The effect of intraoperative dexmedetomidine on acute kidney injury after paediatric congenital heart surgery

Choi J., Kwak H.J., Jo Y.Y., Lee K.C., Kim H.S.

Department of Anaesthesiology and Pain Medicine, Gachon University Gil Medical Center

Background

- Acute kidney injury (AKI)** after paediatric congenital heart surgery with cardiopulmonary bypass (CPB) increased 30-day mortality.
- Dexmedetomidine**
 - renal protection by improving tubular architecture and function following renal ischaemia
 - perioperative infusion of dexmedetomidine might reduce the incidence and severity of AKI and ICU stay after valvular heart surgery .

We hypothesized that intraoperative infusion of dexmed-etomidine might diminish kidney function decline after paediatric open heart surgery.

Methods

- Paediatric patients (1 - 6 yrs) scheduled for atrial or ventricular septal defect repair
- Control group (n=14) : infusion of normal saline
- Dexmedetomidine group (n=15): dexmedetomidine after induction until CPB weaning (a bolus dose of 0.5 µg/kg, infusion of 0.5 µg/kg/h)
- Scr, estimated glomerular filtration rates (eGFRs)

- Renal biomarkers were measured at T1, T2 and T3
- AKI : an absolute increase in Scr of ≥ 0.3 mg/dl
- a percent increase in Scr of $\geq 50\%$.

Results

Table1. Patient characteristics and preoperative data

	Control (n = 14)	Dex (n = 15)	P-value
Age (months)	32 ± 19	31 ± 14	0.878
Gender (M/F)	9/5	9/6	0.812
Weight (kg)	11.1 ± 3.2	11.8 ± 2.2	0.483
Height (cm)	85 ± 14	88 ± 9	0.499
Body surface area (m ²)	0.50 ± 0.11	0.53 ± 0.07	0.394
Anesthesia time (min)	238 ± 50	249 ± 55	0.676
Operation time (min)	185 ± 46	193 ± 45	0.725
CPB time (min)	106 ± 34	107 ± 39	0.919
ACC time (min)	69 ± 27	67 ± 34	0.911
Lowest temperature (°C)	32.7 ± 1.1	32.4 ± 1.1	0.537
Intraoperative use of vasoactive drugs (n)			
Epinephrine	1	0	0.292
Dopamine	2	5	0.231
Milrinone	10	9	0.518
Urine output (ml/kg/h)			
During CPB	2.3 ± 1.0	2.7 ± 2.0	0.480
After CPB	2.6 ± 1.8	2.3 ± 2.0	0.678
POD 1	2.9 ± 0.9	3.0 ± 1.2	0.860
POD 2	3.8 ± 1.2	3.0 ± 1.3	0.127

Values are means ± SDs, numbers of patients(%), or median[IQR]

Table 2. Hemodynamic variables

	Group	T1	T2	T3
MAP (mmHg)	Control	65 ± 7	60 ± 7	82 ± 13
	Dex	64 ± 7	63 ± 15	72 ± 15
HR (beats/min)	Control	119 ± 17	121 ± 13	143 ± 18
	Dex	114 ± 16	119 ± 13	129 ± 21
CVP (mmHg)	Control	4.6 ± 2.3	8.8 ± 2.6	7.6 ± 2.5
	Dexm	5.1 ± 2.9	7.1 ± 3.4	7.1 ± 2.2

Table 3. Perioperative renal indices

	Group	T1	T2	T3
RFI	Control	0.37 [0.21-0.63]	0.77 [0.32-1.02]	0.65 [0.60-1.98] [†]
	Dex	0.48 [0.30-1.20]	0.78 [0.56-1.46]	1.07 [0.52-1.57]
FE _{Na} (%)	Control	0.27 [0.15-0.47]	0.58 [0.24-0.74]	0.47 [0.43-1.38] [†]
	Dex	0.35 [0.22-0.88]	0.57 [0.41-1.09]	0.73 [0.39-1.14]
U _{NAG} /Ucr (U/g)	Control	20.3 [12.4-36.9]	72.9 [27.5-459.6]	233.2 [26.8-1530.2]
	Dex	22.1 [8.8-42.7]	235.2 [102.6-474.1]	422.6 [128.6-1631.0] [†]
U _{Alb} /Ucr (mg/g)	Control	18.3 [12.8-55.9]	185.4 [60.1-268.5]	34.4 [16.3-461.9]
	Dex	9.7 [9.1-70.1]	108.8 [17.8-441.7]	97.3 [17.7-372.2]

RFI, renal failure index; FENa, fractional excretion of sodium; UNAG/Ucr, UNAG to Ucr ratio; UAlb/Ucr, UAlb to Ucr ratio. T1, 10 min after anesthesia induction; T2, 5 min after cardiopulmonary bypass weaning; T3, 2 hours after T2. [†]P < 0.05, vs. T1

Fig.1. Perioperative changes in serum creatinine and estimated glomerular filtration rates

* P < 0.05, vs. the control group, [†]P < 0.05 vs T0

Conclusion

Intraoperative infusion of dexmedetomidine might reduce the incidence of AKI and suppress post-bypass eGFR decline, but was not found to improve other renal biomarkers after paediatric open heart surgery.