"Maintenance" IV fluids in euvolaemic adults

Index: Intravenous fluid therapy

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The easy (autopilot) way:

Assumptions:

1. That the patient is relatively "**normal**"
    - normal size
    - relatively well
    - no kidney failure
    - no heart failure
    - no electrolyte disturbance
    - no particular abnormal losses
2. patient is "**nil-by-mouth**" (i.e., they have no other sources of hydration)
3. patient is **euvolaemic** - i.e., not dehydrated or fluid overloaded.

Bag of IV fluids

If any of the assumptions are false, then you should seriously consider working it out properly. If they are all true, then you can use the following regimens (assuming standard 1L IV fluid bags):

Regimen One

- **Bag 1**: 0.9% NaCl ("normal saline") + 30 mmoL KCl (use premixed if available) *then*
- **Bag 2**: 5% dextrose + 30 mmoL KCl *then*
- **Bag 3**: 5% dextrose *then back to Bag 1*.

Regimen Two

- **Bag 1**: 0.18% NaCl + 4% dextrose ("4% and a fifth") + 30 mmoL KCl (use premixed if available) *then*
- **Bag 2**: 0.18% NaCl + 4% dextrose + 30 mmoL KCl *then*
- **Bag 3**: 0.18% NaCl + 4% dextrose *then back to Bag 1*.

Intravenous fluid infusion rate

- Usual sized person: **125** mL/h (or "q8h")
- Smaller or older person: **100** mL/h (or "q10h")
- Tiny, old and frail person: **84** mL/h (or "q12h") - though you shouldn't be writing fluids on "autopilot" for the tiny, old and fail person.

You are hereby warned that imprudent use of "autopilot" therapy with intravenous fluids can (though rarely) harm your patients.

The proper way

In the usual setting, when you are prescribing intravenous fluids, you need to consider the following components:

1. Water
2. Sodium
3. Potassium

Although you don't "usually" have to worry about it you also need to be mindful of:

- Calcium
- Magnesium
- Phosphate
- Chloride

To work out water requirements, the "paediatric formula" is good for adults too and I recommend it:

> Water infusion rate:
>
> **4 mL/kg/hr for the first 10 kg of body weight**
>
> **+ 2 mL/kg/hr for the next 10 kg of body weight**
>
> **+ 1 mL/kg/hr for the remainder of body weight**

Then work out our sodium and potassium requirements:

> Sodium: **1-2 mmol/kg/day**
>
> Potassium: **0.5-1 mmol/kg/day**

So, for an otherwise healthy, euvolaemic **70 kg** man:

Water:

- (4 mL/kg/hr x 10 kg) + (2 mL/kg/hr x 10 kg) + (1 mL/kg/hr x 50 kg)
- = 40 mL/hr + 20 mL/h + 50 mL/h
- = **110 mL/hr (2.6 L per day)**

Sodium:

- 1 to 2 mmol/kg/day
- = **70 to 140 mmol/day**

Potassium:

- 0.5 to 1 mmol/kg/day
- = **35 to 70 mmol/day**

Now, we need to convert this into the premixed bags of IV fluid:

What is in a bag of fluid?

0.9% NaCl solution (aka, "normal saline")

- 1L of water
- 150 mmol of Na+
- 150 mmol of Cl-

0.18% NaCl + 4% dextrose solution (aka, "4% and a fifth")

- 1L of water
- 30 mmol of Na+
- 30 mmol of Cl-
- 40 grams of glucose

5% dextrose

- 1L of water
- 50 grams of glucose

As you can see, if you use the "autopilot" IV fluid regimens, they give pretty close to what we need.

Regimen one gives in 24 hours:

- 3L of water (target = 2.6 L)
- 150 mmol of sodium (target = 70-140 mmol)
- 60 mmol of potassium (target = 35-70 mmol)

Regimen two gives:

- 3L of water
- 90 mmol of sodium
- 60 mmol of potassium

... which is why the "autopilot" regimens work. Most people eventually work this out through trial and error, but knowing what you're actually doing is probably preferrable.

Traps for young players

1. Underhydration
    - wrong rate of fluid for body weight

    - not calculating for other losses
    - not calculating for pre-existing fluid deficit
2. Overhydration
    - wrong rate of fluid for body weight
    - not taking into account pre-exisiting fluid overload
    - not considering renal (dys)function
3. Giving too much sodium
    - using endless bags of "normal saline" in the euvolaemic patient
    - not monitoring the serum sodium for someone who has received many bags of IV fluid
4. No giving enough potassium
    - forgetting to write up potassium (especially post-operatively)
    - not calculating for losses of potassium rich fluid (e.g., diarrhoea and vomitus)

Updated: Michael Tam (19 June 2006)

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