

Abstract 34045

Sodium Bicarbonate Infusion To Reduce Cardiac Surgery Associated Acute Kidney Injury; A Phase II Multi-Centre, Double-Blind, Randomized Controlled Trial

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Abstract Body

RATIONALE

Cardiac surgery associated acute kidney injury (CSA-AKI) occurs in up to 50% of patients and is associated with increased mortality and morbidity. A previous 100 patient pilot study suggested that prophylactic peri-operative infusions of sodium bicarbonate could reduce the incidence of CSA-AKI and thus could have a beneficial effect on patient outcomes. Before embarking on a large phase III trial of this treatment we completed a multi-centre phase II trial.

METHODS

Between February 2009 and June 2011 427 patients scheduled for cardiac surgery using cardiopulmonary bypass were enrolled. All patients had pre-operative and/or peri-operative risk factors for the development of CSA-AKI (table1). Patients received an infusion of either sodium bicarbonate or placebo (sodium chloride), commencing at the start of anaesthesia, in a dose of 0.5mEq/Kg/hr for the first hour then 0.2mEq/kg/hr for 23hrs.

The primary study outcome was the number of patients who developed CSA-AKI, defined as an increase in creatinine of at least 25% from baseline to peak value within the first 5 post-operative days. Secondary outcomes included acid-base status, length of mechanical ventilation, ICU and hospital length of stay (LOS) and mortality.

RESULTS

215 patients were randomized to receive sodium bicarbonate and 212 to receive sodium chloride. Treating clinicians and study personnel were blinded to the allocation. There were no significant differences in the baseline characteristics of the two groups. There were significant differences in both the plasma and urinary pH between the groups (table2).

Overall 44% of patients developed CSA-AKI by the above definition; however there was no significant difference between the groups (Bicarbonate group 45%, Saline group 44%). There was no significant difference in ventilation hours (22.9hrs (mean): Bicarbonate 20.8, Saline 24.9), ICU LOS (2.25days (mean): Bicarbonate 2.23, Saline 2.28) or hospital LOS (13.1days (mean); Bicarbonate 13.4, Saline 12.8). Overall ICU mortality was 2.8% (Bicarbonate 3.3%, Saline 2.4%) and 90 Day mortality 3.3% (Bicarbonate 3.7%, Saline 2.8%).

CONCLUSIONS

This study demonstrates that, using the criteria described, we are able to select a sub-group of cardiac surgical patients at high risk of developing CSA-AKI. Although the bicarbonate infusion produced an increase in the pH of both blood and urine this did not result in a decrease in the incidence of CSA-AKI. On this basis we cannot recommend the use of peri-operative infusions of sodium bicarbonate to reduce CSA-AKI in these patients and do not believe further investigation of this therapy is justified.

Table 1: Risk Factors for Post-operative Acute Kidney Injury (Patients had to have at least one to be eligible for the study)

Risk Factor	All	Sodium Bicarbonate	Sodium Chloride	p
Age above 70years	244/427 (57.0%)	116/215 (54.0%)	128/212 (60.4%)	0.18
Pre-existing renal impairment (Creatinine 1.4 – 3.4 mg/dl)	55/427 (12.8%)	31/215 (14.4%)	24/212 (11.3%)	0.34
NYHA class III/IV Cardiac Failure	55/427 (12.8%)	23/215 (10.7%)	20/212 (9.4%)	0.66
Left Ventricular Ejection Fraction <35%	24/427 (5.6%)	12/215 (5.6%)	12/212 (5.7%)	0.97
Valvular surgery (with or without coronary artery surgery)	305/427 (71.4%)	153/215 (71.2%)	152/212 (71.7%)	0.9
Previous cardiac surgery involving sternotomy	68/427 (15.9%)	37/215 (17.2%)	31/212 (14.6%)	0.47
Insulin dependent diabetes mellitus	24/427 (5.6%)	15/215 (7.0%)	9/212 (4.2%)	0.22

Table 2: Acid-Base Status

	Sodium Bicarbonate	Sodium Chloride	p
<i>Plasma pH, mean (SD)</i>			
Baseline	7.4(0.06)	7.41 (0.04)	0.2
6 hrs	7.4(0.05)	7.37 (0.06)	0.001
24 hrs	7.44(0.04)	7.36 (0.05)	<0.0001
<i>Plasma Bicarbonate, mmol/l (SD)</i>			
Baseline	25.72 (2.29)	25.91 (2.09)	0.67
6 hrs	27.03 (2.64)	24.35 (2.22)	<0.0001
24 hrs	29.74 (2.69)	23.7 (2.86)	<0.0001
<i>Urinary pH, mean (SD)</i>			
Baseline	5.77 (0.95)	5.51 (0.78)	0.15
6 hrs	6.52 (1.18)	5.85 (0.84)	0.002
24 hrs	7.3 (1.12)	5.22 (0.56)	<0.0001