

Clinical Standardization

Burn Center Fluid Resuscitation, Inpatient

Updated: June 6, 2024

Clinical algorithms:

1. Burn Center Fluid Resuscitation Algorithm: Adults and Peds > 14 yo (>30 kg)

For TBSA greater than 20% or TBSA 15% with Inhalation Injury

ABA Adjusted Fluid Rate: 2 mL LR x wt (kg) x TBSA% = Total volume for 24hrs.

 (Consider 3-4 cc/kg if large percentage of 3rd degree burns or significant inhalation injury)

Pts admit weight _____kg

Total volume per Protocol = _____ml

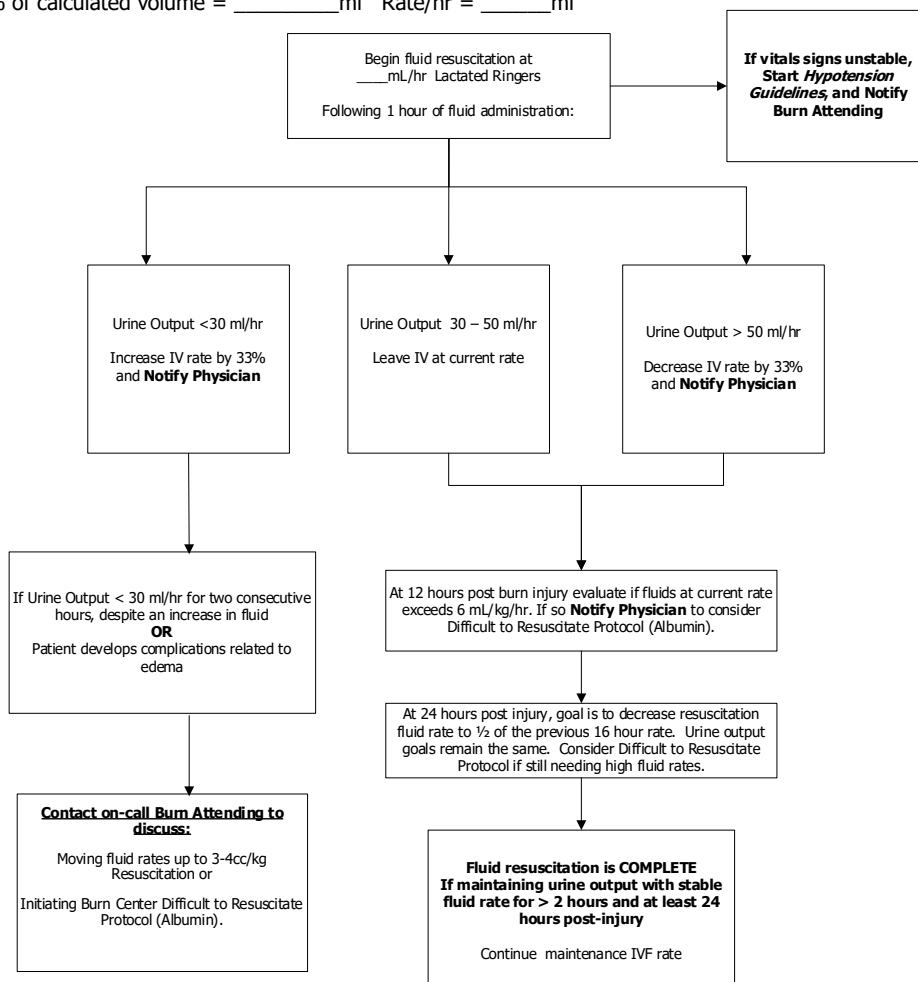
First 8 hour volume starts from time of injury.

Must subtract all pre-hospital volume given from First 8 hr total.

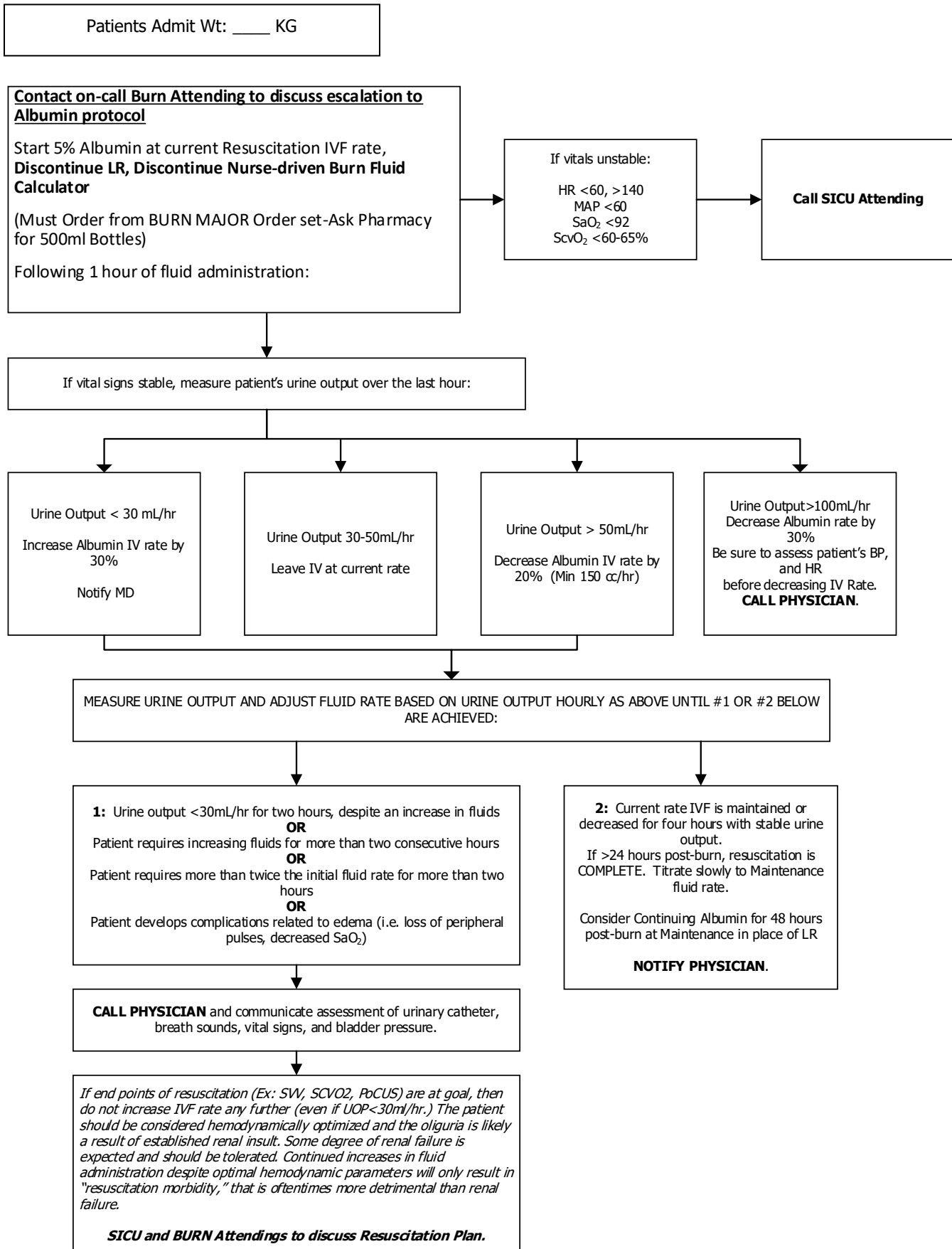
Total pre-hospital fluids _____ml

First 8 hr = 50% of calculated volume = _____ml Rate/hr = _____ml

Last 16 hrs = 50% of calculated volume = _____ml Rate/hr = _____ml



2. Adult Burn Center Difficult to Resuscitate (Albumin Algorithm)



3. Pediatric Burn Center Fluid Resuscitation Algorithm: Age < 14 or <30kg

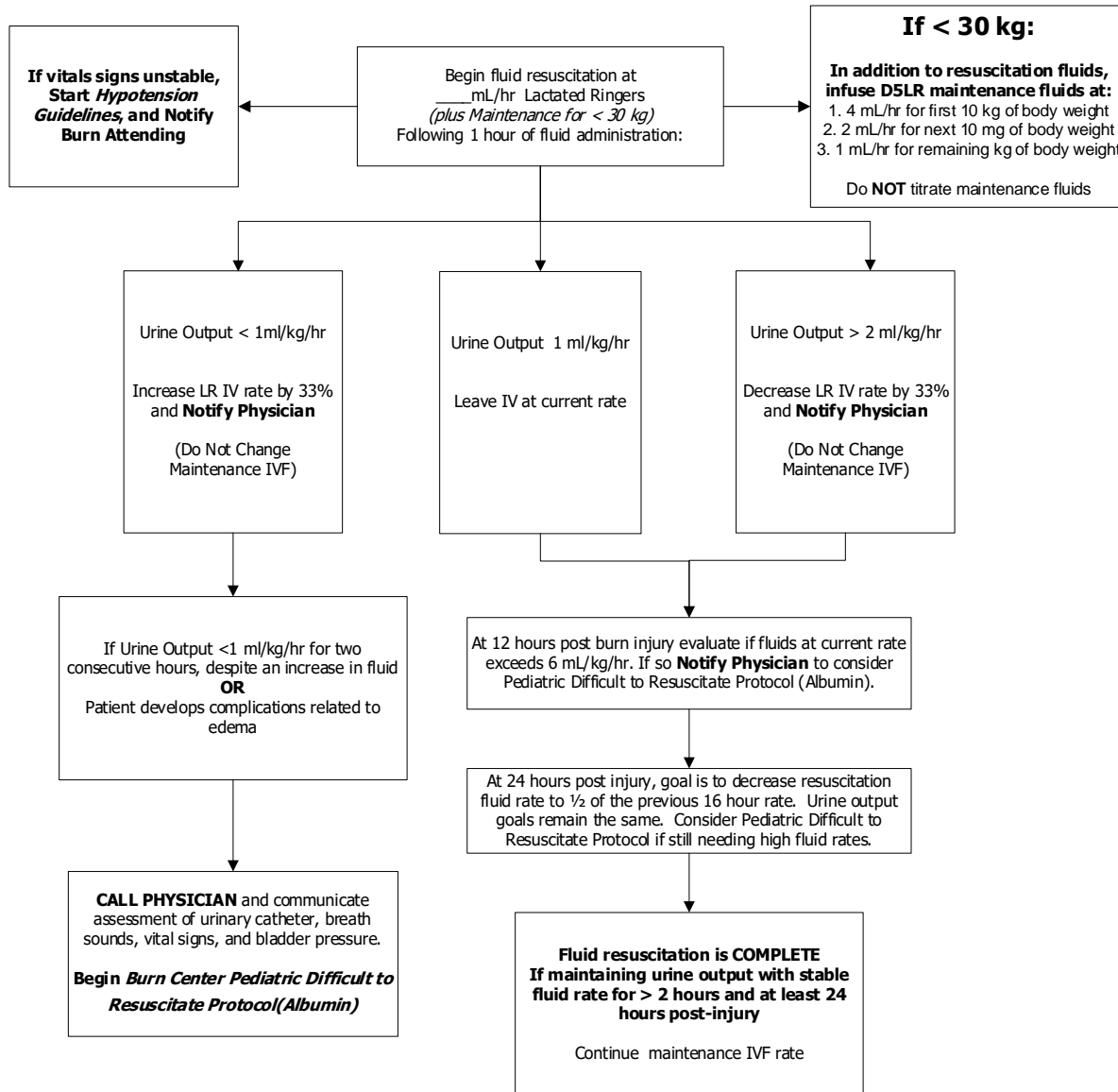
For TBSA greater than 15%. Pts admit weight _____kg
Parkland Protocol: 3 mL LR x wt (kg) x TBSA% = Total volume for 24hrs.
 Total volume per Parkland Protocol = _____ml
 First 8 hour volume starts from time of injury.
Must subtract all pre-hospital volume given from First 8 hr total.

Total pre-hospital fluids _____ml

First 8 hr = 50% of calculated volume = _____ml Rate/hr = _____ml
 Last 16 hrs = 50% of calculated volume = _____ml Rate/hr = _____ml

Example Fluid Calculation:

Child is 20 kg with 30% TBSA thermal burns.
 3ml LR x 20 x 30 = 1800 ml LR
 1800/2 = 900 in 1st 8 hrs and 900 in remaining 16 hours.
 1st 8 hours = 113 ml LR/hr
 Final 16 hours = 56 ml LR/hr
 *subtract pre-hospital fluids from first 8 hour total



Clinical pathway summary

CLINICAL PATHWAY NAME: Burn Center Fluid Resuscitation

PATIENT POPULATION AND DIAGNOSIS: Adult and Pediatric Burn Patients

APPLICABLE TO: Butterworth and Helen DeVos Children's Hospital

BRIEF DESCRIPTION: This guideline presents a standardized approach of best practice for fluid resuscitation in an acutely burned patient. Fluid resuscitation is foundational to early management of the burn injured patient.

LAST REVISED: January 2023

Clinical pathways clinical approach

TREATMENT AND MANAGEMENT:

1. Definitions

Burn Shock: defined as hypovolemic shock and cellular shock with hemodynamic challenges characterized by decreased cardiac output, increased extracellular fluid, decreased plasma volume, and oliguria. Burn shock that is not managed adequately may lead to further complications of ARDS, renal failure and abdominal compartment syndrome.

2. Guideline Contents

The primary goal of resuscitation in the inflammatory phase of a burn is to restore and preserve adequate tissue perfusion and maximize organ function with the least amount of physiologic complications. The patient experiences changes in microvasculature caused by a profound inflammatory response to the burn injury. This is often referred to as capillary permeability and is characterized by a disruption in the balance of fluid between the intravascular space and the interstitial compartment. There are multiple methods to accomplish adequate perfusion and they must be approached systematically.

Primarily a crystalloid solution, specifically Lactated Ringers, is administered intravenously to replace fluid that is lost from the intravascular space. **See Algorithm 1: Adult Burn Center Fluid Resuscitation.**

The secondary approach, determined by failure of the primary approach to achieve adequate resuscitation, includes a colloid solution in addition to the crystalloid. **See Algorithm 2: Adult Burn Center Difficult to Resuscitate.**

Finally, there may be times during the process of resuscitation where the attempted methods do not sustain vitals and there will be a need to review hypotension guidelines for guidance. **See Hypotension Guidelines below.**

3. Parkland Protocol

Parkland Protocol = $2(\text{mL}) \times \text{wt}(\text{kg}) \times \text{TBSA}\%$ = Total volume for 24hrs.

"First 8 hour volume" starts from time of injury

Must subtract all pre-hospital volume given from "First 8 hour" total

Pts admit weight: _____ kg

Total pre-hospital fluids: _____ mL

Total volume per Parkland Protocol = _____ mL

First 8 hr = 50% of calculated volume = _____ mL Rate/hr = _____ mL/hr

Last 16 hr = 50% of calculated volume = _____ mL Rate/hr = _____ mL/hr

4. Hypotension Guidelines for Fluid Resuscitation

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

1. Contact SICU Attending
2. Start with Vasopressin 0.04 units/min IV (do not titrate)
3. Monitor CVP (goal 8-10) or SVV (<13) or ScvO₂ (60-65%)
4. If the CVP/SVV/ScvO₂ is not at goal, increase fluid rate by 33%
5. If the CVP/SVV/ScvO₂ is at goal, then add norepinephrine IV 0.01 mcg/kg/min and titrate to effect. (Maximum dose 0.2 mcg/kg/min)
6. If additional vasopressors are needed, consider the placement of a PA catheter to guide resuscitation with specific PCWP and ScvO₂ goals (goal PCWP 10-12, ScvO₂ 60-65%.) These patients may be volume depleted but a missed injury should be suspected.
 - a. If PCWP/ ScvO₂ is not at goal, increase IVF rate by 33%
 - b. If PCWP/ ScvO₂ is at goal, consider dobutamine 5mcg/kg/min and titrate until ScvO₂ reaches goal. (Max dose of dobutamine: 20mcg/kg/min)
 - c. If hypotension persists, assess for missed injury.
 - d. Consider adding epinephrine or neosynephrine as a last resort.
7. If the patient is exhibiting catecholamine-resistant shock, consider the following diagnoses:
 - a. Missed injury and ongoing blood loss.
 - b. *Acidemia*. If pH is less than 7.2, then adjust ventilator settings to optimize ventilation (target PCO₂ 30-35.) If, despite optimal ventilation, patient still has a pH less than 7.2, consider bicarbonate administration.
 - c. *Adrenal insufficiency*. Check a random cortisol level and start hydrocortisone 100mg every 8 hours.
 - d. *Hypocalcemia*. Maintain ionized calcium greater than 1.1

Note: Hypotension Guidelines are contraindicated in patients with a history of MI in the past 6 months, acute MI or active ischemic changes

Pathway information

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EXPERT IMPROVEMENT TEAM (EIT): Burn Quality

CLINICAL PRACTICE COUNCIL (CPC): Acute Health

CPC APPROVAL DATE: February 7, 2023

OTHER TEAM(S) IMPACTED: Cardiology, Critical Care, Emergency Services, Medical Specialties

References

Cochran, A., Morris, SE., Edelman, LS., Saffle JR. Burn patient characteristics and outcomes following resuscitation with albumin. *Burns* 2007; 33:25-30

Gibran, N. American Burn Association Consensus Statements: Burn Resuscitation (p.368) *DOI: 10.1097/BCR.0b013e31828cb249*

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