the daily presence of nephrologists reduced the ICU length of stay (β -0.095; CI, -0.146 to -0.044; P=0.000) after adjust to confounding variables as death, duration of ventilation, pneumonia, reoperation, Euroscore, renal replacement therapy, AKI, cardiopulmonary bypass time, bleeding, age, weight and GFR estimated by CKD-EPI. In the group of patients requiring RRT, the daily presence of nephrologists decreased the risk of failure to recover renal function (OR 0.023; CI, 0.001-0.384; P=0.009), regardless of other factors such as chronic kidney disease, critical preoperative state and severe infection

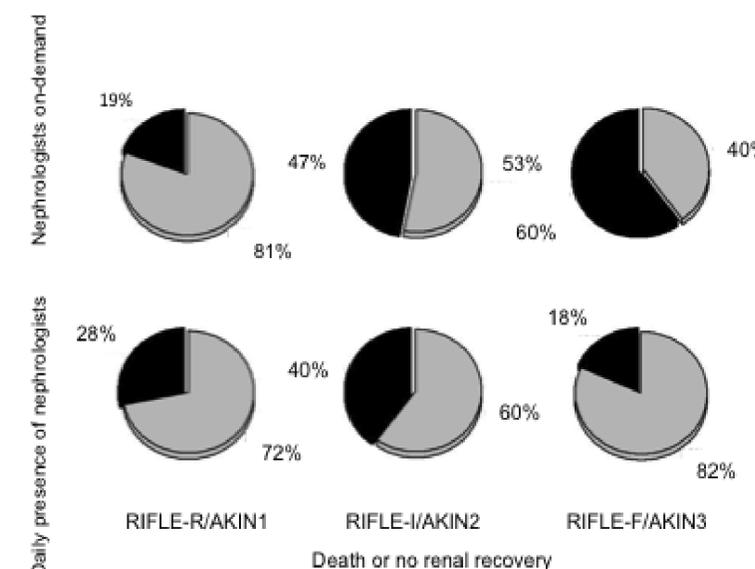


Figure 2. Death or no renal recovery in each stage of AKI for both periods (black color: death or no renal recovery, gray color: survivors with partial or complete recovery of renal function).

Conclusions

The daily presence of the nephrology residents in post-cardiac surgery ICU:

- Reduced the incidence of AKI
- Reduced the in-hospital mortality
- Decreased the ICU length of stay
- Promoted renal recovery in patients requiring RRT

The present model of medical attention is a proposal with potential benefits in teaching hospitals

References

1. Balasubramanian G, Al-Aly Z, Moiz A, et al. Early nephrologist involvement in hospital – acquired acute kidney injury: a pilot study. Am J kidney Dis 2011; 57(2): 228 – 234.
2. Perez-Valdivieso JR, Bes-Rastrollo M, Monedero P, et al. Prognosis and serum creatinine levels in acute renal failure at the time of nephrology consultation: an observational cohort study. BMC Nephrol. 2007; 8:14.