Fluid maintenance

27/3/2019
• In surgery the patient must be NPO, therefore fluid maintenance very important.
• When the patient is in a fasting status there is no input, but we have output (urination, GI secretions, respiration...ect)
• If we don’t maintain sufficient amount of fluid, the patient at risk of complications...
**ROLE OF 4-2-1**

Maintenance Fluids
Hourly Maintenance Fluid Requirement*

**“4 - 2 -1 rule”**

<table>
<thead>
<tr>
<th>WEIGHT</th>
<th>FLUID</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 10 kg</td>
<td>4 ml/kg/hr</td>
</tr>
<tr>
<td>10 - 20 kg</td>
<td>40 ml/hr + 2 ml/kg/hr</td>
</tr>
<tr>
<td>&gt; 20 kg</td>
<td>60 ml/hr + 1 ml/kg/hr</td>
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</tbody>
</table>

Upper limit 100 cc/hr

*Nelsons Text book of pediatrics 19th edition*
4-2-1 rule depends on (weight)

- 5 kg ..... 5*4 = 20ml/hour
- 15 kg .... 40 + (2*5) = 50ml/hour
- 75 kg ..... 60 + (55*1) = 110ml/hour
4-2-1 Rule

- 4 ml/kg/hr for first 10 kg
- 2 ml/kg/hr for next 10 kg
- 1 ml/kg/hr thereafter

**EXAMPLES**

<table>
<thead>
<tr>
<th>Weight (kg)</th>
<th>Rate (ml/hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>40</td>
</tr>
<tr>
<td>20</td>
<td>60</td>
</tr>
<tr>
<td>30</td>
<td>70</td>
</tr>
<tr>
<td>40</td>
<td>80</td>
</tr>
<tr>
<td>70</td>
<td>120</td>
</tr>
</tbody>
</table>
Example

Calculate maintenance fluids for a 75 kg patient who is NPO

- **4-2-1 Rule**
  - $10 \times 4 = 40 \text{ mL}$
  - $10 \times 2 = 20 \text{ mL}$
  - $55 \times 1 = 55 \text{ mL}$

- **Total 115 mL/hr**

- **100-50-20 Rule**
  - $10 \times 100 = 1000 \text{ mL}$
  - $10 \times 20 = 200 \text{ mL}$
  - $55 \times 20 = 1100$

- **Sub total 2300 mL/day**

- **Total 96 mL/hr**
Maintenance of electrolytes

- Normal k level (3.5-5.3) Meq/L
- Normal sodium level (135-148) Meq/L
- Daily requirements of:
  - Na: 2-3 meq/kg/day
  - K: 1-2 meq/kg/day
The most common maintenance fluid is D 5 ½ NS with 20 or 40 mEq KCL (because as we said normal saline doesn’t have potassium) But usually its 20 mEq because with 40 you have higher risks on the cardiac conducting system 20 mEq of potassium = 1500 mg (daily requirement 3.5-4.6 g) 5 mEq of sodium = 100 mg (daily requirement of < 2g) So if we have an adult male patients that weighs 70kg, what is the maintenance therapy plan for him? You tell me… = 10x4 + 10x2 + 50x1 = 110 ml/hour x 24 hours = 2640 so roughly 2.5 liters Na = 1.5 mEq x 70 = 105 mEq/day K= 1 x 70 = 70 mEq/day
• Our choice D5 1/2NS with kcl
1. as a result of a period of fasting (NPO deficit):
   In the absence of oral intake; fluid and electrolyte deficits can rapidly develop as a result of continued urine formation, gastrointestinal secretions, and insensible losses (from the skin and lungs).

   can be calculated by multiplying the patient's hourly maintenance requirements by the number of hours fasted -->
   Maintenance requirements / hour x number of hours fasted
   $ 75 \text{ kg} \times 115 \text{ ml/hr} $
   \[ = 115 \times 8 = 920 \text{ ml} \]

   **in surgery that takes 4 hrs for ex. we give half deficit in 1st hour ( \[920/2 = 460\] ) & other half divided by 3hrs ( \[460/3\] ) per hr**

2. preoperative losses from the gastrointestinal tract (eg. vomiting or diarrhea),
How to calculate the fluid replacement in the intraoperative period?

How to calculate maintenance fluid requirements?

- **4:2:1 rule**
- First ten kilos × 4 mL/kg/hr
- Second ten kilos × 2 mL/kg/hr
- Every kilo after that × 1 mL/kg/hr
- E.g. a 70-kg adult will require \((10 \times 4) + (10 \times 2) + (50 \times 1) = 110 \text{ mL}/\text{h}\) of maintenance.

Preoperative fluid deficit?

- Normal maintenance requirements \((4:2:1 \text{ rule}) \times \) number of hours of fasting “NPO”
- The deficit is infused over 3 hours, 1/2 in the first hour and the rest over the next 2 hours.
- Patient’s pre-procedural volume status may vary due to: vomiting, diarrhea, ileus, fever, burns, ascites, effusions, hemorrhage, bowel preparations, or diuretics.
• IF the hours of fasting unknown or the patient has abnormal fluid loss....(Diarrhoea, vomiting,...ect)
• Give fluid and check the vital signs
• Check the urine output
Replacing in ::

Third space : depends on the cause
Blood loss
Thank you!!