Correlation of Hypothermia and Cytokines in Burned Patients

M. Chacón-Gómez, MD MSc, F. Martínez, MD Dc
Instituto Nacional de Rehabilitación, Luis Guillermo Ibarra Ibarra, México

Introduction: Burns are the most common skin lesion; they generate a local or systemic inflammatory response according to their depth and/or their burned body surface, burning agent, age and/or comorbidities¹; causing an increase in body temperature within the first 24 to 48 hours².

The burned population with hypothermia³⁻⁴, despite physical control before or during their hospital stay, is related to their burn body surface⁵⁻⁶ or alterations in the balance of gain and loss of heat². It has been observed that patients with hypothermia are associated with increased morbidity and mortality⁷⁻¹¹ and no levels of proinflammatory and anti-inflammatory cytokines are known in hypothermic burned patients and their possible relationship.

CYTOKINE CONCENTRATION IN HEALTHY POPULATION AND BURNED PATIENTS			
INTERLEUKIN	HEALTHY POPULATION ¹²		BURNED ¹³⁻¹⁵ Temperature Unknown
	CONCENTRATION (pg/dl)	CHARACTERISTICS	CONCENTRATION (pg/dl)
IL-1α	1.4	INDETECTABLE	15-70
IL-2	9.4 -15.4	NO VARIATION	1 - 8
IL-10	9.5 – 16.7		10 - 45
IL-6	5 - 20	↑ TEENAGERS	100 - 300
TNF-α	20 - 65		3 - 8
INF-γ	90 - 200		7 - 30

Methods: Study authorized by the research committee of the INRLGII in April 2014 and has informed consent for its execution.

Prospective study from April 2014 to December 2015, to determine the concentration of cytokines in a group of burned patients admitted to a Center for Specialized Care for Burn with hypothermia. Inclusion criteria: 15% to 60% of TBSA, gender indistinct, zero to 75 years old; hypothermia (temperature ≤ 36.5 degrees) during admission or hospital stay. Exclusion: septic patients.

Determination of serum cytokines was performed in each patient, from the serum frozen at one time by a single operator, by quantitative immunoassay method for IL-6, IL-10, IL-2, INF-γ, IL1-α and TNF. Statistical analysis was performed using descriptive statistics analysis (ANOVA) and Spearman correlation.

Results: A group of 10/18 patients (n = 10) were studied; gender distribution was 40% (n = 4) for females and 60% (n = 6) for the male. Age range was 1-60 years, mean 27 years; 30% of the population was pediatric population ≤ 18 years; and 70% adult population. 70% burn direct fire and 30% scald. TBSA between 15 to 60% with an average of 36.3%. Nine patients survived (90%), one patient died (10%) during the study period. Temperatures range during their hospital stay was 33 to 38.9°C, with an average of 36.03°C. ANOVA analysis significance of $p \leq 0.001$.

1. Shankar. Inflammation and Sepsis: Past, Present and Future. Journal Burn Care and Research. 2007
2. Childs. Fever in burned children. Burns 1988 (14), 1: 1-6
3. Bravo Brañas E. Hypothermia and burns: A meta - analysis. Annals of Burns and Fire Disaster. 2003, (2), 16
4. Greenhalgh D. American Burn Association. Consensus conference to define Sepsis and infection in burn victims. JBCR
5. Adam J. Singer. The Association between hypothermia, prehospital cooling, and mortality in burn victims. Academic Emergency Medicine 2010, 17: 456-459
6. American Burn Association. Initial Assessment and Management. ABLS Provider Manual 2011
7. Shiozaki T. Recovery from postoperative hypothermia predicts survival in extensively burned patients. Am Jour of Surg 1993- 165(3) 2326-330
8. Shiozaki T. Low oxygen extraction despite high oxygen delivery causes low oxygen consumption in patients with burns recovering slowly from operative hypothermia. Surgery 1995. 118(1) 44-48
9. Hostler D. Admission Temperature and Survival in Patients Admitted to Burn Centers. J Burn Care and Research 2013. 34(5) 498-506
10. Mann-Salinas EA. Novel predictors of sepsis outperform the American Burn Association sepsis criteria in the burn intensive care unit patient. J Burn Care and Research 2013.34 (1)31-43

Spearman correlation: gender relate to the agent that burns the skin; day taken with levels of IL-10; IL-10 with IL-2 and IL-6; IL-6 with INF-γ and IL-2 with INF-γ in the study two-tailed $p \leq$ significance of $p \leq 0.5$ and 0.1.

The deceased patient showed higher levels of IL-6 and IL-10 compared to the rest of the population, as well as lower levels of temperature as the rest of the population; Burn extension of 20%*.

STUDY POBLATION n=10		
DISTRIBUTION		MEDIA
GENDER	MALE 60% (N=6)	
	FEMALE 40% (N=4)	
AGE	1 A 60 YEARS	27 YEARS
ADULT/PEDIATRIC	ADULT 70% (N=7)	
	PEDIATRIC 30% (N=3)	
FIRE/SCALD	FIRE 70% (N=7)	
	SCALD 30% (N=3)	
TBSA	15 TO 65%	36.8%
TEMPERATURE	33 TO 38.9°C	36.03°C
LIVE/DEATH	LIVE 90% (N=9)	
	DEATH 10% (N=1) *	

TEMPERATURE	INTERLEUKINE	P
DEGREES CELSIUS	IL-6	≤ 0.001
	IL-2	
	IL-1α	
	TNFα	
	INF-γ	
	IL-10	0.182

SPEARMAN 0.05	SPEARMAN 0.01
•SAMPLE DAY •IL10, IL6,TNFα, INFγ •GENDER •ETIOLOGY	•IL6 •IL2, INFγ

Conclusions: Interleukins levels are different in the states of hypothermia in the burned patients.

Applicability of Research to Practice: Keep warm environments for the care of burned patients.

11. Rizzo J.A. Perioperative Temperature Management During Burn Care. J Burn Care and Research 2017 38(1) e277-e283
12. Leiner G. Cytokine Levels in The Serum of Healthy Subjects. Mediators of Inflammation 2013; p. 1-6
13. C., F.C., Temporal Cytokine Profiles in Severely Burned Patients: A Comparison of Adults and Children. Molecular Medicine. 2008. 14(9 - 10): p. 553 - 560.
14. C., F.C. and H. David Inhalation Injury in Severely Burned Children Does Not Augment the Systemic Inflammatory Response. 2007. 11, 1 a 7 DOI: 10.1186/cc5698.
15. G., G.G., Are Serum Cytokines Early Predictors for the Outcome of Burn Patients with Inhalation Injuries who do not survive? Critical Care Medicine. 2008. 12(3): p. 1 - 8.