

Recommendations for the difficult fluid resuscitation:

At 12 hours after burn injury, calculate the PROJECTED 24-hour resuscitation if fluid rates are kept constant. If the projected 24-hour resuscitation requirement exceeds 6ml/kg/%TBSA, then the following steps are recommended:

1. Initiate 5% albumin (25gm/L) early as described previously in *Emergency War Surgery Handbook*.
2. Check bladder pressures every 4 hours.
3. If UOP <30ml/hr, strongly consider the placement of a PA catheter to guide resuscitation with specific PCWP and SvO₂ goals. (Goal PCWP 10-12, SvO₂ 65-70%). If PA catheter placement is not practical then consider monitoring CVP from a subclavian or IJ along with central venous saturations (goal CVP 8-10, ScvO₂ 60-65%).
 - a. If CVP or PCWP not at goal then increase fluid rate.
 - b. If CVP or PCWP at goal then consider levophed to augment mean arterial pressure (and thus UOP) or dobutamine 5mcg/kg/min (titrate until SvO₂ or ScvO₂ at goal). Max dose of dobutamine is 20mcg/kg/min.
 - c. If both CVP or PCWP and SvO₂ or ScvO₂ at goal, then stop increasing fluids (even if UOP<30ml/hr). The patient should be considered hemodynamically optimized and the oliguria is likely a result of established renal insult. Some degree of renal failure should be tolerated and expected. Continued increases in fluid administration despite optimal hemodynamic parameters will only result in "resuscitation morbidity," that is oftentimes more detrimental than renal failure.
4. If the patient becomes hypotensive along with oliguria (UOP <30ml/hr), then follow the hypotension guidelines.
5. Every attempt should be made to minimize fluid administration while maintaining organ perfusion. If UOP >50ml/hr, then decrease the fluid rate by 20%.

After 24 hours, infusion of LR should be titrated down to maintenance levels and albumin continued until the 48 hour mark.

Hypotension Guidelines:

The optimal minimum blood pressure for burn patients must be individualized. Some patients will maintain adequate organ perfusion (and thus have adequate UOP) at MAP's lower than 70. True hypotension must be correlated with UOP. If a MAP (generally <55mmHg) is not adequate to maintain the UOP goal of at least 30ml/hr, then the following steps are recommended:

1. Start with Vasopressin 0.04 units/min drip (do not titrate)
2. Monitor CVP (goal 8-10)
3. If CVP not at goal, then increase fluid rate
4. If CVP at goal, then add Levophed 2-20mcg/min
5. If additional pressors are needed, consider the placement of a PA catheter to guide resuscitation with specific PCWP and SvO₂ goals. (goal PCWP 10-12, SvO₂ 65-70%). These patients may be volume depleted but a missed injury should be suspected.
 - a. If PCWP not at goal, then increase fluid rate.

- b. If PCWP at goal, then consider dobutamine 5mcg/kg/min (titrate until SvO₂ at goal).
Max dose of dobutamine is 20mcg/kg/min.
 - c. If hypotension persists, look for missed injury.
 - d. Consider adding epinephrine or neosynephrine as a last resort.
6. If the patient is exhibiting catecholamine-resistant shock, consider the following diagnoses:
- a. Missed injury and ongoing blood loss.
 - b. Acidemia. If pH<7.20, then adjust ventilator settings to optimize ventilation (target PCO₂ 30-35). If, despite optimal ventilation, patient still has a pH<7.2, consider bicarb administration.
 - c. Adrenal insufficiency. Check a random cortisol and start hydrocortisone 100mg every 8 hours.
 - d. Hypocalcemia. Maintain ionized calcium >1.1.

Contraindicated in patients with a history of MI in the past 6 months, acute MI or active ischemic changes.