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Spinal Cord Injury survey to determine pressure ulcer vulnerability in the outpatient population ☆

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ABSTRACT

Pressure ulcers are one of the most common causes of morbidity, mortality and rehospitalization for those living with Spinal Cord Injury (SCI). Literature examining risk and recurrence of pressure ulcers (PrUs) has primarily focused on the nursing home elderly who do not have SCI. More than 200 factors that increase PrU risk have been identified. Yet unlike the elderly who incur pressure ulcers in nursing homes or when hospitalized, most persons with SCI develop their pressure ulcers as outpatients, while residing in the community. The Veterans Health Administration (VHA) provides medical care for a large number of persons with chronic SCI. Included in the VHA SCI model of chronic disease management is the provision of an annual Comprehensive Preventive Health Evaluation, a tool that has potential to identify individuals at high risk for PrUs. This research was motivated by the clinical observation that some individuals appear to be protected from developing PrUs despite apparently 'risky' behaviors while others develop PrUs despite vigilant use of the currently known preventative measures. There is limited literature regarding protective factors and specific risk factors that reduce PrU occurrence in the community dwelling person with chronic SCI have not been delineated. The purpose of this study is to examine the preliminary hypothesis that there are biological and/or psychosocial factors that increase or reduce vulnerability to PrUs among persons with SCI. A limited number of refined hypotheses will be generated for testing in a prospective fashion. A retrospective cross-sectional survey of 119 randomly selected Veterans with SCI undergoing the Comprehensive Health Prevention Evaluation during the year 2009 was performed. Factors that differed between patients with 0, 1 or $\geqslant$2 PrUs were identified and stratified, with an emphasis on modifiable risk factors. Three hypotheses generated from this study warrant further investigation: (1) cumulative smoking history increases the risk of PrUs independent of co-morbidities, (2) being moderately overweight, BMI > 25, with or without spasticity, is a modifiable factor that may be protective and (3) increased use of a caregiver does not reduce PrU risk. Prospective studies that focus on these hypotheses will lead to evidence-based risk assessment tools and customized interventions to prevent PrUs in persons with SCI in the outpatient setting.

Introduction

Development of pressure ulcers (PrUs) is one of the most common complications of Spinal Cord Injury (SCI). Although there has been a dramatic improvement in life-expectancy for persons with SCI since the 1970's, this is mostly attributed to reduced mortality during the initial 2 years post-injury. Sepsis associated with genitourinary conditions and PrUs remains the major source of morbidity and mortality for those with chronic SCI [1,2]. PrUs are one of the major causes of rehospitalization after the initial injury and account for 8% of deaths after SCI. The economic impact of PrUs is large, with the cost of treating a single full thickness PrU estimated at $70,000, leading to $11 billion of US expenditures in healthcare [3]. For Veteran patients with SCI the presence of a PrU adds approximately $73,000 to their total annual healthcare cost with annual hospitalization averaging 61 days compared to 9 days for those without PrUs [4]. This does not include the tremendous impact on the person with SCI, including time off work; the need for assistance with such things as child care, pet care, and household care; and the impact on the family and/or caretakers.

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Unlike the elderly who incur PrUs when hospitalized or in nursing homes, most persons with SCI develop their PrUs as outpatients, while residing in the community [5]. For this reason, the actual prevalence of PrUs in the SCI population is currently unknown, with reported figures varying from 8% to 40% and a recurrence rate of up to 79% [6]. The Veterans Health Administration is responsible for approximately 27,000 Veterans with SCI/D, accounting for 26% of all persons with SCI/D (Spinal Cord Impairment/Disability) in the United States (http://www.queri.research.va.gov/about/factsheets/sci_factsheet.pdf). As our wounded warriors return from Iraq and Afghanistan, VA is faced with managing a very challenging cohort of patients with SCI. Along with SCI, the constellation of injuries for many of these Veterans may include severe pelvic trauma, burn wounds and multiple amputations and/or severe fractures. One can anticipate that the lifetime risk of PrUs in this population will be even higher than past cohorts. Therefore it is imperative that factors which increase PrU risk be identified and mitigated.

Most published research that identifies risk factors for development and recurrence of PrUs has been conducted in the nursing home elderly or in the SCI Model Systems (sponsored by National Institute on Disability and Rehabilitation Research), which includes primarily younger patients with acute SCI injuries [3,8,9]. The literature examining risk and recurrence of PrUs in the Veteran SCI population, i.e., with long-term chronic SCI, focuses on the patients who have already developed PrUs [6,10]. Those who do not develop PrUs are excluded from the study samples, thereby excluding a critical "control" population. More than 200 risk factors have been identified as being involved in PrU development [11]. For example, immobility and incontinence are common factors for all persons at risk: elderly, newly injured or chronic SCI. However, there is such a wide variety of factors implicated in the literature that are specific to the SCI population that it is not clear how to stratify them to develop useful guidelines for PrU prevention [7,11–13]. Because they are recurrent, severe ulcers are reported for a minority of the general patient population, occurring primarily in the SCI patient population [14,15]. It is our premise that the list of potential risk factors affecting PrU vulnerability must be refined so that the people at highest risk can be identified and protected.

The retrospective survey of SCI outpatients completing their annual SCI Comprehensive Preventive Health Evaluation described here is based on our preliminary hypothesis that there are biological and/or psychosocial factors that increase or reduce vulnerability to PrUs among persons with SCI. Our study objective included identifying and stratifying the factors that are different between patients with 0, 1 or $\geqslant 2$ PrUs, with emphasis on modifiable risk factors. The goal of the study is to generate a limited number of refined hypotheses that can be tested in a prospective fashion and will ultimately lead to the development of evidence-based risk assessment tools and customized interventions to prevent PrUs in SCI persons in the outpatient setting.

Methods

Study design

Cross-sectional retrospective.

Sample size justification

Assuming that the prevalence of PrUs in the SCI population is at least 25%, a sample of 120 charts is required to guarantee that 30 of those will be patients who have had PrUs (with 95% confidence).

Participants

A computer-generated random number table was used to select 120 patient charts from nearly 1400 outpatients with SCI who completed their Comprehensive Preventive Health Evaluation (aka "annual exam") at a VA SCI Center between January 1 and December 31, 2009. These evaluations are typically conducted in the outpatient setting, unless the patient lives too far away from the center to complete the entire evaluation as an outpatient. Patients with and without PrUs were included. Patients with SCI due to terminal disease, multiple sclerosis or amyotrophic lateral sclerosis were excluded from the random selection based on ICD-9 coding.

Procedures

The study team developed an electronic data extraction tool, which included demographics as well as physical, medical, and psycho-social variables documented in the literature to be associated with the increased risk of developing PrUs [11,12] and likely to have been assessed and documented in the annual health evaluation.

Data extraction was conducted by three study team members (a nurse practitioner, a medical student and a nurse scientist). The data extraction team members were trained on how and where to find the data in the electronic medical records. Reliability was established among the extraction team members, who practiced together prior to building the data base. A rule book was developed with the first 15 cases, to ensure the data were interpreted and recorded accurately. Verification of extracted data elements was conducted by the senior author on approximately 10% of the patient charts.

Primary outcome

The primary outcome of interest was whether the Veteran with SCI ever developed a PrU.

Independent variables

Table 1 lists the variables identified by the study team, the variable definitions and examples of code used by our statisticians, which may assist other studies with analysis. For the purposes of our analysis, we re-coded a number of variables. For example, we created a new variable: "Good Nutrition", reflecting nutritional status using the recorded albumin and pre-albumin levels at the time of the annual exam (2009). Also, we identified a number of variables with missing data. The sample mean was used for the missing values.

Statistical analysis

Statistical comparisons between PrU groups (0, 1, 2+ PrUs) were performed using either Student's *t*-test, one-way ANOVA or Chi-square, as appropriate. All analyses were performed using SAS (ver. 9.2 Cary, NC) with statistical significance assumed to be $p \leqslant 0.05$, two-tailed. Bivariate analyses comparing patients with and without PrUs identified a set of independent variables that were significantly different between the two groups. Correlational analyses were conducted to examine potential multicollinearity between the independent variables. The final set of variables was entered into a stepwise regression. Unconditional logistic regression was used to model the probability of at least 1 PrU after adjustment for potential confounders. Odds ratio and 95% confidence intervals are presented.

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