







## ICU Fluid Resuscitation and Monitoring for Adult Patients with Severe Burns

**UPDATED 2018** 

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Monitoring	General Management		Initial Goals
☐ Intravascular arterial blood pressure	☐ HOB ≥ 30°		☐ Urine output minimum 30ml/h maximum 50ml/h
☐ CVC (preferably supradiaphragmatic)	☐ Gastric prophylaxis		☐ Temperature ≥ 37°C
☐ ScvO <sub>2</sub> q3h X 24h then R/A	□ DVT prophylaxis		☐ MAP ≥ 65mmHg
☐ CVP as per ICU protocols	☐ Burn dressings as per Plastic Surgery		$\square$ ScvO <sub>2</sub> $\geq$ 70%
☐ Lactate q3h X 24-72h	☐ Elevate all burned body parts when possible		☐ Lactate ≤ 4mmol/L
☐ ABGs as per ICU protocols	☐ Start uninterrupted enteric feeds as early as possible (as per Dietitian) unless legitimate concern of splanchnic hypoperfusion or abdominal compartment syndrome		☐ Hgb ≥ 70g/L
☐ Bladder pressures q6h from 12-72h post burn			$\square$ Plt $\geq$ 50 (Actively bleeding or imminently going to OR)
☐ Increase frequency if pressures ≥ 15mmHg	<ul> <li>□ Fecal containment system for perineal burns as directed by ICU or Burn physician</li> <li>□ Attempt to minimize opioid infusion administration and utilize prn opioids as soon as feasible</li> </ul>		□ INR $\leq$ 1.5 (Actively bleeding or imminently going to OR)
☐ For facial burns or inhalational injury: - Consult Ophthalmology - Consider Bronchoscopy (if suspicion of inhalational injury)			
Initial Fluid Resuscitation	utilize prii opiolas as sc	Recommendations for Hypotens	ion
STEP 1 Calculate initial 24h resuscitation fluid requirements = $(3ml of Ringers Lactate)(kg)$ (% TBSA from Plastics consult) / 24h. ½ of this IVF is administered in the first 8 hours (post burn) and the second ½ is delivered in the remaining 16 hours.		True hypotension MUST BE correlated with urine output.	
		If MAP is consistently $\leq$ 65mmHg and there is evidence of poor end-organ perfusion (urine output $\leq$ 30ml/hr, lactate $\geq$ 4mmol/L, ScvO <sub>2</sub> $\leq$ 70%) the following steps are recommended:	
STEP 2 Determine the administered pre-hospital IVF volume, subtract this from your above calculation, and adjust your treatment appropriately.		<ul> <li>I) Volume Status: If CVP ≤ 5mmHg or pulse pressure variation ≥ 15mmHg and patient is not breathing spontaneously, administer a fluid bolus of 0.5-1L RL in attempt to improve MAP (it is UNCOMMON to achieve CVP goals of 10-12mmHg in severe burn patients).</li> <li>II) Vasopressors: If MAP is persistently ≤ 65mmHg initiate Levophed at 1-20 ug/min to maintain MAP ≥ 65mmHg (massive burn patients commonly require Levophed 1-5 ug/min due to extensive vasodilatory shock secondary to the massive systemic inflammatory response associated with severe burns).</li> </ul>	
Monitor urine output hourly and decrease or increase the RL infusion by 20% to maintain urine output between 30-50ml/hr (50-100ml/hr for high-voltage electrical burns). Avoid boluses if possible. NOTE: Hour to hour fluid resuscitation is critical, particularly during first 24 hours. OVER-RESUSCITATION IS AS HARMFUL AS UNDER-RESUSCITATION.			
STEP 4 If urine output is ≤ 15ml/hr for two or more consecutive hours despite increasing fluid rate OR patient requires twice current calculated rate for more than two hours: CALL ICU FELLOW OR ATTENDING, flush urinary catheter, assess breath sounds and bladder pressure. Consider initiating 5% albumin infusion at 1/3 of current resuscitation rate and make up the remainder of rate with RL. Titrate rate as above based on urine output.		III) MAP Goal: If persistently requiring levophed (1-5ug/min) consider a MAP goal of $\geq$ 55mmHg as long as urine output $\geq$ 30ml/hr, ScvO <sub>2</sub> $\geq$ 70% and lactate $\leq$ 4mmol/L.	
		IV) Ca <sup>2+</sup> and Cortisol (discuss with ICU fellow/attending before initiation of treatment) If patient exhibits catecholamine-resistant shock (defined as SBP ≤ 90mmHg after 1 hour of aggressive IVF and vasopressor administration), consider adrenal insufficiency (check a random cortisol and start hydrocortisone 100mg IV q8h) or hypocalcaemia (maintain ionized calcium ≥ 1.1 mmol/L). (1-5)	
At 12 hours post-burn, calculate the PROJECTED 24 hour resuscitation if fluid rates are kept constant. If the projected 24 hour resuscitation requirement exceeds 6ml/kg/% TBSA burn or 350ml/kg total, the following steps are recommended:  I) Initiate 5% albumin infusion at 1/3 of current resuscitation rate and make up the remainder of rate with RL. Titrate infusion to urine output as described above. After 24 hours post burn, titrate infusion down to maintenance and continue albumin until 48 hours post burn.  II) Watch for signs of Intra-Abdominal Hypertension (bladder pressure ≥ 15mmHg, increased airway pressures, decreased urine output, hypotension) and extremity compartment syndromes (absent doppler signal or pulses that are diminishing on serial exams q30-60 minutes should prompt consideration of escharotomy)			
		<ol> <li>Azzopardi EA, Mcwilliams B, Iyer S, Whitaker IS. Fluid resuscitation in adults with severe burns at risk of secondary abdominal compartment syndrome—An evidence based systematic review. Burns. 2009 Nov 1;35(7):911-20.</li> <li>Ennis JL, Chung KK, Renz EM, Barillo DJ, Albrecht MC, Jones JA, et al. Joint Theater Trauma System implementation of burn resuscitation guidelines improves outcomes in severely burned military casualties. J Trauma. 2008 Feb 1;64(2 Suppl):S146-51; discussion SS1-2.</li> <li>Latenser BA. Critical care of the burn patient: the first 48 hours. Critical Care Medicine. 2009 Oct 1;37(10):2819-26.</li> <li>Saffle JIL. The phenomenon of "fluid creep" in acute burn resuscitation. J Burn Care Res. 2007 Jan 1;28(3):382-95.</li> <li>Cartotto R, Zhou A. Fluid creep: the pendulum hasn't swung back yet! J Burn Care Res. 2010 Jan 1;31(4):551-8.</li> </ol>	