Yung 2017

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Bibliographic Reference	Yung, Michael; Letton, Georgia; Keeley, Steve; Controlled trial of Hartmann's solution versus 0.9% saline for diabetic ketoacidosis.; Journal of paediatrics and child health; 2017; vol. 53 (no. 1); 12-17

Study details

Study type	**Randomised controlled trial (RCT)**
Study location	Australia
Study setting	Paediatric intensive care unit (PICU) or high dependency unit
Study dates	1st July 2007 and 31st August 2010
Duration of follow-up	During treatment - Vital signs were recorded, including GCS, hourly. Venous blood glucose hourly and blood gases, Na, K, Cl, lactate and haemoglobin every 2 h using the ABL725 blood gas analyser (Radiometer, Copenhagen). Study specifies that usual maintenance plus correction of deficit over 48 or 72 h if corrected Na is >150 mmol/L.
Sources of funding	Not specified.

Study type	Randomised controlled trial (RCT)
Inclusion criteria	Children with moderate to severe DKA admitted to the paediatric intensive care unit (PICU) or high-dependency unit with DKA were eligible.
Exclusion criteria	Exclusion criteria were as follows: a Glasgow coma score (GCS) <11, mechanical ventilation, hyponatremia, corrected Na <130 mmol/L (corrected sodium = Measured Na + 2 × ((Glucose − 5.5)/ 5.5) mmol/L), K+ >5.5 mmol/L or previous enrolment.
Sample size	77 children
Loss to follow-up	Not reported
Condition specific characteristics	Biochemical criteria for the diagnosis of moderate to severe DKA are hyperglycaemia (blood glucose >11 mmol/L), venous pH <7.3 and/or bicarbonate <15 mmol/L and ketonemia or ketonuria and glycosuria. Moderate DKA was defined as pH ≥7.1, HCO3 ≥ 5 mmol/L and severe DKA as pH <7.1, HCO3 < 5 mmol/L. If HCO3 did not correlate with pH, the pH determined the severity. Hypovolemic patients were given NS in boluses of 10 mL/kg (maximum 30 mL/kg). Hypovolemia was defined as either hypotension, systolic blood pressure < Age × 2 + 70, or reduced peripheral perfusion.
Interventions	**Hartmann's solution** After resuscitation, subjects were randomised to Hartmann's solution as their initial fluid for at least 12 hours. The rate of administration followed the hospital's DKA protocol: usual maintenance plus correction of deficit over 48 or 72 h if corrected Na is >150 mmol/L. We assumed a mean deficit of 6% for moderate and 10% for severe DKA as clinical signs of dehydration are unreliable in estimating dehydration in DKA. Fluids already received were subtracted from the deficit. After 12 h of study fluid, 0.45% saline was permitted if the corrected Na exceeded 150 mmol/L. When the initial corrected Na was >150 mmol/L, the fluid was changed to 0.45% saline if the corrected Na did not fall by at least 5 mmol/L in 12 h. KCl was added to study fluid unless hyperkalaemia (K >5.5 mmol/L) or anuria was present. KH2PO4 was allowed as an additional source of potassium after the first 24 h if hypophosphataemia occurred, and ionised calcium was monitored. Glucose was added after the blood glucose was <15 mmol/L or had fallen by >5 mmol/L/h, excluding the usual rapid fall with fluid boluses, by replacing 100 ml of the 1-L study fluid with 50% dextrose. Other aspects of treatment were guided by the hospital's DKA protocol and the treating clinicians, including the use of human soluble insulin, which was started after initial fluid resuscitation, when the potassium was known and appropriate replacement started. The initial dosing rate was 0.1 U/kg/h, or 0.05 U/kg/h for children <5 years old and those with known, partially treated diabetes. SC insulin was given when acidosis had resolved and oral intake was tolerated. **0.9% normal saline** After resuscitation, subjects were randomised to 0.9% normal saline as their initial fluid for at least 12 hours. The rate of administration followed the hospital's DKA protocol: usual maintenance plus correction of deficit over 48 or 72 h if corrected Na is >150 mmol/L. We assumed a mean deficit of 6% for moderate and 10% for severe DKA as clinical signs of dehydration are unreliable in estimating dehydration in DKA. Fluids already received were subtracted from the deficit. After 12 h of study fluid, 0.45% saline was permitted if the corrected Na exceeded 150 mmol/L. When the initial corrected Na was >150 mmol/L, the fluid was changed to 0.45% saline if the corrected Na did not fall by at least 5 mmol/L in 12 h. KCl was added to study fluid unless hyperkalaemia (K >5.5 mmol/L) or anuria was present. KH2PO4 was allowed as an additional source of potassium after the first 24 h if hypophosphataemia

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Outcome measures	**Minimum sodium concentration** **Maximum chloride concentration** **Altered conscious state** Glasgow coma scale (GCS) deterioration Acute renal failure **Healthcare utilisation- Paediatric intensive care unit (PICU) or high-dependency unit (HDU) stay** Hours

Study arms

Hartmann's solution (N = 38)
0.9% normal saline (N = 39)

Characteristics

Arm-level characteristics

	Hartmann's solution (N = 38)	0.9% normal saline (N = 39)
Age (years) MedianIQR	12.9 (11.4 to 15.1)	12.4 (8.5 to 15)
% Female Sample Size	n = 15 ; % = 63.2	n = 15 ; % = 38.5
Previously known diabetes Unclear if its T1DM or T2DM Sample Size	n = 19; % = 50	n = 19 ; % = 49

Cochrane risk of bias tool 2.0 (RoB 2.0)		
Section	Question	Answer
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Low
Domain 2a: Risk of bias due to deviations from the intended interventions (effect of assignment to intervention)	Risk of bias for deviations from the intended interventions (effect of assignment to intervention)	Low
Domain 3. Bias due to missing outcome data	Risk-of-bias judgement for missing outcome data	Low
Domain 4. Bias in measurement of the outcome	Risk-of-bias judgement for measurement of the outcome	Low
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Low
Overall bias and Directness	Risk of bias judgement	Low
	Overall Directness	Directly applicable (Directly applicable for outcomes: minimum sodium concentration, maximum chloride concentration, acute renal failure and Healthcare utilisation- Paediatric intensive care unit (PICU) or high-dependency unit (HDU) stay) Indirectly applicable (Outcome 'altered conscious state' not specified in the review protocol but did include fall in GCS.)