

P: In patients with acute metabolic acidosis
I: Is the use of sodium bicarbonate
C: Compared to withholding bicarbonate
O: Associated with better outcomes

Clinical Scenario: 78 yo male presenting from a nursing home to the ED with altered mental status. Recently diagnosed with C Difficile colitis, hypotensive, intubated for airway protection. Initial blood gas with pH 7.12/pCO₂ 45/O₂ 80/HCO₃ 11/BE -18.

Search Strategy: Medline, PubMed, OVID

AUTHOR INFO	STUDY GROUP	STUDY TYPE	KEY RESULTS	WEAKNESSES
Kette, et al Circulation 1990	29 pigs with electrically induced ventricular fibrillation and cardiopulmonary resuscitation	Prospective randomized blinded	Compares carbon dioxide producing (Sodium Bicarbonate) and carbon dioxide consuming buffers (Carbicarb) on intramyocardial acidosis during cardiopulmonary arrest <ul style="list-style-type: none"> - both failed to neutralize intramyocardial acidosis - both had no effect on intramyocardial lactate production 	-Small Study -Pigs
Mathieu, D. et al. Critical Care Medicine 1991	10 patients with lactic acidosis	Prospective randomized blinded	Outcomes: pH, Serum HCO ₃ , lactate, pCO ₂ , pO ₂ , cardiac indices, tissue oxygenation <ul style="list-style-type: none"> - Bicarbonate infusion increased pH, serum bicarb, pCO₂ - No improvement in vasopressor requirements or hemodynamic variables - Did not worsen tissue oxygenation 	-Small study -Pts hemodynamically stabilized prior to -Variables measured only 60 mins after bicarb given.
Cooper,D., et al Ann Intern Med 1990	14 patients in ICU with metabolic acidosis (bicarb<17, base excess <-10)	Prospective randomized blinded crossover	Compares Sodium Bicarbonate and Sodium Chloride Outcomes: pH, serum HCO ₃ , pCO ₂ , ionized Ca, pulmonary capillary wedge pressure, cardiac output, MAP <ul style="list-style-type: none"> -Increased arterial pH, HCO₃, and pCO₂ -Transient increase in pulmonary wedge pressure and cardiac output by both bicarb and NaCl -No change in MAP -Decreased ionized calcium 	-Small study -2 hour study post infusion -Patients hemodynamically stable before infusion

			Conclusions: Bicarbonate infusion to correct metabolic acidosis does not improve hemodynamics or the cardiovascular response to vasopressors.	
Boyd, J., Walley, K. Current Opinions in Critical Care August 2008	Review – Is There a Role for Sodium Bicarbonate in Treating Lactic Acidosis From Shock?	Review Article	<ul style="list-style-type: none"> • Pathophysiology examined of lactic acidosis – impaired clearance (global organ impairment) and increased production -Extremely large H⁺ flux which buffers will never keep up with unless aerobic metabolism is restored -Corrects extracellular pH, no intracellular acidosis -Increase in CO₂ decreases myocardial contractility and can cause cardiac arrest • Bottom Line- little evidence to support use of bicarb, recommend no bicarb until pH < 7.0, then provider discretion. If given, should be slow infusion with correction of ionized calcium 	Limited studies examining effect of bicarb and no studies looking at long term outcomes
Forsythe, S., Schmidt, G. Chest 2000	Review – Sodium Bicarbonate for the Treatment of Lactic Acidosis	Review Article	<ul style="list-style-type: none"> • Examines questions of bicarb in lactic acidosis -Is low pH bad? -Can bicarb raise intracellular pH? -Negative effects of bicarb? -Does it ameliorate the hemodynamic depression of lactic acidosis? 	Limited studies examining effect of bicarb
Dellinger, et al Critical Care Med April 2008	International Guidelines for Management of Severe Sepsis and Septic Shock: 2008	Review Article	<ul style="list-style-type: none"> • 2008 Surviving Sepsis guidelines strongly recommend against the use of sodium bicarbonate therapy for the purpose of improving hemodynamics or reducing vasopressor requirements in patients with hypoperfusion-induced lactic acidemia in patients with pH 7.15 • Sodium bicarbonate infusion associated with <ul style="list-style-type: none"> *increase in lactate and PCO₂ *sodium and fluid overload *decrease in serum ionized calcium 	No studies have examined the effect of bicarbonate administration on outcomes

Clinical Bottom Line: There are no large randomized controlled studies upon which to base recommendations. There have been no studies to examine long-term outcomes. There is no evidence to support routine use of bicarbonate in treatment of lactic acidosis and adverse consequences have been elucidated. Focus should instead be on aggressive resuscitation and ventilatory support.