Paramedic - Evidence Based Medicine (P-EBP) Program
Paramedic CAT (Critically Appraised Topic)

Title: Prehospital Utilization of the Parkland Burn Formula

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Clinical Scenario:
Paramedics arrive at a 25 year old male with significant burns to the head, chest, abdomen and left arm; the result of a small explosion which happened 20 minutes prior. In an effort to provide adequate fluid resuscitation to mitigate the effects of burn shock within the first 24 hours, they implement the Parkland Burn formula. This formula is intended to restore and maintain adequate tissue perfusion and ensure cardiac output while preventing burn shock and subsequent mortality.

PICO (Population-Intervention-Comparison-Outcome) Question:
In prehospital burn patients, does implementing the Parkland Burn Formula prehospitally compared with standard IV fluid bolusing attenuate burn shock and subsequent mortality.

Search Strategy: (prehospital OR paramedic OR EMT OR EMS OR ambulance) AND (Parkland Burn Formula OR Baxter Formula OR fluid resuscitation OR burn)

Search Outcome: 948 results

Relevant Papers:

Author, Date	Population: Sample Characteristics	Design (LOE)	Outcomes	Results	Strengths/ Weaknesses
Chung. K 2009	Adult burn patients with >20% TBSA burned	Retrospective Randomized Control Groups LOE I	To determine adequacy of the Modified Brooke vs Parkland Burn formulas in the first 24 hours of the burn treatment regime	18% mortality rate in Modified Brooke group vs. 14% mortality rate in Parkland group	- Fewer patients treated with Parkland Burn Formula (21) vs Modified Brookes formula (31) - Small population size (52 total) with lack of diversity (51 males, 1 female) + No significant difference in age, %TBSA burned, injury, weight or inhalation
Holm. C et al, 2004	Adult burn patients with	Prospective observational	To determine the adequacy	40% mortality rate in Baxter	+ Treatments consistent with the

	>20% TBSA burned	with a control group LOE I	of Baxter's Formula in the burn treatment regime	group vs. 32% mortality rate in invasive haemodynamic monitoring group (32%)	exception of fluid admin - Small population (50 patients) - Vastly inconsistent burn sample sizes (20-81% TBSA, 50% inhalation, 50% non-inhalation)

Comments:

- Both Parkland and Baxter are synonymous for the formula:
  4ml X TBSA Burned (%) x Patient's Weight (kg) = Total Fluid to be administered over first 24 hours after burn
- Urinary output is a determining factor in the adequacy and favourable outcome for all formulas in both studies
- Patients with inhalation injuries require more fluid resuscitation as a rule than patients without inhalation injuries
- Complications directly related to edema accentuated by fluid resuscitation efforts include the abdominal compartment syndrome, required fasciotomies of unburned extremities, pulmonary edema and prolongation of mechanical ventilation. Failure to correct hypovolemia, however, decreases cardiac output and tissue perfusion, resulting in mortality.

Consider: Why would you NOT change practice, based on this article?

It is difficult to determine the impact of prehospital fluid resuscitation for burn treatment management as there are few studies that address the prehospital aspect at all. This, alongside of the consistently small population sizes and varied TBSA % burned, as well as the inhalation vs non-inhalation aspect make it difficult to determine which formulas are best utilized in-hospital, let alone prehospitally. All studies determine that there is a definite need for aggressive fluid resuscitation within the first 48 hours in order to mitigate the effects of burn shock and maintain tissue perfusion and cardiac output, but paradoxically "fluid begets fluid" and the more fluid the patient receives, the more complications he/she experiences from subsequent peripheral and pulmonary edema. Due to the available evidence I cannot support one burn treatment fluid resuscitation formula more than another; I can only assert that aggressive fluid administration must be administered within the first 24 - 48 hours, as renal perfusion and cardiac output are significant determining factors in mortality, regardless of the complications from edema.

Clinical Bottom Line:

Although some form of fluid resuscitation is necessary in the prevention and treatment of burn shock and subsequent mortality, there is not enough quality evidence to determine which formula is superlative in consistently achieving this goal.

References:

Kevin K Chung, MD; Steven E. Wolf, MD; Leopoldo C. Cancio, MD; Ricardo Alvarado, MD; John A. Jones, BS, BBA; Jeffery McCorcle, PA; Booker T. King, MD; David J. Barillo, MD; Evan M. Renz, MD; Lorne H. Blackbourne, MD. (2009) Resuscitation of Severely Burned Military Casualties: Fluid Begets More Fluid, *J Trauma,* 67: 231–237)

C. Holm, M. Mayr, J. Tegeler, F. Horbrand, G. Henckle von Donnersmarck, W. Muhlbauher, U. J. Pfeiffer. (2004) A clinical randomized study on the effects of invasive monitoring on burn shock resuscitation, *Elsevier*, 798 - 807.