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Dilutional acidosis following hetastarch or albumin in healthy volunteers

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Keywords

Acid base balance, acidosis, albumin, chloride, hetastarch, volume expansion

Comments

It seems increasingly apparent that the make up and volume of fluids given is important in producing an acidosis. The magnitude of this acidosis may be small in healthy volunteers but is of unknown significance in ICU patients, who may have pre-existing acid base disturbance. The administration of hetastarch 6% produced a metabolic acidosis (base excess decreased from 2.5 to 0.7 mEq/l) which was compensated for by a mild degree of hyperventilation. Significant volume expansion occurred with both fluids yet an acidosis only occurred with hetastarch. Hetastarch is reconstituted in sodium chloride whereas 'salt poor' albumin is reconstituted with sodium acetyltryptophanate, sodium caprylate, sodium chloride, sodium carbonate, sodium bicarbonate, and sodium hydroxide. Hence chloride concentration of albumin is 93 mEq/l versus 154 mEq/l of hetastarch. The increase in chloride ions can reduce the strong ion difference (SID) (strong cations [Na^+, K^+] minus strong anions [Cl^-, lactate]) and this causes acidosis. In the albumin group no difference in SID was seen. This effect may be partially offset by the fact that decreases in albumin cause an alkalotic shift. These data together with the other papers (see Additional information), suggest that chloride ion load rather than volume load is responsible for the acidosis.

Introduction

The fact that inadequate fluid resuscitation results in a lactic acidosis is well established. However, the impact on acid base balance of the colloid solutions commonly used in this setting is less well established. The administration of normal saline is known to produce an acidosis and has been theorised to be a result of dilution of bicarbonate. If this theory is correct, then there should be no difference in acid base changes resulting from different fluid infusions. The aim of the study was to document the acid base changes following infusion of colloid solutions and to try to establish the mechanism responsible.

Methods

. Healthy adult volunteers were recruited for the study

. Random assignment to receive either 15 ml/Kg hetastarch 6% solution or 15 ml/Kg human albumin over 30 min

. 4 weeks after initial infusion volunteers returned and received an infusion of the other study solution over 15 min

. A 20 g arterial line was sited and arterial blood drawn before infusion (time 0) and then at end of infusion (time 30 min), and then 60, 90, 120, 210 and 300 min after the start of infusion

. At each time point arterial blood gases were analysed and Na^+, K^+, Cl^-, $HCO3^-$, albumin, and lactate concentrations were measured

. Haemoglobin and haematocrit were measured and percentage changes in plasma volume were calculated

Results

Volunteers were aged 26 ? 4 years. Ten males and one female were recruited but one male was withdrawn after an anaphylactic reaction to albumin. A mean volume of 1094 ml of albumin and 1095 ml hetastarch were transfused. Cl^- levels increased significantly, by 4 mEq, in the hetastarch group but did not increase in the albumin group. Base excess and $HCO3^-$shifted in an acidotic direction in the hetastarch group but not the albumin group. The decrease in base excess was significant at all time points up to and including 210 min. There was no significant difference in changes in plasma volume between the two groups.

Additional information

Scheingraber S, Rehm M, Schmisch C, Finsterer U: **Rapid saline infusion produces hyperchloremic acidosis in patients undergoing gynecological surgery.** *Anesthesiology* 1999, **90**:1265-1270.

Rehm M, Orth V, Scheingraber S, Kreimeier U, Brechtelsbauer H, Finsterer U: **Acid-base changes caused by 5% albumin versus 6% hydroxyethyl starch solution in patients undergoing acute normovolemic hemodilution. A randomized prospective study.** *Anesthesiology* 2000; **93**:1174-1183.

Liskaser FJ, Bellomo R, Hayhoe M, Story D, Poustie S, Smith B, Letis A, Bennett M: **Role of pump prime in the etiology and pathogenesis of cardiopulmonary bypass-associated acidosis.** *Anesthesiology* 2000, **93**:1170-1173.

There is also an accompanying Editorial View

Prough DS: **Acidosis associated with perioperative saline administration: dilution or delusion?** *Anesthesiology* 2000, **93**:1167-1169.

References

1. Waters JH, Bernstein CA: Dilutional acidosis following hetastarch or albumin in healthy volunteers. Anesthesiology. 2001, 1184-1187.