ANTRIM HOSPITAL
45 BUSH ROAD · ANTRIM BT41 2RL · TELEPHONE (028) 9442 4000 · FACSIMILE (028) 9442 4001

Paediatric Department, Antrim Hospital

Dr. Jarlath McAloon
Consultant Paediatrician

Direct Tel. No - [redacted]
Fax No.- [redacted]

Date dictated:
Date typed: 2nd August 2004

JMA/GM

Dr. Henrietta Campbell,
Chief Medical Officer,
Department of Health, Social Services & Public Safety,
Castle Buildings,
Stormont Estate,
BELFAST.
BT4 3SQ

Re: Prevention and Management of Hyponatraemia

Dear Dr. Campbell,

Please find enclosed a copy of a Regional Audit that has been conducted in 2003-2004 to examine adherence to the DHSSPS guidance. I think the information contained is important and would be of interest to you. I am sending a copy of the Paper to Mrs. Jacqui Henry, to have it included with the Papers for the SAC meeting in October. I also intend to submit it to the Ulster Medical Journal as it represents some logical follow on from the Editorial on this subject in last November's issue.

With best wishes,

Yours sincerely,

Jarlath.

Dr. J. McAloon
Consultant Paediatrician

A Regional audit of adherence to DHSSPSNI guidance for prevention of hyponatraemia in children receiving prescribed fluids.

Summary

Guidance on the prevention of hyponatraemia in children was issued by DHSSPSNI in March 2002. Two years later Dr Henrietta Campbell, the Chief Medical Officer, wrote to the Chief Executives of acute and combined trusts to seek assurances that the guideline had been incorporated into clinical practice and its implementation monitored. This paper reports the findings of the first Regional audit undertaken to examine practice following introduction of the guidance. The evidence suggests that implementation has so far been incomplete.

Introduction

Following the deaths of two children in N.Ireland associated with complications of hyponatraemia and fluid therapy, the Department of Health, Social Services and Public Safety issued guidance on the prevention of hyponatraemia to all trusts in March 2002 [1]. The recommendations made contain advice regarding: patient assessment to include a check of the weight of the child; how to calculate fluid requirements; the choice of fluids to be utilised and specified details of the clinical and biochemical monitoring required while receiving intravenous (IV) fluids. This was followed by an Editorial in the Ulster Medical Journal outlining the background and rationale for the guidance disseminated [2]. An audit was subsequently undertaken in order to examine adherence by paediatric units to the guideline and is reported here.

Methods

All eight acute paediatric inpatient units in N.Ireland were invited by one of the authors (JMA), through a lead clinical coordinator, to participate in a simultaneous snapshot audit of paediatric practice around the Province and readily accepted. It was proposed that the management of all patients in receipt of IV fluids between 12.00 and 14.00hrs on the same day in May 2003, and who had also been been in receipt of IV fluids in the previous twenty-four hours, would be audited for compliance with the guidance. This time window was chosen in the expectation that a morning ward round would normally by then have been conducted, thus providing a pragmatic method of targeting for the audit a high risk group requiring ongoing therapy post baseline assessment and for whom there would have been adequate opportunity for management plans, monitoring and associated decision making to have been put in place. Neonates and intensive care patients, whose management is different, were excluded. The coordinators were asked to inform the relevant Clinical Director(s) that an audit was being planned, asked to identify a medical assistant for local data collection and to ensure that the date for the audit was kept confidential in order to avoid a positive influence on clinician behaviour. To facilitate maximum participation coordinators were reminded of the audit date in the preceding week. The same single page data collection form, previously piloted and refined by a paediatric SHO (RK) during two one week trial periods at Antrim Hospital, was used in each contributing unit. For collation of data a prescription for maintenance fluids was judged to be inconsistent with the guideline if the volume prescribed was greater than +/- 5% and inappropriate if greater than +/- 10% of the guideline calculation. Identical exercises was repeated in June 2003 and January 2004 as the initial numbers satisfying the inclusion criteria were small.

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Results

There were thirty-eight eligible children for whom data was returned and all units contributed at least one patient. Twenty-six children had a medical diagnosis and twelve had a surgical problem, eight of whom were in the post operative period. The grades of staff prescribing the fluids were PRHO (4); first term SHO (19); second term SHO (5); SpR (5); SAS (1); consultant (3) with one audit return incomplete. The results are summarised below by reference to the audit question used to examine adherence to a specific standard.

a. Was the child's weight recorded?
Data was returned for thirty-five children. Weight was measured in 33 cases and estimated in 2.

b. Was the calculation for maintenance IV fluid volume consistent with the guidance?
Data was returned for thirty-seven children. Calculations were consistent with the guidance in 28 cases (76%), inconsistent in 3 (8%) and inappropriate in 3 (8%). There were two children receiving fluid treatment in association with chemotherapy and one with a diagnosis of benign intracranial hypertension for whom the guidance was judged not relevant and where an alternative therapeutic fluid protocol was being followed.

c. Was the composition of IV fluids used appropriate?
Data was returned for thirty children who had received either maintenance fluids alone or both resuscitation and maintenance fluids and for five children who, in addition, also had a deficit replacement and/or ongoing losses prescription. The electrolyte and glucose content of the fluid utilised was appropriate in all thirty-five cases.

d. Were maintenance and replacement fluids prescribed separately?
Data was returned for seven children who had both maintenance and replacement losses prescribed. Two children had replacement prescribed separately but five did not.

e. Was fluid balance assessed at least every twelve hours?
Data was returned for thirty-seven children. The guidance was considered applicable to thirty-three as three were following an alternative regimen and one was terminally ill. Fifteen cases (45%) had documented evidence of reassessment of requirements in the first twelve hours of treatment and seven others within the first twenty-four. There was no record of reassessment in eleven (33%).

f. Was U&E checked at least once per twenty-four hours?
Data was returned for thirty-seven children of whom the guidance was applicable for thirty-four. Four children (12%) had not had a U&E checked any time in the preceding 24 hours. There were no children with severe hyponatraemia (serum Sodium < than130mmol/l) though nine children had a Na^+ <135mmol/l at some point.

g. Was the oral fluid intake considered in the most recent IV fluid prescription?
Data was returned for thirty-six children, of whom the guidance was applicable for twenty-three. Allowance for oral intake occurred in only twelve cases (52%).

h. What oral fluids were used during this period?
Information was available for seventeen children (table 1)

Fluid type	N
Water	2
Water and juice	4
Water and soup	1
Juice	2
Juice and milk	1
Milk	5
Rehydration solution	2

Table 1

Discussion

While the number of children in the study was inevitably small given the strict selection criteria, the information obtained should be a valid reflection of clinical practice following issue of the guidance and it is consequently important. As the audit period included three induction periods for new/ changing medical staff it is reasonable to conclude that there was sufficient opportunity for the guidelines to be both fully disseminated and introduced. Also, at the times of the study, the included patients comprised the group of ward-managed children throughout N.Ireland with the highest risk of complications associated with fluid therapy, and for whom greatest awareness and attention to the application of the management guidelines would be expected.

It is laudable that the standard for weight, namely that it should always be measured or estimated in a bed bound child, was met. However this should be interpreted with some caution as it does not necessarily reflect guideline conscious behaviour given that measurement of weight and its recording has become part of normal paediatric practice regardless of diagnosis and in/out patient status.

The standard achievement rate (82%) for maintenance fluid calculation was also high but with some evidence of the co-existence of potentially significant variation from advised practice. Jenkins and colleagues [2] acknowledge that guidance regarding maintenance fluid requirements is general guidance and emphasise that assessment needs to be individualised. The audit acknowledged this by accepting a total calculated volume within +/- 5% of the guideline value as meeting the standard. The clinical rationale for this percentage limit is that in terms of degrees of dehydration a larger variation could correspond to incorrect management e.g. treating a moderately dehydrated patient for mild dehydration or vice versa. Of the six children whose calculation was outside the guideline there were three whose prescriptions were classified as inappropriate, two being underestimates and the third an overestimate. The two underestimates were in a fifteen year old (-17%) on day 1 post appendectomy with a first term SHO as prescriber and in a thirteen year old (-19%) with urinary infection and prescriber not indicated. The overestimated child was a six year old (+27%) admitted with vomiting, constipation and no fluid deficit who, additional to the prescription, received oral fluids and for whom the prescriber was a first term SHO. The management of this younger child is of concern though there is indication that close monitoring took place with the U&E checked on four occasions and the lowest Na^+ recorded was 134mmol/l.

The choice of fluids for resuscitation, maintenance and replacement is also important. The guidelines recommend 0.9% saline as an appropriate crystalloid for resuscitation; they direct that the anticipated Na^+, K^+ and glucose requirements, for which age is an essential factor, determine the type of maintenance fluid and suggest that for most replacement scenarios fluid with minimum sodium content 130mmol/l should be used. The audit returns identified full compliance in implementing this standard. However, problems were encountered at the next step in the process for some children, namely recording the prescription. A separate prescription for maintenance and replacement fluids is recommended to reduce the potential risk of excess fluid administration resulting from a combined prescription inadvertently over running the period required for deficit correction. Separation of the prescriptions did not occur in seventy percent of relevant situations. This audit does not permit determination of the reason for this. While it may reflect lack of clinical awareness, another factor may be lack of user friendliness and ability of the various prescription sheets utilised to facilitate implementation of the standard.

The guidance highlights the essential role of monitoring for hydration status and fluid balance when prescribed fluids continue beyond twelve hours, specifying that reassessment should occur at least twelve hourly and that U&E should be checked at least once per day. The audit can identify that the standard for reassessment was only met in two thirds of cases but not explain why achievement was disappointingly low, though it is possible that reassessment activity was higher than actually recorded in the notes. However, it seems unlikely that poor note keeping alone provides a complete explanation as there were four children without a U&E checked in the preceding twenty-four hours of IV therapy, three of whom had actually been on full maintenance. These three included two post-operative, hence relatively high risk, patients aged 6 weeks and 11 years and a 8 year old with septic arthritis. There should also be some concern about the rigour of some assessments as, contrary to advice, no consideration had been allowed for the oral intake in the most recent prescription in almost 50% of affected children. Whether this reflects ignorance or disregard of the guidance, or some other factor such as poor design of fluid balance and prescription sheets, can only be conjecture. The guidelines also make reference to hyponatraemic risk in association with use of inappropriate oral rehydration fluids. There were only two children whose oral fluid was a commercial rehydration solution with the reported majority using an alternative (table 1). While there is insufficient information available to conclude that the management of any particular child was as a consequence compromised, the prevalent use of hypotonic solutions in a high risk group suggests that this general practice needs to be reviewed. Since this audit the first author has personal experience of an incident where a two year old dehydrated, hyponatraemic (Na^+ 129mmol/l) patient, with rota virus gastroenteritis, and receiving IV therapy, overnight drank her full maintenance requirement as water given by a parent and prior to scheduled medical reassessment on the morning ward round.

In March 2004 the Chief Medical Officer wrote to each Chief Executive of an acute or combined trust in N.Ireland requesting assurance that the guideline had been incorporated into clinical practice and that implementation had been monitored. The evidence from this Regional audit is that implementation has so far been incomplete. This could, but does not necessarily, indicate that there is inadequate guideline awareness due to failure of training programmes and/or failure of units to provide direction to junior staff. It would not be difficult for a paediatric unit to determine whether either or both of these observations applies and take appropriate corrective action if required. A plausible alternative explanation is that there may be significant,

but less obvious, intrinsic operational hindrances to implementing the guideline. If this is the situation they should be corrected. If not done already, units should organise a review by nursing, pharmacy and medical staff, both junior and senior, to identify the difficulties and possible solutions. Relevant issues for discussion and action could include: the redesign of prescription sheets to facilitate separation of prescriptions when only one IV infusion/ line is present; the facility to indicate required infusion finish times; the provision of action boxes on fluid balance sheets to trigger clinical and biochemical reassessments; appending for reference a simplified maintenance fluid calculation formula on the back of prescription sheets; outlining clinical descriptions for assessment of hydration status on the back of fluid balance forms; provision of oral fluid management information and advice for carers and the introduction of a method for effective nursing and medical handover of management plans for all children receiving IV fluids. Redrafted or new documentation should then be standardised in all trusts; a consensus should be developed on the appropriate use of hypotonic oral fluids and the task of achieving both of these could be undertaken by the original guideline Working Group as part of its process of guidance review.

To conclude, it is probable that the current guidelines will be modified in conjunction with the developing evidence base on appropriate fluid therapy in situations where physiology is not normal, such as illness or postoperatively. Internationally best practice is still controversial [3, 4] and preparation of definitive protocols is not yet possible. Until then it is essential that all clinicians in N.Ireland caring for children in receipt of fluid therapy know of the associated risks and are aware of our Regional best practice guidance and that paediatric departments initiate a process of regular monitoring of guideline adherence as part of their multidisciplinary audit and clinical governance programme.

ACKNOWLEDGEMENTS

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References

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Authors
Jarlath McAloon, MPhil, Consultant Paediatrician
Raj Kottyal, MB, Senior House Officer
Paediatric Department, Antrim Hospital