

Evidenced-Based Practice in Wound Care

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“Chronic wounds are always manifestations of other systemic problems”

Healing Rate of Chronic Stage 3 and 4 Pressure Ulcers

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“Anabolic Steroid Therapy on Pressure Ulcer Healing in Persons with SCI”

Background

Despite vast clinical experience, the healing rate of chronic Stage 3 or 4 pressure ulcers (PU) in patients with spinal cord injury (SCI) is not known.

Literature Review (Healing Rate)

1. [Gardner SE, Frantz RA, Bergquist S, Shin CD.](#) A prospective study of the pressure ulcer scale for healing (PUSH). *J Gerontol A Biol Sci Med Sci*, 2005 60:93-7.
2. [Stotts NA, Rodeheaver GT, Thomas DR, Frantz RA, Bartolucci AA, Sussman C, Ferrell BA, Cuddigan J, Maklebust J.](#) An instrument to measure healing in pressure ulcers: development and validation of the pressure ulcer scale for healing (PUSH). *J Gerontol A Biol Sci Med Sci*, 2001 56:M795-9.
3. [Cukjati D, Rebersek S, Miklavcic D.](#) A reliable method of determining wound healing rate. *Med Biol Eng Comput*, 2001 Mar;39(2):263-71.
4. [Brown GS.](#) Reporting outcomes for stage IV pressure ulcer healing: a proposal. *Adv Skin Wound Care*, 2000 13:277-83.
5. [Cukjati D, Rebersek S, Karba R, Miklavcic D.](#) Modelling of chronic wound healing dynamics. *Med Biol Eng Comput*, 2000 38:339-47.
6. [Berlowitz DR, Brandeis GH, Anderson J, and Brand HK.](#) Predictors of pressure ulcer healing among long-term care residents. *J Am Geriatr Soc*, 1997 45:30-4.

Literature Review (Albumin)

1. [Cordeiro MB](#), [Antonelli EJ](#), [da Cunha DF](#), [Junior AA](#), [Junior VR](#), [Vannucchi H](#). Oxidative stress and acute-phase response in patients with pressure sores. *Nutrition*. 2005:901-7.
2. [Reed RL](#), [Hepburn K](#), [Adelson R](#), [Center B](#), [McKnight P](#). Low serum albumin levels, confusion, and fecal incontinence: are these risk factors for pressure ulcers in mobility-impaired hospitalized adults? *Gerontology*, 2003:255-9.
3. [Gengenbacher M](#), [Stahelin HB](#), [Scholer A](#), [Seiler WO](#). Low biochemical nutritional parameters in acutely ill hospitalized elderly patients with and without stage III to IV pressure ulcers. *Aging Clin Exp Res*, 2002:420-3.
4. [Russell L](#). The importance of patients' nutritional status in wound healing. *Br J Nurs*. 2001:S42, S44-9
5. [Guenter P](#), [Malyszek R](#), [Bliss DZ](#), [Steffe T](#), [O'Hara D](#), [LaVan F](#), [Monteiro D](#). Survey of nutritional status in newly hospitalized patients with stage III or stage IV pressure ulcers. *Adv Skin Wound Care*. 2000:164-8.
6. [Berlowitz DR](#), [Brandeis GH](#), [Anderson J](#), and [Brand HK](#). Predictors of pressure ulcer healing among long-term care residents. *J Am Geriatr Soc*, 1997 45:30-4.

Research Design

Feasibility Study CS #535

A prospective multi-center,
28-day, observational
study was performed.

N=213

10 omitted, missing Day 28 data

193 used for analysis

14 SCI Services

	<u>#</u>
Augusta	(11)
Bronx	(13)
Cleveland	(12)
Dallas	(24)
Hines	(11)
Houston	(6)
Long Beach	(7)
Milwaukee	(8)
Palo Alto	(4)
Richmond	(49)
San Juan	(14)
St Louis	(15)
Tampa	(15)
West Roxbury	(4)

Methods

- SCI inpatients with at least one Stage 3 or 4 pelvic PU were enrolled at each site and provided “*usual standards of care*” then followed for one month (28 ± 2 days).
- Descriptive and demographic data was collected.
- Percent change was calculated for serum albumin and PU measurements from Day 1 to Day 28.

Methods

- Subjects were stratified on PU%ch by:
 - Healing \Rightarrow decreased area (Healers)
 - Worsening \Rightarrow increased area (Non Healers)
- Unpaired T-tests were used on the continuous variables to compare the sub groups (Healers vs. Non Healers)
- A logistic regression model was used to predict healing status.
- Results are reported as mean \pm SD.

Demographic Variables for the Total Group (N=193)

<u>Variables</u>	<u>Mean</u>	<u>SD</u>	<u>Min</u>	<u>Max</u>
Wt (lbs)	173.3	47.4	82.0	346.0
Ht (in)	70.3	3.8	42.5	77.0
Arm Span (in)	69.5	4.1	59.0	80.0
SBP (mmHg)	118	20	80.0	187.0
DBP (mmHg)	67	11	40.0	101.0
Wt (6m prior)	174.5	44.7	87.0	300.0
Wt (12m prior)	177.9	48.8	90.0	336.0
# PU's w/SCI	3.4	4.5	1.0	36.0
Pk/d	1.3	0.8	0.2	5.0
Current #PUs	1.8	1.5	1.0	13.0

Characteristics of the Subjects Stratified by the Sub Groups

<u>Variables</u>	<u>Healers</u>	<u>Non Healers</u>
Current SMKRs	25%	23%
Males	99%	100%
College(+)	51%	47%
ASIA A	78%	82%
Para	65%	56%
High Tetra	24%	27%
Latino	12%	4%
Black	33%	27%
White	51%	67%

Characteristics of the Subjects Stratified by the Sub Groups

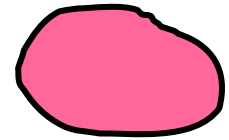
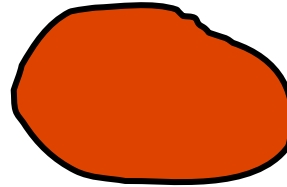
<u>Variables</u>	<u>Healers</u>	<u>Non Healers</u>
Age (y)	57±12	57±13
Wt (lb)	172±47	180±48
DOI (y)	21±13	21±14
#PU's Current	2±1	2±2
#PU's w/SCI	3±4	3±2
#Flap Surgeries	2±2	2±1

Target Pressure Ulcer

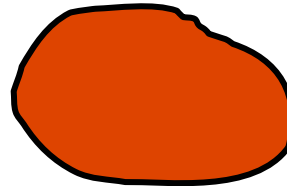
<u>TPU</u>	<u>Healers</u>	<u>Non Healers</u>
Day 1 Area (cm ²)	16.8±25.2	14.2±18.0
Day 28 Area (cm ²)	9.8±17.0	22.0±27.5
%ch Day 1 to 28	47% ↓	103% ↑
TPU Age (wks)	46±66	31±43

Results

- Overall reduction in PU area was **$22\pm 46\%$**

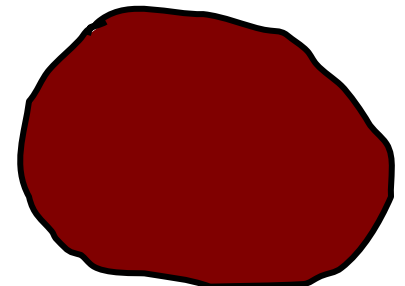
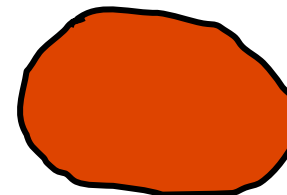


- Healers (n=138), PU area decrease was **$47\pm 28\%$**



– 9 healed completely

- NonHealers (n=55), PUs increased by **$103\pm 239\%$**



– 11 doubled in size

Categories of Healing

(n=138)

<u>Healing Percent</u>	<u>n</u>	<u>% of S's</u>
85 to 100	18	13
50 to 84	40	29
25 to 49	49	36
1 to 24	31	22

Categories of Non Healing (n=55)

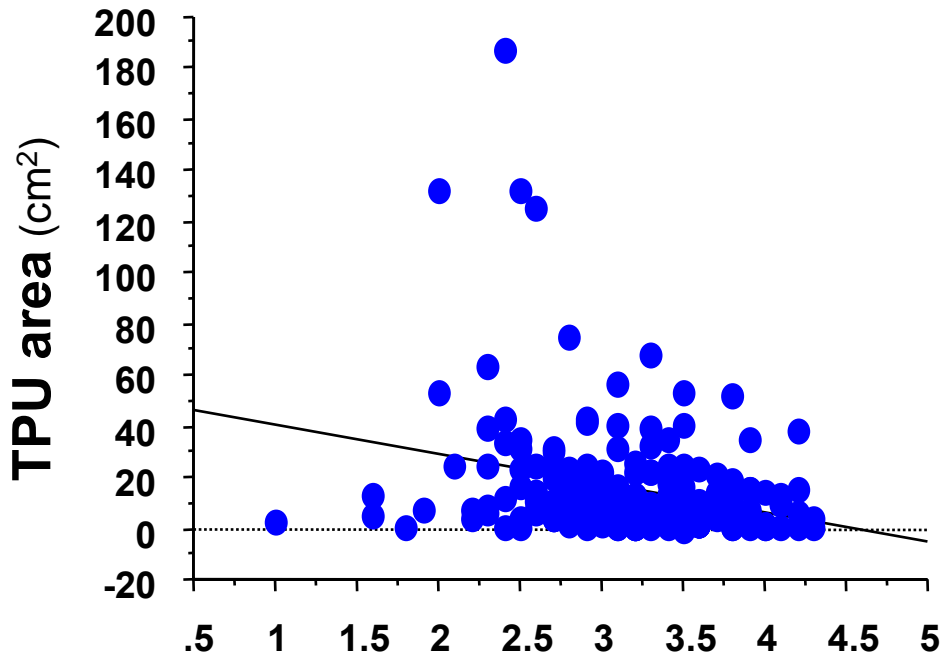
<u>Percent Worsening</u>	<u>n</u>	<u>% of S's</u>
>100	11	20
50 to 100	11	20
25 to 49	8	15
0 to 24	25	45

Albumin Results

<u>Albumin</u>	<u>Healers</u>	<u>Non Healers</u>
Day 1 (g/dL)	3.2±0.5	3.1±0.6
Day 28 (g/dL)	3.3±0.5	3.0±0.7
%ch Day 1 to 28	4.6% ↑	1.4% ↓
Day 28 ≥3.0	55%	17%

Relationship of Serum Albumin with TPU size

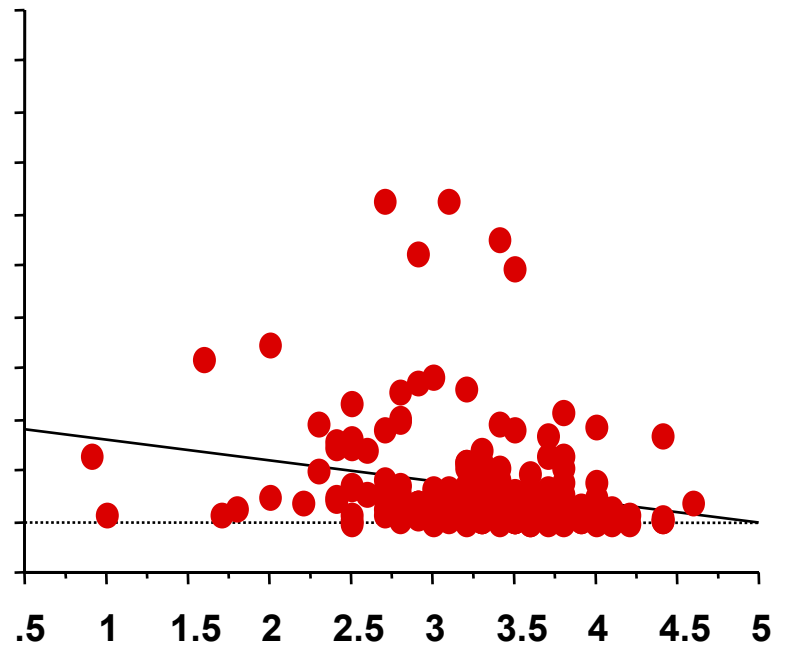
Day 1



Albumin (mg/dL)

$R=0.28$, $P<0.0001$

Day 28



Albumin (mg/dL)

$R=0.23$, $P<0.005$

Logistic Regression Model

- Variables $P > 0.20$
 - Age
 - DOI
 - Height
 - Weight
 - Education
 - Ethnicity
 - Smoking Hx
 - Day 1 Albumin
 - Day 1 TPU area
- Variables $P < 0.19$
 - TPU age (wks) (0.13)
 - LOL (0.16)
 - ASIA (0.15)
- **Variables $P < 0.05$**
 - **Day 28 Albumin**
(* $P < 0.009$)

Results

- The single significant predictor of healing PU status was the Day 28 serum albumin >3.0 mg/dL (**odds ratio=2.4** $P=0.03$).
- Age, DOI, ethnicity, smoking history, level of lesion, ASIA classification, Day 1 PU area, and PU location were not significantly related to healing status.

Conclusion

- Applying the usual standards of care associated with normal serum albumin concentrations, the expected healing rate in 28 days was 47%.
- If serum albumin level is depressed, an increase in PU size is likely, strongly supporting the concept that nutritional status effects wound healing in an SCI population.