

Efficacy of Sodium Bicarbonate Infusion in Reversal of Acute Renal Failure



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Fig. 3

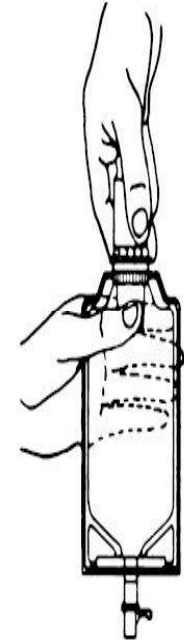


Fig. 4

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INTRODUCTION

1. Acute kidney injury or acute renal failure (ARF) has been cited as a major factor that may contribute to end stage renal disease (ESRD) in diabetes.
2. Any episode of ARF was risk a factor for chronic Kidney disease (CKD) stage 4 (HR 3.56)
3. Each ARF episode doubled that risk [1]

[1] Thakkar CV et al. Acute Kidney Injury episodes and Chronic Kidney disease risk in diabetes mellitus. Clin J Am Soc Nephrol 2011; 6: 2567-72

INTRODUCTION (cont.)

4. Aggressive blood pressure – lowering treatment approaches with angiotensin converting enzymes inhibitors (ACEI) and angiotensin receptor blockers (ARB) may contribute to ARF episodes and enhance CKD progression

[2] Onuigbo MA, can ACE inhibitor and angiotensin receptor blockers be detrimental in CKD patients. Nephro Clin Pract 2011; 118: C407-19

Drugs Causing ARF/ESRD

- Angiotensin Converting Enzyme Inhibitor (ACEI)
Most Common: Lisinopril (70 percent)
- Angiotensin Receptor Blocker (ARB)
Most Common: Valsartan (Diovan)

Intention: To decrease proteinuria and thus reduce the risk of ESRD.

Irony: With prevalent and indiscriminate use of ACEI / ARB, the incidence of ESRD has increased over the years.

Annual Number of Patients with ESRD – Data from U.S. ESRD Program

| Year | ESRD – Dialysis (number of Patients) |
|------|--|
| 1978 | 14,000 |
| 1986 | 32,000 |
| 1991 | ACEI entered the market as a renoprotective drug |
| 1994 | 65,000 |
| 1998 | 75,000 |
| 2006 | 354,754 |
| 2011 | 616,600 |
| 2020 | Projection: 750,000 Americans will have ESRD |

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Why?

PURPOSE OF PRESENTATION

1. This presentation is intended to demonstrate that ARF is reversible with appropriate therapy.
2. Our aim is to determine the effectiveness of sodium bicarbonate infusion in reversal of ARF

MATERIALS AND METHODS

1. Any patients with ARF should be treated with sodium bicarbonate infusion
2. ARF is defined by increase of serum creatinine by more than 0.5 mg/dl from the baseline.
3. Concomitant metabolic acidosis and hyperkalemia are important prerequisites to the success of bicarbonate infusion.

METHODS (cont.)

1. Bicarbonate infusion is prepared by mixing sodium bicarbonate 50, 100 or 150 mEQ in a liter of isotonic saline solution (0.9 % NaCl), half normal (0.45 % NaCl) or 5% dextrose solution. While isotonic or half normal saline may be preferable in diabetics, 5 % dextrose solution is preferred in non-diabetics.

METHODS (cont.)

2. No information on infusion rate available. However, rate varies from 75 to 100ml/hour for 48 hours depending on blood pressure level and severity of metabolic acidosis then at a reduced rate for another 48-72 hours until CO₂ level (Renal Panel) reaches near normal to normal.

Study In Support of Bicarbonate Therapy in ARF/CKD

○ Bicarbonate supplementation slows progression of CKD and improves nutritional status. Ione de Brito-Ashurst, et al, *J Am Soc Nephrol* 2009;20: 2075-2086

DATA OF PATIENTS ARE TESTIMONIAL TO THAT EFFECT.

Table 1. Serial Laboratory Studies in a 59 year old African American Male with a long History of Diabetes Mellitus. Admitted to Hospital for Acute Renal Failure

| Date 2005 | Glucose (F) (mg/dl) | BUN (mg/dl) | Scr (mEq/L) | Na + (mEq/L) | K+ (mEq/L) | CO ² (mEq/L) |
|---|---------------------|-------------|-------------|--------------|------------|-------------------------------|
| Aug 18 | 302 | 76 | 7.4 | 128 | 5.9 | 15 |
| Hospital admission: Lisinopril discontinued | | | | | | |
| Aug 19 | 274 | 80 | 8.2 | 127 | 5.0 | 17 (ph 7.31, base excess 7.7) |
| Normal saline with 3 ampules of sodium bicarbonate infusion started. Regular insulin given subcutaneously | | | | | | |
| Aug 20 | 249 | 68 | 2.2 | 133 | 5.6 | 18 |
| Aug 21 | 196 | 22 | 0.8 | 139 | 4.2 | 32 |
| Aug 22 | 186 | 10 | 0.8 | 140 | 3.8 | 33 |
| Discharged from hospital | | | | | | |

F = Fasting, BUN = blood urea nitrogen, Scr = serum creatinine

EFFECT OF SODIUM BICARBONATE INFUSION REVERSING ARF

Table 2 Serial Laboratory Studies in a 68 years old Caucasian female with a weakness, very low BP.

Medication: Lisinopril ; Lisinopril was discontinued

| Date 2010 | pH | HC03 (mmol/L) | BUN (mg/dl) | Scr (mg/dl) | eGFR (ml/min) | UA mg/gl | PO4 mg/dL | Hb |
|--|------|------------------|----------------|----------------|------------------|-------------|--------------|------|
| Nov 7 | 7.06 | 6.5 | 70 | 7.46 | 6 | 10 | 10.9 | 13.5 |
| Bicarbonate infusion started, 125 ml/ hour, then at 75ml/hour Allopurinol 300mg BID x 2 days then 300mg daily x 2 days then 150mg daily | | | | | | | | |
| Nov 9 | 7.4 | 18 | 64 | 2.87 | 17 | ND | ND | 9.4 |
| Decreased Bicarbonate infusion to 50ml/hour x 48 hours | | | | | | | | |
| Nov 11 | ND | ND | 49 | 1.43 | 39 | 2.9 | 2.3 | 9.1 |
| Reduced bicarbonate infusion to 35 ml/h x 24 hours then stopped | | | | | | | | |
| Nov 13 | ND | ND | 25 | 1.09 | 53 | ND | 2.8 | 8.7 |
| <i>Scr=serum creatinine; eGFR = estimated glomerular filtration rate; ND= not done UA=uric acid; PO4=phosphorus; Hb=hemoglobin; ABG Arterial blood gas</i> | | | | | | | | |

EFFECT OF SODIUM BICARBONATE INFUSION REVERSING ARF.

Table 3- Serum Electrolytes

| Date 2010 | Na (mmol/L) | K+ (mmol/L) | Cl (mmol/L) | CO2 (mmol/L) |
|------------------|----------------|----------------|----------------|-----------------|
| Nov 7 13:14 h | 125 | 3.8 | 93 | 10 |
| 22:05 h | 130 | 2.9 | 100 | 15 |
| Nov 9 | 130 | 4.0 | 110 | 22 |
| Nov 11 | 143 | 3.8 | 116 | 23 |
| Nov 13 | 144 | 3.9 | 110 | 22 |

Table 4- Renal Function Test at Baseline and Most Recent

| Date | Na mmol/L | Scr (mg/dl) | eGFR ml/min | CO2 (mmol/L) |
|-------------|--------------|----------------|----------------|-----------------|
| 2010 Sep | 132 | 1.39 | 40 | 22 |
| 2014 Apr | 133 | 1.21 | 46 | 26 |

Scr= serum creatinine eGFR= estimated glomerular filtration rate

PEARL OF WISDOM

1. Sodium Bicarbonate Infusion for 3 to 5 days is considered a promising alternative to hemodialysis in therapy of ARF
2. Try sodium bicarbonate infusion in all cases of ARF
3. ARF doesn't necessarily progress into CKD.

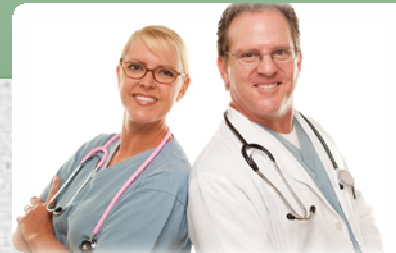
PEARL OF WISDOM

4. Volume overload and hypertension are unlikely to occur with bicarbonate infusion.

5. Oral supplementation didn't increase blood pressure or require increased dose of antihypertensive therapy.

*The good physician treats the disease.
The great physician treats the patient
who has the disease.*

William Osler
The Cambridge History of Medicine



Dictum



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THANK YOU