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Development and Validation of a Patient-Reported Checklist for Dermatological Complications in Chronic Spinal Cord Injury

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Abstract

Study Design: Cross-Sectional

Objectives:

This study aimed to develop and validate a comprehensive, patient-reported checklist for identifying dermatological complications in individuals with chronic SCI

Setting
Sina Trauma and Surgery Research Center, Sina Hospital, Tehran, Iran

Methods:

A multi-phase, cross-sectional methodological study was conducted. Items were generated via literature review and expert opinion, followed by content validation with a panel of 11 specialists using the Content Validity Ratio (CVR) and Content Validity Index (CVI). After face validation with patient representatives, the final checklist was field-tested in structured interviews with individuals from a national SCI registry. Inter-rater reliability was assessed with Cohen's Kappa.

Results:

The final 16-item checklist demonstrated excellent content validity, with all items meeting CVR thresholds and achieving high Scale-Level CVI scores (**Relevance = 0.88, Simplicity = 0.92, Clarity = 0.89**). Inter-rater reliability was excellent **Cohen's Kappa = 0.89**). The tool was administered to 139 individuals with chronic SCI (mean age 43.9 years; 76.8% male), of whom **44.6%** (n = 62) reported at least one complication. Of the 102 complications identified, those related to fungal infections (**25.5%**) and early-stage pressure injuries (**20.6%**) were the most prevalent. The mean onset time for the first complication was **2.7 months** post-injury.

Conclusions:

The Spinal Cord Injury Skin Complications Checklist (SCI-SCC) is a valid and reliable patient-reported tool for screening dermatological issues in this population. Its integration into routine clinical practice can facilitate standardized monitoring, promote early detection, and ultimately improve patient-centered care for individuals living with chronic SCI.

Introduction

Spinal cord injury (SCI) is a debilitating condition that results in a wide range of physical and psychological consequences, significantly impacting the daily lives of affected individuals. While motor and sensory dysfunction are the most apparent manifestations of SCI, dermatological complications are also prevalent and contribute substantially to the morbidity of patients. Among these complications, pressure ulcers, fungal infections, rashes, and other skin disorders are common and often exacerbate

the healthcare challenges faced by individuals with SCI (1). Individuals with SCI frequently develop skin issues – pressure ulcers (pressure injuries) being the most well-known, but also fungal infections, dermatitis, acne, xerosis (dry skin), and hair or nail changes due to autonomic and vascular alterations (14). These skin conditions arise primarily due to the loss of sensation and impaired mobility, which hinder the ability to detect discomfort and prevent skin breakdown. Additionally, individuals with SCI often experience prolonged immobility, which increases the risk of skin lesions and infections (2). The global burden of bacterial skin diseases, including those associated with SCI, has garnered increasing attention in recent years. Studies highlight that skin infections, particularly fungal infections such as candidiasis, significantly contribute to morbidity due to compromised skin integrity and frequent use of medical devices that create environments conducive to infection (3). In particular, fungal infections, such as candidiasis, are of great concern in individuals with SCI due to their compromised skin integrity and frequent use of indwelling catheters (4). Moreover, dermatological issues not only complicate the physical health of patients but also diminish their psychological well-being, thereby lowering their quality of life. Despite the significant clinical challenges posed by these dermatological complications, much of the existing literature focuses on objective measures of health outcomes, often overlooking the subjective experiences of patients. This gap in understanding the patient's perspective calls attention to the importance of Patient-Reported Outcome Measures (PROMs) in dermatology. PROMs provide a standardized method of capturing the patient's report of their health status and can be instrumental in evaluating the impact of skin conditions on individuals with SCI. PROMs commonly manifest as questionnaires, rating scales, or individual assessment items, which may be administered through traditional paper-and-pencil methods or via electronic platforms. PROMs serve as a foundational reference point, enabling healthcare professionals to assess therapeutic efficacy, monitor adverse effects, or identify exacerbations over time (5). Although PROMs have been widely utilized in dermatology for various conditions, there is a notable lack of studies examining their use specifically in SCI populations, where skin complications play a crucial role in the overall health and well-being of patients (4). Integrating PROMs into clinical practice can bridge this gap, offering more comprehensive care that addresses both the physical and emotional aspects of skin complications in individuals with SCI.This paper aims to explore the spectrum of dermatological complications that arise following spinal cord injury, emphasizing the role of fungal infections, rashes, and pressure ulcers, while also highlighting the need for a more patient-centered approach through the use of PROMs. By investigating the prevalence, onset, and patient-perceived impact of these dermatological conditions, this study aims to develop a clinically valuable patient-reported assessment tool.

METHODS

Study Design

This cross-sectional methodological study aimed to develop and validate a patient-reported checklist for identifying dermatological complications among individuals with chronic spinal cord injury (SCI ≥ 12 months). The validation process involved four sequential phases: 1. Checklist Development, 2. Content

Validation, 3. Face Validation, and 4. Checklist Administration and Validation through structured patient interviews.written or verbal informed consent was obtained from all participants before data collection.

Checklist Development

The development phase began with an extensive literature review conducted in major electronic databases (such as PubMed, Web of Science, Scopus, and Embase) to identify all reported and potential dermatological complications associated with chronic SCI. The findings were synthesized into a preliminary list of 33 complications, which was subsequently reviewed by a multidisciplinary expert panel consisting of three dermatologists (A.GH., H.B., M.R.) and three neurosurgeons (V.R., M.S., H.E.). Based on their clinical experience and judgment, the experts refined the preliminary list by confirming the relevance of each complication. Additionally, the experts were asked to specify, for each complication, 1. the symptoms likely reported by patients, and 2. the probable timing of symptom onset following SCI. This qualitative input contributed to the creation of an initial checklist comprising 16 structured questions.

Content Validation

To evaluate the content validity of the checklist, a validation round was conducted involving a broader expert panel consisting of four dermatologists (A.GH., H.B., M.R., N.M.) seven neurosurgeons (V.R., M.S., H.E., F.F., H.H., MR.HK., A.P.), - (total: 11 experts). Each checklist item was rated for relevance and essentiality using standardized validation forms:

- Essentiality: assessed by Lawshe's method on a three-point scale (essential, useful but not essential, not essential).
- Relevance: assessed on a four-point Likert scale (1 = not relevant, 2 = Somewhat Relevant, 3 = Quite Relevant, 4 = highly relevant).

The Content Validity Ratio (CVR) was calculated for each item using Lawshe's formula (11):

$CVR = (N_e\text{-}N/2)/(N/2)$

where N_e is the number of experts rating the item as "essential," and N is the total number of experts.

The Content Validity Index (CVI) was calculated for each item as the proportion of experts rating it as "quite relevant" or "highly relevant" (ratings of 3 or 4). Items scoring below the acceptable thresholds (CVR < 0.62 and CVI < 0.80) underwent further review and revisions for improved clarity, specificity, and relevance. The final checklist consisted of 16 validated items, all meeting or exceeding these thresholds.

Face Validation

To confirm clarity and readability, a face validation phase was conducted separately. This stage involved a small group of 10 individuals representing the target population (individuals with SCI) or healthcare

professionals familiar with individuals with SCI. Participants reviewed each checklist item to ensure they were clear, simple, understandable, and clinically relevant. Any unclear or ambiguous items were revised based on feedback to enhance comprehension.

The validated 16-item Spinal Cord Injury Skin Complications Checklist (SCI-SCC) was finalized in Persian, the language of administration. For the benefit of an international audience, an English translation was also prepared. The full text of the original Persian checklist and its English translation are provided as supplementary materials (see Supplementary Files 1 and 2, respectively).

Participants and Data Collection

Eligible participants were identified through the National Spinal Cord Injury Registry of Iran (NSCIR-IR). The inclusion criteria were:

- Age ≥ 18 years
- Confirmed diagnosis of SCI sustained ≥ 12 months prior
- Presence of a neurologic injury resulting from SCI that required surgical intervention
- No comorbid traumatic injuries (e.g., traumatic brain injury, severe abdominal trauma) that could confound the assessment
- Individuals with pre-existing chronic dermatological conditions were excluded to ensure identified complications could be attributed to SCI.
- Adequate cognitive and communicative abilities to participate in interviews

Of the total participants screened (178 individuals met criteria), eligible participants were contacted and invited to participate. Interviews were conducted either face-to-face or by telephone. Interview duration was approximately 20–30 minutes. All interviewers were trained to ensure standardized data collection procedures, which included standardized prompts, clarification techniques, and accurate recording of responses in structured electronic or paper forms. Ultimately, 139 participants consented and completed the checklist.

Inter-rater reliability was assessed using Cohen's Kappa coefficient. For feasibility, a random subset of 20% (n = 26) of participants was independently re-interviewed by a second trained interviewer.

Data Analysis

Descriptive statistics were used to summarize demographic and clinical characteristics of the participants (mean, standard deviation, frequency, percentage). CVR and CVI values were calculated as previously described to confirm the content validity of the checklist items.

Statistical analysis was conducted using SPSS version 26. CVR critical values were interpreted based on the number of panelists, and CVI values ≥ 0.80 were considered acceptable (12).

RESULTS

Expert Panel

The expert panel involved in content validation included 11 specialists: four dermatologists and seven neurosurgeons. The average clinical experience of the expert panel was 14 years (range: 10–30 years).

Checklist Development and Content Validation

Initially, the checklist draft consisted of 16 structured items, addressing key dermatological complications post-spinal cord injury (SCI). Each item was assessed independently by the experts for relevance, essentiality, clarity, and simplicity.

The content validation process was conducted in two sequential rounds to ensure the quality of the checklist items. In the first round of evaluation by the 11 experts, most items showed strong validity. However, three questions were identified for revision as they fell below the pre-specified Item-Content Validity Index (I-CVI) threshold of 0.80 for one or more criteria.

As detailed in Table 1, the first-round scores showed that Question 3 had an I-CVI of 0.70 for both Relevance and Clarity. Question 4 scored 0.60 for Relevance and Simplicity. Question 8 had an I-CVI of 0.70 for Relevance.

Based on the qualitative feedback and suggestions provided by the experts, these three items were reworded to enhance their clarity, simplicity, and relevance. The revised checklist was then submitted to the same expert panel for a final round of validation.

The final round results demonstrated a significant improvement. All 16 items successfully met or exceeded the acceptable thresholds for both the Content Validity Ratio and the Item-Content Validity Index (I-CVI ≥ 0.80) across all criteria. The final overall Scale-Level CVI (S-CVI) for the checklist was 0.88 for Relevance, 0.92 for Simplicity, and 0.89 for Clarity, confirming the high content validity of the final instrument.

Face Validation

Face validation was conducted with 10 participants, including individuals with SCI and/or healthcare providers familiar with dermatological complications. Feedback primarily addressed item clarity, relevance, and ease of understanding. Minor modifications were made for improved readability, resulting in final face validity scores consistently above the acceptable threshold (≥ 0.80), confirming patient comprehension.

Reliability Analysis

Reliability analysis, conducted on 26 randomly selected participants, demonstrated excellent inter-rater agreement with an average Cohen's Kappa of 0.89.

Participant Demographics and Clinical Characteristics

From an initial pool of 178 eligible individuals, a total of 139 participants with spinal cord injury (SCI) completed the checklist interview, yielding a response rate of 78.08%. The mean age of the participants was 43.9 (± 14.9) years, and the majority of participants were male (76.8%). The mean Body Mass Index (BMI) was 24.5 kg/M^2.

The clinical characteristics of the SCI participants are detailed in Table 2. The sample included 84 individuals with paraplegia (60.5%) and 55 with tetraplegia (39.5%). The most common level of injury was cervical (n = 55, 39.5%), followed by lumbar (n = 33, 24.0%), combined thoracic and lumbar (n = 28, 19.4%), and thoracic (n = 23, 17.1%). A complete spinal cord injury was reported by 63% of participants, while 37% had an incomplete injury.

Prevalence and Onset of Dermatological Complications

Of the 139 participants, 62 (44.6%) reported 102 dermatological problems since their injury. The mean time from the date of the spinal cord injury to the onset of the first reported skin complication was 2.7 months.

The frequency and timing of specific complications, as identified by the checklist questions, are detailed below. (Table 3)

_ Pressure-Related Skin Changes (Questions 1–3): Early signs of pressure injury, including discoloration, blisters, or discharge, were the second most frequently reported issue. These were reported by 21 of the 139 participants (15.1%). The onset of these complications occurred early, typically ranging from less than one month to two months post-injury.

_ Surgical site complications (Question 4) were reported by 2 participants (1.96%), with an onset between one and three months post-injury.

_ Viral skin infections consistent with HSV or Zoster patterns (Questions 5–6) were reported by 6 participants (5.88%), occurring between one and four months after injury.

_ Bacterial skin infections, such as boils or cellulitis (Question 7), were noted in 9 participants (8.82%), with an onset ranging from three to twelve months.

_ Symptoms suggestive of superficial fungal infections (Question 8) were the most common complication reported, affecting 26 participants (25.49%). The onset of these issues typically occurred later, between three and twelve months post-injury.

_ Changes in skin texture, such as thickening or roughness (Question 9), were reported by 7 participants (6.86%), with onset between four and twelve months.

_ Seborrheic dermatitis-like symptoms (Question 10) were reported by 6 participants (5.88%), with a wide onset range from five months to over a year post-injury.

_ Hair loss (Question 11) was reported by 3 participants (2.94%), occurring between three and six months.

_ Toenail issues, including ingrown nails or paronychia (Question 12), were noted in 6 participants (5.88%), with an onset of three to five months.

_ Fungal-like nail changes (Question 13) were reported by 8 participants (7.84%), with onset between three and twelve months.

_ Decreased sweating (anhidrosis/hypohidrosis) (Question 14) was reported by 3 participants (2.94%) over a wide time frame.

_ Increased or episodic sweating (hyperhidrosis or autonomic dysreflexia-related) (Questions 15–16) was reported by 5 participants (4.90%), with an early onset ranging from less than one month to three months post-injury.

Discussion

This study successfully developed and validated the SCI-SCC, a robust checklist for identifying dermatological complications in individuals with chronic SCI.

The multi-stage process used to develop and validate the Spinal Cord Injury Skin Complications Checklist (SCI-SCC) is consistent with established best practices for creating robust clinical instruments. Similar to the methodologies employed in other validation studies, our initial item generation and content validation relied on a multidisciplinary expert panel to ensure clinical relevance and comprehensiveness. The excellent quantitative results from this process, with final Scale-Level Content Validity Index (S-CVI) scores for our instrument all exceeding 0.84, demonstrate strong content validity and meet the high thresholds reported in similar studies, such as the work by Khalid et al (6). Furthermore, the inter-rater reliability of the SCI-SCC was demonstrated to be exceptionally high, with an average Cohen's Kappa of 0.89, indicating almost perfect agreement. This result compares favorably to the substantial agreement (Kappa = 0.70) reported by Alphonso et al (7), and sits at the upper end of the "moderate to almost perfect" range found by Pacheco et al (8). This rigorous, multi-stage process, supported by strong quantitative scores, confirms that the SCI-SCC is a valid and highly reliable tool, comparable or superior to previous checklist validation studies. In SCI care, PROMs have become increasingly important for comprehensive assessment. Traditional clinical evaluations often focus on objective findings (e.g., wound dimensions or lab results), but these may overlook outcomes that matter most to patients, such as pain, functional limitations, or psychosocial impacts (13). The “Needs Assessment Checklist (NAC)”

developed for SCI rehabilitation evaluates multiple domains, including skin care, activities of daily living, bladder management, and psychological status. In a study involving 193 inpatients with SCI, the NAC demonstrated strong internal consistency (mean Cronbach's α = 0.889) and item correlation (mean = 0.534), along with sensitivity to change across the rehabilitation process. Notably, psychological concerns and pain significantly impacted patient outcomes. While the NAC incorporates skin care as one of its domains, our checklist uniquely focuses on dermatologic complications in greater detail. This allows for a more targeted assessment of cutaneous health, which is often underrepresented in broader rehabilitation tools. Moreover, our validation process using content validity index (CVI) and content validity ratio (CVR) complements the NAC's psychometric rigor, reinforcing the importance of precise, patient-reported tools to guide comprehensive post-SCI care (15). Unifying causes of immune dysfunction are complex, influenced by numerous factors including diet, activity, and biological states. In individuals with SCI, the primary cause is decentralization of autonomic functions, currently without remedy. Other contributing factors, such as physical inactivity, diet, catecholamine overstimulation, and medications, also negatively impact immune function and may be improved through lifestyle interventions (17). Cruse et al. revealed that poor nutritional status is strongly linked to pressure ulcers in individuals with SCI, with patients having ulcers showing significantly lower mean zinc levels (52.3 µg/dl) than those without **(82.0 µg/dl).** This nutritional deficit is compounded by a rapid decline in immune function post-injury, where Natural Killer (NK) cell activity halves within two weeks and T-cell function drops to 40% of normal by three months. These interconnected nutritional and immune deficits, which are more severe in cervical injuries, contribute to the impaired wound healing seen in this population (21). Our discovery that nearly **50%** of individuals with SCI experience dermatological issues aligns well with earlier reports. Gul et al (16). examined 100 paralyzed patients (traumatic paraplegia and stroke-related hemiplegia) and reported that **92.9%** showed at least one cutaneous abnormality upon close examination. Rao and colleagues (2), found a **30.4%** incidence of skin conditions following acute SCI, with **50%** of these being fungal infections. Additionally, Korean data indicated fungal infections as the most common (≈ 62%) among post-SCI skin lesions. The predominance of fungal issues is echoed by other research. In a cross-sectional study from Turkey, tinea pedis (athlete's foot) was the single most frequent skin disorder, affecting 18% of 100 paralyzed patients. Fungal toenail infections (onychomycosis) were also very common at 14%. These rates were significantly higher than in neurologically normal controls (9). Results indicated significant impairment of both natural and adaptive immune functions in SCI patients, correlating with elevated urine-free cortisol levels due to increased ACTH secretion. NK cell function reached its lowest at 2 months post-injury, whereas the adaptive immune response was lowest at 3 months, suggesting NK cells are more susceptible to SCI-related stress than T cells (18). This fact may support the timing of onset in our sample (mean 2.7 months) also resembles the 80-day (~ 2.6 months) average reported in previous studies (23). A report on DermNet highlights that tinea cruris and tinea pedis are the most common fungal manifestations in individuals with SCI (1). Though earlier studies frequently show fungal infections dominate, they often report bacterial lesions at around 9%, very close to our 8.82% (9/139). Additionally, literature typically gives less prominence to viral symptoms in chronic SCI, whereas our study specifically identified reactivation of HSV and VZV in 6 participants—a noteworthy proportion, possibly reflecting increased community

exposure or comorbidities not captured in hospital-based analyses (2). Seborrheic dermatitis is a common issue in SCI patients, especially quadriplegics. Our findings support previous observations that spinal cord injury alters susceptibility to specific skin conditions. Reed et al. (19), reported a high prevalence of seborrheic dermatitis in quadriplegic patients (58%), primarily affecting the scalp and face, despite the absence of sweating and neural input. This suggests sebaceous gland activity may be maintained through systemic or hormonal mechanisms. In line with this, seborrhea emerged as one of the most frequently reported complications in our study. Conversely, Reed et al. found no cases of dermatophytosis among 100 SCI patients, likely due to anhidrosis and the resulting dry skin, despite a history of tinea in 36% of cases. Similarly, our data showed lower rates of tinea pedis compared to candidiasis, reinforcing the idea that post-injury skin changes may reduce the risk of certain fungal infections while increasing susceptibility to others. Ulker Gül et al. (9) identified tinea pedis (18%), onychomycosis (14%), xerosis (13%), and lower extremity hair loss (12%) as the most common skin disorders in individuals with hemiplegia or paraplegia, significantly more than in controls.

In our study, 6.86% of participants reported changes in skin texture consistent with thickening or roughness (Q9). This finding is consistent with previous research, which indicates that the prevalence of this complication is highly dependent on the neurological level of injury. For instance, a large prospective study by Stover et al. (20), found that significant skin thickening occurred in **57.9%** of individuals with cervical injuries but in only **16.0%** of those with thoracolumbar injuries. The same study also demonstrated that the likelihood of skin thickening increases with time, rising from **20.3%** at one-year post-injury to over **51%** after five years. Our checklist identified toenail issues, such as ingrown nails or paronychia (Q12), in 5.88% of the study population. This prevalence aligns with the findings of Stover et al., who reported that toenail hypertrophy occurred in 6.0–12.3% of their participants. Importantly, and in contrast to skin thickening, they noted that nail complications were not correlated with the neurological level of the injury, suggesting the neurological deficit itself is the primary predisposing factor. Stover et al. also highlighted that paronychia is frequently seen in the first year after injury and is considered a potential cause of increased spasticity. Also, Jaffray and colleagues (21), showed that Ingrowing toenails are a significant complication in individuals with tetraplegia, particularly those with complete cord lesions, with one study reporting a prevalence of 44%. The primary cause appears to be structural changes to the nail itself; 87% of affected patients reported their nails had become brittle and easily broken post-injury, leading the remnant to ingrow after breaking. Our checklist successfully identified the complex pattern of sweating disturbances common after SCI, with participants reporting both decreased (Q14) and increased (Q15-16) sweating. The physiological basis for these patient-reported experiences is well-documented. A study by Yaggie et al. (22), quantified this sweating imbalance, demonstrating that it results from a combination of decreased sweat gland sensitivity below the level of injury and a compensatory, adaptive increase in sweat production in glands above the lesion. Therefore, our checklist serves as an effective tool for capturing the clinical signs of this established sudomotor dysfunction. In our study, surgical site complications (Question 4) were a relatively uncommon finding, reported by only 1.96% of complications. This prevalence is comparable to, though slightly lower than, the incidence reported in a large study (10) of 518 patients, which found a surgical site infection (SSI) incidence of

3.2% at 1 month and 3.7% at 3 months post-procedure. Regarding the timing, our study identified these complications occurring between one and three months post-injury. This onset is somewhat later than the findings from the cited study, where the median onset of SSI was 16 days, with 75% of cases occurring within 44 days. The difference in the reported onset timing may be attributable to the methodologies; our patient-reported checklist relies on long-term recall, which may be less precise than the active surveillance often used in prospective surgical studies. Nonetheless, both studies confirm that surgical site complications represent a tangible, albeit low-frequency, risk in the months following injury. Despite lacking a control group, this alignment supports the reliability of our checklist and underscores the need for routine skin evaluations in individuals with SCI.

The potential discrepancies between our findings and those of other studies can likely be attributed to several key factors. First, and most importantly, is the methodological approach. Our study utilized a comprehensive, patient-reported checklist designed to screen for a wide range of symptoms, some of which may not have prompted a clinical visit or been formally diagnosed. This approach may capture a higher rate of bothersome but less severe conditions, like mild fungal infections, compared to studies relying on retrospective chart reviews, which only capture diagnosed and documented diseases. Second, population characteristics may play a role. Our study was from a specific national registry in Iran, and differences in climate, hygiene practices, healthcare access, and patient education compared to cohorts in North America or Europe could influence the prevalence of certain conditions like fungal infections. Finally, the definition of a "case" differs. Our checklist screens for symptoms (e.g., "ring-shaped red and itchy patches"), which is a sensitive approach that may include mild cases. In contrast, studies requiring a formal clinical diagnosis or specific culture results will naturally report lower prevalence rates. This highlights the value of our checklist as a sensitive screening tool designed for early detection of patient-perceived problems.

This study has several strengths, including its rigorous multi-stage validation process, robust statistical validation of checklist items (high CVR and CVI values), high inter-rater reliability (Cohen’s Kappa = 0.89), the patient-centered approach emphasizing patient-reported outcomes, the comprehensive and multidisciplinary nature of the expert validation panel, and the clinical practicality of the checklist in facilitating early detection and monitoring of dermatological issues in chronic SCI patients. However, some limitations must be acknowledged. The cross-sectional design provides a snapshot in time and cannot establish causality or track the progression of complications. Furthermore, the data relies on patient recall, which can be subject to bias, and the checklist serves as a screening tool, not a diagnostic one; all findings would require clinical confirmation. Additionally, Participants registered in national databases might represent individuals who are more engaged with healthcare services, potentially leading to an overestimation or underestimation of the true prevalence of dermatological issues.

Based on these findings and limitations, we propose several directions for future research. Employ prospective longitudinal designs to track real-time onset and progression, include clinical evaluations or photo documentation to confirm self-reported findings, and investigate the checklist’s applicability across different cultural or language settings with appropriate adaptation and revalidation. Specifically,

prospective longitudinal studies could track dermatological complications over time, and incorporating photographic documentation could validate patient-reported skin conditions, enhancing diagnostic accuracy and clinical utility.

Conclusion

This study developed and validated a practical checklist to identify skin complications in individuals with chronic spinal cord injury. The findings highlight that dermatological issues are common and often appear early after injury. The checklist effectively captures a wide range of relevant conditions and can serve as a valuable tool for early screening and routine monitoring, supporting timely intervention and improved patient care. Future integration of this validated checklist into routine clinical practice and rehabilitation programs could enhance early detection and improve the overall management and outcomes for patients with chronic SCI.

Declarations

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Ethical Approval: The study protocol was reviewed and approved by the Research Ethics Committee (97-02-38-972)

Competing Interests: The authors declare no competing interests.

Author Contribution

Statement: H.Kh contributed to the study design, methodology, data analysis, project administration, conducted interviews, and wrote the initial manuscript. P.BS and A.H conducted interviews, interpreted results, and contributed to writing the manuscript. I.S and Kh.N conducted interviews and interpreted the results. M.R, A.Gh, H.B, N.M, H.E, F.F, A.PR, M.S, H.H, and MR.HK all served as members of the expert validation panel and contributed to revising the checklist and the final manuscript. V.RM conceptualized and supervised the study, administered the expert panel, and revised the checklist and final manuscript. All authors have read and approved the final manuscript.

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Data Availability Statement:

Data sharing not applicable to this article as no datasets were Generated or analyzed during the current study.

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Tables

Table 1: CVR and CVI values for first and final validated checklist items

Item	CVR (Round 1)	CVR (Final)	I-CVI Relevance (R1)	I-CVI Relevance (Final)	I-CVI Simplicity (R1)	I-CVI Simplicity (Final)	I-CVI Clarity (R1)	I-CVI Clarity (Final)
Q1	1	1	0.81	0.81	0.81	0.81	0.81	0.81
Q2	0.82	0.82	0.9	0.9	0.9	0.9	0.9	0.9
Q3	1	1	0.7	0.81	0.81	0.81	0.7	0.81
Q4	0.82	0.82	0.6	0.81	0.6	0.9	0.9	0.9
Q5	1	1	0.9	0.9	0.9	0.9	0.9	0.9
Q6	1	1	0.9	0.9	0.9	0.9	0.9	0.9
Q7	0.82	0.82	0.9	0.9	1	1	1	1
Q8	1	1	0.7	0.81	0.9	0.9	0.81	0.81
Q9	0.82	0.82	0.81	0.81	0.81	0.81	0.81	0.81
Q10	0.82	0.82	0.9	0.9	0.9	0.9	0.81	0.81
Q11	0.82	0.82	0.81	0.81	0.9	0.9	0.81	0.81
Q12	1	1	0.9	0.9	0.9	0.9	0.81	0.81
Q13	0.82	0.82	0.81	0.81	1	1	1	1
Q14	1	1	0.9	0.9	0.9	0.9	0.9	0.9
Q15	0.82	0.82	1	1	1	1	0.9	0.9
Q16	0.82	0.82	0.9	0.9	1	1	1	1

Table 2: Demographic and Clinical Characteristics of Participants (N=139)

Characteristic	Category	N (%) or Mean ± SD
Age (years)		43.89 ± 14.9
Body Mass Index (BMI)		24.45 kg/m²
Gender	Male	107 (76.8%)
	Female	32 (23.2%)
Type of Injury	Paraplegia	84 (60.5%)
	Tetraplegia	55 (39.5%)
Level of Injury	Cervical	55 (39.5%)
	Thoracic	23 (17.1%)
	Lumbar	33 (24.0%)
	Combined Thoracic/Lumbar	28 (19.4%)
Completeness of Injury	Complete	88 (63.0%)
	Incomplete	51 (37.0%)

Table 3: Prevalence and Reported Onset of Dermatological Complications (N=102)

Checklist Item(s)	Associated Dermatological Condition	Number of complication(s) (%)	Reported Onset Time Range (Post-Injury)
Q1-Q3	Early signs of pressure injury (discoloration, blisters, discharge)	21 (20.58%)	<1 month to 2 months
Q4	Surgical site complications/infection	2 (1.96%)	1 month to 3 months
Q5-Q6	Viral infections (e.g., HSV, Zoster patterns)	6 (5.88%)	1 month to 4 months
Q7	Bacterial infections (e.g., boils, cellulitis, infected wounds)	9 (8.82%)	3 months to 12 months
Q8	Fungal infections (ringworm, skin folds, athlete's foot)	26 (25.49%)	3 months to 12 months
Q9	Skin thickening or roughness (hyperkeratosis, lichenification)	7 (6.86%)	4 months to 12 months
Q10	Seborrheic dermatitis (scaling, redness on scalp/face/chest)	6 (5.88%)	5 months to >12 months
Q11	Hair loss/thinning (alopecia)	3 (2.94%)	3 months to 6 months
Q12	Ingrown toenails/Paronychia	6 (5.88%)	3 months to 5 months
Q13	Nail changes (e.g., onychomycosis)	8 (7.84%)	3 months to 12 months
Q14	Decreased sweating (anhidrosis/hypohidrosis)	3 (2.94%)	1 month to 12 months
Q15-Q16	Increased/episodic sweating (hyperhidrosis)	5 (4.90%)	<1 month to 3 months

Note: Participants could report multiple dermatological complications

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- PersianversionofChecklistforSkinProblemsinPatientswithSpinalCordInjury.pdf
- EnglishversionofChecklistforSkinProblemsinPatientswithSpinalCordInjury.pdf