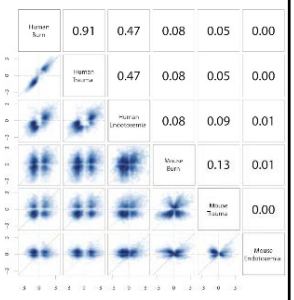
Critical Care and the Severely Burned

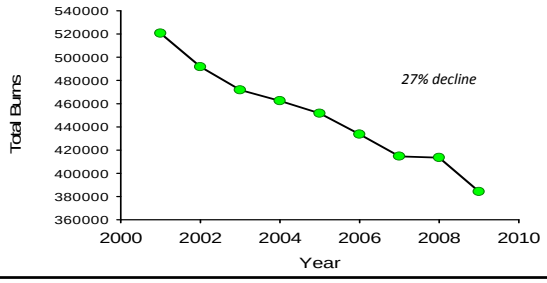
Steven E Wolf, MD
Golden Charity Guild Charles R Baxter MD Chair
Professor and Vice-Chairman for Research
Chief, Burn Services
Department of Surgery
University of Texas Southwestern Medical Center
Editor-in-Chief, Burns

Critical Care is a crucial part in the treatment of severely burned patients. Such persons have all of the typical findings common in general critical care units such as issues with ventilation and indwelling catheters, but often with a twist,... For instance, resuscitation volumes are often gargantuan with associated consequences. Furthermore, once this hurdle has been forded, infections and complications associated with the massive wounds lie in wait. Recent studies have shown that the genetic response to burn is very close to those with other severe injuries, but it has the advantage in that the injury burden can be relatively easily quantitated. Therefore, some have stated that severe burn is the universal critical care model, at least for injury.

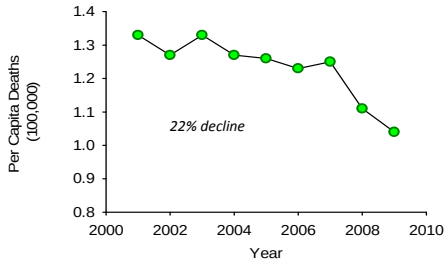
This presentation will highlight some of the critical care issues that are commonplace in burns and some of the solutions that have been developed. Perhaps some of these can be implemented not only in the severely burned, but also other critical care populations.



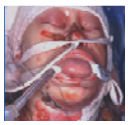
Burns in the USA



Burn Mortality



Resuscitation Morbidity



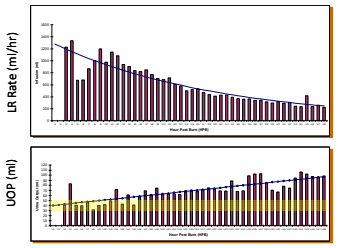
Outcomes

	Control Group (n=62)	BRG Group (n=56)	*p* value
Extremity Fasciotomies	68%	80%	0.1705
Myonecrosis	30%	27%	0.6439
ACS	16%	5%	0.06201
Mortality	31%	18%	0.1071
Composite Endpoint (ACS+Mortality)	36%	18%	**0.0315**

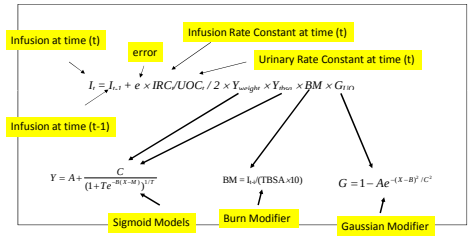
Hypothesis

- The use of information technology coupled with computer decision support systems (CDSS) provides better fluid management for severely burned patients during resuscitation and leads to better outcomes.

Measured Responses



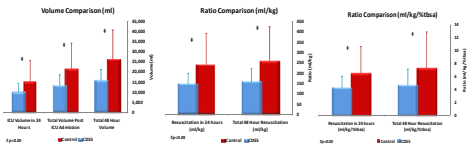
Model



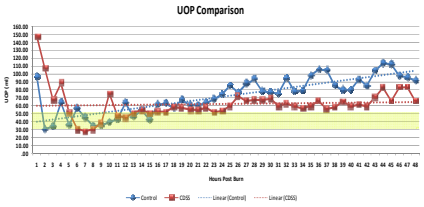
Example: Over-resuscitation



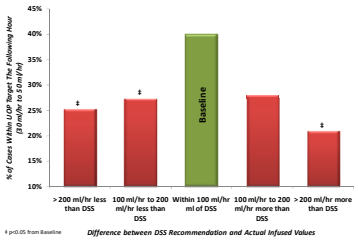
Volume Comparisons

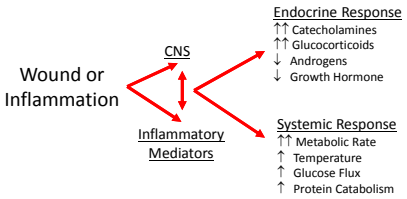


Urine Output

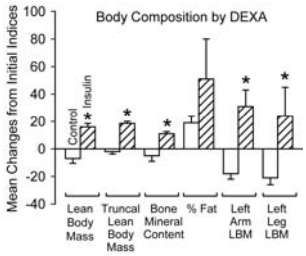


Utilisation





The Effect of Prolonged Euglycemic Hyperinsulinemia on Lean Body Mass in the Severely Burned

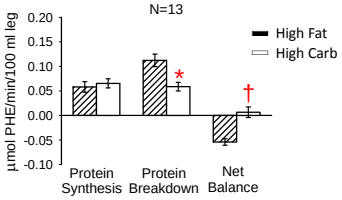


Thomas, Wolf, et al. *Surgery* 2002 (in press)

Muscle Protein Kinetics

R_d, R_a, Net Balance

N=13

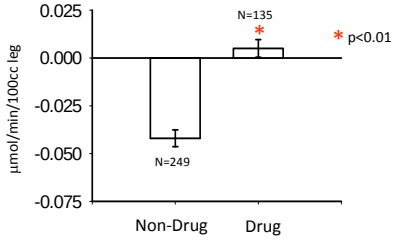


Data presented as mean±SEM

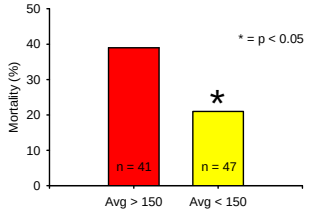
*p=0.01

†p<0.01

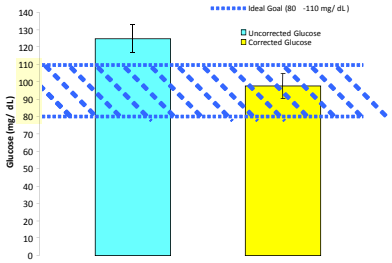
Anabolic Agent Effect



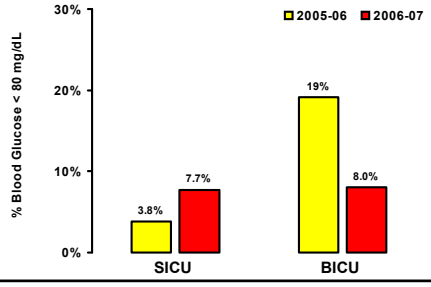
Lower Mortality with Better Glycemic Control



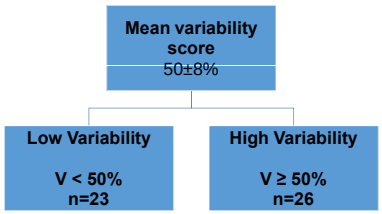
Impact of Glucometer Error



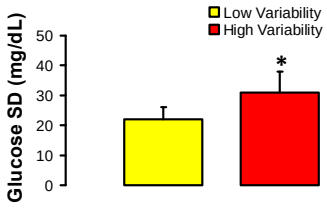
Glucose Control After Formula Implementation



Variability Groups

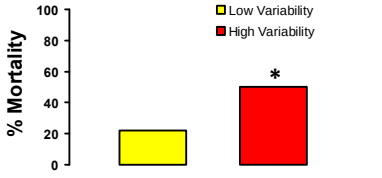


Mean SD in Blood Glucose

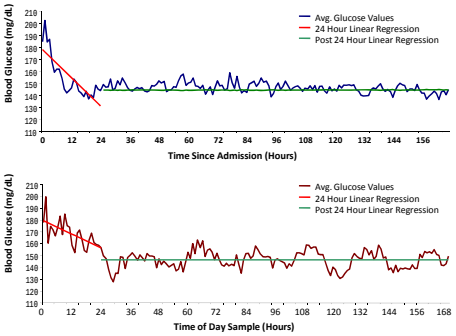


*p<0.001

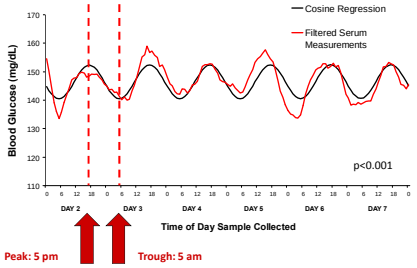
Outcome Measures



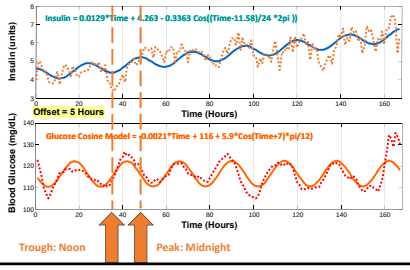
p < 0.05



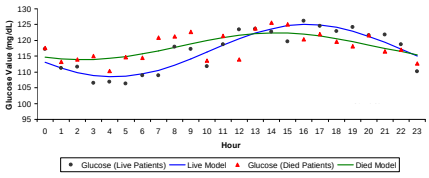
Diurnal Patterns Observed



Insulin and Glucose Patterns



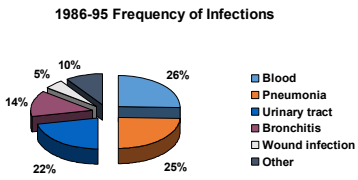
Survivors v Non-Survivors



Causes of Death in Burns

- Immolation and overwhelming damage at the site of injury, with relatively immediate death
- Death in the first few hours/days due to overwhelming organ dysfunction associated with burn shock
- Death due to medical error at some time during the hospital course
- Development of progressive multiple organ failure with or without infection, highlighted by the development of acute respiratory distress syndrome
- *Development of overwhelming infectious sepsis from the burn wound or other source in the days/weeks following injury. This form is highlighted by cardiovascular collapse*

Burn Infection
ISR- Historical



J World Surg 1998;22:135-145

Most Common Pathogens Recovered from Blood of 92 Burn Patients
January 2003 to May 2006

Organism	n	No. of isolates	Multi-drug resistant isolates	
			n	%
Pseudomonas	36	96	38	40
Klebsiella	34	83	59	71
Acinetobacter	44	67	45	67
Staph aureus	23	37	28	76

Predictors of Mortality for Bacteremic Burn Patients

Risk factor	*Univariate*			*Multivariate*		
	Relative risk	*95% CI*	*p Value*	*Relative risk*	*95% CI*	*p Value*
Age	1.03	1.00–1.06	0.03	1.06	1.02–1.09	<0.01
TBSA burned (%)	1.03	1.01–1.05	<0.01	NS	NS	NS
Injury Severity Score	1.05	1.01–1.08	0.01	1.08	1.03–1.13	<0.01
Bacteremia with more than one organism	1.92	0.82–4.53	0.14	NA	NA	NA
Multiple episodes of bacteremia	*0.34*	*0.12–1.03*	0.051	NS	NA	NA
Bacteremia with a MDRO	2.78	1.13–6.83	0.03	NS	NS	NS
Bacteremia with *Pseudomonas aeruginosa*	*2.25*	*0.96–5.3*	0.06	NA	NA	NA
Bacteremia with *Klebsiella pneumoniae*	*2.71*	*1.14–6.49*	0.03	*3.72*	*1.3–10.6*	*0.01*
Bacteremia with *Acinetobacter*	*0.48*	*0.21–1.11*	0.08	NA	NA	NA
Bacteremia with *Staphylococcus aureus*	0.79	0.30–2.06	0.63	NA	NA	NA

Clinical Predictors
Correlation of Vital Signs

	Mean Maximal Temperature (ºF)				
	Time of culture	Previous 0-6 hours	Previous 6-12 hours	Previous 12-18 hours	Previous 18-24 hours
Blood culture growth	101.4 (2.0)	101.9 (1.7)	101.0 (1.6)	100.8 (1.5)	100.9 (1.5)
No blood culture growth	101.5 (1.7)	102.0 (1.5)	101.1 (1.3)	101.1 (1.3)	101.2 (1.5)

( ) - standard deviation

Clinical Predictors
Correlation of Vital Signs



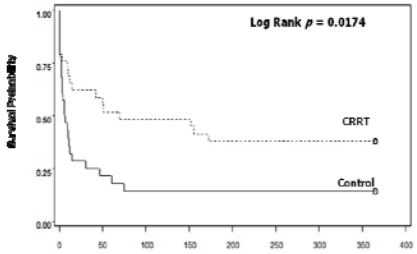
	WBC (10^3 cells/mm^3)		Neutrophil Percent	
	Time of culture	Previous 24 hours	Time of culture	Previous 24 hours
Positive blood culture	14.1 (8.1)	13.1 (7.0)	83.2 (9.5)	82.9 (8.5)
Negative blood culture	14.1 (7.7)	13.9 (7.4)	80.1 (9.5)	80.4 (8.0)

( ) - standard deviation

Renal Support



Kaplan-Meier Curve



VDR-4 Characteristics

- Pressure-limited
- Time-cycled
- Flow-interrupted
- Pneumatically powered



Outcomes

	HFPV (n=31)	Conventional (n=31)	p value
Vent Free days*	12+/-9	11+/-9	ns
Days Free of MODS*	15+/-11	15+/-10	ns
Death (%)	6 (19)	6 (19)	ns
Rescue (%)	2 (6)	9 (29)	0.02
VAP (%)	10 (32)	16 (52)	0.12
Barotrauma (%)	0 (0)	4 (13)	0.04

* Mean+/-SD

Ideal Skin Substitute

- Ready off the shelf
- Easy handling
- Excellent graft take
- Doesn't scar
- No donor sites