Extracorporeal techniques for chloride removal to treat severe acidemia: in vitro study

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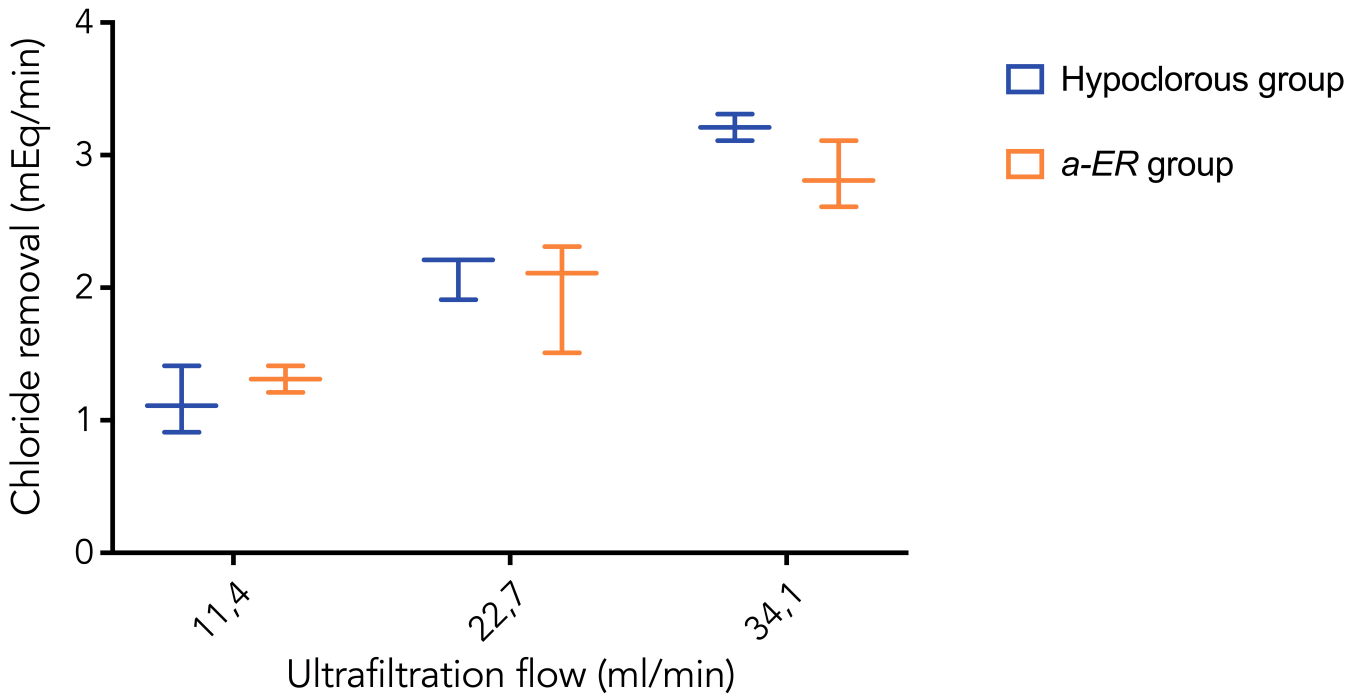
Argomento: Funzione renale e metabolica in terapia intensiva

Introduction: Blood chloride reduction may be used to increase pH in case of severe acidemia. Chloride removal may be achieved through ultrafiltration and postdilution with hypochlorous reinfusate or through treatment of ultrafiltrate with an anion Exchange Resin (*a-ER*) able to replace chloride with bicarbonate ions. We tested, in-vitro, the efficacy of these two extracorporeal strategies.

Methods: A bicarbonate-based solution (Multibic®: [Na^+] 140, [K^+] 2, [Ca^{2+}] 1.5, [Cl^-] 110, and [HCO_3^-] 35, mEq/l) was pumped through an hemodiafilter at 100 ml/min. Two strategies have been studied: 1- "hypochlorous group": the ultrafiltrate was discarded and the same volume was reinfused in postdilution as sodium bicarbonate 140 mEq/l. 2- "*a-ER gr*oup": the ultrafiltrate was pumped through an *a-ER* and then reinfused in postdilution. We chose ultrafiltration flows of 11.4-22.7-34.1 ml/min to achieve a theoretical removal of 1.25-2.5-3.75 mEq/min of chloride, respectively. Downstream postdilutional infusion the solution was sampled for blood gas analysis (outflow) and then wasted. The experiment was repeated three times. Data are reported as mean±standard deviation.

Results: [Cl^-], [HCO_3^-] and pH of the bicarbonate-based solution were 104±1, 34.6±0.9 (mEq/l) and 7.44±0.07, respectively. Hypochlorous group: outflow [Cl^-] was 93±3, 83±2, and 72±1 (mEq/l), outflow [HCO_3^-] was 50.1±1.7, 63.8±2.9 and 80.6±5.3 (mEq/l) and outflow pH was 7.59±0.02, 7.73±0.03 and 7.95±0.03 with ultrafiltration flow 11.4, 22.7 and 34.1 ml/min, respectively. *a-ER* group: outflow [Cl^-] was 91±1, 84±4 and 76±3 (mEq/l), outflow [HCO_3^-] was 34.6±1.4, 48.3±2.7 and 66.3±2.9 (mEq/l) and outflow pH 7.49±0.01, 7.56±0.01 and 7.59±0.03 with ultrafiltration flow of 11.4, 22.7, and 34.1 ml/min, respectively.

Conclusion: chloride removal obtained with the two different techniques was close to theoretical expectations. In *a-ER* group we observed an increase of [HCO_3^-] at outflow lower than the expected. Further investigation are needed to confirm these results and prove feasibility and safety on blood and in-vivo.


Chloride removal (mEq/min)
4
3
2
1
0
11,4
22,7
34,1
Ultrafiltration flow (ml/min)
Hypoclorous group
a-ER group