Ratios Some drugs are expressed as ratios, for example Adrenaline which comes in two strengths, 1:10,000 and 1:1,000

So what does that mean?

1:10,000 is 1 mg in 10 mls

1:1,000 is 1mg in 1 ml

So, it is very clear that the 1:1000 solution is 10 x stronger than the 1:10,000 solution.

Regardless of how it is expressed, the strength of the solution is what is important, W W W still works for these calculations,

Example: the dose for cardiac arrest is 10mcg / kg

A child weighs 40 kgs the dose = 400 mcg or 0.4 mg

0.4mg is 4.0 mls of the 1:10,000 or 0.4mls of 1:1000

However this would need further dilution to make it safe to administer so the 1:10,000 dose is pre mixed to make it quick and safe to administer in an emergency.

For an Adrenaline infusion the same child would need 0.3 mg/kg of adrenaline made up to a total of 50mls with suitable diluent

40kg x 0.3 = 12mgs so,

12mgs = 120 mls of 1:10,000 or 12 mls of 1:1000 which is easier to make up in an infusion in a 50ml syringe.

For peripheral adrenaline infusion the maximum concentration is 4mg in 50mls so the rate of the infusion has to be increased to achieve the same dose.

For further copies please see our website:

https://www.networks.nhs.uk/nhs-networks/east-of-england-paediatric-critical-care

To contact us please email:

add-tr.eoepccodn@nhs.net

East of England Paediatric Critical Care Operational Delivery Network

Collaborative working to deliver high quality care to our children and their families

Paediatric Calculations Resource Book

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If found please return to

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IV Fluids Children require IV fluids for a number of reasons, for example, to correct a fluid deficit, to correct electrolyte imbalance, or to replace ongoing losses. IV fluid maintenance requirements are calculated differently depending on age, but is always calculated over 24hrs. Children presenting in DKA are a special case —refer to clinical guidelines for fluid management and seek senior help early.

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Neonates up to 28 days usually have their maintenance fluids made up by adding electrolytes depending on their individual requirements. The local policy should be followed.

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Babies over 28days up to 10Kgs the general formula is 100mls/kg/day

Eg. 6 month old baby weighs 7.3 kgs

100 x 7.3 = 730 mls per 24 hrs then divide by 24 to get 30mls/hr

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Children over 10kgs, the following formula is used:

100mls per kg for the 1st 10kgs

50mls per kg for the next 10 kgs (or part thereof)

20 mls/kg for every subsequent kg.

Max - female 2000mls/24hrs Male 2500mls/24hrs

Eg.

12kg boy : 10kgs x 100mls + 2kgs x 50mls = 1100 mls per 24 hrs so divide by 24 = 46mls/hr

26kg girl - 10kg x 100 + 10kg x 50 + 6kg x 20 = 1620mls per 24hrs = divide by 24hrs = 67.5mls/hr

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Remember if your patient is also receiving large amounts of fluid from IV medications, discuss with the medics about reducing the IV maintenance

Critical Care Infusion rate calculations
mcg / kg / hour

To calculate the rate in mls/hr to deliver X mcg/kg/hr	What does a rate of 1ml/hr deliver in mcg/kg/hr ?
Multiply the required dose (in mcgs) by the patients weight (in kgs)	Convert the total amount of the medicine in the syringe to micrograms
Divide this number by the total amount of the drug (in mcgs) in the syringe	Divide this by the patients weight in kilograms
Multiple this by the total volume of the syringe	Divide this by the total volume of the syringe
This is the rate required (mls/hr) to provide an Infusion of X mcg/kg/hr	This is the dose at 1ml/hour, in mcg/kg/hr multiply this by the rate of the infusion to calculate the dose being delivered in mcg/kg/hr

Critical Care infusion rate calculations
mcg / kg / minute

To calculate the rate in mls / hr to deliver x mcg / kg / min	What does a rate of 1 ml/hr deliver in mcg/kg/ min ?
Multiply the required dose (in mcgs) by the patients weight (in kgs)	Convert the total amount of the medicine in the syringe to micrograms
Multiply this number by 60 (minutes)	Divide this by the patients weight (in kgs)
Divide this by the total amount of the drug in the syringe (in mcg)	Divide this number by 60 (minutes)
Multiply this by the total volume of the syringe	Divide this by the total volume of the syringe
This is the rate required (mls/hr) to provide an infusion of x mcg/kg/min	This is the dose at 1ml/hr in mcg/kg/min multiply this by the rate of the infusion to calculate the dose being delivered in mcg/kg/min

Units Drug administration and calculations involve the use of different units, both volume and weight. It is essential to understand the relationship between units. When preparing medicines it may be necessary to convert prescribed doses into a different unit depending on the preparation strength available.

ng ⇨ mcg ⇨ mg ⇨ g Divide by 1,000 g ⇨ mg ⇨ mcg ⇨ ng Multiply by 1,000	**ng = nanogram** **mcg = microgram (1,000 ng)** **mg = milligram (1,000 mcg)** **g = gram (1,000 mg)**
Examples: **4grams = 4000 mgs** **320 mcg = 0.32 mg** **6.5mg = 0.65g / 6500 mcg**	**Also handy to know-** **1000 mls per litre** **1000 grams per kg** **30mls = 1 fluid ounce**

Drug calculations As paediatric drugs are calculated by weight, often the amount of drug actually required is not the same as the total amount in the vial. To calculate the proportion of the medication required to be taken from the vial, the following formula can be used

W W W $\frac{\text{What you want}}{\text{What you've got}}$ **X What volume its in**

Example: the prescribed dose of Benzyl penicillin is 480mg, you have 600mg in a vial made up to 6mls with diluent, so

$\frac{480mg}{600mg}$ X 6mls = 4.8mls

So 4.8mls of the 600mg vial gives the required dose.

Infusions Some medications require to be infused rather than given 'stat' (as a bolus) . The length of the infusion time varies according to the drug and the dose. You will be required to calculate the rate for infusion to programme the infusion device.

All infusion devices are based on (delete programming in) mls per hour. If a medication needs to be infused over 1 hour then the hourly rate will be the total amount.

For any other duration the following calculation can be used:

$$\frac{\text{Volume to be infused}}{\text{duration in minutes}} \times 60 = \text{rate (mls/hr)}$$

Example:

Give 165 mls over 20 mins

$$\frac{165 \text{ mls}}{20 \text{ mins}} \times 60 \text{ (mins in 1hr)} = 495 \text{ mls/hr}$$

So setting the infusion pump to run at 495mls/hr means the 165 mls will be infused over 20 minutes.

More infusions Some medications require to be administered at a maximum rate per kg either per hour or minute.

mg / kg / hr

Eg: 5 mg/kg/hr for 20kg patient 250mg in 20 mls

First work out how many mg per hr can be infused (weight x rate)

5 (mg/kg) x 20 (kgs) = 100mgs /hr

Then do W W W to calculate the hourly infusion rate.

$$\frac{100\text{mg}}{250\text{ml}} \times 20\text{mls} = 8\text{mls/hr}$$

Mg / Kg / Min

Eg: 10 mg/kg/min for a 20kg patient 1000mgs in 20mls

First work out how many mg per hour can be infused

(weight x rate)

10 (mg/kg) x 20 (kgs) = 200mgs

Then multiply this by 60 to get minutes = 12,000

Then do W W W to calculate the rate

$$\frac{12{,}000}{1000} \times 20 = 240\text{mls/hr}$$

Dilution Some medicines can be given as they are – straight from the vial, but many of them require further dilution before they can be administered safely. This is usually expressed in terms of 'further dilute to 5mgs/ml for administration'. This dilution information can be found in your trust IV guideline. In order to calculate this you divide the dose prescribed by the dilution required.

Example:

Acyclovir
Dose of 480mgs
Further dilute to 5mgs per ml.

$$\frac{480\text{mg}}{5\text{mg}} = 96 \text{ mls}$$

So for this dose of Acyclovir the final infusion volume is 96mls.

(follow local guidelines for administration requirements)

Percentages Some medications or fluids are expressed as a percentage, Mannitol, Sodium Bicarbonate, Glucose etc They can either be prescribed in terms of mls of a certain strength or as a dose in either milligrams or grams.

When medications are described with percentage, this is the strength of the solution, and indicates how many grams of the medication are in every 100mls of the solution.

A 5% solution has 5grams per 100mls A 20% solution has 20 grams per 100mls …. etc We can then work out how many grams are in the amount of the solution we are using. Or how many mls we need to administer to give the dose prescribed.

Eg: mannitol comes in 10% or 20% so to give a dose of 6grams

10% = 60mls (10grams per 100mls)

or 20% = 30mls (20 grams per 100mls)

Remember to ensure all your doses are in **grams**

This also helps when making up non standard bags of IV fluids and the grams of glucose/sodium etc is also printed on all IV fluid bags!