

FLUID MANAGEMENT

Introduction

- Maintaining perfusion & normotension
- Excretion of solute load
- Maintain whole body homeostasis

Fluid Balance

INPUT :

- Water intake :1500ml
- Solid food :600ml
- Endogenous :400ml

- Total ~~2500ml

OUTPUT :

- Urine: 1500ml
- Respiration: 500ml
- Feces :100ml
- Insensible :400ml

- Total ~~2500ml

Maintenance of Fluid Balance

- Osmoreceptors
- Hormonal regulation :.

ADH

RAAS

ANP etc.

Fluid Distribution

- 60% of body weight is water.
- Intracellular(400-450 ml/kg)—70%
- Extracellular
 - Interstitial(150-200ml/kg)—20%
 - Intravascular(50-60ml/kg)—10%
- 3rd space fluid (Shires, 1960).

Fluid Distribution Maintenance

- Osmolality $\sim\sim 270-280$ mosmol/kg
 $2x[\text{Na}^+ + \text{K}^+] + \text{Glucose}/18$
 $+ \text{BUN}/2.8$
- Colloid Osmotic Pressure (COP)
(Oncotic Pressure)
Plasma COP ~ 25 mmHg
Interstitial COP ~ 20 mmHg

Maintenance of Fluid (contd.)

- Na-K ATPase Pump
- Capillary Permeability
- STARLING EQUATION
$$Q = K \cdot [(P_c - P_i) - k(\Pi_c - \Pi_i)]$$

Monitoring

- Clinical : Normal parameters
CVP ~ 5 to 10 cm H₂O
Urine output
- Laboratory : Electrolyte balance
Acid – Base balance
Osmolality

TYPES OF FLUIDS

Crystalloids

- Clear & Transparent
- Low molecular weight
- Short plasma $\frac{1}{2}$ life
- 1:3 distribution
- Increase interstitial edema
- Well tolerated in Renal Failure
- Less costly

Colloids

- Translucent
- Larger molecular weight
- Longer plasma $\frac{1}{2}$ life
- 1:1 distribution
- Lesser interstitial edema
- Relative C/I in renal failure
- Costlier
- :anaphylaxis, coagulopathy,

Crystalloids(contd.)

- 5% D (250 mosmol/kg)
- 10%D(510 mosmol/kg)
- Ringer lactate (270 to 280 mosmol/kg)
- 0.9% NS(300 mosmol/kg)
- 3%NS (~1000 mosmol/kg)

Colloids (contd.)

- Hemaccel
- Hetastarch
- Albumin
- Blood & components

Albumin

- Maintains COP
- Drug binding
- Acid base balance
- Free radical scavenging

Albumin controversies

- Initially used as “magic fluid”
- Cochrane study(1998) doubted the validity of albumin use.*
- NO outcome improvement in critically ill
- Role similar to other colloids

* (BMJ1998;317:235-240)

Crystalloids vs. Colloids

WHY COLLOIDS ?

- Lesser volume
- Lesser interstitial edema
- Better tissue oxygenation
- Better wound healing.

CONTROVERSIES

- Capillary permeability altered in critically ill patients.
- NO improved outcome with colloids.
- Colloids more effective in nonseptic & non traumatic patients.*

*(.Surgery1989;105:65-71.)

Fluid Therapy

- Maintenance
- Deficit
- Replacement
- Compensatory volume expansion
(5 to 7 ml/kg)

Maintenance

- **4:2:1 formula**
 - upto 10 kg – 4ml/kg/hr
 - 11—20kg -- 2ml/kg/hr
 - > 20 kg -- 1ml/kg/hr
- Adults usual req. is 2ml/kg/hr.

Fluid Therapy(contd.)

- DEFICIT : due to fasting. Replace over 3hr
- REPLACEMENT: due to loss. To be replaced at the earliest.
- COMPENSATORY VOLUME EXPANSION: due to IPPV & vasodilation. To be replaced in the first hr.

Fluid Therapy (contd.)

- Total Fluid Requirement =
Maintenance + Deficit +
Replacement + Compensatory volume
expansion

GI loss replacement guidelines(per L lost)

Fluid	NS	5%D	KCl	Sod.B i
Saliva	250ml	750ml	20mEq	45mEq
Gastric	250	750	20	---
SI	750	250	5	22
Pancr.	500	500	5	90
Biliary	750	250	5	45

FLUID RESUSCITATION

- Which fluid?
 - <15% loss – Crystalloids 1:3
 - 15-30% loss – Crystalloids (+colloids)
 - > 30% loss -- Colloids+ Blood

(Am. College of Surgeons ATLS manual 1992)

Fluid Challenge(“7-3 Rule”)

- PAWP/CVP(cmH₂O)

<10	<u>Fluid infusion</u> 200ml/10min
10-15	100ml/10min
> 15	50ml/10min
- Response

>7 increase	<u>Therapy</u> Stop
3-7 increase	Wait for 10 min
<3 increase	Continue

50 kg adult with intestinal obstruction for 24 hrs. admitted for emergency surgery. Pt came in shock with no urine output for 12 hrs, 38⁰C tachycardia, BP 80mmHg systolic & CVP of 1 cm H₂O. Gastric aspirate ~1 litre. Pt resuscitated for 2hrs & underwent surgery for 2hrs. Blood loss was 600ml. & peritoneal fluid loss of 2litres. There was no dys-electrolytemia. Write fluid prescription for the patient for the initial 4hrs.

All the best..