ACHIEVING A NEGATIVE FLUID BALANCE by Nick Mark MD

ADVANTAGES OF A NEGATIVE FLUID BALANCE:
• Volume overload is very common in the later (e.g. de-escalation) phases of critical illness.
• Achieving a negative fluid balance is key to liberation from MV, mobility, & ultimate recovery.

INs OUTs

MINIMIZE INs

USE FLUIDS PARSIMONIOUSLY IN RESUSCITATION
Assess fluid responsiveness and/or fluid tolerance prior to boluses (goal directed instead of empiric fluids); examples include VxUS, Lung B-lines, EtCO2, PPV, PAC, NICOM, etc

SWITCH IV TO PO
Earlier IV to PO transitions can limit IV fluids. Antibiotics & electrolytes replacements can be large volumes (>1 L/day)

USE HIGH CONCENTRATION MEDICATIONS
Concentrate medications for CVCs. Vasopressors, abx, & electrolyte replacement can be concentrated (e.g. at ‘maximum’ dose, 16 mg norepinephrine saves 2.1 L/day compared to standard 4 mg conc)

AVOID MAINTENANCE FLUIDS
ICU patients seldom require MIVF to replace insensible losses. MIVF can be a huge fluid load. Even “KVO” infusions can be significant (e.g. 15 ml/hr = 2.7 L/week)

REMOVE UNECESSARY MEDS
Consider removing unnecessary IV meds to limit fluids. (e.g. low dose esmolol gtt can be 750 ml/day)

On rounds, always try to reduce the number of infusion pumps attached to the patient

MAXIMIZE OUTs

BOLUS LOOP DIURETIC
If no response, double the dose
Once an effective dose is found
Schedule more BOLUSES or start DRIP

Start with LOOP DIURETICS which are short acting and rapidly titrated to achieve UOP Furosemide – Start with 20-40 mg IV (diuretic naive), higher doses required in renal failure (dose = 30*Cr) or if on home diuretics (dose = 2x home dose); double dose q2 hrs until response or maximum dose reached (160-200 mg); 5-40 mg/hr (rebolus w/ increases), duration 6-8 hrs Bumetanide – Start with 1 mg, max dose 10 mg; 0.5-2mg/hr, duration 6-8 hrs Torsemide – Start with 10-20 mg, max dose 100-mg; duration 4-6 hrs

Na > 135 or resistant to LOOP diuretic?
Consider THIAZIDE

High Aldo or low K with diuresis?
Add a SPIRONOLACTONE (or ENaC INHIBITOR) to normalize Potassium homeostasis especially in high aldosterone states (CHF, Cirrhosis) Spironolactone – 25-100mg PO daily; ideal furosemide:spironolactone ratio is 20:50 Amiloride – 5-10 mg PO daily

Metabolic alkalosis?
Add ACETAZOLAMIDE to correct a contraction metabolic alkalosis & further augment diuresis.

Acetazolamide – 500 mg IV daily; increase to maximum of 500 mg TID

Consider ACETAZOLAMIDE

Consider ULTRAFILTRATION & RRT

ULTRAFILTRATION is indicated for removal of fluids in volume overloaded patients who are refractory to diuresis.
Timing is controversial. Early nephrology consult may be associated with improved survival in AKI.

Evaluation of a patient with diuretic resistance
R/o compression POCUS exam to look for tense ascites or other etiologies

Exclude obstruction POCUS exam of bladder and kidneys to look for hydronephrosis

Sequential targeting of the nephron with diuretics

SPECIFIC CIRCUMSTANCES

Hypoalbuminemia – use bumetanide over furosemide (less albumin binding)
Cirrhosis – be cautious about over diuresis (risk for hepatorenal sx); use a 50:20 ratio of spironolactone:furosemide; check urine Na/K to evaluate efficacy of diuresis
Nephrotic Sd – 2x doses of loop diuretics