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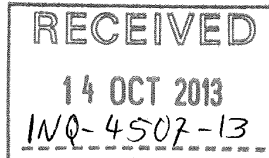
2 Franklin Street, Belfast, BT2 8DQ
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Your Ref:

Our Ref:
HYP/S71/01

Date:
11th October 2014

Ms Anne Dillon
Solicitor to the Inquiry
Arthur House
41 Arthur Street
Belfast
BT1 4GB



Dear Madam,

RE: INQUIRY INTO HYPONATRAEMIA RELATED DEATHS

I refer to the above and now enclose the following for your urgent attention: -

- 1) Email from Dr Smith to Dr Bell, Dr Thompson, Dr Hogan, Dr Lowry and Dr Sharpe;
- 2) Attachment referred to in the email above.

I have taken instructions from Dr Sharpe who advises that he has no recollection of being involved in drafting the guideline referred to by Dr Smith but accepts that he may have been informally consulted as a matter of courtesy given his position as Lead Clinician in Clinical Biochemistry. Dr Sharpe states that he would not have had the knowledge or expertise to contribute to this document in any substantive manner.

Yours faithfully

Joanna Bolton
Solicitor Consultant

Providing Support to Health and Social Care



From: Smith, M DR

Sent: 13 September 2001 12:42

To: 'Barbara at home'; Bell, B DR; Thompson, Sam DR; Shepherd, DR; Hogan, M DR; 'Martina Hogan'; 'Sam Thompson's other computer'

Cc: Lowry, D W DR (Anaesthetics); Sharpe, Peter Dr

Subject: IV fluid guideline

Dear All,

Please find attached a draft guideline of IV fluid replacement. I have consulted with Bob Taylor who was writing one at the same time so we blended ours. I have also met with Darryl Lowry and Peter Sharpe and this is the result. It is for use for pediatric medical and surgical patients on 3N. It is predominantly written for children over 1 (<10 kg) but we need to debate the lower age or weight level. Please have a look and we can discuss at the next meeting.

Mike

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Intravenous Fluids in Children

Revised: 11 October 2013

Dilutional hyponatraemia has been documented in otherwise healthy children following routine elective surgery. It occurs in (often female) children 3-10 years of age and is associated with "stress" such as postoperatively.

A fluid for children recommended for many years as a standard is 0.18 NaCl in 4% Glucose. It contains 40 mmol/l of sodium which when administered at the calculated rate (4 mls/kg/hour for the first 10 kgs body weight) provides the daily requirement of sodium and glucose.

0.18 NaCl in 4% Glucose is **isotonic** *in vitro* ie has the same osmotic potential so will not cause fluid shifts within the body. However in the catabolic (sick) child the glucose is metabolised rapidly causing the fluid to become **hypotonic** thereby leading to massive fluid shifts. At the same time because of the loss of fluid from the circulation often combined with a degree of dehydration a potent anti-diuretic hormone (ADH) response causes the kidneys to retain water resulting in a low volume concentrated urine, high in sodium. This may be compounded by the administration of a "fluid challenge" to elicit an improved urinary output.

This is a "double whammy" excess free water is administered and excess free water is retained. Water is drawn across blood capillaries into the interstitial and intracellular spaces. The child will become "puffy" looking and of greater consequence the brain will swell with the shift of water, leading to seizures and herniation of the tentorium and death. Therefore to prevent hyponatraemia we must limit the free water component of intravenous fluids AND monitor urine output and serum chemistry.

Recommendations:

1. Regular measurement of blood biochemistry, including a baseline measurement and measurements following each intervention, eg, fluid resuscitation or surgery.
2. Maintenance fluids should be calculated separately from "replacement" fluids. The rate of maintenance fluid is critically dependent on body weight, which should be accurately measured or estimated by a professional with substantial paediatric experience.
3. DO NOT give GLUCOSE containing intravenous fluids for fluid resuscitation. This is in keeping with APLS recommendations (use 0.9% NaCl, Normal Saline or other salt solution). You MUST measure blood sugar and administer a GLUCOSE bolus if there is hypoglycaemia (< 3 mmol/L).

AVOID albumin as an immediate fluid bolus unless there are specific indications. Fresh Frozen Plasma (FFP) is indicated if there are infection or coagulopathy problems.

The usual resuscitation volume is 10-20mls/kg bolus over 15-60 minutes depending on the clinical state.

4. Maintenance fluid should contain at least 0.45%NaCl in 2.5% Glucose. A balanced salt solution such as Normal Saline or Hartmann's does not contain glucose. Regular, 12 hourly, blood sugar estimation is required and must be documented.

5. Measurement of urine output or body weight is mandatory. Daily body weight measurement will accurately assess free fluid but is not feasible in the surgical bed bound child with acute pain. Urine output must be measured and clearly documented. An experienced doctor must assess fluid balance at least twice daily and take appropriate action to correct fluid loss or retention. If urine output is problematic a urinary sodium, potassium and urea should be measured.

6. Care must be exercised when additional fluids are administered as this may seriously complicate the maintenance fluid regimen. Intravenous antibiotics, oral fluids or contrast media are commonly forgotten additional fluids.

| Type of IV fluids | Volumes | Type of solution | | |
|---|--|--|-------------------------------------|---|
| | | <10kg and Na=140-145 mmol/L | >10kg and Na=140-145 mmol/L | All weights and Na< 140mmol/L |
| Maintenance Fluids in 24 hour period | 1st 10 kg (0-10) = 4 mls/kg/hr 2nd 10 kg (11-20) =2mls/kg/hr Subsequent kg = 1 ml/kg/hr i.e. for a typical 4 year old of 16kg this would translate to 52mls/hr (40mls+12mls) | 0.18 NaCl solution in 4% glucose (if well) 0.45% NaCl solution in 2.5% glucose (if sick or post-op) | 0.45% NaCl solution in 2.5% glucose | Ask for advice Usually Normal saline or Hartmann's |
| Replacement of previous losses | Replace equivalent volume lost ie correction of dehydration over 24-36 hours | Usually Normal saline or Hartmann's | | |
| Ongoing losses | Replace equivalent volume lost at intervals | Depends on type of loss ie gastric losses replaced with Normal saline | | |

IV Fluid replacement = maintenance + replacement + ongoing losses