

Fluids in kids (outside neonatal age)



5 questions

1. Why am I giving fluid?
2. How will I give fluid (is IV necessary)?
3. What fluid?
4. How much fluid?
5. How will I monitor?

1. Why give fluid?

1. Why give fluid?

- Fluid loss
 - Urine
 - Insensible (unmeasurable)
 - Respiratory
 - Skin
 - Stool

1. What is maintenance?

- Well child, normal hydration, no intake...
- Fluid volume required under normal conditions to:
 - Replace insensible losses
 - Allow excretion of excess solute load (urea, creatinine, electrolytes) in a volume of urine which has osmolarity similar to plasma

1. Maintenance varies with age

- Intake adult (70 kg)
 - ~ 2.5 L/d
 - 35 ml/kg/d
- Intake 6 month baby (7 kg)
 - ~1 L/d
 - ~150 ml/kg/d milk
 - 100 ml/kg/d fluid

1. Maintenance varies with clinical sit'n

More

- Stool loss (diarrhoea)
- Skin loss (fever, burns)
- Urine loss (DI)
- Other losses (drains, capp leak)

Less

- SIADH
 - Sick
 - Brain
 - Respiratory
- Heart failure
- Renal failure
- Ventilated

1. As well as maintenance..

Think of 3 components

- Deficit
- Maintenance
- Ongoing losses

1. Fluid deficit

- Ideally: immediate pre-morbid weight-current weight
- Estimate degree dehydration (% BW) x weight
- Clinical signs only approximate deficit

1. Fluid deficit

Useful clinical signs

- Cool peripheries with delayed capillary refill
- Decreased turgor
- Deep acidotic breathing
- Increased thirst

*Irritability/lethargy, sunken eyes, dry mucus membranes, sunken fontanelle not useful in mild-moderate dehydration

1. Fluid deficit

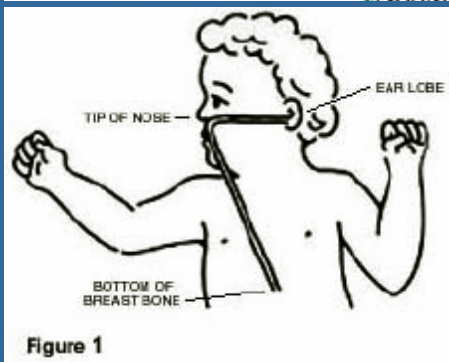
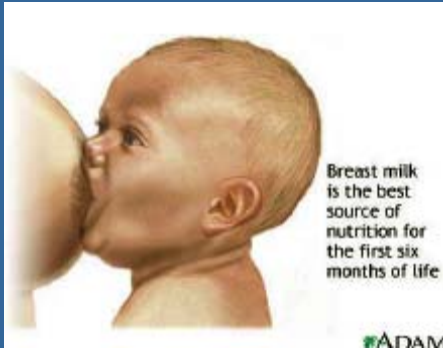
- Mild (< 4 %)
 - No clinical signs
- Moderate (4-6 %)
 - Some clinical signs
- Severe (7 % +)
 - Multiple signs
 - +/- acidosis, hypotension

1. Ongoing losses

- Urine
- Stool
- Skin
- Drains
- Redistribution

2. How will I give fluid?

2. Options



- Enteral
 - Oral
 - Nasogastric
 - Other
- Parenteral
 - IV
 - other

2. Oral and NG feeds

- Enteral feeding is best
- Even a small amt is good
 - Gut mucosal integrity/trophic effects
 - Lower risk electrolyte problems
- Wherever possible use enteral fluids
- Do not use polyjoule/high calorie feeds in dehydrated patients with diarrhoea

2. Nasogastric feeds



- A very good option
- Well tolerated
- Lower risk electrolyte abnormalities
- Treatment of choice in gastroenteritis in young kids

2. C/I to enteral feeds

- Bowel obstruction
 - Mechanical
 - Functional
- Risk of aspiration
 - e.g. reduced conscious state
- Pre-operative

**Vomiting generally not a contraindication*

2. Indications IV fluids

- Shock
 - Enteral fluids not effective
 - Resuscitation- ASAP
- Contraindications to enteral feeds

2. General points

- IV fluids are potentially dangerous
- Commonest source of adverse events
- Always check orders
- You can always ask for help
- Clinical guidelines

3. What fluid will I give?

3. General principles

- Resuscitate
 - 0.9% saline
- Maintenance well kids, normal hydration, Na
 - 0.9% saline & 5% dextrose & KCl 20 mmol/L
 - Can use 0.45% saline & 5% dextrose & KCl 20mmol/L

3. General principles

- Maintenance for unwell children
 - need 0.9% saline & 5% DW & KCl 20mmol/L
 - Fluid of choice in meningitis, head injury, SIADH, low Na
 - Need less fluid – fluid restrict

3. General principles cont'd

- Do not give IV fluids containing dextrose alone
- Drug lines usually 0.9% saline
- Stronger dextrose solutions- NICU and PICU
- KCl 20 mmol/L unless high K or anuric
- Do not use hypo-osmolar solutions

- Correct hyper or hyponatraemia slowly
 - lower or raise by 0.5 mmol/l per hour

3. Pre-made bags at RCH

- 0.9% saline
- 0.9% saline & 5% dextrose
- 0.45% saline
- 0.45% saline & 5% dextrose & KCl 20 mmol/L
- 0.45% saline & 5% dextrose
- Hartmann's
- [*Dextrose only- 5%, 10%, higher*]
- Colloids
- Blood products

3. A venture into physiology...

- Osmolarity
 - number of particles dissolved in 1L solution
 - $2(\text{Na} + \text{K}) + \text{glucose} + \text{urea}$ (270-295)
- Osmolality
 - number of particles dissolved in 1kg solution
- Hypo-osmolar solutions are dangerous

3. A venture into physiology...

- 0.9% saline = 300 mOsm- **isotonic saline**
- 0.9% saline 5% DW= 578 mOsm
 - But dextrose redistributes - **'isotonic saline'**
- 0.45% saline= 150 mOsm
- 0.45% saline 5% DW & 20 mmol KCl/L= 471 mOsm
- 0.45% saline 5% DW = 430 mOsm
- 5% dextrose= 278 mOsm

4. How much will I give?

4. Deficit

- Hypovolaemia
 - Give boluses 10-20 ml/kg 0.9% saline
 - May be repeated
- Replace deficit
 - Quickly in gastroenteritis (enteral fluids) *6H*
 - Slowly in DKA, meningitis *24-48H*
 - Slowly where Na abnormal *48-72H*

4. Ongoing losses

- Best measured and replaced
- 0.9% saline may be sufficient
- May need 5% albumin if Se Alb low

4. Maintenance fluids

Bodyweight	Fluid required per 24 hours	Fluid required per hour
1 st 10 kg	100 ml/kg	4 ml/kg
2 nd 10 kg	50 ml/kg	2 ml/kg
Subsequent kg	20 ml/kg	1 ml/kg

4. SIADH

- Sick kids retain free water
- Hyponatraemia
 - ECF osmolality falls
 - Shift fluid into ICF
 - Brain- cerebral oedema
- So fluid restrict and give adequate Na

4. SIADH

- Kids at risk (the simple version)
 - Post operative
 - Sick heads
 - Sick chest

 - Any sick child

4. Maintenance fluids

- Any sick child may need fluid restriction
 - ICU situation – usually 50-70%
 - Worry about decrease in sodium,
 - even in normal range
 - Low urine output may be due to SIADH (not necessarily dehydration)
 - Monitor...

5. How will I monitor?

5. Monitoring

Fluid status

- Clinical- HR, perfusion
- Weight- baseline, 6 hours then daily
- Input/output charts

Electrolytes- Na, K, glucose

- Baseline
- At least 24 hourly, at least 6 hourly if sick

5. Monitoring

Charts

- 'Total fluid intake'- hourly rate
 - Include drugs/flushes in total volume
 - Adjust for oral
- State: why, how, what, how much
 - 100% maintenance + 5% deficit correction over 24 hours
 - 70% maintenance
 - IV 0.9% saline 5% dextrose & KCl 20 mmol/L

Pop quiz



- 15 kg 3 yr old
- What is her normal daily fluid requirement?
- What is her fluid requirement per hour?

3 yo, 15 kg, daily fluids

- $10 \text{ kg} \times 100 \text{ ml/kg/d} + 5 \text{ kg} \times 50 \text{ ml/kg/d}$
- 1250 ml/d
- $1250/24 = \sim 50 \text{ ml/h}$

presents with 3/7 gastro

CR 3s, mild reduced turgor, alert

Mod dry.....5%

- Why?....deficit & maintenance (?losses)
- How?.....enteral (NGT)
- What?....Gastrolyte

Gastro.....

How much?

- Deficit $\sim 5\% = 0.05 \times 15 \text{ kg} = 750\text{ml}$
- Maintenance 1250 ml/24h
- Deficit 1st 6h, days maintenance next 18h
- 1st 6h = 125ml/h, next 18h = 70 ml/h

Monitor.....

- Obs, fluid status, weight, charts, elect, BSL

Early appendicitis- OR

She got better from her gastro...

Normal hydration, uncomplicated surgery

- Why?- nil oral, maintenance
- How?- IV, enteral C/I
- What?- 0.9% saline, 5% DW, 20 mmol/L KCl
- How much?- 1250 ml/24h= ~ 50 ml/h
- Monitor.....
 - Obs, fluid status, weight, charts, elect, BSL

She develops a bowel obstruction....

3/7 profuse vomiting, LOW 1kg
HR 150, CR 4s, poor turgor

Why?- nil oral and...

- Shocked....
- Deficit
- Maintenance
- Ongoing losses

Bowel obstruction....

- How?
 - IV, enteral C/I
- What?
 - Resuscitation- bolus 0.9% Saline
 - Deficit- 0.9% Saline
 - Maintenance- 0.9% saline, 5% DW, 20 mmol/L KCl
 - Losses- 0.9% saline + 20 mmol/L KCl

Bowel obstruction.....

- How much?
 - Resuscitation 10-20 ml/kg bolus
 - Deficit- 1000 ml over 24 hours=40 ml/h
 - Maintenance- 1250 ml/d=50ml/h
 - Ongoing losses- measure (NGT) and replace
- Monitor- **6H**
 - Obs, fluid status, weight, charts, elect, alb, BSL
 - Fluid restrict if Na low,
 - Consider Albumin

She develops a terrible headache...

CSF micro >999 PMN, GPC

Drowsy, oedematous, CR 2s

- Why?
 - nil oral, control intake, part of maintenance
- How?
 - IV
- What fluid?
 - 0.9% saline, 5% DW, 20 mmol/L KCl

She develops a terrible headache...

- Decide
 - Na status
 - ICU involvement needed (general oedema)
- How much fluid?
 - 25-50% maintenance
 - 12.5-25 ml/h- say 20 ml/h
- Monitor- **6H**
 - Obs, fluid status, weight, charts, elect, CAB, BSL

Take home messages

- 5 questions
 - Why?
 - How, do they need IV?
 - What fluid?
 - How much fluid?
 - Monitoring?

Take home messages

- Enteral fluids safer than IV
 - Consider contraindications
- Resuscitation fluid
 - 0.9% Saline, 10-20 ml/kg boluses

Take home messages

- Maintenance fluid
 - 100/50/20 and 4/2/1 rules
 - Generally
 - 0.9% saline, 5% DW, KCl 20 mmol/L
 - In well kids, (no SIADH), 0.45% saline, 5% DW KCl 20 mmol/L
 - Use KCl unless high K or anuric
 - Do not use dextrose alone
 - Monitor

Take home messages

- Sick (SIADH)
 - 0.9% saline, 5% dextrose + KCl 20 mmol/L
 - May need to fluid restrict and monitor closely
 - Beware rapid correction of low or high Na

Guidelines available

- General fluid guidelines (and low/high Na)
- Neonatal fluid guidelines
- Meningitis fluid guidelines
- DKA guidelines
- Burns fluid guidelines
- Gastroenteritis guidelines
- Adrenal crisis guidelines

- http://www.rch.org.au/clinicalguide/index.cfm?doc_id=5033

Neonates

For fluids purposes: < 6 weeks, <5 kg

- Use NICU/NICU liaison nurse
- May need less Na and more dextrose
 - 0.45% saline and 10% dextrose (+/- 20 mmol/L KCl)
- Same 5 questions
 - Still may need to fluid restrict
 - Be extra careful with total fluid intake/hourly rate (drug volumes)
 - Monitor, monitor, monitor