

# Care of Burns in Scotland

National Managed Clinical Network

## Adult Guideline

# Fluid Resuscitation

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### NOTE

This guideline is not intended to be construed or to serve as a standard of care. Standards of care are determined on the basis of all clinical data available for an individual case and are subject to change as scientific knowledge and technology advance and patterns of care evolve. Adherence to guideline recommendations will not ensure a successful outcome in every case, nor should they be construed as including all proper methods of care or excluding other acceptable methods of care aimed at the same results. The ultimate judgement must be made by the appropriate healthcare professional(s) responsible for clinical decisions regarding a particular clinical procedure or treatment plan. This judgement should only be arrived at following discussion of the options with the patient, covering the diagnostic and treatment choices available. It is advised, however, that significant departures from the national guideline or any local guidelines derived from it should be fully documented in the patient's case notes at the time the relevant decision is taken.

## Fluid resuscitation in adults

### Summary

Fluid resuscitation for adults with burns is indicated for patients with greater than 15% burns. Patients with smaller burns will need fluid resuscitation if they also have smoke inhalation, co-morbidities, hypotension or other reasons for a fluid deficit.

**Strong recommendation:** Normal saline, hypertonic saline and albumin should not routinely be used for adult burn resuscitation in Scottish Burns Units.

**Recommendation:** Fluid resuscitation should be with Compound Ringer Lactate solution.

**Recommendation:** The initial resuscitation plan for major burns in adult in Scotland should be based on the Parkland formula.

**Recommendation:** Fluid requirements should be calculated according to actual body weight.

**Recommendation:** Urine output ranges should use ideal body weight.

**Strong recommendation:** Baseline fluids will also be required and should be partially or entirely given as enteral feeding.

**Recommendation:** An hourly urine volume between 0.25 and 0.5 ml/kg (ideal body weight) should be managed with a fluid challenge of 250 mls. A urine volume less than 0.25 (ideal body weight) should be managed with a fluid challenge of 500 mls.

**Recommendation:** Low urine volumes for over 2 hours which have not responded to fluid challenges merit urgent re-evaluation of the patient

**Recommendation:** If hourly urine volume is between 1-2ml/kg (ideal body weight) reduce resuscitation fluid rate by 50ml/hr

**Recommendation:** If hourly urine volume is more than 2ml/kg (ideal body weight) reduce resuscitation fluid rate by 100ml/hr

Detail of these recommendations can be found in the following pages

## Recommendations

Recommendations are based on the GRADE system.

Strong recommendations are unlikely to be changed by new research. Recommendations are consistent with current evidence.

Fluids used for burns resuscitation vary throughout the world and vary within countries between institutions. Whilst there is no clear research demonstrating superior outcomes in head to head comparisons in burns patients there are some clear principles which should be followed. Fluids with high sodium content (such as older albumin preparations and normal saline) are known to be associated with hypernatraemia, hyperchloraemia and metabolic acidosis which has potential deleterious effects. The use of albumin solutions for resuscitation has not shown to be beneficial.

**Strong recommendation: Normal saline, hypertonic saline and albumin should not routinely be used for adult burn resuscitation in Scottish Burns Units.**

Basis for this recommendation:

- 2011 Cochrane review. Roberts I, Blackhall K, Alderson P, Bunn F, Schierhout G. Human albumin solution for resuscitation and volume expansion in critically ill patients. Cochrane Database of Systematic Reviews 2011, Issue 11. Art. No.: CD001208. DOI:10.1002/14651858.CD001208.pub4.

Balanced salt solutions, with lower concentrations of sodium and chloride are more suitable for resuscitation as they are less likely to be associated with hyperchloraemic acidosis. As no head to head comparisons show improved outcomes with acetate solutions compared to the lactate based solutions, at present Compound Ringer Lactate solution is preferred. (agreed at COBIS conference 2013)

**Recommendation: Fluid resuscitation should be with Compound Ringer Lactate solution.**

Basis for this recommendation:

- Waters JH, Gottlieb A, Schoenwald P, et al. Normal saline versus lactated Ringer's solution for intraoperative fluid management in patients undergoing abdominal aortic aneurysm repair: an outcome study. Anesth Analg 2001; 93: 817–22

Under resuscitation of burns patients is associated with organ failure, over resuscitation is associated with oedema, including pulmonary oedema and abdominal compartment syndrome. The majority of published protocols for burns resuscitation aim for 2-4 ml/%BSA burn in the first 24 hours. The most widely used protocol is the Parkland Formula. In the absence of evidence of superiority of any other regimen and the widespread knowledge of this formula this is the preferred protocol in Scotland. This is:

Actual body weight (in Kg) X Body surface area burned (as a %) X 4

...this gives the volume of resuscitation fluid in mls to be given in the first 24 hours, half of which should be given in the first 8 hours, half in the second 16 hours.

This can be also calculated as an initial fluid hourly rate of:

Actual body weight (in Kg) X Body surface area burned (as a %) X 1/4

After 8 hours this would become:

Actual body weight (in Kg) X Body surface area burned (as a %) X 1/8

**Recommendation:** The initial resuscitation plan for major burns in adults in Scotland should be based on the Parkland formula.

Basis for this recommendation:

- Familiarity with this formula.

The fluid administered for resuscitation does not include base line fluids or fluids to make up for any other losses. Therefore fluids will be required to match these requirements This should include enteral nutrition as soon as possible.

**Recommendation:** Fluid requirements should be calculated according to actual body weight.

Basis for this recommendation:

- The actual area burned will be larger for a given percentage in larger patients

**Recommendation:** Urine output ranges should use ideal body weight.

Basis for this recommendation:

- The production of creatinine is related to muscle mass and not related to amount of adipose tissue

**Strong recommendation:** Baseline fluids will also be required and should be partially or entirely given as enteral feeding.

Basis for this recommendation:

- Rodriguez N.A., Jeschke M.G., Williams F.N., Kamolz L.P., Herndon D.N. Nutrition in burns Galveston contributions. JPEN J. Parenter. Enteral Nutr. 2011;35:704–714.

Formula are good initial guides but are at best imprecise estimates of actual fluid requirements. Therefore hourly urine volumes should be measured to provide evidence for continued over or under resuscitation. A target of 0.5-1.0ml/kg (ideal body weight) is an accepted range of urine volumes indication adequate resuscitation. A low hourly urine volume should be followed by a clinical evaluation and a fluid challenge. A very low urine volume should be managed with a larger fluid challenge.

**Recommendation:** An hourly urine volume between 0.25 and 0.5 ml/kg (ideal body weight) should be managed with a fluid challenge of 250 mls over a maximum of 15 mins. A urine volume less than 0.25 (ideal body weight) should be managed with a fluid challenge of 500 mls over a max of 30 mins.

Basis for this recommendation:

- Standard teaching and current practice is to give fluid challenge in presence of oliguria.
- Volumes of 250 and 500mls are normal practice and convenient as fluid is stored in 500ml and 1000 ml bags.

Persistent low urine volumes may be due to other problems, including blocked catheters, sepsis and intra-abdominal compartment syndrome. If low urine volumes persist despite 2 fluid challenges, a further clinical review is required and this should include laboratory investigations and measurement of bladder pressure. A bladder pressure over 12mmHg is of concern pressure over 20mmHg is a medical emergency and expert assistance should be sought.

**Recommendation:** Low urine volumes for over 2 hours which have not responded to fluid challenges merit urgent re-evaluation of the patient

- Andrew W. Kirkpatrick, Derek J. Roberts, Jan De Waele, et al Intra-abdominal hypertension and the abdominal compartment syndrome: updated consensus definitions and clinical practice guidelines from the World Society of the Abdominal Compartment Syndrome. Intensive Care Medicine. July 2013, Volume 39, Issue 7, pp 1190-1206,

Fluid overload is a major concern as there are many potential consequences. Urine volumes in excess of the target range should be flowed by a reduction in the amount of prescribed fluid.

**Recommendation:** If hourly urine volume is between 1-2ml/kg (ideal body weight) reduce resuscitation fluid rate by 50ml/hr

**Recommendation:** If hourly urine volume is more than 2ml/kg (ideal body weight) reduce resuscitation fluid rate by 100ml/hr

Basis for this recommendation:

- Volumes are easy to calculate
- Klein MB, Hayden D, Elson C, Nathens AB, Gamelli RL, Gibran NS, et al.: The association between fluid administration and outcome following major burn: A multicenterstudy. Ann Surg 2007, 245(4):622-628.