

Rehydrating a child (without shock) orally or via a nasogastric tube

For childhood gastroenteritis, enteral rehydration is as effective if not better than IV rehydration. Enteral rehydration by the oral or nasogastric route is associated with significantly fewer major adverse events and a shorter hospital stay compared with IV therapy and is successful in most children. Fonseca B et al. Enteral vs Intravenous Rehydration Therapy for Children With Gastroenteritis: A Meta-analysis of Randomized Controlled Trials. *Pediatr Adolesc Med.* 2004;158(5):483-490

Working out the fluid requirements:

You need to know the child's weight

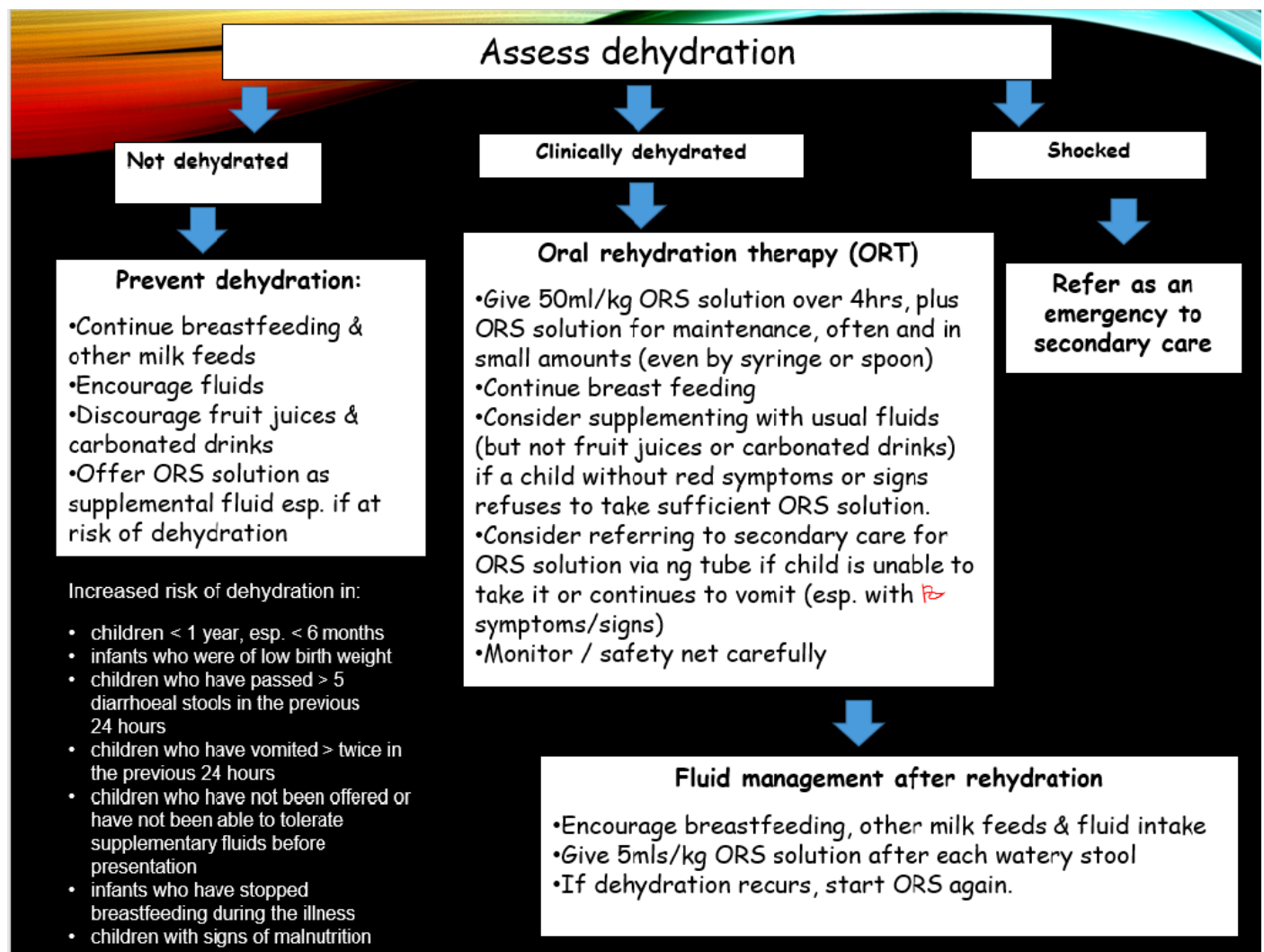
Work out maintenance fluids for 24 hours using the following guide:

- 100mls/kg for the first 10kgs
- 50mls/kg for the next 10kgs
- 20mls/kg thereafter up to a maximum volume of 2500mls (males) or 2000mls (females)

Give an extra 50mls/kg over the first 4 hours of rehydration (the bolus) and keep the background maintenance volume going too. The volume per hour for the first 4 hours will therefore be higher than for the next 20 hours.

If you're trying to rehydrate orally or advising parents who are going to keep their child at home to do this, divide the total fluid for 24 hours by 24 and then work out how much volume should be given in small aliquots every 5 minutes (the "5mls per 5 minutes" adage is OK in small children if they are not yet dehydrated but it's not enough if you're aiming to rehydrate effectively in an Emergency Department. And they all go to sleep anyway...).

If using a nasogastric tube and feeding pump, set the feeding pump to give the diarolyte continuously. Again, the volume per hour over the first 4 hours will be greater than for the next 20 hours.



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NICE (CG84): Diarrhoea and vomiting caused by gastroenteritis in under 5s: diagnosis and management 2009, next review due January 2019

↗ denotes a child at increased risk of progression to shock

	No clinically detectable dehydration	Clinical dehydration	Clinical shock
SYMPTOMS	Appears well	↗ Appears to be unwell	-
	Alert and responsive	↗ Altered responsiveness	Decreased level of consciousness
SIGNS	Normal urine output	Decreased urine output	-
	Skin colour unchanged	Skin colour unchanged	Pale or mottled
	Warm extremities	Warm extremities	Cold extremities
	Eyes not sunken	↗ Sunken eyes	
	Moist mucous membranes	Dry mucous membranes	
	Normal heart rate	↗ Tachycardia	Tachycardia
	Normal breathing pattern	↗ Tachypnoea	Tachypnoea
	Normal peripheral pulses	Normal peripheral pulses	Weak pulses
	Normal capillary refill time	Normal capillary refill time	Prolonged capillary refill time
	Normal skin turgor	↗ Reduced skin turgor	-
Normal blood pressure	Normal blood pressure	Hypotension	

Resources:

Diarrhoea and vomiting caused by gastroenteritis in under 5s: diagnosis and management
Clinical guideline [CG84] Published date: April 2009 (<https://www.nice.org.uk/guidance/cg84>)

Intravenous fluid therapy in children and young people in hospital
NICE guideline [NG29] Published date: December 2015 (<https://www.nice.org.uk/guidance/ng29>)

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SOME WORKED EXAMPLES:

Primary Care: Clinically dehydrated 3 year old

Jenny is 3, weighs 16kgs and is a bit miserable after a couple of days of gastroenteritis. She has a dry mouth and is passing less urine than normal but does not have any of the red flags in the slide above. The vomiting seems to have slowed down but she had a loose stool this morning. You assess her as being clinically dehydrated but not shocked. As the vomiting seems to be settling, you and her mother agree that she can remain at home and be rehydrated with diarolyte orally with appropriate safety netting should your plan not work out.

Fluids needed:

- Maintenance:
100mls/kg for first 10kgs of weight = 1000mls
50mls/kg for the next 6kgs = 300mls
Total maintenance over 24 hours = **1300mls** = 54mls/hr
- Rehydration bolus to be given in the first 4 hours in addition to the maintenance amount:
50mls/kg = 800mls = 200mls/hr

Therefore, over the first 4 hours Jenny will need 200 + 54 mls/hr = 254mls

A practical way to give this in this scenario might be 64mls every 15 minutes for the first 2 hours, 130mls every 30 minutes for another 2 hours and then ensure that she gets the equivalent of 54mls/hr for the rest of the 24 hours. The child is likely to be better by then and want to drink considerably more than 54mls/hr. They are less likely to vomit if you keep the volumes "little and often" in the early stages.

If Jenny does vomit again or have a diarrhoeal stool, she should have 5mls/kg = 80mls diarolyte to keep up with this loss and prevent worsening dehydration.

Primary Care: Vomiting 9 month old, not dehydrated

Jenny's Mum rings again the next day. Jenny is better but her 9 month old brother, Sam, seems a bit under the weather and has vomited once this morning. What should she do to prevent him getting as dry as his sister became? You recognise that he is at increased risk of becoming dehydrated because of his age but he does not have any of the other concerning features from the 1st slide above in his history and no red flags from slide number 2. He weighs 8kgs.

Fluids needed (breastmilk, water, ORS, usual formula are all OK at this stage):

- Maintenance:
100mls/kg for his 8kgs = 800mls

No rehydration bolus needed

Therefore, Sam's mum should ensure that he drinks around 33mls per hour to prevent dehydration. In practical terms this is 5mls every 10 minutes. And, as she won't be able to keep that regime up for a full 24 hour period, 10mls every 10 minutes might make more sense. At this end of the illness, Sam will probably continue to vomit so he will also need 5mls/kg (40mls) of extra diarolyte every time he vomits or has diarrhoea. If he can't tolerate this, he will need to go to hospital for nasogastric fluids.

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Secondary Care: 9 month old clinically dehydrated

Sam's mum gave it a good go for 24 hours but he continued to vomit up most of his diarolyte, last vomited an hour ago, hasn't had a wet nappy this morning and isn't smiling like he usually does. He is alert but clingy and doesn't want any more syringes of diarolyte. You assess him as clinically dehydrated but not shocked. He weighs 7.8kgs.

Fluids needed:

1. Maintenance:
100mls/kg for first 10kgs of weight = **780mls** = 32.5mls/hr
2. Rehydration bolus to be given in the first 4 hours in addition to the maintenance amount:
50mls/kg = 390mls = 97.5mls/hr

Therefore, over the first 4 hours Sam will need $32.5 + 97.5$ mls/hr = 130mls/hr, followed by 32.5mls/hr for the next 20 hours. As he is about to fall asleep, he should have a nasogastric tube inserted, a feeding pump set up to give the diarolyte as calculated above and be moved into a short stay facility as he should be able to go home within 24 hours. As with the other worked examples, he should have 5mls/kg (40mls) diarolyte extra per vomit or diarrhoeal stool.

Gastroenteritis in the UK is a fact of life in childhood and not the killer that it is in some areas of the world. The rotavirus immunisation has reduced the number of very dehydrated babies coming in to hospital. Let's swap our needles for nasogastric tubes and get these children home safely and more quickly.

NO SHOCK = NO BLOOD TESTS, NO IV FLUIDS, NO 4 HOUR BREACH, NO TRAUMATISED FAMILY