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# Clinical Guidance

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## Paediatric Critical Care: Diabetic Ketoacidosis: Two Bag Technique

### Summary

This guideline is for staff to use when utilising the two bag technique to optimise glucose control in children with diabetic ketoacidosis. This has been the management strategy for over a decade in the South Thames region but is not part of the national BSPED guideline.

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<p>This clinical guideline has been produced by the South Thames Retrieval Service (STRS) at Evelina London for nurses, doctors and ambulance staff to refer to in the emergency care of critically ill children.</p> <p>This guideline represents the views of STRS and was produced after careful consideration of available evidence in conjunction with clinical expertise and experience. The guidance does not override the individual responsibility of healthcare professionals to make decisions appropriate to the circumstances of the individual patient.</p>	

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## Two bag technique to optimise glucose control in diabetic ketoacidosis



Prepare two bags for all maintenance/ rehydration fluid: one without any glucose (bag1) and the other with added glucose (bag2):

**Bag1** is 0.9% sodium chloride (do not add glucose)

**Bag2** is 0.9% sodium chloride with added glucose (usually 10% glucose)

Add 40mmol/L of potassium chloride to each bag unless serum [K+] is > 5.5mmol/L and/or patient is anuric

The aim of this technique is to allow a steady and gradual fall in blood glucose on commencement of insulin therapy in DKA. This can be done by TITRATING the glucose free fluid (bag1) with a glucose containing fluid (bag2) such that the total volume of maintenance/rehydration fluid remains CONSTANT but the glucose intake can be varied by altering the PROPORTION of Bag2 relative to Bag1 according to changes in blood glucose. This will minimise the need to keep changing insulin infusion rates in response to changes in blood glucose. Blood glucose must be monitored at least hourly.

1. **Titrate Bag1 and Bag2 to achieve a target blood glucose value.** Start Bag1 (0.9% sodium chloride) on commencement of DKA therapy when blood glucose is likely to be high (e.g. if blood glucose >15mmol/L). Avoid rapid fall in blood glucose (**aim for rate of fall in blood glucose of 1 mmol/L per hour**). Starting insulin 1 hour after fluid resuscitation rather than immediately helps to prevent a rapid fall in blood glucose.
2. Blood glucose will fall following the use of insulin. In order to avoid changes in the dose of insulin, **Bag2 (0.9% sodium chloride WITH 10% glucose)** can be introduced to keep the blood glucose level constant. Arbitrarily increase the proportion of Bag2 relative to Bag1 to aim for a target blood glucose value.
3. **NB: The total amount of fluid must remain constant (Bag1 + Bag2 must be constant)**
4. As ketoacidosis resolves a point may be reached where all fluid is Bag2 (glucose containing). Rarely 0.9% sodium chloride + 10% glucose is not sufficient to maintain blood glucose. If the anion gap has resolved, then the insulin dose can be reduced. If the anion gap is still high (ongoing ketoacidosis) then the % glucose in Bag2 can be increased to a maximum of 12.5% glucose via a peripheral venous line.

E.g.: Theoretical example in a 9.9kg patient with DKA: total fluid intake is 4ml/kg/hr = 39.6ml/h=40ml/h

	Start therapy	12 hrs	16 hrs	24 hrs
Blood glucose	30 mmol/L	15 mmol/L	8 mmol/L	8 mmol/L
Bag1 0.9% Sodium Chloride	40 ml/h	30 ml/h	10 ml/h	0 ml/h
Bag2 0.9% Sodium Chloride + 10% Glucose	0 ml/h	10 ml/h	30ml/h	40 ml/h
Total fluid (ml/h)	40 ml/h	40 ml/h	40 ml/h	40 ml/h

Please note the above proportions of Bag1 and Bag2 are just examples. The correct proportions vary widely from patient to patient but can be worked out rapidly by titrating Bag1 with Bag2 to the desired blood glucose value every 15 minutes. Blood glucose must be monitored at least hourly and sometimes more frequently.