Strategies to Prevent Heel Ulcers and Plantar Flexion Contractures In the Ventilated Patient

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Purpose

The aim of this project was to assess the impact of a clinical intervention to decrease the rate of heel pressure ulcers (hPUs) and to prevent plantar flexion contractures through the use of heel protector devices in high risk, sedated, intensive care unit (ICU) patients.

Introduction

- ICU patients have a high risk of developing hPUs and plantar flexion contractures[1-3]
- The prevalence of pressure ulcers (PUs) in the ICU has been estimated to range from 14% to 41%[1]
- The incidence of PUs in the ICU has been estimated to range from 1% to 56%[1]
- Approximately 25% of PUs develop into hPUs[4]
- The estimated cost of treatment is $3,000 per hPU[5]
- Plantar flexion contractures are a negative outcome in sedated ICU patients and result in a reduced quality of life[3]

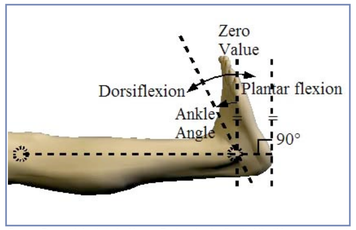
Methods

Study Inclusion Criteria:

- Sedated patient in the ICU for ≥5 days
- Intubated or not intubated
- Braden score of ≤16
- Patients not eligible for Prevalon™ boot included in the study as control subjects; pillows used to elevate the heels
- Passive range of motion (ROM) as ordered for all ICU patients, not withheld or viewed as a variable in the prevention of plantar flexion contractures

Procedure:

1. Heel skin assessed and Braden scale administered to all patients upon admission to the ICU
2. All ICU patients who met criteria had ankle ROM measured with a goniometer upon admission and prior to application of the Prevalon™ boot; heel skin assessed and Braden scale and Ramsey sedation scale administered
3. All patients who met criteria had ankle ROM measured every other day
4. Heel skin assessed and Braden scale and Ramsey sedation scale administered every shift and recorded as part of the study every other day
5. Measurements continued until patients transferred, boots discontinued per physician order, or patients had a Braden scale score of >16
6. Control patients also had ankle ROM measured, heel skin assessed, and Ramsey sedation scale, and Braden scale administered at admission and every other day.
7. Measurements performed by trained ICU nurses and physical therapists



Source: Research Institute for Human Engineering for Quality Life, "Measurement and evaluation of the human dynamic characteristics," Joint Passive Resistance Database a4, 2000. Available at: http://www.dh.aist.go.jp/bodyDB/a/HQL-00-04e.html

- 100% prevention of hospital-acquired hPUs
- 100% prevention of plantar flexion contractures

Results

Process Improvement Efforts

- Effective prevention of hPU development in patient population [100%]
- Effective prevention of plantar flexion contracture development in patient population [100%]
- 9.4% of patients showed improvement in heel status from entry to discharge
- 11.3% of existing heel skin conditions stayed the same, with no change or worsening of wound status
- Establishment of a protocol to prevent hPUs in a high-risk patient population
- Establishment of a protocol to prevent plantar flexion contractures in a high-risk patient population
- Earlier recognition of heel skin issues in a high risk patient population
- Standardization of care and ease of use intended to promote caregiver compliance with protocol
- Data collection tool used frequently to ensure appropriate evaluation

Data Collection Tool for Conroe Hospital
Prevalon II Plantar Flexion Prevention

MRN_____ AGE_____ GENDER _____
DIAGNOSIS_____
ADMISSION DATE_____
INTUBATED: YES or NO DATE_____
SEDATED: YES or NO DATE_____
PREVALON BOOT APPLIED: YES or NO PILLOWS USED: YES or NO

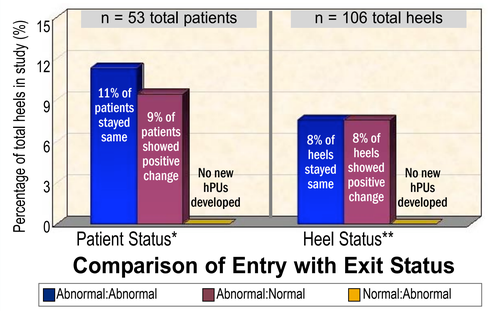
	Ankle Measurement	Braden Scale	Heel Skin Assessment	Ramsey score	Comments
Admission					
Day 3					
Day 5					
Day 7					
Day 9					
Day 11					
Day 13					
Day 15					

Goniometer used by trained and licensed clinicians to assess for plantar flexion contracture[6-8]

Ramsey Score Averages				
Score	Entry	Totals	Exit	Totals
1	7	7	8	8
2	22	44	20	40
3	3	9	9	27
4	11	44	11	44
5	7	35	4	20
6	0	0	0	0
Avg.		2.78		2.67

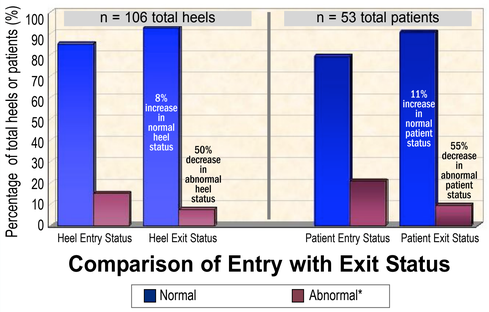
Modified Ramsey Sedation Scale:
1. Anxious, agitated, restless
2. Cooperative, oriented, tranquil; accepts mechanical ventilation
3. Responds to commands only
4. Brisk response to light glabellar tap or loud noise
5. Sluggish response to light glabellar tap or loud noise
6. No response

Assessment of hPU Prevention



* Abnormal patient status means that patient had at least one abnormal heel
** Abnormal heel defined as having status OTHER than pink, clean, clean and dry, OK or intact

Change in Heel/Patient Status



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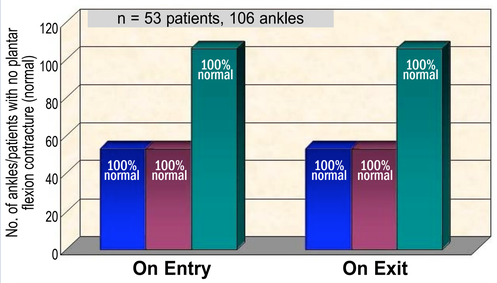
Assessment of Development of Plantar Flexion Contractures

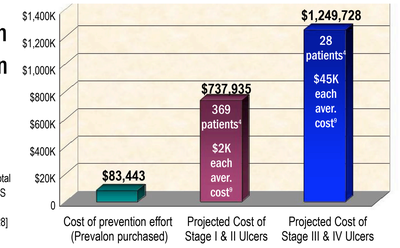


* Normal = measurements with goniometer within normal range and showing no evidence of plantar flexion contracture

Financial Benefits of hPU Prevention

The hPU prevention protocol resulted in annual savings of $1,904,220.

[Avg census 260; 7.3%[4] may develop PUs = 19; 28%[9] may develop hPUs = 5; total hPU days (365) = 1825; avg LOS 4.6 (NIS Data) = 397 actual hPU days; 93% stage 1 or 2[4] = 369; 7% stage 3 or 4[4] = 28]



[4] Whittington KT, Briones R. *Adv Skin Wound Care.* 2004;17:490-494; [9] Young ZF, Evans A, Davis J. *J Nurs Adm.* 2003;33:380-383.

Use of a heel protector to maintain heel suspension and proper foot and ankle alignment in 53 sedated ICU patients **prevented the development of any new hPUs** in this high risk patient population during this 7-month study.

In addition, assessment of all individual heels (n = 106) indicated that 16 heels were abnormal upon entry into the study compared to only 8 heels on study exit, **which indicated a 50% decrease in abnormal heel status**. Measurement of ankle ROM with a goniometer upon admission and every other day for the duration of the study showed no development of plantar flexion contractures in any patient (based on definition of contracture of -50 [90°=0]).

Conclusion

A comparison of the cost of heel protector devices with the projected costs of treating hPUs indicated a calculated **annual savings of $1.9 million**.

- A heel protector should be used on all immobile, sedated patients. The results of this study indicate that such use may reduce or eliminate the risk of hPUs and help prevent the development of plantar flexion contractures.
- An effective hPU prevention protocol that incorporates accurate risk identification, early recognition of skin issues, and methods to maintain heel suspension should be established. hPUs and plantar flexion contractures may be preventable if standardized protocols designed the ensure consistent application of heel protector devices are followed.
- The proposed hPU prevention protocol represents a shift in clinical paradigm from traditional methods, substantially reducing the risk of heel injury, and concomitantly reducing the risk of plantar flexion contracture in this high risk-patient group.
- The clinical and economic outcomes of this intervention should be studied further. The estimated annual savings due to prevention ($1,904,220) are based on the literature. However, additional research is needed to determine the cost benefit of hPU prevention.

References

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