

Peri-operative Fluid Management

Fluid management in any situation can be divided into three components: *deficit*, *maintenance*, and *ongoing loss*.

Pre-operative

Most elective operations do not need pre-operative IV fluid administration. The exception is in those who cannot take fluid orally (e.g. due to carcinoma of the upper GI tract).

Every emergency, however, needs IV fluid. In emergencies there is no time limit for eating and drinking (i.e. that of the usual fasting guideline) since gastric emptying is delayed, so fluid needs to be administered IV instead of orally.

The type of fluid given pre-operatively is generally glucose saline.

Deficit → Correct what is already lost (determined by level of shock).

Maintenance → Use the rule of 4-2-1 mL/kg/hr or simply 1.5 mL/kg/hr for maintenance.

Ongoing loss → Calculate ongoing losses as follows:

- add 10% of maintenance or 250 mL of fluid for every 1 degree of fever
- for gastric aspirate replace same amount with normal saline + potassium
- do not replace urine output (normal should be 1 mL/kg/hr)
- replace blood loss with crystalloid (3 x amount of blood lost) or with colloid (same amount as that lost)

Intra-operative

Deficit → If the patient didn't take fluids pre-operatively they may have a deficit and this needs to be corrected during the operation.

Maintenance → during operation maintenance differs because of increased insensible loss (by 2 mL/kg/hr), stress, and 3rd space; so add to maintenance as follows:

- minor operation → 3-4 mL/kg/hr
- moderate operation → 5-6 mL/kg/hr
- major operation → 7-8 mL/kg/hr
- when in doubt or for super major operation put central line and give fluid to keep the CVP above 10 mmHg and keep blood pressure within normal range

Ongoing loss → same as above for fever, NG losses, and urine output; as for blood loss calculate the losses as follows:

- a blood clot the size of a fist = 500 mL
- 1 pack soaked in blood = 100 mL

- 1 gauze soaked in blood = 50 mL (for the latter two you can also measure pre- and post-soaking weights and subtract them to get the weight of the blood lost)
- other methods to measure intra-operative blood loss include hemodilution method and suction device

Risks with blood transfusion include major incompatibility (causes severe retrosternal and loin pain but masked when patient under GA) and risk of transmission of yet undiscovered viruses.

Estimated blood volume (EBV) of any patient is equal to

- male → 60-65 mL/kg
- female → 50-55 mL/kg
- infant → 80 mL/kg
- neonates → 90 mL/kg

The decision to give blood transfusion or not depends on the following:

1. if blood loss cannot be controlled give blood transfusion
2. if blood loss can be controlled estimate the amount of blood loss:
 - < 15% → do not give blood transfusion
 - 15-30% → depends on the case
 - > 30% → give blood transfusion

The blood should be given within 30 minutes, and the amount given should decrease the loss to less than 15%.

Post-operative

Deficit → This should not be present, except if not properly hydrated during the operation.

Maintenance → Use the rule of 100-50-20 mL/kg/day to calculate maintenance. After 24 hours you can give fluids based on urine output plus 1000 mL for insensible loss.

Ongoing loss → This is the same as above.

Notes:

1. Whenever you need large amounts of crystalloid you can alternatively give colloid.
2. For non-GI and non-peritoneum surgery oral intake for fluids and food can start immediately after the operation is over and the patient can take it.
3. For GI and peritoneum surgery oral fluid intake can start after bowel sounds are positive, and oral food intake can start after patient passes flatus or feces.

4. The 100-50-20 rule means you give 100 mL/kg for the first 10 kg of the patient's weight, 50 mL/kg for the next 10 kg of the patient's weight (i.e. from 11-20 kg), and 20 mL/kg for each remaining kg of the patient's weight.

Example: If a person is 63 kg their maintenance fluid requirement for the next 24 hours is as follows:

- first 10 kg → 100 mL x 10 = 1000 mL
- next 10 kg → 50 mL x 10 = 500 mL
- remaining 43 kg → 20 mL x 43 = 860 mL
- total = 2360 mL over the next 24 hours

5. The 4-2-1 is the same as the 100-50-20 rule but per hour not per 24 hours.

6. Classes of shock (due to hemorrhage) are as follows:

Classification of hemorrhage				
Parameter	Class			
	I	II	III	IV
Blood loss (mL)	<750	750–1500	1500–2000	>2000
Blood loss (%)	<15	15–30	30–40	>40
Heart rate (bpm)	<100	>100	>120	>140
Blood pressure	Normal	Orthostatic	Hypotension	Severe hypotension
CNS symptoms	Normal	Anxious	Confused	Obtunded

bpm = beats per minute; CNS = central nervous system.