Skin sores after spinal cord injury: relationship to life adjustment

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Study design: A field study of the relationship between skin sores and life adjustment after spinal cord injury (SCI) was conducted by surveying a sample of more than 1000 participants with SCI.

Objectives: The purpose of this study was to identify the relationship between the number of skin sores and days adversely impacted by skin sores with multiple indicators of life adjustment after SCI.

Summary of background data: Most existing research on skin sores after SCI has been epidemiologic in nature, with limited investigation of the relationship between problems with skin sores and psychosocial adjustment.

Methods: A total of 1017 participants completed the Life Situation Questionnaire-revised (LSQ-R), a measure of multiple long-term outcomes after SCI.

Results: Just less than half of all respondents (46%) reported having at least one skin sore during the 2 year period prior to the study, but only 27% reported having to reduce their sitting time by at least 1 day during the same time period due to skin sores. Although biographic characteristics were generally unrelated to skin sores (eg, gender, race), both the number of skin sores and days adversely impacted by sores were correlated with poorer adjustment in nearly every area of life studied.

Conclusions: Although the results are correlational and cannot be taken as evidence for causation, it is clear that prevention of skin sores is critical for people with SCI. There is a need for research to identify psychological and behavioral risk factors for skin problems after SCI.

Keywords: skin sores; spinal cord injury; life adjustment

Introduction

The purpose of this study was to identify the relationship between problems with skin sores and life adjustment after spinal cord injury (SCI). Both the number of skin sores and days adversely impacted by sores were correlated with poorer adjustment in nearly every area of life adjustment studied among the 1017 participants.

Traumatic spinal cord injury results in an immediate and profound physiological change, including moderate to complete paralysis and loss of sensation below the level of injury, the extent of which varies as a function of both the level of the lesion and the neurological completeness of the injury. Numerous alterations in the body's metabolic functioning also occur secondary to central nervous system trauma. In addition to these immediate and direct sequelae, SCI also predisposes people to a higher risk of numerous secondary medical conditions. These secondary complications which are indirectly caused by SCI (common examples include pressure sores and urinary tract infections), can occur long after recovery from the initial injury and are difficult to predict based on factors such as injury level or severity.

Pressure sores, also known as pressure ulcers, have long been recognized as one of the most devastating

secondary complications among people with SCI and other disabling conditions. These skin sores are common, can cause further disability, are expensive to treat, and if left untreated can result in even graver health problems. In the most severe cases, advanced pressure sores can lead to amputation of the leg and/or fatal infections.

Although they are preventable with proper self-care maintenance, pressure sores remain common in people with SCI because paralysis and loss of sensation create a situation in which sores are bound to develop if the person's vigilance ever lapses. In people with SCI, sores most often occur in the parts of the body which are under pressure during sitting, namely the ischium buttocks, tailbone area, and hips. If the sore is detected early, it can be easily treated by keeping all pressure off the sore, but this often means staying out of the wheelchair and thus temporarily losing mobility and independence. An untreated sore will continue to get worse until surgery is required.

Epidemiology

Despite their preventability, pressure sores remain a common problem for people with SCI. Urinary tract infections and spasticity are the only secondary

conditions which occur with equal or greater frequency. The National Spinal Cord Injury Statistical Center (NSCISC), which has collected data on almost 17 000 persons treated for SCI in 24 Model SCI Care System institutions nationwide, reports that almost a third of these patients developed pressure sores during their initial acute care and rehabilitation.¹ Among those with complete tetraplegia, the rate was 45%. The fact that these figures represent the incidence of sores in patients who were under the care of medical staff specifically trained in spinal cord injury care highlights the degree of vigilance which is required to prevent pressure sore formation.

Pressure sore prevention training, which teaches patients to shift their weight regularly and inspect themselves daily for early signs of sore formation, is now a key component of SCI rehabilitation. Although this reduces the development of pressure sores, it is still a substantial problem following discharge back into the community. NSCISC follow-up data have documented a 15% incidence of pressure sores within the first year after injury, and this rate increases steadily each post-injury year to 26% of all cases in the 20th year since injury.¹ Other epidemiological studies confirm the high incidence of pressure sores in the spinal-injured community. A long-term study of over 800 British persons with SCI of over 20 years' duration found that pressure sores were the most commonly occurring complication each year (23%), followed by urinary tract infections (20%).² Researchers at the Baylor College of Medicine physically examined 100 men and 40 women living with SCI and found that 33% of the men and 30% of the women had skin sores.³ In a recent survey of secondary complications completed by 350 individuals with longstanding SCI, roughly 25% of respondents reported having had a pressure sore in the past year.⁴ These studies make it clear that people with SCI remain at high risk for the formation of pressure sores for the rest of their lives.

Anderson and Andberg⁵ performed one of the few existing studies which has explored the relationships between psychological factors and pressure sores. They found that responsibility taken for skin care was related to the number of days interrupted by pressure sores. Participants who took greater responsibility for their skin care reported fewer days adversely impacted by pressure sores. In addition, the number of days adversely impacted by pressure sores was negatively correlated with both life satisfaction and self-esteem. In a later study, Heinemann and Hawkins⁶ investigated the relationship between substance abuse and two types of secondary conditions over a 30 month period after SCI. They noted an increased risk for pressure sores among participants who used psychotropic medications, and among those who were abstinent from alcohol use but had a history of drinking problems. This suggests that problematic pre-injury drinking may have adverse consequences for post-injury

health, even if the drinking behavior pattern has changed.

In another study, Rodriguez and Garber⁷ conducted a study to determine whether health beliefs predict adherence to pressure ulcer prevention strategies. They reported that those who developed an ulcer (34%) tended to have more ulcers previously, to have injury levels above T6, were more likely to be unemployed, and less likely to attend school. No significant differences existed between those who developed an ulcer and those who did not with regard to the importance of prevention strategies and their beliefs about the risks or seriousness of developing an ulcer. A difference did exist between the perception of developing an ulcer and previous past experiences (ie, those who had fewer ulcers believed they were less likely to develop an ulcer).

Theoretically, either the presence of negative, self-destructive behaviors (eg, risk-taking, alcohol abuse) or the absence of positive, health-promoting behaviors (eg, good diet, weight shifts) may lead to a greater risk for pressure sore development.⁸ Taken together, the studies cited above suggest a relationship between both positive health maintenance (responsibility in skin care) and self-destructive behaviors (substance abuse) and pressure sores, but leave unanswered questions regarding the relationship between sores and post-SCI outcomes.

There is a pressing need for further research to determine what relationships exist between pressure sore incidence and other psychosocial, vocational, and health outcomes. Existing studies have suggested that certain traits or characteristics may be identifiable risk factors for the development of pressure sores. The identification of such risk factors will make it possible to develop more sophisticated prevention programs. Additionally, it is important to know whether the development of pressure sores may place additional burdens on an individual's psychosocial and vocational functioning, leading to lower overall outcomes.

Purposes

The purpose of this study was to identify the relationship between two pressure sore related variables (number of sores and days adversely impacted by sores) and multiple indicators of life adjustment after SCI, in order to obtain a clearer idea of the extent of the effects of this medical problem.

Methods

Participants

To be eligible for the study, participants were required to meet three screening criteria: (1) traumatic SCI, (2) 18 years of age, and (3) a minimum of 2 years postinjury. A total of 1032 participants from two distinctive samples returned the Life Situation Questionnaire-revised (LSQ-R). The first sample was

identified through outpatients files of two Midwestern rehabilitation hospitals and included all individuals who met the three screening criteria. A total of 435 of a possible 491 individuals participated from the Midwestern sample (89%). The second participant sample was identified from outpatient files of a Southeastern rehabilitation hospital. However, because this hospital had a much larger than needed number of cases in the outpatient system, a random stratified sample was selected from a much larger outpatient pool. It over-sampled participants who were female, from minority backgrounds, and over the age of 50 at the time of the study. A total of 597 of a possible 710 participants returned usable questionnaires (84%). Fifteen participants were eliminated due to inconsistent responses, leaving a final sample of 1017.

Procedures

Cover letters describing the study were sent to all prospective participants 4 to 6 weeks prior to transmittal of study materials. Participants were offered a \$20 stipend and copies of the general study results as inducements to return the materials. A second mailing and a follow-up phone call were made to all initial nonrespondents. If an individual was unable to complete the materials, his/her responses were taken by phone.

Instruments

The Life Situation Questionnaire-revised (LSQ-R) was used to measure the outcomes in this study.⁹ It was developed in 1974 to elicit mostly objective information on a wide range of long-term post-SCI outcomes. The current revised version includes several sets of variables, including: biographic status, participation in employment and education, social activities, life satisfaction, problems, fitness, self-rated adjustment, general health, and recent medical history. Individuals interested in obtaining copies of the Life Situation Questionnaire may do so by making a written request to the author, along with a brief description of how the measure will be used.

The two primary items of interest related to skin sores in the current study were the number of skin sores and days adversely impacted from these sores within the 2 years prior to the study. The item, days adversely impacted by skin sores, was presented in multiple choice format with eight response options: none, less than 1 week, 1 to 2 weeks, 3 to 4 weeks, 5 to 8 weeks, 9 to 12 weeks, 13 to 18 weeks and more than 18 weeks. Participants were also asked the number of skin surgeries that they have had over the past 2 years and the total since their injury. Because the incidence of skin surgeries is low, these two items were of primary use for descriptive purposes.

Ten outcome scales were used from the LSQ-R as study outcomes.⁹ They included seven subjective well-

being scales that were derived from factor analysis of 20 satisfaction and 30 problems items. An eighth scale measured Adjustment, by summing two 10-point self-rated adjustment items (current adjustment and predicted future adjustment). The Medical Instability Scale combines three items reflective of seeking medical attention within the past two years: number of non-routine doctor visits, number of hospitalizations, and number of days hospitalized (each item had six response categories). A self-reported fitness scale was generated by summing five items which asked participants to rate different aspects of their fitness on 5-point scales (1=poor; 5=excellent). These items were: overall fitness, coordination, flexibility, strength, and endurance. Lastly, three individual items were used to measure sitting tolerance, the frequency of social outings, and employment status. Alpha coefficients for the ten scales averaged 0.85, with a range of 0.77 to 0.94.

Analyses

Both descriptive and comparative analyses were implemented. Descriptive statistics (ie, frequencies, means) were used to summarize the biographic characteristics of the sample. A second set of descriptive analyses was used to summarize data on the four skin sore variables, including the number of skin sores, days adversely impacted, and skin surgeries within the last 2 years, as well as the number of skin surgeries since injury.

Two sets of comparative analyses were run: the first set identified the relationship of severity of problems with skin sores to biographic status; the second set focused on skin problems and adjustment outcomes. The number of skin sores and the number of days adversely impacted by these sores were independently recorded in order to develop severity indexes for frequency and impact of sores. For the number of skin sores, the three classification groups were: (1) none, (2) one to four sores, and (3) more than five sores. For days adversely impacted by sores: (1) none, (2) 8 weeks or less, and (3) 9 or more weeks. These indices were then used to identify the relationship of severity of skin problems with biographic status and life adjustment.

There were eight biographic variables of interest: gender, race, injury level, completeness of injury, chronologic age, age at injury onset, years since injury, and years of education. In terms of life adjustment, the ten scales and three individual items were of interest (ie, employment status, sitting tolerance, outings). The chi square statistic was used to identify the significance of each of the indicators of skin problems (ie, number of sores and days adversely impacted) with categorical variables (ie, gender, race, injury level, employment status). The analysis of variance (ANOVA) was used to identify the relationship of skin severity groups with continuous biographic and life adjustment outcomes (eg, age, time

since injury, adjustment scales). Student Neuman-Keuls (SNK) follow-up post-hoc tests were used when the overall ANOVA was significant.

A Bonferonni correction was used for comparisons of outcome scales ($n=26$) to control for an inflated probability of Type-I error due to multiple significance tests. The adjusted alpha was 0.002 for each ANOVA and Chi square comparison using an outcome measure, with no additional correction was made for the SNK follow-up contrasts (they remained at $P \leq 0.05$). Adjustment for multiple comparisons were also made for the 14 biographic comparisons, resulting in an effective alpha of 0.004.

Results

Descriptive

Biographic characteristics Sixty-nine percent of the participants were male, and 75% were Caucasian. The average age of the participants was 29.1 years at the time of injury and 42.4 years at the time of the study. An average of 13.3 years had passed since injury. Fifty-five percent reported cervical injuries. The sample averaged 13.5 years of education. Thirty-six percent of the participants were employed at the time of the study.

Skin sores Participants averaged 1.2 sores during the 2 years prior to the study. Less than half of all respondents (46%) reported having at least one skin sore, and another 30% reported having only 1 or 2 sores during the 2 year period. Only 6% of the participants reported five or more sores. Twenty-seven percent of the respondents reported having to reduce their sitting time by at least 1 day during the same time period, indicating that many of the sores were not severe enough to reduce sitting time. Twenty percent of the participants reported non-severe impact in reduced sitting time (ie, 8 weeks or less), with 7% reporting having to reduce their sitting time by 9 weeks or more. Skin surgeries were reported by only 10% of the participants over the 2 year period, although 28% of participants reported at least one skin surgery at some time since their injury.

Comparisons between severity groups

Biographic After correcting for multiple comparisons, only two biographic characteristics reached significance in relationship to skin problems. Participants with cervical injuries were more likely to report skin sores, $Chi(2, n=994)=15.6, P \leq .001$, as were participants with complete injuries, $Chi(2, n=982)=20.4, P < .001$. Sixty percent of the participants with thoracic and lumbar injuries reported no skin sores, compared with 49% for those with cervical

injuries. Similarly, 61% of participants with incomplete injuries reported no skin sores, in contrast with 48% for those with complete injuries. None of the eight biographic variables were significantly related to days adversely impacted by skin sores.

Outcome measures

Both skin sore severity indices were highly correlated with life adjustment outcomes, as all but one comparison was significant for each of the two indices (even after correction for multiple comparison). However, the pattern of findings on the post-hoc contrasts differed for the two indices.

Number of skin sores All seven of the subjective well-being scales were significantly related to the number of skin sores: Positive Engagement $F(2,937)=17.13, P \leq 0.001$; Negative Emotions $F(2,974)=25.22, P \leq 0.001$; Health Problems $F(2,974)=58.65, P \leq 0.001$; Career Opportunities $F(2,849)=10.81, P \leq 0.001$; Finances $F(2,985)=13.01, P \leq 0.001$; Living Circumstances $F(2,980)=6.36, P \leq 0.01$; Interpersonal Relationships $F(2,940)=14.55, P \leq 0.001$. Post-hoc follow-ups revealed that participants with no skin sores had significantly superior scores than both of the other two groups on six of seven scales. They reported higher scores than both groups on Engagement, Career Opportunities, Finances, and Interpersonal Relations; lower scores on Negative Emotions and Health Problems. Participants who had moderately severe skin problems also reported superior scores than the high severity participants on five of these six scales, as they reported higher scores on Engagement, Finance, and Interpersonal Relations; and lower scores on Negative Emotions and Health Problems. On the Living Circumstances scale, post-hoc contrasts revealed that the participants with no sores reported significantly higher scores (16.7) than the moderate severity group (15.9).

Significant differences were also observed on each of the three other scales: Medical Instability $F(2,979)=51.4, P \leq 0.001$; Adjustment $F(2,985)=8.06, P \leq 0.001$; Fitness $F(2,990)=13.25, P \leq 0.001$. Participants with no sores reported lower Medical Instability scores (low=2.2; moderate=3.5; high=4.0), higher self-rated Adjustment (low=16.4; moderate=15.9; high=14.4) and higher overall fitness (low=19.3; moderate=18.1; high=16.9) than either of the other two groups. The moderate severity group reported significantly higher Adjustment scores than the high severity group, although no differences were noted between moderate and high severity groups for either Medical Instability or Fitness.

The number of skin sores were significantly related to employment status, $\chi^2=14.4, P \leq 0.001$, as 42% of the participants with no skin sores were working, compared with 30% of those with one to four sores and 28% of those with five or more sores.

Participants with no skin sores also reported a significantly higher sitting tolerance (13.4 h) than either participants with one to four sores (12.6 h) or those with five or more sores (11.0 h). The differences in sitting tolerance between the moderate and high severity groups were also significant. The same pattern of significant differences was observed for the frequency of social outings (low = 4.2; moderate = 3.9; high = 3.4).

Days adversely impacted by sores Except for a few deviations, a similar pattern between number of skin sores and days adversely impacted was observed. Each of the seven subjective well-being scales was significantly related to days impacted by skin sores: Positive Engagement $F(2,891)=12.71$, $P\leq 0.001$; Negative Emotions $F(2,926)=25.02$, $P\leq 0.001$; Health Problems $F(2,928)=53.53$, $P\leq 0.001$; Career Opportunities $F(2,810)=10.15$, $P\leq 0.001$; Finances $F(2,938)=12.89$, $P\leq 0.001$; Living Circumstances $F(2,934)=7.89$, $P\leq 0.001$; Interpersonal Relationships $F(2,899)=12.7$, $P\leq 0.001$. In each case, participants who had no days impacted by sores reported superior scores to both those with moderate impact (8 weeks or fewer) and those with severe impact (9 or more weeks). There was only one subjective well-being scale, Health Problems, in which the moderate impact group reported significantly better scores (21.7) than those with a severe impact (23.7).

Of the three non-factor scales, significant differences were noted for Medical Instability ($F(2,933)=57.86$, $P\leq 0.001$) and Fitness ($F(2,941)=7.83$, $P\leq 0.001$), but not Adjustment ($F(2,936)=5.35$, $P\leq ns$). For Medical Instability, participants with no adverse impact reported the lowest scores (2.5), followed by the moderate impact (3.4) and high impact groups (5.1), with each of these differences being statistically significant. The no impact group reported significantly higher Fitness scores (19.0) than either of the other two groups (moderate = 17.9; high = 17.5), who were not significantly different from each other.

There was a significant relationship between employment and days adversely impacted by sores, $\chi^2=13.4$, $P\leq 0.01$, as 39% of the participants with no impact reported working, compared with 29% and 23% for the moderate and high impact groups. The no impact group had a significantly greater sitting tolerance (13.4 h), than those with moderate impact (12.4 h), who in turn had a greater sitting tolerance than those with a severe impact (9.9 h), $F(2,935)=17.1$, $P\leq 0.001$. Lastly, the no impact group reported significantly more outings than either of the other two groups, $F(2,935)=6.8$, $P\leq 0.01$ (low = 4.1; moderate = 3.8; high = 3.6).

Discussion

This study generated several important types of data on skin sores and spinal cord injury. It provided descriptive data on the number of skin sores, days

adversely impacted by sores, and number of skin surgeries among a large sample of participants with SCI ($n=1017$). More importantly, it generated data on the relationship between the number of sores and days adversely impacted by sores with both biographic characteristics and life adjustment. The latter comparisons were particularly enlightening.

Summary and implications

The first generalization is that significant problems with skin sores impacted only a select portion of the study sample. Even though just fewer than half of all respondents (46%) reported having at least one skin sore during the 2 year period, only about a quarter of the participants (27%) reported having to reduce their sitting time due to the sores, with skin surgeries reported in only 10% of the participants over the 2 year period.

When sores did occur, they were related to a lesser overall quality of life. Having at least one skin sore over the 2 year period was associated with lower levels of subjective well-being and activity, and greater health problems. The magnitude of these problems was related to the number of sores. Having the adverse impact of reduced sitting time due to sores was also associated with less favorable outcomes. However, any adverse impact on sitting was associated with poorer life adjustment, with little difference thereafter for the amount of days impacted. Taken together, these findings suggest that the presence of skin sores has an unfavorable relationship with life adjustment; reduced sitting time in response to sores is a particularly strong risk factor for poor life adjustment.

Even though life adjustment variables were highly correlated with skin sores, biographic variables were not. Outside of the relationship between injury severity and number of skin sores, none of the other factors were significantly correlated with sores. Although this may be partially attributable to the strict alpha related to correction for multiple significance tests, it suggests that personal factors are more likely to moderate the relative risk for sores after SCI.

Limitations/future research

There are three primary limitations in this study. First, the data are based on self-report. Although this is necessary for subjective well-being measures, estimates of skin sores and activities are more open to errors in recall. Nevertheless, the number of skin sores identified in the current study sample paralleled that identified in epidemiologic studies. Second, there was a 2 year window for skin sores. It would be interesting to study skin sores over a longer period of time. Lastly and perhaps most importantly, the current study cannot address causation between skin problems and life adjustment. In reality, it is likely that there is a mutual influence between skin problems and life adjustment, with certain people having poor adjust-

ment patterns that increase their risk for skin sores, which in turn leads to further diminished adjustment.

Future research would benefit from inclusion of a number of variables which may be expected to be related to skin problems. For example, a tighter investigation of how coping strategies relate to skin sore problems would be of great interest. Also, it would be interesting to investigate the role of multiple behavioral risk factors, including both the presence of positive preventative behaviors (eg, weight shifts, skin checks) and the absence of self-destructive behaviors (eg, smoking, alcohol abuse, risk taking), in relation to problems with skin sores. A model has been developed to investigate the relationship between each type of factor with secondary conditions, including skin sores.⁸ Longitudinal studies may be particularly enlightening in these types of studies. Lastly, studies are needed that both lay the foundation for the development strategies and test these strategies in efforts to reduce the number and impact of skin sores on the lives of people with SCI.

Acknowledgements

This research was supported by grants from the Disabilities Prevention Program of the Centers for Disease Control and the National Center for Medical Rehabilitation Research (Grant #3R01HD29835-02S2), the National Institute for Disability and Rehabilitation Research (Grants #H133G20200-93 and #H133N00023-95), and

from the Shepherd Center in Atlanta, Georgia. The principal investigator would like to thank the following members of the research team, without whose contributions completion of this paper would not have been possible: Bryan Bell, Sarah Lottes, Maya Sternberg, and Joseph Maides.

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