

POSTER PRESENTATION

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# Extracorporeal selective chloride removal by electro dialysis: an innovative treatment for respiratory and metabolic ACIDOSIS

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## Introduction

Acidosis is a frequent disorder among critically ill patients. When patient compensatory responses fail to restore a normal pH, administration of sodium bicarbonate (NaHCO<sub>3</sub>) or renal replacement therapy may be required. Intravenous NaHCO<sub>3</sub> increases plasma Strong Ion Difference ([SID] = [Na<sup>+</sup>] + [K<sup>+</sup>] - [Cl<sup>-</sup>]) and HCO<sub>3</sub><sup>-</sup> concentration by raising Na<sup>+</sup> concentration. Although effective, this treatment is not devoid of complications, such as hypernatremia, hyperosmolarity and fluid overloading[1]. Selective chloride (Cl<sup>-</sup>) removal, by increasing SID in an alternative way, may allow a rapid correction of acidosis without altering plasma osmolality and Na<sup>+</sup> concentration.

## Objectives

In an experimental animal model of severe respiratory and metabolic acidosis, we aimed to assess the efficacy of an electro dialytic system, able to selectively remove anions from plasma ultrafiltrate, to normalize pH.

## Methods

Seven sedated and paralyzed healthy swine were connected to a veno-venous extracorporeal circuit including a dialyzer and an electro dialysis unit. Animals underwent 2 randomly-ordered experimental sequences of respiratory and metabolic acidosis, obtained by reducing the respiratory rate or by continuous infusion of lactic acid, respectively, targeting an arterial pH of 7.15 ± 0.02. The electro dialysis treatment was then started to restore

baseline pH. Hemodynamics, acid-base equilibrium, and laboratory parameters were recorded.

## Results

An arterial pCO<sub>2</sub> of 91 ± 11 mmHg and a lactate concentration of 13.2 ± 1.4 mmol/L were required to achieve the targeted respiratory and metabolic acidosis, respectively. The electro dialysis treatment restored the baseline pH by reducing plasma Cl<sup>-</sup> concentration respectively from 105 ± 4 to 79 ± 8 mEq/L in 306 ± 54 min (for respiratory acidosis), and from 105 ± 3 to 91 ± 5 mEq/L in 175 ± 47 min (for metabolic acidosis) (p < 0.001 for both, see Figure 1). No adverse events ascribable to the treatment were recorded.

## Conclusions

Selective extracorporeal removal of Cl<sup>-</sup> by electro dialysis is a feasible, rapid and effective in-vivo treatment to completely reverse severe respiratory or metabolic acidosis.

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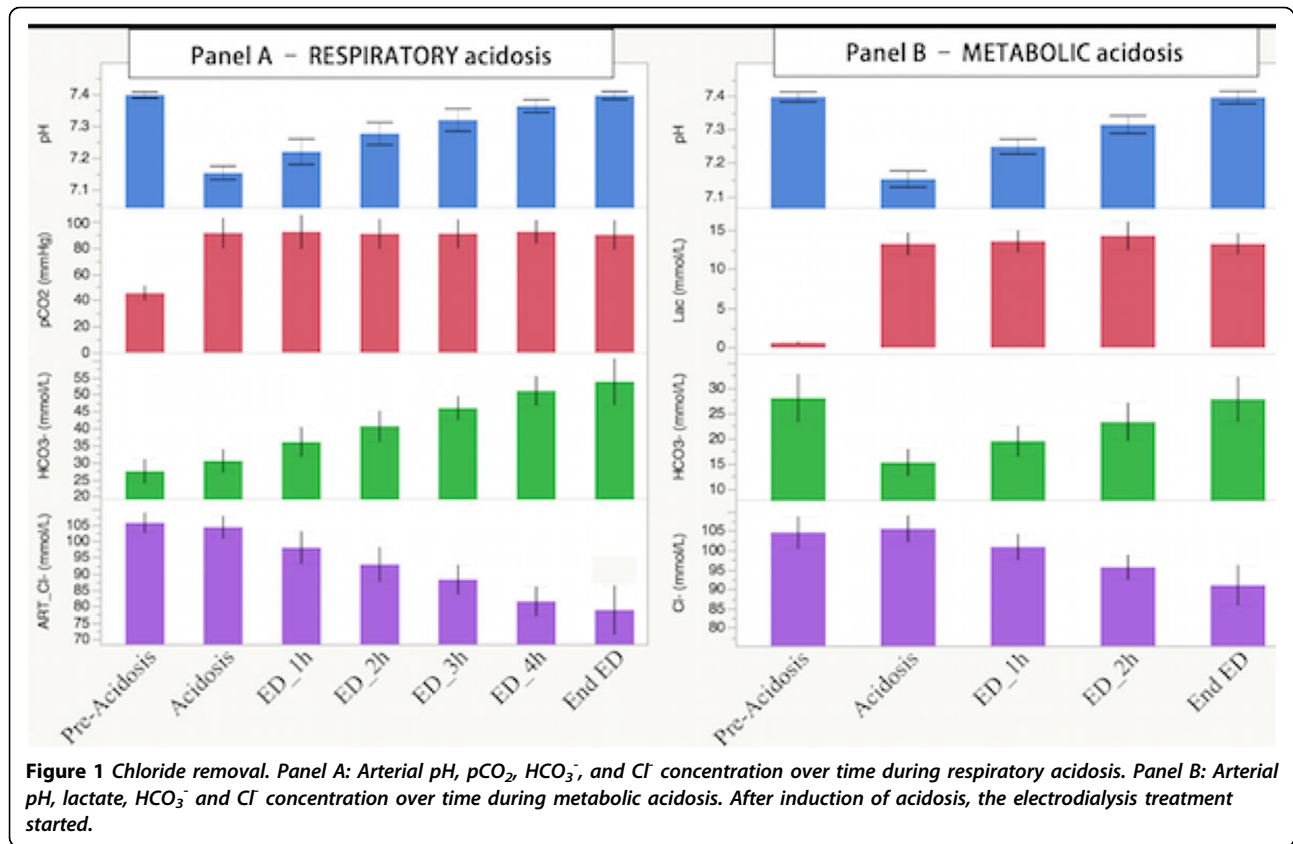
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**Figure 1** Chloride removal. Panel A: Arterial pH, pCO<sub>2</sub>, HCO<sub>3</sub><sup>-</sup>, and Cl<sup>-</sup> concentration over time during respiratory acidosis. Panel B: Arterial pH, lactate, HCO<sub>3</sub><sup>-</sup> and Cl<sup>-</sup> concentration over time during metabolic acidosis. After induction of acidosis, the electro dialysis treatment started.

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