**PRESENTING PROBLEM:**
**ACUTE DIARRHOEA +/- VOMITING**

- Evaluate and maintain A,B,C according to APLS
- Consider differential diagnoses, see Table 1. Refer to paediatric team if any uncertainty over diagnosis of acute infective gastroenteritis.

**DIAGNOSIS OF EXCLUSION:**
**ACUTE INFECTIOUS GASTROENTERITIS**

- **No dehydration,** go to Page 3
- **Mild to moderate dehydration,** go to Page 2

**Severe dehydration,** with signs of circulatory compromise. Involve paediatric or A&E registrar or consultant.

- Rapid bolus of 20ml/Kg Normal Saline or Ringers lactate
- **Is the circulation restored?**
  - **Yes**
  - **Na>150?**
    - **Yes**
    - **No**
      - Continue rehydration, ideally via the oral route, use NG if necessary. See Table 3 and 3.1 for volume requirements and indications for IV fluids

FURTHER BOLUSES OF NORMAL SALINE TO A MAXIMUM OF 40ML/KG. IF
>40ML/KG REQUIRED CALL ANAESTHETIST AS INTUBATION AND
VENTILATION SHOULD BE CONSIDERED.

**ADMIT**

**ADMIT** to ward. Consider stool sample (Table 4), 2 hourly review of hydration. If ORS failing (unimproved or worsening dehydration) despite NGT fluids give IV fluids see Table 3.2

No signs of dehydration commence feeds (Table 5).
ACUTE DIARRHOEA, MILD TO MODERATE DEHYDRATION (3-8%)

? doughy skin, possible hypernaatraemic dehydration

Yes

Check Ur/Cr/Elec/bicarb

No

ADMEm
Rehydration over 4 hours (Table 3 for volume) with ORS. Review 2 hours and reassess at 4 hours

No

Na>150?

Yes

Continue as on PAGE 1 (box 1)

No

Administer ORS via NG tube
If already on NG fluids use IVI (if IV, check U&E).
See Table 3 Review 2 hours.

Yes

Review 2 hours
Worsening dehydration?

No

4 hour review
If no signs of dehydration commence normal fluids and diet at least maintenance volume (Table 5) Observe for further 2-4 hours. Reassess.

Still dehydrated?

Yes

Commence IVI (check U&E)
Continue if already on IVI
See Table 3
Review 2 hours. Once no signs of dehydration remain go to Box 2

No

Remains well hydrated?

Yes

Advice to carer; give information leaflet. ORS sachets for home use if substantial losses continue.

No

Carer happy to take child home?

Yes

DISCHARGE

No

Continue management and carer education in HOSPITAL
ACUTE DIARRHOEA, NO SIGNS OF DEHYDRATION

Assess risk of dehydration

HIGH RISK:
Age<6 months or vomits* >4 /day or liquid stools* >8 /day.

LOW RISK:
Age>6 months and vomits* ≤4 per day and stools* ≤8 /day.

*Count vomits if they are more than an effortless, small volume posset.
*Count stools if they are a discrete bowel action. Do not underestimate watery stools where a substantial component is absorbed into the nappy.

If 1 risk factor only may go home if parents happy with advice and information leaflet (although if < 6 months strongly consider admission.)
If > 1 risk factor ADMIT for observation
Continue usual fluids at at least maintenance see Table 3.1 and encourage larger volumes. Replace substantial ongoing losses with ORS at 10ml/Kg per stool/vomit. Reassess at 4 hours

Good hydration maintained?

Yes

Advice to carer, give information leaflet. ORS sachets for home use if substantial losses continue.

No

Go to PAGE 2

ADMIT for observation

Yes

High carer/doctor concern?

No

Carer happy to take child home?

Yes

Continue management and carer education in HOSPITAL

No

DISCHARGE. Stool sample if indicated (Table 4)
Throughout the guideline the word **ADMIT** refers to observation in any acute paediatric facility, short stay unit, observation area or paediatric ward.

**Table 1:** Broad differential diagnosis of the child presenting with acute diarrhoea (+/- vomiting). The latter diagnoses are more likely to present chronically.

NB. The following features may be indicative of diagnoses other than acute viral gastroenteritis:
- Abdominal pain with tenderness/guarding and/or bilious vomiting (?surgical)
- Pallor, jaundice, oligoanuria, bloody stool (?HUS)
- Systemically unwell, out of proportion to the level of dehydration (other infections, surgical, CAH etc)
- Shock

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**Table 2:** Assessment of severity of dehydration
- Signs are ordered in each column by severity
- If a pre-illness accurate weight is available calculate deficit from weight loss
- Pinch test – Pinch skin of abdomen. Skin recoils instantly = normal, 1-2 sec = mild/moderate, >2sec = severe.

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<td>• Altered neurological status (drowsiness, irritability)</td>
<td>capillary refill time&gt;2 seconds)</td>
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Table 3: Calculation of fluid requirements in dehydration

* Ideally all children should be rehydrated orally (even if the child initially presented with severe dehydration and required IV resuscitation) see table 3.1 for calculation of total volume.

* Intravenous fluids are indicated if the child is unable to tolerate oral rehydration (including a trial of NG fluids if appropriate) OR oral rehydration fails i.e. persistent vomiting or worsening dehydration (as assessed 2 hours following commencement of oral rehydration) see table 3.2 for calculation of IV volume.

Table 3.1
Calculation of total ORAL rehydration requirements
Follow steps 1-3 in the table to work out the fluid requirement

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<td>Estimate the level of dehydration from table 2 and work out the volume required</td>
<td></td>
</tr>
<tr>
<td>Replace deficit over 4 hours</td>
<td></td>
</tr>
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<td></td>
</tr>
<tr>
<td><strong>2 Maintenance</strong></td>
<td>100ml per Kg per 24 hours for the first 10Kg body weight</td>
</tr>
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<td>Give over 24 hours</td>
<td></td>
</tr>
<tr>
<td>50mls per Kg per 24 hours for the next 10 Kg body weight</td>
<td></td>
</tr>
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<td>20mls per Kg per 24 hours for the remaining Kg’s body weight</td>
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</tr>
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<td><strong>3 Ongoing losses</strong></td>
<td>10mls per Kg for any significant vomit or watery stool</td>
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e.g.
A 12 Kg child who is 5% dehydrated with a sodium < 150 would require
Deficit 50mls/kg over 4 hours = 600mls (150mls/hour for the first 4 hours)
Maintenance (10x100) + (2x50) = 1100mls over 24 hours or 45mls/hour
Therefore 195mls/hour for the first 4 hours plus any additional losses.
Decrease to maintenance plus ongoing losses at 4 hours if no signs of dehydration.

The same child with a sodium of >150 would require
Deficit 50mls/kg over 12 hours = 600mls (50mls/hour for the first 12 hours)
Maintenance (10x100) + (2x50) = 1100mls over 24 hours or 45mls/hour
Therefore 95mls/hour for the first 12 hours plus any additional losses.
Decrease to maintenance plus ongoing losses at 12 hours if no signs of dehydration.

Practical Points:
* Children who are dehydrated are thirsty and do not normally refuse ORS.
* Give fluid little and often. If the child is vomiting decrease volumes and increase frequency (every 5-10 minutes).
* Where carers are not willing/able to do this under supervision (or child is asleep) then rehydrate by NGT.
* Suitable ORS are Dioralyte, Diocalm Junior or Electrolade.

*1 Oral rehydration is preferable in hypernatraemic dehydration.
If oral rehydration is not tolerated and the deficit has to be given by the IV route the speed of replacement should be agreed upon locally (no evidence available).
Table 3.2: Calculation of total intravenous fluid requirement

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Therefore 95mls/hr for the first 12 hours then 45mls/hr plus any additional losses

Table 4: When to send a stool to the lab for microscopy, culture, sensitivity and virology.

- A history of blood +/- mucous in the stool
- A combination of abrupt onset of diarrhoea with > 4 stools per day and no vomiting pre-diarrhoea
- Temperature >40 degrees
- >5 stools in the previous 24 hours
- If the child is admitted to hospital (to be decided locally)
- A history suggestive of food poisoning
- Recent travel abroad

Table 5: Management of feeding during gastroenteritis.

- Breast fed: Continue breastfeeding throughout rehydration and maintenance phases
- Formula fed: Restart feed at full strength as soon as rehydration complete (ideally 4 hours)
- Weaned children: Restart normal fluids and solids following rehydration. Avoid fatty foods or foods high in simple sugars.

Table 6: Guide to drug treatment.

- Antidiarrhoeals: Infants and Children should not be treated with antidiarrhoeal agents.
- Antibiotics: The use of antibiotics is beyond the scope of this guideline but they should be considered in patients with invasive salmonella typhi, shigella, amoebiasis and giardiasis following local microbiological advice.
Guideline for the management of children presenting to hospital with diarrhoea, with or without vomiting

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Conflict of interest: none

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- Children Nationwide for their generous funding of this research

- Jeanette Taylor-Meek for effective administration of the Delphi process

Key words

Diarrhoea, gastroenteritis, Delphi consensus, guideline
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Evaluate and maintain A,B,C according to APLS

Consider differential diagnoses, see Table 1. Refer to paediatric team if any uncertainty over diagnosis of acute infective gastroenteritis.

DIAGNOSIS OF EXCLUSION: ACUTE INFECTIOUS GASTROENTERITIS

No dehydration, go to Page 3

Estimate severity of dehydration. See Table 2

Mild to moderate dehydration go to Page 2

Severe dehydration, with signs of circulatory compromise. Involve paediatric or A&E registrar or consultant.

Rapid bolus of 20ml/Kg Normal Saline or Ringers lactate

Is the circulation restored?

Yes

Na>150?

Yes

Continued rehydration over 12 hours (NB oral route preferable) See Table 3 and 3.1 for volume requirements and indications for oral or IV fluids
Box 1

No

Continued rehydration, ideally via the oral route, use NG if necessary. See Table 3 and 3.1 for volume requirements and indications for IV fluids

No

Further boluses of Normal Saline to a maximum of 40ml/Kg. If >40ml/Kg required call anaesthetist as intubation and ventilation should be considered.

ADMIT

ADMIT to ward. Consider stool sample (Table 4), 2 hourly review of hydration. If ORS failing (unimproved or worsening dehydration) despite NGT fluids give IV fluids see Table 3.2

No signs of dehydration commence feeds (Table 5).
ACUTE DIARRHOEA, MILD TO MODERATE DEHYDRATION (3-8%)

? doughy skin, possible hypernatraemic dehydration

Yes
Check Ur/Cr/Elec/bicarb

No
Na>150?

Yes
Continue as on PAGE 1 (box 1)

No

ADMIT
Rehydration over 4 hours (Table 3 for volume) with ORS. Review 2 hours and reassess at 4 hours

Yes
Review 2 hours
Worsening dehydration?

No

Continue ORS via NG tube
If already on NG fluids use IVI (if IV, check U&E).
See Table 3 Review 2 hours.

No

Still dehydrated?

Yes
Commence IVI (check U&E)
Continue if already on IVI
See Table 3
Review 2 hours. Once no signs of dehydration remain go to Box 2

No

4 hour review
If no signs of dehydration commence normal fluids and diet at least maintenance volume (Table 5) Observe for further 2-4 hours. Reassess.
Box 2

No
Remains well hydrated?

Yes
Advice to carer, give information leaflet.
ORS sachets for home use if substantial losses continue.

No
Continue management and carer education in HOSPITAL

Yes
Carer happy to take child home?

DISCHARGE
ACUTE DIARRHOEA, NO SIGNS OF DEHYDRATION

Also consider co-morbidity, including short bowel syndrome, ileostomies, CHD, Renal failure etc.

Assess risk of dehydration

HIGH RISK:
Age<6 months or vomits* >4 /day or liquid stools* >8 /day.

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No
Go to PAGE 2

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ADMIT for observation

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High carer/doctor concern?

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Carer happy to take child home?

No
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Throughout the guideline the word **ADMIT** refers to observation in any acute paediatric facility, short stay unit, observation area or paediatric ward.

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Therefore 195mls/hour for the first 4 hours plus any additional losses.
Decrease to maintenance plus ongoing losses at 4 hours if no signs of dehydration.

The same child with a sodium of >150 would require
Deficit 50mls/kg over 12 hours = 600mls (50mls/hour for the first 12 hours)
Maintenance (10x100) + (2x50) = 1100mls over 24 hours or 45mls/hour
Therefore 95mls/hour for the first 12 hours plus any additional losses.
Decrease to maintenance plus ongoing losses at 12 hours if no signs of dehydration.

Practical Points:
* Children who are dehydrated are thirsty and do not normally refuse ORS.
  * Give fluid little and often. If the child is vomiting decrease volumes and increase frequency (every 5-10 minutes).
  * Where carers are not willing/able to do this under supervision (or child is asleep) then rehydrate by NGT.
  * Suitable ORS are Dioralyte, Diocalm Junior or Eleclorlate.

* Oral rehydration is preferable in hypernatraemic dehydration.
  If oral rehydration is not tolerated and the deficit has to be given by the IV route the speed of replacement should be agreed upon locally (no evidence available).
Table 3.2: Calculation of total intravenous fluid requirement

<table>
<thead>
<tr>
<th>Fluid Requirement</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Deficit</strong></td>
<td></td>
</tr>
<tr>
<td>Estimate the level of dehydration from table 2 and work out the volume required</td>
<td></td>
</tr>
<tr>
<td>Replace deficit over 12 hours</td>
<td></td>
</tr>
<tr>
<td>(See *1 above for use of IV fluids in hypernatraemic dehydration)</td>
<td>Mild to moderate (3-8%) dehydration ➔ 30-80mls/kg</td>
</tr>
<tr>
<td></td>
<td>Severe dehydration (9% or more) ➔ 100 ml/kg</td>
</tr>
<tr>
<td></td>
<td>NB Any fluid given as a bolus should be subtracted from this volume</td>
</tr>
<tr>
<td><strong>2 Maintenance</strong></td>
<td>100ml per Kg per 24 hours for the first 10Kg body weight</td>
</tr>
<tr>
<td>Give over 24 hours</td>
<td>50mls per Kg per 24 hours for the next 10 Kg body weight</td>
</tr>
<tr>
<td></td>
<td>20mls per Kg per 24 hours for the remaining Kg’s body weight</td>
</tr>
<tr>
<td><strong>3 Ongoing losses</strong></td>
<td>10mls per Kg for any significant vomit or watery stool</td>
</tr>
</tbody>
</table>

E.g.
A 12 Kg child who is 5% dehydrated would require
Deficit 50mls/kg over 12 hours = 600mls (50mls/hr)
Maintenance (10x100) + (2x50) = 1100mls over 24 hours or 45mls/hour
Therefore 95mls/hr for the first 12 hours then 45mls/hr plus any additional losses

Table 4: When to send a stool to the lab for microscopy, culture, sensitivity and virology.

- A history of blood +/- mucous in the stool
- A combination of abrupt onset of diarrhoea with > 4 stools per day and no vomiting pre-diarrhoea
- Temperature >40 degrees
- >5 stools in the previous 24 hours
- If the child is admitted to hospital (to be decided locally)
- A history suggestive of food poisoning
- Recent travel abroad

Table 5: Management of feeding during gastroenteritis.

- Breast fed Continue breastfeeding throughout rehydration and maintenance phases
- Formula fed Restart feed at full strength as soon as rehydration complete (ideally 4 hours)
- Weaned children Restart normal fluids and solids following rehydration. Avoid fatty foods or foods high in simple sugars.

Table 6: Guide to drug treatment.

- Antidiarrhoeals Infants and Children should not be treated with antidiarrhoeal agents.
- Antibiotics The use of antibiotics is beyond the scope of this guideline but they should be considered in patients with invasive salmonella typhi, shigella, amoebiasis and giardiasis following local microbiological advice.
Technical report on guideline development

Clinical guidelines are being developed at an increasing rate around the world [1]. The driving forces are; rising health care costs and an increasing patient demand for the best available care. In England paediatric attendance to accident and emergency departments (A&E) or acute admission wards continues to rise, yet the length of stay in hospital continues to fall [2-5]. Admission rates have increased from 40 per 1000, aged 0-4 years in 1970, to 100 per 1000 in 1997[3]. The reasons for this change are not clear. Children attending A&E with medical problems account for at least 15% of all attendances and it is estimated that at Sheffield Children’s Hospital, 40% of children less than 2 years attending the A&E department have a medical condition [6].

Diarrhoea is defined as a change in bowel habit for the individual child resulting in substantially more frequent and/or looser stools. The UK incidence of diarrhoeal illness in children is not known, but it leads to high GP consultation rates (204/1000/year in the 0-4 age group) [7] and hospital admissions (at least 7/1000/year <5 years old) [Macfaul, 2000 #138;OPCS, 1994 #141]. It accounts for 16% of all paediatric medical presentations to A&E [8]. In 1996 OPCS data for England and Wales states that there were 58 deaths from intestinal infections in children 0-15 years, accounting for 0.9% of all causes of death in this age group [9]. This guideline was developed because gastroenteritis is common, management varies and junior doctors make many of the initial decisions.

Aim of the guideline

- To provide clinicians with recommendations for the management of children presenting with diarrhoea +/- vomiting.
- To promote consistency of care of patients with similar clinical problems.
- To guide the decision making process of junior doctors seeing the majority of patients in the first instance[8].
- To promote the use of oral rehydration which is the appropriate treatment for the majority of children who present with gastroenteritis.
The main guideline consists of:

1. Evidence based recommendations
2. An algorithm used to translate the recommendations into a format that can be implemented and easily used by clinicians.
3. A care pathway
4. Patient information leaflets

The key recommendations are intended to direct the clinician to the most appropriate management of patients based on the best evidence available from the literature. Recommendations have also been included based on a multidisciplinary consensus opinion to provide guidance in clinically important areas where evidence is lacking. The guideline is transparent about which recommendations are evidence based and which are based on consensus opinion.

Scope of the guideline

- This policy is for the child presenting to an acute facility (accident and emergency or admissions / paediatric assessment unit) with acute diarrhoea (≤7 days) with or without vomiting.
- Children presenting with vomiting alone or chronic diarrhoea (>7 days) are not considered.
- This algorithm is intended for use when a child is first seen in any acute paediatric assessment unit. Further management decisions over the next 6-12 hours and indications for review and discharge are also given.

Key areas covered:

- Symptoms and signs that may alert the clinician to diagnoses other than infectious gastroenteritis.
- Assessment of the degree of dehydration.
- Management of rehydration – indications for oral and intravenous routes.
- Indications for laboratory investigations.
- Management of hypernatraemia.
- Indications for admission and discharge.
Information for parents.

The guideline is evidence based apart from the following 2 areas:

1. Emergency assessment of the airway, breathing and circulation: the user is directed to the APLS (advanced paediatric life support) guidelines for management if indicated.

2. Maintenance fluid requirements: the standard formula used in many paediatric texts are quoted [10, 11].

The development group assumes that health care professionals will use general medical knowledge and clinical judgement in applying the recommendations in this document to the management of individual patients. These recommendations may not be appropriate for use in all circumstances.

Guideline Exclusions

- Management of children in primary care
- Children with chronic diarrhoea

Guideline Users

The guideline has primarily been written for use by junior doctors who see children in acute hospital settings, whether that is an accident and emergency department or GP referral unit. Senior doctors, nurses or other professionals, allied to medicine, may wish to refer to its recommendations in order to keep them up to date with the current evidence.

Details of guideline development

A multi-disciplinary group was convened to advise on the development of the guideline and met regularly throughout the process. The group consisted of Dr Kate Armon (clinical research fellow), Dr Maria Atkinson (clinical research fellow), Professor Terence Stephenson (Professor of Child Health and Honorary Consultant Paediatrician), Dr Roderick Macfaul (DGH Paediatrician), Ursula Wemeke (statistician), Dr Stephanie Smith (Paediatric A&E Consultant), Pippa Ecclestone (nurse reseracher). A GP and parent representatives were also consulted.
Details Of Guideline Development

The guideline development process is based on the methodology suggested by the Scottish Intercollegiate Guideline Network [12] and the 'AGREE' criteria used to appraise guidelines provided in the Royal College of Paediatrics Standards for development of clinical guidelines [13]. The literature was appraised by following recommendations for grading provided in a recent report by SIGN [12]. A modified Delphi method, (described in Appendix 3), was used to provide consensus where evidence was lacking and to help translate the evidence into relevant and unambiguous recommendations.

The recommendations for clinical practice are based on:

- The results of a systematic literature search, review and appraisal of the available research evidence identified from the electronic databases from 1966 to December 2002.
- A review of the literature identified by hand searching journals thought to be most relevant to the subject from January 1998 to January 2003.
- A search of the relevant journals not found on the electronic databases.
- A limited search for unpublished studies.
- Expert opinion from the Delphi panel where evidence was lacking.

Composition of the Delphi panel

Members – as listed in the acknowledgments.

The panelists selected were drawn from the United Kingdom, represented practice in both urban and rural settings and were clinicians who would be involved in management of a child after presentation at hospital. We did not include general practitioners, parents or patients. Ninety-six medical (consultant, registrar and SHO) and nursing staff from mixed adult/ paediatric A&E departments, paediatric A&E departments, general paediatric departments (both teaching hospital and district general hospital) and specialist paediatric gastroenterology services were invited of whom 54 agreed to be included.

Delphi process

This is described in more detail in Appendix 3

First round

All panelists received by post: the literature review with derived management statements; a copy of all the articles cited, along with the critical appraisal abstraction sheet which included grades of evidence; a response form detailing each statement together with a 1-9 Likert scale and space for comments. The panelists were asked to rate their level of agreement with each statement as written and to comment. This
first round ‘pack’ was piloted (n=4) and revised where necessary to improve clarity and remove ambiguity. A reminder letter and a subsequent telephone call were made to non-responders. 39 panellists returned the first round response form and were included in subsequent rounds.

The definition of consensus is crucial to the ‘consensus development’ process, and should be decided before the process starts. For ‘nominal group consensus development’ rules have been developed to assess agreement when statements have been ranked on a 9-point scale. We chose to apply this to the Delphi method since the same scale was used. One sixth of the ratings furthest from the median were removed. This is done so that outliers, (who may not have understood the question, or are unique in their views), do not overly influence the results. Consensus within the panel (known as ‘relaxed’ agreement for a nominal group) is defined as all remaining panellists’ responses falling within 3 boxes of each other on the Likert scale. Consensus agreement with the statement as presented to the panel is defined as all remaining responses falling in boxes 7-9 (thus agreement both between the panel members and with the statement as given, known as ‘strict agreement’ for a nominal group).

Second and third rounds

All statements that achieved ‘strict’ consensus were removed from subsequent rounds and used for guideline construction where evidence was lacking. For statements that did not gain consensus, modified and new statements were used in the second round. After the extreme one sixth of responses were removed, the range, inter-quartile range and median of the remaining responses were reported back to the panellists, along with any comments made. Panellists were asked to re-consider the statements in the light of the responses and comments of the rest of the panel. A third round consisted of statements that had not yet achieved consensus.

The guideline

The literature review, level of evidence and grade of recommendation is given for each step on the algorithm. If no evidence was available this is clearly stated followed by a further statement which details whether Delphi consensus was reached. The algorithm formed the basis of an integrated care pathway, which was used to pilot the guideline (described later) and to study its impact.

Throughout, the word ‘admit’ is defined as follows: ‘any admission to a paediatric facility with paediatric trained staff for observation, further investigation and management regardless of the expected length of stay’.
Systematic Literature Review

A systematic review of the literature was performed following the methodology suggested by SIGN. The literature was identified by an explicit search strategy, according to pre-set criteria, and evaluated against standards provided by SIGN. A librarian, (from the Greenfield Medical Library University of Nottingham), experienced in Medline searching, checked the initial searches and found them to be satisfactory.

The search strategies used identified:

- Existing guidelines
- Systematic reviews and meta-analyses
- Randomised controlled trials
- Observational studies
- Cohort studies
- Case series

Search strategy

Full details about the pre-set criteria for identifying the relevant literature and the results of the literature search for critical appraisal can be found in Appendices 1 and 2.

In general, because research evidence in paediatrics is still sparse it was impossible to restrict inclusion to well-conducted randomised-controlled trials. However, the studies needed to use an appropriate study design for the question asked and the study needed to be rigorous and provide results that were valid and reliable. Articles were chosen according to four criteria:

- Addressed the key clinical question.
- Indicated a thorough scientific review of the literature.
- A review or guideline that was written by a national body.
- An indication of a well designed clinical trial.

We included the following computerised databases: The Cochrane Library, Medline, Embase, Cinhal, and Best Evidence. We searched from 1966 to the present (December 2002) using MesH headings and ‘textwords’, limited to 0-16 years of age. Further articles were obtained from colleagues and by hand searching the bibliography of articles. A hand search for the last 5 years of the most relevant journals was performed. The web site of Ulrichs Periodicals Directory was searched to identify any relevant journals not found on Medline. The journals not listed on Medline were only searched if thought to be relevant to
the subject area. The Internet was searched for existing guidelines and links to other evidence based sites. (Details of all Internet sites searched can found in Appendix 1).

Details about the exact number of papers generated and selected are provided in Appendix 2. Information from reports or existing guidelines was also extracted where appropriate but the guideline is clear about the source of information when providing a grade of recommendation. The articles were assessed for their relevance and quality and then critically appraised. Grading of the papers was discussed with colleagues experienced in critique of papers and evidence based medicine. Good quality data was recorded in evidence tables and the strength of evidence generated was graded. The level of evidence was graded 1 to 4 and recommendations were graded A to D based on the level of evidence found.
Table of the grades of recommendations included in the final guideline

<table>
<thead>
<tr>
<th>Grade of recommendation</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade A</td>
<td>7</td>
</tr>
<tr>
<td>Grade B</td>
<td>1</td>
</tr>
<tr>
<td>Grade C</td>
<td>3</td>
</tr>
<tr>
<td>Grade D</td>
<td>12</td>
</tr>
</tbody>
</table>

Levels of evidence

<table>
<thead>
<tr>
<th>Level</th>
<th>Type of evidence (based on SIGN 2000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1++</td>
<td>Evidence from high quality meta-analyses, systematic reviews of RCTs, or RCTs with a very low risk of bias</td>
</tr>
<tr>
<td>1+</td>
<td>Evidence from well conducted meta-analyses, systematic reviews of RCTs, or RCTs with a low risk of bias</td>
</tr>
<tr>
<td>1-</td>
<td>Evidence from meta-analyses, systematic reviews of RCTSs, or RCTs with a high risk of bias</td>
</tr>
<tr>
<td>2++</td>
<td>Evidence from high quality systematic reviews of case-control or cohort studies or high quality case-control or cohort studies with a very low risk of confounding, bias, or change and a moderate probability that the relationship is causal</td>
</tr>
<tr>
<td>2+</td>
<td>Evidence from well conducted case-control or cohort studies with a low risk of confounding, bias, or chance and a moderate probability that the relationship is causal</td>
</tr>
<tr>
<td>2-</td>
<td>Evidence from case-control or cohort studies with a high risk of confounding, bias, or chance and a significant risk that the relationship is not causal</td>
</tr>
<tr>
<td>3</td>
<td>Evidence from non-analytical studies e.g. case reports, case series</td>
</tr>
<tr>
<td>4</td>
<td>Evidence from expert opinion</td>
</tr>
</tbody>
</table>
Grading of recommendations

<table>
<thead>
<tr>
<th>Grade</th>
<th>Type of recommendation (based on SIGN 2000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Requires at least one meta-analyses, systematic review or RCT rated as 1++, and directly applicable to the target population, and demonstrating overall consistency or results</td>
</tr>
<tr>
<td>B</td>
<td>Requires a body of evidence including studies rated as 2++, directly applicable to the target population, and demonstrating overall consistency of results; or extrapolated evidence from studies rated as 1++ or 1+</td>
</tr>
<tr>
<td>C</td>
<td>Requires a body of evidence including studies rated as 2+, directly applicable to the target population and demonstrating overall consistency of results; or extrapolated evidence from studies rated as 2++</td>
</tr>
<tr>
<td>D</td>
<td>Evidence level 3 or 4; or extrapolated evidence from studies rated as 2+</td>
</tr>
</tbody>
</table>

The method used to derive the final recommendation involved the following stages:

- Evaluation of the methodological quality of the evidence and the allocation of a quality rating.

\[
\text{Study type + methodological quality} \rightarrow \text{level of evidence}
\]
Dissemination

Prior to implementation an active period of dissemination was undertaken. This involved teaching sessions with nurses and doctors working in accident and emergency and in the GP referral unit. Copies of the algorithm and the tables were distributed to these areas.

Implementation pilot

The guideline has been provided as a series of recommendations and also as a care pathway to aid the decision-making process by junior doctors. Pre- and post implementation data has been collected from the paediatric emergency department at the Queens Medical Centre Nottingham where the guideline has been developed and piloted. It would be possible for any institution implementing this guideline to undertake a similar audit process. Cost analysis was not addressed but would be important to consider in a further audit.

Method: A care pathway was developed with nursing and medical staff, based on the guideline algorithm. This was used as the documentation for children presenting with diarrhoea, and followed the child to the ward if admitted.

The key elements of the assessment and management of the child with diarrhoea, using this guideline, were used to develop a data collection form. These data were collected from the notes of children attending A&E, (both GP referrals and self referrals), during a four month period in 1997 and compared with those attending during a four month period in 1999, following implementation of the care pathway. Data were compared using SPSS®, Chi-square and Man-Whitney-U tests.

Results: 292 children attended with diarrhoea pre care pathway and 239 post. There was no difference in age, sex, or time of arrival. Numbers admitted increased from 27% to 34%. During the same period there was a 14% increase in admissions of children presenting with all other medical problems. There was no change in the numbers of children returning to A&E having been discharged.

The time taken from seeing the doctor to discharge was reduced by 15 minutes from a median of 55 minutes to 40 minutes, and the total time in the department reduced by 24 minutes from median 102 to 78 minutes.

The number of children investigated for FBC and U&E fell (17% to 6%, $\chi^2$ p = 0.02 and 18% to 7%, p=0.02 respectively), and intravenous infusions fell (13% to 2%, $\chi^2$ p=0.002). Other investigations remained the same. Documentation of symptoms, signs and management plan was improved.
**Conclusion:** The implementation of a care pathway for diarrhoea was associated with a reduction in the number of unnecessary investigations and unnecessary IV canulations. It also reduced the time spent in the A&E department. The proportion of attenders admitted increased in keeping with the overall increase in medical admissions.

**Audit recommendations**

The following data are valuable for monitoring compliance with guideline recommendations and auditing the impact of the guideline on clinical practice:

- Proportion of children admitted within the three levels of dehydration, (none, with or without risk factors for dehydration, mild/moderate and severe), pre and post guideline implementation.
  
  *Standard – admit only those fulfilling the guideline criteria.*

- Proportion of children returning to hospital, (within 7 days), with the same presenting problem before and after guideline implementation.

- Proportion of children investigated by clinical chemistry and microbiology, (include data on criteria for stool samples), pre and post guideline implementation. Record frequency of abnormal results.

  *Standard – investigate only those fulfilling guideline criteria.*

- Proportion of children within each category of dehydration level who have a cannula sited with or without commencement of IV rehydration, pre and post guideline implementation.

  *Standard – only children with severe dehydration or failed oral (including naso-gastric tube) rehydration should have a cannula sited and IV rehydration commenced.*

- Monitoring length of time for rehydration in dehydrated children, and duration of ‘starvation’ prior to recommencing feeds.

  *Target – Aim for rehydration within four hours of admission and feeding recommenced.*

Monitoring of length of time taken to manage a child presenting with diarrhoea from consultation to admission or discharge.
Patient Information Leaflets

The patient information leaflets were reviewed and revised by the hospital patient representative and 10 other parents. They have been successfully implemented along with the care pathway and are regularly used.

Disclaimer

It is important to remember that guidelines are only one tool used to improve patient care. Clinical acumen and judgement must always be used in conjunction with the guideline. Research is a continuum and it may be necessary to alter practice in light of new evidence before the guideline has been up-dated. It is also important for all clinicians to remember that all guidelines must be used in association with individual patient needs and preferences.

Conflict of interest

The views or interests of the charity funding the development of this guideline have not influenced the final recommendations

Members of the development group have not expressed any conflict of interest with the development of the guideline.

Date for review

Due for review January 2006
Main Guideline

Recommendations and supporting evidence

The evidence supporting each step on the algorithm is described below, followed by a recommendation along with the grading of the papers applicable to that particular statement.

A. Definition of diarrhoea

Diarrhoea is present when there is an increase in the frequency, volume or liquidity of the stool relative to the usual habit of the individual. There is no research specifically addressing the definition of diarrhoea. There is a great variability in stool patterns amongst normal infants. Most papers accept a working definition of diarrhoea as follows:

RECOMMENDATION

*Diarrhoea is defined as a change in bowel habit for the individual child resulting in substantially more frequent and/or looser stools.*

No evidence, delphi consensus

Grade D Recommendation

B. Differential diagnosis

Once a child has attended Accident and Emergency with a presenting complaint of diarrhoea, with or without vomiting, we need to know the possible differential diagnoses and the likelihood of these. Unfortunately there are very little data available to help with this clinical question. Conway, level 3 evidence [14] performed a prospective hospital cohort study. The aim of this study was to document the paediatric population admitted with gastroenteritis to a sub-regional infectious disease unit. Patients initially thought to have acute gastro-enteritis and subsequently given other diagnoses were included. 1,148 children were enrolled of whom 59 (5%) were found to have other diagnoses, which included infections other than in the GI tract, pyloric stenosis, feeding problems and cows milk protein intolerance. This is by no means a comprehensive list as the aim of the study was not to identify end diagnoses in children with diarrhoea.
Fleischer in his textbook of paediatric emergency medicine [15] gives a differential diagnostic list for children presenting with diarrhoea. In the absence of published evidence a modified list of differentials was sent to the Delphi panel and consensus agreement was achieved on table 1 of the algorithm.

**RECOMMENDATION**

*The following differential diagnoses should be considered in a child who presents with diarrhoea*

**Table 1**

<table>
<thead>
<tr>
<th>Category</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infections</td>
<td>Enteral: viral (commonest cause), bacterial, parasitic</td>
</tr>
<tr>
<td></td>
<td>Non enteral infections (UTI, pneumonia, Otitis media)- vomiting predominates</td>
</tr>
<tr>
<td>Surgical</td>
<td>Appendicitis, Intussusception, Obstruction, Short bowel syndrome</td>
</tr>
<tr>
<td>Systemic illness</td>
<td>Endocrinopathy (Diabetes, Hyperthyroidism, Congenital Adrenal Hyperplasia, Addison’s disease, hypoparathyroidism), Immunodeficiency. Metabolic</td>
</tr>
<tr>
<td>Antibiotic associated</td>
<td>Whilst taking antibiotics and rarely Pseudo-membranous colitis</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>Constipation with overflow, Toxins, Haemolytic-uraemic syndrome (HUS), Toddler diarrhoea, Child Abuse (Munchausen by proxy, sexual)</td>
</tr>
<tr>
<td>Dietary disturbance</td>
<td>Food allergy/ intolerance (Lactose, Cows milk protein), starvation stools.</td>
</tr>
<tr>
<td>Malabsorption</td>
<td>Cystic fibrosis, Coeliac disease,</td>
</tr>
<tr>
<td>Inflammation</td>
<td>Ulcerative colitis/ Crohn’s, Hirschsprung’s enterocolitis</td>
</tr>
<tr>
<td>Idiopathic/ Psychogenic</td>
<td>Irritable bowel syndrome</td>
</tr>
</tbody>
</table>

No evidence
Delphi consensus
Grade D recommendation
C. Symptoms and signs which should alert the clinician to diagnoses other than gastroenteritis

As described above the list of differential diagnoses for children presenting with diarrhoea +/- vomiting is long and varied. There are some symptoms and signs with may be helpful in alerting the clinician to more serious diagnoses such as HUS (haemolytic uraemic syndrome).

Macdonald and Beattie, level of evidence 2+ [16] carried out a retrospective review of children with intussusception over a 10 year period. Population incidence was found to be about 1 per 1000 in the first year of life. There were 110 children in whom 32% had diarrhoea at first presentation, 26% were shocked or dehydrated, 83% were vomiting (27% bilious), and 32% had bloody stool. The peak age of diagnosis was 5 months with 80% under 1. Only 42% were diagnosed correctly within 3 hours of admission.

Milford, level of evidence 2+ [17] reported on the clinical and epidemiological aspects of HUS in the British Isles (1987-1989), finding cases through the British Paediatric Surveillance Unit and other sources. The overall incidence in children aged 0-15 years was 0.91/100,000. The peak incidence was in the age group 1-2 years at 3.3/100,000/year. 298 children were reported over the three-year surveillance. A prodrome of diarrhoea was present in 273 (95%) of cases and in 199 it was bloody. Diagnostic features on presentation were pallor in 92%, jaundice in 35% and oligo/anuria in 38%.

Many children with diarrhoea have associated abdominal pain, a few of these children will have surgical causes for their symptoms. This sub-group of children are often difficult to differentiate and present the clinician with a diagnostic dilemma. Reynolds, level of evidence 2+ [18] looked retrospectively at children presenting with abdominal pain to the A&E department. 371 children were identified over 4 seasonally diverse months. The final diagnoses were medical in 64.4%, surgical in 6.5% and nonspecific in 29.1%. Guarding and abdominal tenderness were the two signs most strongly associated with a surgical diagnosis. The paper does not state how many children had associated diarrhoea but does say that diarrhoea was not significantly associated with surgical causes of abdominal pain.

RECOMMENDATION

The following clinical features should alert the clinician to look for causes other than acute infectious gastroenteritis for a child’s diarrhoea +/- vomiting:

- Abdominal pain with tenderness +/- guarding
- Pallor or jaundice or oligo/anuria
• Blood in the stool
• Shock
• Bilious vomiting

Based on Reynolds, Milford and Macdonald level of evidence 2+
Grade C recommendation

D. Estimation of severity of dehydration

Weight loss

The severity of dehydration is most accurately assessed in terms of weight loss as a percentage of total body weight (prior to the dehydrating episode). An accurate weight immediately pre-illness is rarely available in the clinical situation, but if it is (for example a recent weight in the parent held record) dehydration can be estimated with some accuracy.

Clinical signs

In a prospective cohort study of children between 3 and 18 months of age in Egypt, Duggan level of evidence 2+ [19] found that ‘prolonged skinfold’, dry oral mucosa, sunken eyes and ‘altered neurological status’ were the best clinical signs correlating with dehydration as determined by post rehydration weight gain. In a similarly designed study, with children <4 years old, Mackenzie level of evidence 2+ [20] found ‘decreased skin turgor’, decreased peripheral perfusion and deep (acidotic) breathing to be the best clinical signs. A urea of >6.5mmol/L on serum blood sample and Ph<7.35 on blood gas were positive investigations associated with dehydration. However the sensitivity and specificity of all these signs were very low.

The textbook estimation of dehydration came originally from the Medical Research Council descriptions in 1952, and was modified by Ironside in 1970 [21], and more recently by Santosham in 1987 [22]. The percentage weight losses on which they were based were not subject to confirmation in a clinical study. This was addressed in the studies by Duggan and Mackenzie. Duggan level of evidence 2+ [19] found that those thought to be mildly dehydrated by Santosham’s scale showed weight gains of 3.6-3.9%, those moderately dehydrated showed gains of 4.9-5.3% and those severely dehydrated 9.5-9.8%.
Mackenzie level of evidence 2+ [20] looked only at children who were thought to be moderately dehydrated (7-10% estimated, with one of; diminished skin turgor, sunken eyes, dry mucous membranes, oliguria, recent weight loss). They found weight gains of 3.4-4.0%. The disparity between the estimated and true dehydration in this study may have been exacerbated by the rehydrated weight being recorded when signs of dehydration were no longer present rather than at the cessation of diarrhoea, as in Duggan’s study. In the latter there was a smaller difference between the true and estimated levels of dehydration. These studies need repeating on larger numbers with rigorously defined clinical signs in order to confirm the findings. Nevertheless it is clear that estimation of dehydration may not be accurate.

Both studies demonstrate that levels of dehydration become apparent at weight losses of 3% or above. In Duggan’s study changes in the mucous membranes, eyes, skin turgor, and neurological status became apparent at mean weight losses of 3.26% to 8.06%. A weak pulse and prolonged capillary refill time became apparent at levels of dehydration over 9%.

Capillary refill time >2 seconds has been proposed as a useful indicator of dehydration. This sign lacks sensitivity and specificity. Gorelick level of evidence 2++ [23] showed that in healthy children the capillary refill time was abnormally prolonged following 15 minutes in a cool (air conditioned) room. However, given it’s limitations it is important to note that a child who is severely dehydrated is very unlikely to have a normal capillary refill time. Likewise a prolonged capillary refill in a child with diarrhoea should be taken as a sign of dehydration until proven otherwise.

RECOMMENDATION

1. Signs of dehydration are unlikely when the weight loss is below 3%.

2. Dry mucous membranes, sunken eyes, diminished skin turgor (pinch test 1-2 secs or longer), altered neurological status and deep breathing are present with levels of dehydration 3-8%.

3. The above signs become more marked with levels of dehydration 9% or above combined with circulatory collapse and poor perfusion.

The above statements are presented in a tabulated form in the algorithm (table 2)

Based on Duggan 1996 and Mackenzie 1989 level of evidence 2+.

Grade C Recommendation.
E. Management of rehydration

The overriding principles of the management of gastroenteritis are rehydration and prevention of dehydration. There are many studies addressing the best way this can be achieved. The Western world has lagged behind the developing world in using ORS despite there being good evidence that children with mild to moderate dehydration can be safely rehydrated with these solutions. [24] and [Sharifi, 1985 #119] conducted two of the biggest studies addressing this question. In the former study, a 111 children were randomised to either ORS (containing 50mmol Na) given over 6 hours or IV therapy given over 12 hours. ORS failed in only 2 children (a failure rate of 3.8%). ORS was found to be as good as IV rehydration when judged by biochemical parameters and there was no significant difference in the stool output between the two groups. The second study by Sharifi compared 470 children randomised to ORS or IV therapy. Two different ORS were used in this study. Solution A with a sodium content of 80mmol and osmolarity of 270 was given until signs of dehydration had disappeared followed by solution B with 40 mmol sodium and an osmolarity of 270 which was used for maintenance. The aim of this study was to compare the two therapies in severe dehydration but in fact the mean weight gain in the study group at discharge was 8.9% and 7.2% in the control group. The results showed that nearly 99% of children in the oral group were successfully treated with ORS. Duration of diarrhoea in hospital was found to be significantly less in the oral group. Other similar studies have come to the same conclusion [Tamer, 1985 #117;Vesikari, 1987 #118] both level 1+ evidence. A meta-analysis by Gavin [25] also addresses this question but includes both studies comparing ORS and IV therapy and those comparing different strength ORS’s. Randomised trials with oral and IV arms were felt to be the most appropriate trials to answer this particular question and so were studied separately to make a recommendation.

RECOMMENDATION

Oral rehydration should be the standard treatment for children with mild-moderate dehydration secondary to gastroenteritis (see below for the type of ORS).


Grade A recommendation

F. Composition of ORS

In the 1970’s the WHO adopted a glucose-electrolyte solution for the treatment of diarrhoea that contained 90mmol/l of sodium. Since then there have been many controlled trials looking at the ideal concentration
of electrolytes and carbohydrate in ORS and in particular the incidence of hyper and hyponatraemia with the different solutions. In developing countries where cholera is more common, rapid losses of sodium and potassium are documented. In developed countries diarrhoea tends to be isotonic, and therefore replacement of large quantities of sodium is not so imperative, and indeed may be harmful. Hahn level 1+ evidence [26] conducted a Cochrane systematic review on reduced osmolarity oral rehydration solution for treating diarrhoea caused by acute gastroenteritis in children. They conclude that reduced osmolarity ORS in children with mild to moderate diarrhoea is associated with fewer unscheduled IV infusions, lower stool output and less vomiting. Importantly they did not document an increased incidence of hyponatraemia with reduced osmolarity ORS. Within this review the osmolarity of the reduced ORS’s varied from 250mmol/l to 270mmol/l. Standard WHO ORS has an osmolarity of 311mmol/l. Two studies with osmolarities up to 331mmol/l were included. A randomised double blind multi-centre trial including 676 children by the CHOICE Study Group was one of the studies included in the systematic review. This study compared reduced ORS with a sodium concentration of 75mmol with standard WHO ORS. They found a significant reduction in unscheduled use of IV infusions in the reduced ORS group but no difference in stool output or vomiting. These studies demonstrate that reduced osmolarity ORS compared to standard WHO ORS has a beneficial effect by decreasing the number of children who require IV fluids because of failed rehydration. Debate remains as to the exact optimum concentration of reduced ORS and further studied are needed to resolve this.

RECOMMENDATION

Reduced osmolarity ORS should be used for rehydration of children with acute gastro-enteritis in the UK. Commercial solutions conforming to this include: dioralyte and diocalm Junior.

Based on Hahn, level of evidence 1+

Grade A recommendation

Many papers have been published looking at the different types of carbohydrate to be used in ORS, in particular rice based ORS to reduce the severity and duration of diarrhoea. A cochrane systematic review by Fontaine level 1+ evidence [27] demonstrated that rice based ORS are effective in reducing stool output in children and adults with cholera diarrhoea but not in those with non-cholera diarrhoea. A meta-analysis by Gore level 1+ evidence [28] using many of the same studies came to the same conclusion.
RECOMMENDATION

Rice based ORS do not significantly reduce stool output compared to glucose based ORS in children with non-cholera diarrhoea.

Based on Fontaine, level of evidence 1+
Grade A recommendation

G. Practical administration of ORS to children with mild to moderate dehydration

There is no evidence specifically addressing how quickly fluid deficits should be replaced and when to review once ORS has been started. Review articles and other guidelines[29] state that ORS should be used for rehydration and be given over a period of 3-4 hours. This was therefore put to the Delphi panel and reached consensus.

Children who have mild-moderate dehydration secondary to acute gastro-enteritis should have their deficit estimated (3% to 8%) and replaced with ORS (30-80ml/kg) given 'little and often'* over 3-4 hours, whenever this is practically possible".

* An attempt was made to define little and often further. The literature discusses the correct administration of ORS and recommends 5ml aliquots every 1-2 minutes. Only if this is well tolerated with no vomiting the size of the aliquots may be increased with decreasing frequency (grade 4 evidence). However, this regime was thought to be too labour intensive for compliance in the UK by the Delphi panelists and did not achieve consensus.

The literature discusses the definition of “Whenever practically possible”:

"Whenever practically possible implies that the child’s carer is willing and able to carry this out under supervision. Where this is not the case (or overnight) rehydrate by continuous naso-gastric tube infusion (preferred) or IV.
"
RECOMMENDATION

*Children who have mild-moderate dehydration* secondary to acute gastro-enteritis should have their deficit estimated (3% to 8%) and replaced with ORS (30-80ml/kg) given ‘little and often’ over 3-4 hours, whenever this is practically possible. Regularly assess success of rehydration (2 hourly). If no improvement in clinical signs of dehydration or worsening signs, consider NGT or IV infusion

*(Whenever practically possible implies that the child’s carer is willing and able to carry this out under supervision. Where this is not the case (or overnight) rehydrate by continuous naso-gastric tube infusion (preferred) or IV).*

Based on grade D evidence

Delphi consensus

**H. Rehydration / maintenance and ongoing losses**

Table 3 gives the calculations required for rehydration and maintenance requirements which are well established. As described in the technical report the calculations for maintenance fluids are based on well known paediatric textbooks.

The literature suggests that ongoing losses should be replaced with 10ml/Kg of ORS for each loose stool and substantial vomit. However, when this was put to the Delphi panel there was no consensus. An alternative of replacing estimated amounts lost was put to the panel but this also did not achieve consensus. Thus this issue had to be decided locally.

**I. IV Rehydration fluid in severe gastroenteritis**

Few studies assessing the efficacy of ORS include children with severe dehydration. The exception being the study by Shariffi level 1+ evidence [30]. This was a randomised controlled trial to compare oral and IV rehydration in children with severe dehydration. 64% of the oral group and 65% of the IV group were
felt to have severe dehydration with signs of shock at presentation. The paper states that severe dehydration is equivalent to 10% or more weight loss. The mean weight gain in the oral group was 8.9% and 7.2% in the IV group suggesting most children were at the upper end of moderate dehydration rather than severe. Despite this only 1 child in the oral group went on to need IV fluids and the study group generally did better with significantly less vomiting, diarrhoea and improved weight gain at discharge. Most studies either exclude children with severe dehydration Mackenzie [24] or treat with IV fluids until signs of shock have disappeared and the child is able to tolerate oral fluids then randomise (CHOICE Study 2001[31]). The results from Shariffi’s study are encouraging but it is not possible to make a recommendation regarding the use of ORS in severe dehydration based on this study alone in view of the problems noted above. There are unlikely to be further studies in the developed world on the use of ORS in severe dehydration due to the small number of children who present and the ethical dilemmas in undertaking this type of study when signs of shock are present.

In the absence of evidence this question was put to the Delphi panel. Many of the panellists made comments about the controversy that surrounds the use of colloid and crystalloid. There is no literature on the particular issue of crystalloid versus colloid in the resuscitation of infants and children with diarrhoea. In studies in adults crystalloid is known to be as effective for rapid restoration of circulating fluid volume. Until we have more evidence for children, (and this is likely to have to come from a developing country as the numbers of children presenting in shock with diarrhoea are so small in the UK), we will have to use the current literature which does not include a randomised controlled trial on crystalloid versus colloid. No studies report the use of colloid in diarrhoea.

The child with dehydrating diarrhoea is different from a child with shock secondary to trauma or sepsis. The dehydrated child has lost water and salts from all body compartments. In severe dehydration the final compartment to decompensate is the intravascular one. The child will have a high haematocrit and will not have lost any plasma proteins. It thus seems reasonable from a theoretical point of view to restore what has been lost, namely water and salts.

It is argued that if crystalloids are used they diffuse more readily into the interstitial and intracellular compartments. As these compartments are depleted in dehydrating diarrhoea, this seems a theoretically good thing, as long as further fluid is given to maintain intravascular volume.

RECOMMENDATION

*Children who have severe dehydration with circulatory compromise secondary to acute gastroenteritis should have their circulation restored by rapid IV infusion of normal saline or*
ringers lactate with a 20ml/kg bolus over one hour (faster if necessary). An experienced paediatrician should be involved early.

A further bolus of 20ml/kg should be given if the circulation is still compromised. If further boluses are required (>40ml/Kg) involve an anaesthetist early as intubation and ventilation should be considered

No evidence

Based on Delphi consensus

J. Oral versus IV rehydration in the severely dehydrated child following restoration of circulating fluid volume.

No studies have specifically looked at whether children treated with IV fluids for severe dehydration do better with oral or ongoing IV fluids once the circulating volume has been restored. There are studies though where children have been randomised to different types of ORS following IV fluid resuscitation for severe dehydration (CHOICE Study 2001[31]). In this study 56/675 presented with severe dehydration and following resuscitation were randomised to reduced ORS or WHO ORS. Overall 12% needed unscheduled IV fluids. It is not possible to tell from the data whether this group represents a higher than average proportion of children who initially presented with severe dehydration. Since there is good evidence that children with moderate dehydration should be treated with ORS it seems sensible that once the circulating volume has been restored ORS should be introduced.

There is no evidence to guide the clinician in deciding how fast the deficit should be replaced in children who require IV fluids. There are no studies comparing different rehydration times in children requiring IV fluid resuscitation. There are many studies comparing oral and IV rehydration, within these studies IV fluids are given over a variable period. Vesikari [32] compared oral and IV rehydration over 12 hours and gave 2/3 of the deficit over the first 6 hours and the remaining 1/3 over the next 6 hours. A similar study by Mackenzie [24] comparing oral and IV fluids rehydrated children over 24 hours. This was not put to the Delphi panel as it was felt to be more relevant to ongoing management on the wards rather than acute management in A&E. However, following feedback from clinicians using the guideline this was felt to be important and so has been decided at a local level and included. Clinicians may want to adapt this recommendation following discussion at a local level.
RECOMMENDATION

Once signs of circulatory compromise have resolved following fluid resuscitation for severe dehydration further rehydration should be with ORS.

Based on extrapolated evidence from CHOICE Study 2001, level of evidence 1+

Grade B recommendation

RECOMMENDATION

If IV fluids are required the deficit should be given over 12 hours taking into account any fluid already given as boluses.

No evidence

To be decided locally prior to implementation.

K. Investigations (plasma)

No studies have addressed this issue directly. Most episodes of dehydration caused by diarrhoea in developed countries are isonatraemic. Even when there is derangement of electrolytes in the serum, this is due to relative losses of salt and water. It is clear from several hospital cohort studies that derangement of electrolytes in acute gastroenteritis in the UK is now rare. Table 7 summarises three recent UK papers looking at hospital cohorts of children with GE. Approximately 1% of these admissions had hyponatraemia. None of these studies reported hypokalaemia or hyponatraemia, which are commonly found in patients dehydrated with cholera. A fourth study by Klein level 2+ evidence [33] from America studied 221 children admitted with gastroenteritis and treated with IV fluids all of whom had electrolytes tested. 87% of sodiums tested were normal, 12% were abnormal and 1% were in the critical range quoted as <115 or >160. Potassium, 88% normal, 10% abnormal and 2% in the critical range quoted as <3 or >6.5. Unfortunately the paper doesn’t state whether any of the children with results in the critical range were symptomatic, or whether the results changed clinical management. Abnormal results due to sampling errors were not considered.

Other studies have tried to evaluate the usefulness of laboratory tests in assessing dehydration. Bonadio level 2+ evidence [34] evaluated 50 children with dehydration and found that blood urea did not correlate
with the degree of clinical dehydration. This study used clinicians estimation of dehydration rather than rehydrated weight. The former is known to be difficult to estimate and inaccurate and may have affected the interpretation of the results. Vega level 2+ evidence [35] studied 97 children and found that urea correlated significantly with severe dehydration (assessed by rehydrated weight) but not with mild or moderate dehydration. A combination of clinical assessment and bicarbonate had high sensitivity but low specificity for assessing dehydration. Yilmaz level 2+ evidence [36] studied 168 children and found using multiple linear regression that urea and bicarbonate correlated with dehydration. The studies by Klein, Bonadio, Vega and Yilmaz all studied children admitted to hospital who received IV fluids for dehydration secondary to gastroenteritis. None of the papers specifically address whether this was the indicated treatment for the level of dehydration. 53 children in the study by Yilmaz were admitted and treated with IV fluids for mild dehydration only. So it seems that electrolytes when tested are rarely abnormal and there is conflicting evidence surrounding how useful laboratory investigations are in determining the level of dehydration. No evidence being higher than 2+. All of these studies have looked at children receiving IV fluids in hospital. Less children are now treated this way as there is grade 1 evidence supporting the use of ORS in children with dehydration secondary to gastroenteritis. There are no studies specifically addressing the need for laboratory investigations in children rehydrated orally. Since there is no evidence to specifically address when electrolytes and bicarbonate should be measured the following were put to the Delphi panel and reached consensus.

RECOMMENDATION

The child who presents with diarrhoea +/- vomiting should have blood taken for urea/creatinine, electrolytes and bicarbonate in the following circumstances:

- Severe dehydration with circulatory compromise
- Moderate dehydration where a ‘doughy’ feel to the skin might indicate hypernatraemia
- Moderately dehydrated children whose histories or physical findings are inconsistent with straightforward diarrhoeal episodes
- When intravenous rehydration is required. E.g. Severe dehydration with circulatory compromise

No evidence

Delphi consensus
L. Hypernatraemic dehydration

It is acknowledged that ORS is quicker in the correction of dehydration and acidosis and safer than IV therapy. Moreover the use of Oral Rehydration Therapy (ORT) appears to reduce the risk of seizure during correction of hypernatraemic dehydration, Pizarro 1984 level 3 evidence [37] reported no seizures among 35 infants with hypernatraemic dehydration whose deficit was replaced with WHO-ORT over 12 hours. An earlier study by Pizarro 1983 also level 3 evidence [38] of 61 infants with hypernatraemic dehydration found 5 patients had overt convulsions following oral rehydration over 6 hours. Both of these studies used ORS with sodium concentrations of 90 mmol.

In the largest Randomised Controlled Trial (RCT) of IV versus ORT Sharifi, level 1+ evidence [30] randomly assigned 470 children aged 1 to 18 months (without malnutrition) admitted to hospital in Tehran with severe acute GE to receive either ORS (administered initially by Naso-gastric tube (NGT) or IV fluid. Of the 34 hypernatraemic patients in the ORT group, 2(6%) developed generalised seizures compared with 6 of 24 (25%) in the intravenous group.

RECOMMENDATION

*The child with hypernatraemic dehydration (Na>150mmol/L) secondary to acute gastro-enteritis should be rehydrated with ORS, giving their estimated deficit over 12 hours.*

Based on Pizarro et al 1983 and 1984 level 3 evidence

Grade D recommendation

M. Re-feeding following rehydration

Historically children were starved for the period of rehydration (often over 24 hours) and were then regraded onto increasing strengths of milk feed following gastroenteritis. This was not based on any evidence, but thought to reduce the incidence of lactose intolerance. Evidence exists to support the early introduction of age appropriate diets in children who are weaned, Sandhu level 1+ evidence [39]. In this study all children were rehydrated over 4 hours with ORS. They were then randomised to early feeding (normal diet) or late feeding (ORS for a further 20 hours followed by diet). They concluded that early
feeding including full strength lactose containing milk did not lead to a worsening or prolongation of diarrhoea or increased lactose intolerance.

Good evidence exists to show that children who are breast fed should continue breast feeding throughout the rehydration and maintenance phases of their therapy. In so doing they reduce the risk of dehydration, pass smaller volumes of stool and recover quicker King-Mung level 1+ evidence [40].

So the above 2 trials suggest that children who are breast fed should continue to breast feed through their illness and that weaned children should continue full strength milk and normal diet following rehydration. What then should happen to children who are not breast fed and not weaned? Brown [41] performed a meta-analysis on the use of non-human milks in gastro-enteritis and concluded that the vast majority (over 80%) of young children with acute diarrhoea can be successfully managed with continued feeding of undiluted non-human milks. The results of this meta-analysis are difficult to interpret as many different diets were compared and many studies were performed using different rehydration regimes to those in use now (intravenous as opposed to oral). However, individual papers from the meta-analysis were reviewed and 1 was found to be relevant to refeeding in non-breast fed babies who aren’t weaned, [42]. The aim of this study was to compare rapid refeeding with standard cows milk formula, a low lactose formula, a soya based formula and gradual introduction of full strength feeds. Two hundred babies were enrolled; the average age was 4.9 months. Although the group receiving a low lactose formula showed better early weight gain in hospital there was no difference in the overall duration of the diarrhoea or time to discharge compared to the group receiving full strength milk. It is of note in this study that of the 18 treatment failures 4 occurred in those rehydrated orally and 18 in those rehydrated by the IV route.

RECOMMENDATION

An age appropriate diet (including full strength lactose containing milk) should be restarted in weaned children following rehydration with ORS (normally given over 4 hours).

Based on Sandhu 1997

Grade A recommendation
Infants who are not weaned should recommence full strength lactose containing formula following rehydration with ORS (normally given over 4 hours)

Based on Conway level of evidence 1+

Grade A recommendation

Breast feeding infants should continue to breast feed through the rehydration and maintenance phases of their acute gastro-enteritis illness.

Based on King-Mung-U 1985 level of evidence 1+

Grade A recommendation

These principles are stated in table 6 of the algorithm.

N. Information

No evidence was found concerning the interests of other people, namely parents, carers and the children themselves in the management of acute gastroenteritis. It would be interesting to know what their views are about the use of oral rehydration therapy, intravenous infusions, naso-gastric tubes and care in hospital or at home. No evidence on which to base a statement is currently available.

At a basic level, however, parents or carers should always be discharged with written information concerning the home management of diarrhoea +/- vomiting. The information sheet that we use is shown in appendix 4, and was developed from comments made by the Delphi panellists.

RECOMMENDATION

Parents / carers should be given an information sheet concerning the home management of diarrhoea +/- vomiting on discharge home.

No evidence

Delphi consensus
P. Admission criteria

There is no evidence from the literature on which to make clear recommendations about when a child with gastroenteritis should be admitted to hospital. Of course there are many factors both medical and non-medical which may influence a doctors decision to admit a child to hospital. Some of these influences have been studied.

Fitzgerald level 2+ evidence [43] found that for the same severity of acute gastroenteritis, children with mothers reporting higher levels of psychological distress were more likely to be admitted. These mothers were also likely to have poor social resources. These factors influencing admission are less easy to define, but are equally important and should be incorporated into a guideline. Work in America has found that supply of beds, type of medical facility available (teaching or district general) and distance from the hospital has a profound effect on hospitalization rates in children. In this study children with gastroenteritis had a 15% higher chance of admission when living in an area with a bed supply of 4/1000 compared with 1.9/1000, Goodman [44].

It is clear that the child with severe dehydration must be admitted. Children with moderate dehydration and those at high risk of developing dehydration will need to be watched carefully. Those moderately dehydrated should be observed frequently by medical staff until they are fully rehydrated, and those at risk of dehydration will need to be observed for a period to ensure that they remain well hydrated. (No evidence from the literature).

In cases where there is diagnostic uncertainty, children may need admission for investigation or observation of the progress of their illness.

In the absence of evidence this question was put to the Delphi panel and the following reached consensus.

RECOMMENDATION

- Children presenting to hospital with acute gastro-enteritis who are severely dehydrated should be admitted to hospital.

- Those children with mild/moderate dehydration should be observed in a hospital paediatric facility for a period of at least 6 hours to ensure successful rehydration (3-4 hours) and maintenance of hydration (2-3 hours).
- Those children at high risk of dehydration on the basis of young age, high frequency of watery stools or vomits, should be observed in a hospital paediatric facility for at least 4-6 hours to ensure adequate maintenance of hydration.

- Those children whose parents or carers are thought to be unable to manage the child’s condition at home successfully should be admitted to hospital.

No evidence

Delphi consensus

Grade D recommendation

Q. Risk of dehydration

If a child is at high risk of becoming dehydrated, even though they are not dehydrated at the time of being seen in A&E, they need to be managed differently to the child who is very unlikely to become dehydrated. The following factors were noted in the literature to increase the risk:

Age of the child

From first principles it seems reasonable that the young infant would be at higher risk of dehydration than the older child. They have increased insensible loses due to their surface area:volume ratio, they have an inherent tendency to more severe vomiting and diarrhoea, and their prime source of nutrition is milk which has a high osmotic load. This theory is born out by studies in India and Brazil. Bhattacharya level 2+ evidence [45] found a non significant trend towards the younger age groups (<12 months) being at more risk. Fuch level 2+ evidence [46] found a definite association, with young infants (<9 months and especially 2-3 months) at greatest risk of dehydrating diarrhoea.

Severity of symptoms

It seems reasonable to assume that the severity of the symptoms would affect risk of dehydration. Bhattacharya level 2+ evidence [45] in Calcutta performed a prospective case-control study. 379 infants<2 years old were enrolled on presentation with diarrhoea of <24 hours (defined as >3 loose stools in 24 hours). They were interviewed and assessed independently. The infants were then categorised as moderate/severe dehydration (cases) versus mild dehydration (controls), and risk factors compared. The most significant were withdrawal of breast feeding around the time of the illness and not giving extra fluids. Additional factors were age<12months, stool frequency >8/day, vomits>2/day, vibrios in stool and
malnutrition. Faruque level 2+ evidence [47] had very similar results in an almost identical trial design of 1,013 infants 1-35 months in Bangladesh. They found the same risk factors for dehydration as Bhattacharya [45] (age<6 months, stool>11 per day, history of vomiting) and in addition lack of maternal education.

Fuchs level 2+ evidence [46] in a case control study in Brazil found that those who were formula fed, or who had been recently weaned from the breast were at highest risk of developing moderate to severe dehydration, independent of confounding variables.

Unfortunately risk factors for dehydration have not been looked at in developed countries where rotavirus is more common and malnutrition rare, the above findings may not be directly applicable to the UK. In particular vomiting >2 times/day does not seem to equate with a high risk of dehydration in our clinical practice. In the UK rotavirus is very common and often causes frequent vomiting as the first sign of illness, without necessarily increasing the risk of dehydration. Since there is no evidence available from this country the following recommendations were made based on the Delphi consensus.

RECOMMENDATION

*The following factors in the history of a child presenting with diarrhoea should alert the clinician to a high risk of dehydration:*

- Infants <6 months
- More than 8 significant* diarrhoeal stools in the last 24 hours.
- More than 4 significant* vomits associated with diarrhoea in the last 24 hours.

_A ‘significant’ vomit is anything more than an effortless, small volume, posset._

No evidence

Based on Delphi consensus

**R. Replacement of losses in the child at risk of dehydration.**

There are no trials concerning this issue, but the AAP practice parameter[29] and Murphy’s review[48] recommend that ongoing losses for the infant at high risk of dehydration should be replaced with 10ml/Kg
of ORS for each loose stool and substantial vomit. However, the Delphi panel did not agree with this point. An alternative of replacing the estimated volume lost was put to the panel but this also did not achieve consensus. In view of the lack of consensus and no evidence in the literature either way, this issue will have to be decided at a local level.

S. Literature concerning the need for stool culture

Diagnosis & treatment

Once a diagnosis of acute gastro-enteritis has been made clinically, the question of the aetiology of the infection arises. For the individual, it would be important to know what is causing the symptoms if treatment of the infection could eliminate them. As we shall discuss later, treatment is rarely necessary and therefore stool culture for this reason alone is not productive.

Prognosis

Some might argue that we would have a clearer idea of the prognosis if we knew the aetiology. With respect to acute risk of dehydration this does not seem to be the case. The risk of dehydration was the same for all aetiologic agents except cholera in both Faruque [47] and Bhattacharya’s studies [45] (level 2+ evidence). Fortunately in the UK cholera is only seen rarely in children who have travelled abroad. With respect to predicting which infections are likely to become chronic, it may be useful to know the pathogen. However, when a child presents acutely it is unnecessary to make this distinction.

In the UK a history of travelling abroad must be taken seriously. There are case series which describe children with malnutrition and severe chronic diarrhoea treated in UK hospitals following an extended trip abroad but none which specifically address whether a stool sample should be sent in children presenting with acute diarrhoea following a trip abroad. In view of this the statement was put to the Delphi panel.

Implications of aetiology for Public Health

From a public health point of view it is clearly important to know which organisms in the community are causing infections, and more specifically whether there is any evidence of outbreaks of disease. With respect to food poisoning (shigella, salmonella, campylobacter) it is important that the source of any outbreak is traced and dealt with.
Thus it is clear from the public health point of view that some stool samples should be sent for culture. However, if all patients with a short spell of diarrhoea had a stool sample sent to the laboratory for culture the lab would be overwhelmed. It therefore seems reasonable to try to limit stool specimens sent to those likely to have important (bacterial or parasitic) infections.

*Important historical features*

DeWitt level 2+ evidence [49] looked at the value of various features of history and examination and stool screening tests in predicting whether diarrhoea was caused by a bacterial agent. They studied 200 children less than 4 years old presenting to a primary care centre in the USA with diarrhoea of less than 10 days. The best predictor on clinical grounds alone of bacterial infection was a cluster of 3 historical variables—abrupt onset of diarrhoea, more than 4 stools per day and no vomiting before the onset of diarrhoea. This cluster had a sensitivity of 86% a specificity of 60%, PPV of 27% and NPV of 96%.

Diarrhoea which is frankly bloody is more likely to be caused by invasive bacteria than viruses. Finkelstein level 2+ evidence [50] found that in 1,035 infants under 1 year of life with diarrhoea (of which 108 (10.4%) had a bacterial cause), 5 or more stools in the previous 24 hours had the highest sensitivity (67%) as a single predictor. Temperature $>$40 degrees had the highest positive predictive value. Combinations of temperature $>$39°C and $>$10 stools per day or blood in the stool with $>$10 stools/day were useful with positive predictive values of 64% and 63% respectively. Conway level 4 evidence [14] looked at 1148 children <16 years with diarrhoea, in whom 153 (13%) had bacterial, protozoal or mixed pathogen aetiology. They found that the bacterial group had a statistically significant higher stool frequency of $>$7 per day, but the difference was of little use to the clinician (36% in bacterial group and 26% in rotavirus group, no figures given to calculate sensitivity etc). They also found that the stool more frequently contained blood or mucus (25% in the bacterial group compared with 2.8% in the viral group). In Milford’s study of HUS, level 2+ evidence [17], 199 children (73%) had a prodrome of bloody diarrhoea, with 178 of these growing colliforms in the stool.

Based on these studies Table 4 was developed.

**RECOMMENDATION**

The following clinical features are associated with an increased risk of bacterial gastroenteritis and hence a stool sample should be sent for culture and sensitivity

- A history of blood +/- mucous in the stool
• A combination of abrupt onset of diarrhoea with more than 4 stools per day and no vomiting pre diarrhoea

• Temperature > 40 degrees

• 5 or more stools in the previous 24 hours

Based on DeWitt 1985 and Finkelstein 1983 level of evidence 2+

Grade C recommendation

• Systemically unwell, severe or prolonged diarrhoea

• A history suggestive of food poisoning

• Recent history of travel abroad

No evidence based on Delphi consensus

There is no evidence to answer the question of whether a stool sample should always be sent if a child is admitted to hospital. No consensus was reached in this area and it should be decided at a local level.

T. The role of medication in gastroenteritis

Anti-diarrhoeal/ anti-motility agents

Despite grade 1 evidence supporting the use of ORS in gastroenteritis many parents and indeed health professionals still perceive successful treatment as resolution of diarrhoea. Ongoing diarrhoea in an otherwise well child can cause disruption to the family with child care problems and time off work. This along with many other reasons led to interest in the use of anti-diarrhoeal medication in acute infectious diarrhoea. The anti-diarrhoeal effects of loperamide have been most extensively studied and are described below.

Motala level 2+ evidence [51] conducted a case control study to evaluate the efficacy of high dose loperamide in acute dehydrating diarrhoeal disease. 60 male infants 6 weeks to 1 year were recruited (30 cases and 30 controls). 2 children in the loperamide group 4 and 8 months respectively developed an ileus and severe vomiting both thought to be secondary to loperamide, these cases were excluded from the
subsequent analysis. 4 infants all less than 4 months developed mild drowsiness after 3-5 doses of loperamide. A significant reduction in the daily stool output was noted in the loperamide group (52 to 26 gm/kg body weight on day1) but it wasn’t apparent whether this was clinically significant. This difference was not apparent when a sub-group analysis was carried out on those affected by rotavirus (7 cases and 8 controls) though the numbers were small.

A randomised double blind placebo trial by Bowie level 1+ evidence [52] studied 200 children admitted to hospital with mild to moderate dehydration. They were randomly assigned to placebo or high dose loperamide 0.8mg/kg/day and the effect on length of hospital stay examined. No significance difference was found between the 2 groups in terms of aetiology or duration of diarrhoea, duration of hospital stay (p>0.05), or treatment failures.

Another randomised double blind placebo trial by Hendricks level 1+ evidence [53] studied the effects of 0.4 and 0.8mg/kg/day of loperamide on children admitted with diarrhoea. Weight gain by day 3 was noted in 58% of children who had received 0.8mg loperamide, 51% of children who had received 0.4mg loperamide and 36% of those who had received placebo. The differences were significant. The primary outcome measure in this study was not clearly stated. There were also a number of patients who didn’t open their bowels for 24 hours following hospital admission - 32% in the 0.8mg loperamide group, 30% in the 0.4mg group and 17% in the placebo group. This may be evidence for the efficacy of loperamide or could indicate that children randomised to the trial did not have a true diagnosis of diarrhoea. A definition for diarrhoea is not given in this study. The recovery of children receiving 0.8mg loperamide was hastened by 24 hours.

So it can be seen that results are contradictory and benefits where demonstrated are small and may not be clinically apparent. One study also demonstrated high levels of serious side effects. In view of this loperamide cannot be recommended.

RECOMMENDATION

_Loperamide is not recommended for the treatment of acute gastroenteritis in children_

Based on Bowie 1990 level 1 evidence

Grade A Recommendation
As discussed above most of the work on anti-diarrhoeals agents in children has been carried out using loperamide. In addition the Delphi panellists felt that no anti-diarrhoeal agents should be used in children with gastroenteritis.

RECOMMENDATION

*Anti-diarrhoeal medication should not be used in children with acute gastrienteritis*

No evidence
Delphi consensus

U. Use of probiotics

A probiotic is a live microbial food additive that may be beneficial to health. The use of probiotics in children with acute infectious diarrhoea has been explored for some years now.

Niell level 1+ evidence [54] conducted a meta-analysis level of evidence 1+ on the use of lactobacillus therapy for acute infectious diarrhoea in children. 9 studies met the inclusion criteria. Children receiving lactobacillus had a shorter duration of diarrhoea reduced by 0.7 days and less frequent diarrhoea on day 2 reduced by 1.6 stools. The authors make the comment that although the results seem consistent between the studies the definition of diarrhoea and its severity differed markedly between the studies, as did the strain of lactobacillus and dose used. Many of the studies were funded by pharmaceutical and food agencies. 361 children were studied in total, there was no difference in the number of adverse reactions noted in each group. The results suggest that treatment with lactobacillus will reduce the length of diarrhoea by 17 hours but the direct and indirect cost benefits of this have not been addressed. Adverse reactions have been noted in the elderly population treated with lactobacillus. It may well be that bigger studies are needed to identify any potential problems in children.

A Cochrane systematic review is currently in progress to assess the use of probiotics for treating infectious diarrhoea. The result of this will be available when the guideline is updated. The guideline development group felt if would be most appropriate to wait for the result of this prior to making a statement.
**Table 7:** Frequency of deranged electrolytes in acute gastroenteritis in developed countries.

<table>
<thead>
<tr>
<th>Jenkins [55] Cohort of GE in South Wales, 1987/8, children &lt;16 years</th>
<th>Conway [14], Cohort of GE in Leeds, 1986/7, Children &lt;16 years</th>
<th>Ellis [36] Cohort of GE in Manchester, 1982 (Infectious dis Unit) Infants &lt;2 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>No of cases</td>
<td>215</td>
<td>1148</td>
</tr>
<tr>
<td>No. (%) moderate-severe dehydration (5-10%)</td>
<td>15 (7%)</td>
<td>12 (1%)</td>
</tr>
<tr>
<td>No. in whom electrolytes were measured</td>
<td>76 (35%)</td>
<td>1119 (97%)</td>
</tr>
<tr>
<td>Hyponatremia (as defined in each study in mmol/l)</td>
<td>Na &gt;145 2 (&lt;1%)</td>
<td>Na &gt;149 8 (&lt;1%)</td>
</tr>
<tr>
<td>Urea (mmol/l)</td>
<td>Urea &gt;6 17 (8%)</td>
<td>Urea &gt;7 86 (7%)</td>
</tr>
<tr>
<td>Bicarbonate &lt;15mmol/l</td>
<td>13 (6%)</td>
<td>NR</td>
</tr>
</tbody>
</table>

NR= Not reported.
Table 8: Composition of fluids for intravenous and oral rehydration.

<table>
<thead>
<tr>
<th></th>
<th>Osmolality mOsm/L</th>
<th>Glucose mmol/L</th>
<th>Na mmol/L</th>
<th>Chloride mmol/L</th>
<th>Potassium mmol/L</th>
<th>Base mmol/L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oral</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ESPGAN</td>
<td>200-250</td>
<td>74-111</td>
<td>60</td>
<td>Not&lt;25</td>
<td>20</td>
<td>Citrate 10</td>
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<tr>
<td>Dioralyte</td>
<td>240</td>
<td>90</td>
<td>60</td>
<td>60</td>
<td>20</td>
<td>Citrate 10</td>
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<tr>
<td>Diocalm Jr</td>
<td>251</td>
<td>111</td>
<td>60</td>
<td>50</td>
<td>20</td>
<td>Citrate 10</td>
</tr>
<tr>
<td>Rehidrat</td>
<td>335</td>
<td>91*</td>
<td>50</td>
<td>50</td>
<td>20</td>
<td>Bicarb 20</td>
</tr>
<tr>
<td>Electrolyte</td>
<td>251</td>
<td>111</td>
<td>50</td>
<td>40</td>
<td>20</td>
<td>Bicarb 9</td>
</tr>
<tr>
<td>WHO ORS</td>
<td>330</td>
<td>111</td>
<td>90</td>
<td>80</td>
<td>20</td>
<td>Citrate 10</td>
</tr>
</tbody>
</table>

Intravenous

<table>
<thead>
<tr>
<th>Ringers Lactate</th>
<th>Osmolality mOsm/L</th>
<th>Glucose mmol/L</th>
<th>Na mmol/L</th>
<th>Chloride mmol/L</th>
<th>Potassium mmol/L</th>
<th>Base mmol/L</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.9% saline</td>
<td>308</td>
<td>...</td>
<td>154</td>
<td>154</td>
<td>...</td>
<td>...</td>
</tr>
</tbody>
</table>

*Glucose given with fructose 1mmol/L and sucrose 94mmol/L
Appendix 1

Search Strategy
Search Strategy

This Appendix describes the search strategy used to identify the evidence for the guideline.

A systematic search for the evidence involved the following steps:
1) A search of internet sites for existing guidelines
2) A systematic search of appropriate databases for identification of existing studies
3) Hand search
4) Limited search for unpublished studies

Inclusion criteria

Papers were included if they:
a) Addressed the clinical question
b) Published since 1966
c) Primary research
d) Reliable and valid
e) Included methodology in the paper and the results were thought to be valid and relevant

Searches were not limited to papers in the English language.

Exclusion Criteria

a) Literature referring solely to adults
b) Case reports
c) Overviews
d) Assessed to be of poor quality

Internet Search

The following sites were accessed to look for evidence-based links and existing guidelines. This list of web sites was generated from information gathered from study days attended on guideline development and evidence based medicine, from an established list of sites searched by previous guideline developers at Nottingham and finally a search of the web for any new evidence based medicine sites.
**Internet web sites searched**

AHCPR (US Agency for Health Care Policy and Research) This is the site for the National Guideline Clearing House
Canadian Medical Association Clinical Practice Guidelines Database
Centre For Disease Control and Prevention
Group Health Northwest: Evidence-Based Guidelines
New Zealand Guidelines Project
University of Washngtons Physicians
Evidence-Based Guidelines and Critical Pathways For Quality Improvement
Evidence Based Guidelines
World Health Organization Site
CDR Database (this site searches the databases of DARE, NHS EED, HTA)
Scottish Intercollegiate Guideline Network
National Institute of Clinical Excellence
TRIP
The Centre For Clinical Effectiveness
Centre For Evidence-Based Child Health
Centre For Evidence-Based Medicine
Clinical Governance Resource
E-guidelines
Clinical Practice Guidelines Infobase
Medical Matrix
BestBETS
Netting the Evidence
SUM Search
American Academy of Pediatrics

**Computerized Databases**

The following databases were searched
The Cochrane database of systematic reviews and cochrane trials register
Medline
Embase
Cinhal
Best Evidence

The searches were performed using MesH headings and 'textwords' limited to 0-18 or 0-16 depending on the limits available on the different databases. The searches were limited to children with the filters available rather than using “Child” as a MesH heading as this generated more hits. The quality of the initial searches was checked and discussed with a librarian experienced in Medline searching and found to be satisfactory.

**Hand Search**
A hand search of the following journals was performed from January 1998 to January 2003.
Archives of Disease in Childhood
Journal of Paediatric Gastroenterology and Nutrition
Journal of Pediatrics

Further articles were obtained by speaking to colleagues (a mixture of specialists and general paediatricians). A search of Ulrich's Periodical Directory was undertaken to identify further journals relevant to the guideline. This directory contains some journals not available on the databases searched.

**Appraisal and Data Extraction**
The research fellow used data-extraction forms and quality checklists developed by SIGN (2000) to appraise each paper.
Details of the literature search and the number of abstracts reviewed and papers finally used can be found in appendix 2.
Appendix 2

Results of the search
Cochrane systematic reviews
MeSH headings diarrhoea or gastroenteritis – 195 hits
3 Abstracts reviewed
3 Papers reviewed
Papers used 2

Cochrane trials register
MeSH Heading diarrhoea or gastroenteritis
Limit to child 1322 titles reviewed
Abstracts reviewed 113
Papers reviewed 6
Papers used 3

Hand Searching
1. Archives of Disease In Childhood
January 1998 to January 2003
5 abstracts reviewed
No new papers reviewed

2. Journal of Pediatrics
January 1998 to January 2003
1 article reviewed
Not used

3. Journal of paediatric gastroenterology and nutrition
January 1998 to January 2003
5 abstracts reviewed
No new papers reviewed

1 article was found but not used due to being in a foreign language
Incidence and symptoms of gastroenteritis in hospitalized children out of a cohort of 10271

38 papers were used to development the guideline.
Differential diagnosis of a child who presents with acute diarrhoea

<table>
<thead>
<tr>
<th>Search Term</th>
<th>Medline</th>
<th>Cinhal</th>
<th>Best Evidence</th>
<th>Embase</th>
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<tbody>
<tr>
<td>Diarrhoea expl + tw</td>
<td>39642</td>
<td>1138</td>
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<td>41592</td>
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<td>Gastro expl + tw</td>
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<td>6102</td>
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<td>Combine (or)</td>
<td>44866 -1</td>
<td>1367 -1</td>
<td>21 -1</td>
<td>46181 -1</td>
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<td>241461</td>
<td>1865</td>
<td>8</td>
<td>1208</td>
</tr>
<tr>
<td>Aetiology</td>
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<td>410</td>
<td>0</td>
<td>14433</td>
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<td>257396 -2</td>
<td>4722 -2</td>
<td>0 -2</td>
<td>15628 -2</td>
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<td>1+2 Limit child</td>
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<td>0</td>
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</table>

Most articles in these searches addressed the differential diagnosis of chronic rather than acute diarrhoea. The aetiology of acute infectious diarrhoea is well documented but the overall differential diagnosis of a child presenting with acute diarrhoea is not.

Clinical signs as indicators of levels of dehydration in children

<table>
<thead>
<tr>
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<th>Embase</th>
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<tr>
<td>Gastro exp + tw</td>
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<td>278</td>
<td>6</td>
<td>5832</td>
</tr>
<tr>
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<td>1382 -1</td>
<td>25</td>
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</tr>
<tr>
<td>Clinical signs tw</td>
<td>21339</td>
<td>154</td>
<td>17</td>
<td>14119</td>
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<td>Dehydration exp + tw</td>
<td>5924</td>
<td>385</td>
<td>6</td>
<td>5437</td>
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<tr>
<td>Combine (and)</td>
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<td>0</td>
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<td>16</td>
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### Indication for urea and electrolytes in children with diarrhoea or gastroenteritis

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<td>278</td>
<td>6</td>
<td>5832</td>
</tr>
<tr>
<td>Combine (or)</td>
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</table>

### Indications for admission to hospital in children with diarrhoea

<table>
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<th>Best Evidence</th>
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<td>41927</td>
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<td>6</td>
<td>5832</td>
</tr>
<tr>
<td>Combine (or)</td>
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<td>21 -1</td>
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<td>Hospitalization</td>
<td>75629 -2</td>
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<td>202</td>
<td>4824</td>
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Most papers in this area addressed specific aspects of the child admitted with diarrhoea e.g. number of positive stool cultures rather than indication for admission

### Management of children with diarrhoea/gastroenteritis – fluid therapy

<table>
<thead>
<tr>
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<td>650 -3</td>
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### Management of children with hypernatraemic dehydration

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### Use of anti-diarrhoeals

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<td>1151</td>
<td>18</td>
<td>41927</td>
</tr>
<tr>
<td>Gastro exp + tw</td>
<td>9210</td>
<td>278</td>
<td>6</td>
<td>5832</td>
</tr>
<tr>
<td>Combine (or)</td>
<td>47085 - 1</td>
<td>1382 - 1</td>
<td>21 -1</td>
<td>46415 -1</td>
</tr>
<tr>
<td>Anti-diarrhoeals*</td>
<td>519 - 2</td>
<td></td>
<td>506</td>
<td></td>
</tr>
<tr>
<td>Combine</td>
<td>294</td>
<td></td>
<td>336</td>
<td></td>
</tr>
<tr>
<td>Limit</td>
<td>92</td>
<td></td>
<td>58</td>
<td></td>
</tr>
<tr>
<td>Abstracts reviewed</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Papers reviewed</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Papers used</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

There were no hits for anti-diarrhoeals or anti-motility drugs in Cinhal or Best Evidence
Rejected Papers

1. Enteric infections, cows milk intolerance and parenteral infections in 118 consecutive cases of acute diarrhoea in children. Capano G et al. European Journal of Pediatrics 1984 142:281-285. This was a prospective hospital cohort study. Aim not clearly stated. 118 children under 3 yrs referred with diarrhoea were studied and end diagnoses noted. This paper was selected for evidence to support the differential diagnoses that should be considered in children with diarrhoea. Rejected as the sample is not representative of all children who present to hospital with diarrhoea e.g. Children over 3 excluded and children presenting to other specialities e.g. surgeons.


3. The diagnostic value of symptoms and signs in childhood abdominal pain. Williams NM et al. Journal of the Royal college of Surgeons of Edinburgh. 1998 43(6):390 –2. Retrospective case note review of children admitted with abdominal pain over a 1 year period. Split into 5 groups depending on final diagnoses non specific abdominal pain, viral gastroenteritis (3.8%), those who underwent appendectomy for acute appendicitis, constipation and miscellaneous. Symptoms and signs only extracted from the notes for the children with final diagnoses of acute appendicitis and non-specific abdominal pain.

4. Comparison of nasogastric and intravenous methods of rehydration in paediatric patients with acute dehydration. Nager AL et al Pediatrics 2002, 109(4):566-72. Randomised controlled trial of rapid NG or IV rehydration in children with acute moderate dehydration. Rejected as the mean post treatment weights only raised by 2.2% in the NG group and 3.58% in the IV group suggesting that this group of children infact had only mild dehydration. The children were given a challenge of ORS prior to being considered for the trial. It was not stated what this challenge consisted of and what was taken as a failure. It may have been that children were reluctant to drink ORS as they were only mildly dehydrated.

6. How commonly are children hospitalized for dehydration eligible for care in alternative settings? McConnachie KM, Conners GP, Wilson C. Archives of Pediatric and Adolescent Medicine. 153(12):1233-41. Good paper which tries to addresses why children remain in hospital when rehydration has taken place and whether they could be cared for in alternative settings but is beyond the scope of the guideline. Doesn’t address whether appropriate treatment was being administered as inappropriate use of IV fluids may have led to prolonged admissions in some children.


11. Guidelines for managing acute gastroenteritis based on a systematic review of published research. Murphy MS. Archives of Disease in Childhood. 1998;79:279-284. This was an excellent review and provided important background reading and references but recommendations were not used for the following reasons. The literature search included Medline and Cinhal only therefore was not systematic. The article was not transparent about linking recommendations to specific studies.

RCT comparing oral and IV treatment is the best trial to answer the clinical question of whether ORS is as efficacious as IV therapy. In view of this the best individual studies with both oral and IV arms were looked at individually and used to make a recommendation.


Appendix 3

Incorporating consensus into guideline development
Performing Consensus Processing

Systematic reviews and meta-analyses are the gold standard for research and are used to summarize research evidence. Their conclusions can be readily incorporated into a guideline. In Paediatrics, however, as in many other disciplines, there is a dearth of available research evidence [57] and systematic reviews are not available to answer many of the clinical questions, especially those related to the decision-making processes. It is therefore important to be able to identify and critically appraise other levels and sources of evidence and use this information for producing recommendations so long as the process used to develop this recommendation is made clear to the guideline users.

Guidelines should ideally be based on the current available evidence and high quality evidence may currently be accumulating but we would be mistaken if we did not accept that other influences such as clinical experience have an effect on decision-making. We must be aware that ‘the art of medicine is unlikely to be managed away for many years to come [58].

Consensus methods can be used in guideline development as a means by which evidence can be combined with clinical acumen and experience to produce a practical and useable clinical tool. They can be described as qualitative rather than quantitative research methods used 'to determine the extent to which experts or lay people agree about a given issue [59]. Qualitative methods are useful for studying decision-making processes and despite being criticized for lacking scientific rigor [59] they can be used to complement evidence-based medicine [60]. The guideline development group decided to use the Delphi method for the consensus process used in the development of this guideline.
Delphi

Introduction
This method was named after the Greek oracle thought to have the power to predict the future[61]. It was initially developed as a research technique by the RAND Corporation in the 1950's to synthesize expert opinion on new technologies[61]. The method was originally used for military purposes but is now much more widely used and is still more commonly by nurses than by doctors. With the increasing interest in improving quality of care and clinical guidelines, the Delphi method is being adopted as a way to combine evidence with expert opinion and experience[58]. The technique can be used to deal with a complex problem by a multiple iteration survey[62, 63]. The key features of this procedure include anonymity, iteration, controlled feedback, and statistical group response[64]. Guidelines are an important component of clinical governance and to be useful to the clinician they have to be able to aid management decisions such as treatment, investigations, admission, discharge and follow-up. There are few areas in medicine which have an evidence base to answer all of these questions for a particular symptom or disease. Delphi consensus is a formal transparent process to aid this important part of guideline development until a research base is available to address the particular questions.

The first round of the Delphi consists of a group of invited individuals being presented with information in the form of statements[62]. These individuals have a particular interest in the subject under discussion or they have in-depth knowledge about it. The relevant individuals then provide an opinion on this information based on their own knowledge, experience and often information provided[65]. In the second round the questionnaire is mailed out to the respondents again but this time, the panel are able to alter their judgment in light of the group's responses. The panel ranks the level of agreement or disagreement with each of the statements after receiving feedback on the group's responses. This process continues and the participants continue to re-rank their agreement or disagreement with the statements until an accepted degree of consensus is reached[62, 65]. Finally, the responses are statistically analyzed to determine which statements reached consensus of agreement or disagreement[61]. At no time does the group meet and therefore this method allows access to a large number of people and maintains anonymity. The Delphi method has however been adopted and altered over the years so that the technique can be used in a number of different circumstances[66].

Details of the Delphi process used in the development of the guideline for children with diarrhoea
The guideline development group selected members of the Delphi panel. Panel members were selected to reflect their involvement in the care of children with diarrhoea. The aim was to compose a multi-

professional panel and to select members whose input would be valued either for their expert knowledge base in the area, or their practical involvement with children or their expertise in interpreting evidence-based medicine.

**Delphi process**

**First round**

Panellists were sent: the literature review and derived management statements; complete copies of all the articles cited, the critical appraisal abstraction sheet and grade of evidence; a response form detailing each statement with a 1-9 Likert scale and space for comments.

The panellists were asked to rate their level of agreement with each statement and to comment. This first round ‘pack’ was piloted (n=4) and revised where necessary to improve clarity and remove ambiguity. A reminder letter and a subsequent telephone call were made to non-responders.

Definition of consensus was predetermined. Often consensus is accepted when 75% of participants agree, and lack of consensus when more than 25% disagree. For nominal groups, rules have been developed to assess agreement when statements have been ranked on a 9-point scale. We chose to apply this to the Delphi method since the same scale was used. One sixth of the ratings furthest from the median were removed (17%). This is done so that outliers (who may not have understood the question, or are unique in their views) do not overly influence the results. Consensus within the panel (known as ‘relaxed’ agreement for a nominal group) is defined as all remaining panellists’ responses falling within 3 boxes of each other on the Likert scale Consensus agreement with the statement as presented to the panel is defined as all remaining responses falling in boxes 7-9 (thus agreement both within the panel members and with the statement as given, known as ‘strict agreement’ for a nominal group).

**Second and third rounds**

All statements that achieved ‘strict’ consensus were removed from subsequent rounds and used for guideline construction where evidence was lacking. Statements that did not gain consensus and modified or new statements were used in the second round. After the extreme one sixth of responses were removed, the range, inter-quartile range and median of the remaining responses were reported back to the panellists. Panellists were asked to re-consider the statements in the light of the responses and comments of the rest of the panel. A third round consisted of statements that had still not achieved consensus.
Incorporation of Delphi into the guideline

Statements that had reached Delphi consensus were used in the algorithm where evidence was lacking but never in preference to evidence. There was only one recommendation where evidence was lacking and the Delphi panel were unable to achieve consensus.
Appendix 4

Parent information

Your guide to ‘Gastroenteritis’

Your doctor/nurse will fill in the boxes for you.

Name............................................Date..............

What is gastroenteritis?

Gastroenteritis is an infection in the gut, which leads to diarrhoea and/or vomiting (sickness). diarrhoea is frequent watery poo. The infection may also give your child a temperature and tummy pain. It is usually caused by a virus, which the body clears on it’s own without treatment. The diarrhoea and vomiting may lead to dehydration (too much water lost from the body).

What do I do?

Your doctor has carefully looked for signs of dehydration and has not found any. They are therefore happy for you to take your child home. You must encourage your child to drink.

What is enough fluid?

- Your child’s weight today is ................Kg
- He/She needs to take in at least ..............ml over a 24 hour period.
- A teaspoon is 5mls. 1oz is 30mls. A typical beaker holds about 200 ml.

What kind of drinks should I give?

You can give any drink that your child usually has including milk. However try not to give very concentrated or sugary drinks like real fruit juices or fizzy drinks unless they are well diluted with water (4 times as much water as drink).

What if my child is vomiting?

- Stop all solid food until the vomiting has settled
- If your baby is breast fed continue to feed on demand
- If your baby is formula fed, give feeds in very small amounts (approximately 1oz(30ml)) often (every 20 minutes or so). If they continue to vomit, stop milk feeds for 4 hours and give cooled boiled water instead, little and often.
- Any other fluids that your baby or child has should be given as above (about 1oz(30ml) every 20 minutes) by bottle, spoon or cup. Do not offer a full bottle or cup as large amounts may make your child vomit again.
- As the vomiting settles you can start to offer larger amounts of fluid less often and the child’s usual solid food.
- Try rice, pasta, potatoes, toast, plain biscuits. Don’t worry if they are not hungry.
- AVOID fatty foods and sugary foods.
What about the diarrhoea?

Diarrhoea usually continues for 6-7 days. As long as your child is drinking and is improving in themselves this does not matter.

What about the temperature?

If your child has a temperature or appears to have tummy pains then give Paracetamol according to the instructions on the bottle.

What is Dioralyte/ Diocalm junior/ Electrolade?

- These are all names for salt and sugar solutions that are made up with water, to replace what is being lost. You will only be given these by your doctor if your child is dehydrated or at risk of becoming dehydrated.
- When a child is not dehydrated they may be used to supplement the child’s normal fluid.
- Try to give ............... ml each time your child has a very loose poo, or large vomit. Give small amounts often. If your child does not like the taste try adding a drop of juice or sugar-free squash.

When should I ask for help or advice?

Seek advice if:
- The diarrhoea has blood in it
- Your child becomes more sleepy, lethargic or irritable than usual
- Your child has 5 or more vomits in 24 hours
- Your child has 9 or more loose poos in 24 hours
- The diarrhoea continues for more than 7 days

You could call your Health Visitor or General Practitioner

You could call the short stay unit at the Queen’s Medical Centre up to 48 hours after being on the ward
Telephone No 0115 919 4425

You could call NHS Direct
Telephone No 0845 4647 or 0800 665544

You could call Children’s A&E at the Queen’s Medical Centre up to 48 hours after being seen there
Telephone No 0115 924 9924 ext.41148

When can my child return to school or nursery?

When the diarrhoea has settled to 2 or 3 formed poos a day they are safe to return.

What about my baby’s sore bottom?

Frequent diarrhoea can make your baby’s bottom sore.
- Try to change the nappy as soon as it is dirty.
- Clean carefully with cotton wool and water or baby lotion (some wipes are alcohol based which can be sore on a red bottom).
- Apply barrier cream or Vaseline liberally.

**How can I stop it happening again?**

- Gastroenteritis is an infection that can be passed on from person to person or in contaminated food.
- Always wash hands before preparing any foods or eating and after nappy changes or going to the toilet.
- It is very important to wash and sterilise all baby bottles, teats and feeding equipment.
Appendix 5

Care pathway for implementation of diarrhoea guideline

The following 3 pages show the care pathway exactly as used in the Nottingham paediatric A&E during the implementation study.
THE CHILD WITH DIARRHOEA+/VOMITING
Evaluate and maintain A and B.
C. Signs of circulatory compromise go to BOX A
Please tick box when completed. Circle Y / N.
If deviations from pathway occur please record in variance table (page 2)
Complete Nursing, History and Examination for all. Then complete Box A or B or C as applies. DATE……………………………..

NURSING assessment: Nurse name:………………………….. Date/time………………………….. Triage score…….. Weight…………

<table>
<thead>
<tr>
<th>Time</th>
<th>Temp</th>
<th>Pulse</th>
<th>Resps</th>
<th>Sats</th>
<th>If febrile, Antipyretics given</th>
<th>N.B. Only rpt BP/Sats if abnormal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Comments……………………………..
……………………………..
……………………………..

Fluid Balance in A&E

<table>
<thead>
<tr>
<th>1 Hr time periods</th>
<th>Oral/NGT</th>
<th>IV</th>
<th>Tot. In</th>
<th>Urine</th>
<th>Stools</th>
<th>Vomits</th>
<th>Tot. Out</th>
</tr>
</thead>
<tbody>
<tr>
<td>1……….to……….</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2……….to……….</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3……….to……….</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4……….to……….</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

MEDICAL assessment: Doctor name:………………………………….. Date/Time…………………………………..

HISTORY: History taken from……………………………………………. Child’s age……………………
HPC…………………………………………………………………………………………………………………………..
…………………………………………………………………………………………………………………………..
Stool freq (past 24 hrs)…………………………blood* Y / N…………………………mucous* Y / N…………
Vomit freq (past 24 hrs)…………………………blood Y / N…………………………mucous Y / N………… bile Y / N
Recent foreign travel* Y / N where……………………Family/friends affected* Y / N……………………(*If Y, stool MC&S )
Usual feeds: Breast Y / N Bottle Y / N Solids Y / N As last 24 hours fluid in (vol/type)…………………………..
Urine output…………………………………………………..solids/appetite………………………………
History of other symptoms (fever etc)…………………………………………………………………………………………..
……………………………………………………………………………………………………………………………………..
SE……………………………………………………………………………………………………………………………..
PMH…………………………………………………………………………………………………………………………..
Meds/allergies…………………………………………….Immunisations up to date Y / N If N specify……………………
FH/SH……………………………………………………………………………………………………………………..

EXAMINATION general
General appearance……………………………………………………………………………………………………………..
CVS RS ABDU NEURO...
Ears…………………………………………….Throat……………………………………………………………..
EXAMINATION of dehydration
See Table 2 to assess dehydration. For each sign tick applicable box.

<table>
<thead>
<tr>
<th>Sign</th>
<th>None</th>
<th>Present</th>
<th>Marked</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry mucous membranes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sunken eyes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diminished skin turgor</td>
<td>instant</td>
<td>1-2 sec</td>
<td>&gt;2 sec</td>
</tr>
<tr>
<td>Drowsy/lethargic</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Irritable</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deep (acidotic) breathing</td>
<td>instant</td>
<td>1-2 sec</td>
<td>&gt;2 sec</td>
</tr>
<tr>
<td>Capillary refill time</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Differential diagnosis Table 1. ..............................................................................................

WORKING DIAGNOSIS ACUTE INFECTIOUS GASTROENTERITIS Y / N
If Y Go to box A, B or C as applicable
If N Discuss with paed reg or paed surgeon Dr. ....................................................... contacted, time ................................

Management plan ..................................................................................................................

BOX A. SEVERE DEHYDRATION (page one of algorithm)
Involve senior paediatrician. Ensure Airway and Breathing secure, IV access. 20ml/Kg Normal Saline fast
Reassess circulation. Pulse ...............BP ...............Capillary Refill ...............Circulation Restored? Y / N
If Y Further bolus 20ml/Kg Normal saline
Reassess. Discuss with PICU staff re: ADMISSION and anaesthetic involvement.
If Y ADMIT to ward.

Dr. .............................................................. contacted, time ................................

See Tables 3, 3.1, 3.2, 4 & 5 for guidelines on further management.
Continue documentation on admission sheets.

Tick investigations done
| Ur/Cr/Elec | Blood cult |
| bicarb     | Blood gas |
| glucose    | Stool cult |
| FBC        | Other:     |
| CRP        |            |

BOX B. MILD TO MODERATE DEHYDRATION (follow page two of algorithm)
ADMIT TO Childrens Short Stay Unit. Dr. .............................................................. contacted, time ................................
Consider blood tests if any uncertainty over diagnosis of acute infective gastroenteritis or ‘doughy skin’ indicating possible haemopnaea. Record any investigations done in above table.

BOX C. NO SIGNS OF DEHYDRATION (follow page 3 of algorithm)
Infant < 6 months Y / N Vomiting >4/day Y / N Diarrhoea >8/day Y / N Serious co-morbidity Y / N
If Y to any of above defined as ‘High risk’
If Y to only one of above, may go home provided parents are happy and will seek advice in 24 hours if no improvement
Home management as follows:
- Maintenance (table 4) ............... mls/24 hours
- Ensure that at least this is given. Encourage larger volumes.
- Replace substantial loses with Oral Rehydration Solution at 10ml/Kg per stool/vomit ............... mls/stool/vomit

If Y to 2 or more ADMIT to CSSU on above management
Dr. .............................................................. contacted, time ........

If N to all of above defined as ‘Low risk’
Calculate maintenance (Table 4) ........... mls/24 hours
Give advice on:
Usual fluids at at least maintenance
When to return
Information leaflet
DISCHARGE
Stool sample (table 5) Y / N
### ADDITIONAL MEDICAL NOTES (CSSU)

Record progress at each review. Print name, date, time and sign each entry. Follow box d or e as applicable.

<table>
<thead>
<tr>
<th>Box d. Mild/moderate dehydration (algorithm page 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimated percentage (between 3-8% depending on number and severity of signs) ……………………….% (a)</td>
</tr>
<tr>
<td>Rrehydration fluid required (table 3)</td>
</tr>
</tbody>
</table>

(a) x wgt (Kg) x 10 = ………………….mls over 4 hours.  
Give ORS little and often. If child vomiting, ↓ amount and ↑ freq. If ORS fails, consider NGT (preferred) or IVI.  
Time of next review (2-4 hrs suggested).…………………..

<table>
<thead>
<tr>
<th>Box e. High risk ≥ 2 factors (algorithm page 3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Calculate maintenance (table 4)……………….mls</td>
</tr>
<tr>
<td>• Give usual fluids at at least maintenance, encourage larger volumes.</td>
</tr>
<tr>
<td>• Replace substantial loses with ORS at 10ml/Kg per stool/vomit…………………………………….mls</td>
</tr>
</tbody>
</table>

Time of next review (4 hrs suggested).…………………..

ORS=Oral Rehydration Solution, “dioralyte” or equivalent. More palatable with addition of sugar free squash.

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Stool sample obtained □

If NGT rehydration commenced record time……………….  
Reason…………………………………………………….  
………………………………………………………………|

If IV rehydration commenced record time……………….  
Reason…………………………………………………….  
………………………………………………………………|

Record U&E: Na……. K……. Ur…….Cr…….Bic…….
Appendix 6

Appraisal Instrument
Appraisal of a guideline for management of diarrhoea +/- vomiting in A&E using the ‘AGREE appraisal instrument

Scope and Purpose
1. The objectives of the guideline are specifically described
   1  2  3  ✓  4

2. The clinical questions covered by the guideline are specifically described
   1  2  3  ✓  4

3. The patients to whom the guideline is meant to apply are specifically described
   1  2  3  4  ✓

4. The guideline development group contains individuals from all the professional groups
   1  2  3  ✓  4

5. The patients’ views and preferences have been sought
   1  2  3  ✓  4

Comments

Rigour of development
6. Systematic methods were used to search for the evidence
   1  2  3  4  ✓

7. The criteria for selecting the evidence are clearly described
   1  2  3  4  ✓

8. The methods used for formulating the recommendations are clearly described
   1  2  3  ✓  4

9. The health benefits, side effects and risks have been considered in formulating the recommendations
   1  2  3  ✓  4

10. There is an explicit link between the recommendations and the supporting evidence
    1  2  3  4  ✓

11. The guideline has been externally reviewed by experts prior to its publication
    1  2  3  4

Comments
Submitted to the QPC

12. A procedure for updating the guideline is provided
    1  2  ✓  3  4

Comments
Date for review only given

80
Clarity and presentation
13. The recommendations are specific and unambiguous

1 2 3 ✓ 4

14. The different options for management of the condition are clearly presented

1 2 3 4 ✓

15. Key recommendations are easily identifiable

1 2 3 ✓ 4

Applicability
16. The target users of the guideline are clearly defined

1 2 3 4 ✓

17. The potential organisational barriers in applying the recommendations have been discussed

1 2 ✓ 3 4

18. The potential costs of applying the recommendations have been discussed

1 2 ✓ 3 4

19. The guideline is supported with tools for application

1 2 3 4 ✓

20. The guideline presents key review criteria for monitoring and or audit purposes

1 2 3 4 ✓

21. The guideline has been piloted among end users

1 2 3 4 ✓

Editorial Independence
22. The guideline is editorially independent from the funding

1 2 3 4 ✓

23. Conflicts of interest of guideline development members have been recorded

1 2 3 4 ✓
References

2. HMSO, Children first, a study of hospital services. 1993: Audit Commission.


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