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CLINICAL REPORT

Improvement in Psoriasis Area and Severity Index Score Predicts Improvement in Skin Pain Over Time in Patients with Psoriasis

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Pain and discomfort are common and often severe skin symptoms in patients with psoriasis. However, no studies have investigated skin pain and discomfort over time, or factors that explain changes in these symptoms. The aims of the present study were to describe the changes in skin pain, skin discomfort and Psoriasis Area and Severity Index (PASI) over time, and to investigate whether change in PASI predicted change in skin pain intensity. A total of 129 patients participated in this exploratory, longitudinal study. Data were obtained through interviews and questionnaires. The results indicated reduction in skin symptoms and psoriasis severity over a period of 3 months. However, a majority of patients with skin pain at baseline reported also skin pain at follow-up. Furthermore, changes in PASI predicted changes in skin pain intensity. In conclusion, improvement in psoriasis severity predicts improvement in skin pain. ***Key words: PASI; skin pain; psoriasis*****.**

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Psoriasis is an inflammatory and symptomatic skin disease that involves variable periods of improvement or exacerbation (1). Symptoms are subjective experiences that normally change over time, and may reflect disruption of physical, mental, and social functioning (2, 3). Previous research has described a variety of patient-reported skin sensory symptoms in psoriasis patients, such as itching, soreness, hurting, pain, discomfort, burning, stinging, irritation, and sensitivity of the skin (4–8). Skin pain was reported by up to 42% of subjects (4, 9), was of moderate intensity (9), and had a clinically significant impact on functions, such as sleep, enjoyment of life, mood and work. Skin discomfort was reported by up to 44% of subjects (7, 9, 10), and had less impact on functions than skin pain. Of note, no studies investigated changes in skin sensory symptoms over time, or factors that explained these changes.

Stimulus from tissue damage and inflammation produce activity in the sensory nervous system and contribute to form the patients' pain experience (11, 12). Therefore, clinical indicators of psoriasis severity (i.e. erythema, induration, scaling) may predict skin pain over time. Despite conflicting evidence (5, 13), cross-sectional studies have indicated that psoriasis severity is associated with skin sensory symptoms (e.g. itch, pain, soreness, irritation) (4, 9, 14, 15). Furthermore, significantly higher Psoriasis Area and Severity Index (PASI) scores have been found in patients with skin pain compared with patients with skin discomfort or no sensory skin symptoms (9). Longitudinal studies showed that change in psoriasis severity correlated with change in patient-reported outcomes; higher PASI score was associated with poorer quality of life and poorer satisfaction with skin condition (16–18). In addition, improvement in PASI was associated with improvement in general bodily pain (17).

Traditionally, psoriasis treatment has been focused mainly on improvement in skin signs (e.g. erythema, induration, desquamation). However, the relief of unpleasant sensory skin symptoms is an additional important target of therapy for patients with psoriasis (6). Therefore, clinicians should recognize and value the importance of subjective symptoms. To our best knowledge, no studies have investigated changes in skin sensory symptoms over time, or psoriasis-related factors that predict changes in skin symptoms. Thus, the aims of the present study were: (*i*) to describe the changes in skin pain, skin discomfort, and PASI over time, and (*ii*) to investigate whether changes in PASI predict changes in skin pain intensity.

MATERIAL AND METHODS

Sample and setting

Patients were recruited prior to a consultation at the inpatient and outpatient dermatology units at a university hospital in Oslo, Norway, between January and September 2006. Patients who agreed to participate provided written informed consent. The study was recommended by the Regional Committee for Medical Research Ethics, region south, and approved by the Norwegian Data Inspectorate.

A total of 139 patients was included in the study at baseline. Detailed information on the inclusion/exclusion criteria, recruitment procedure, and the baseline enrolment process were described in a previous publication (9).

Study participants were followed up 3 months (± 14 days) after recruitment. A total of 10 patients was lost to follow-up for unknown reason ($n=5$), illness ($n=2$) or because the patients declined to participate ($n=3$). These patients were classified as drop-outs. The final sample in this study included 129 patients who attended the follow-up interview. Furthermore, 18 patients did not return questionnaires or complete questionnaires. A total of 111 patients provided complete data from baseline and follow-up.

Study procedures

For each patient, a 30–40 min interview was conducted by one investigator (TML) at baseline and 3 months follow-up. Patients were screened for skin pain and skin discomfort. Specific definitions of pain and discomfort were not provided, as this exploratory study aimed to investigate the patients' subjective experience of sensory skin symptoms without biasing their responses. During the interview, information was collected on demographic and clinical characteristics. Severity of psoriasis was evaluated and medical records were reviewed for disease and treatment information. Patients were taught how to complete the questionnaires (within 24 h) and return them in postage-paid envelopes.

Instruments

Demographic characteristics. Information was collected on age, gender, education, employment status, and living arrangements.

Skin pain and skin discomfort. Two questions were used to investigate whether patients experienced pain, discomfort, or no pain/discomfort due to psoriasis skin lesions. First, patients indicated, using a yes/no format, whether they experienced any skin pain or skin discomfort during the past 24 h. Patients who responded yes indicated whether the sensation was pain or discomfort. Patients who reported both pain and discomfort ($n=3$) were categorized in the pain group.

Psoriasis severity. The PASI was used to determine the severity of skin disease. The PASI total score ranges from 0 to 72. Higher scores indicate greater psoriasis severity (19). PASI is sensitive to change in psoriasis severity with treatment over time; however, less so with PASI score <3 and small skin areas of psoriasis involvement (20). A PASI score reduction of at least 50% (PASI 50) is considered as clinically meaningful improvement (21).

Skin pain intensity. One item from the Brief Pain Inventory (BPI) (22) was used to investigate the severity of skin pain. Patients were asked to report, on a 0–10 numeric rating scale (NRS), the worst skin pain intensity that they had experienced during the past 24 h. Higher scores indicate greater skin pain intensity. There is no consensus in the research literature or clinic on the association between pain and discomfort (10). The present study treats pain and discomfort as 2 different symptoms, and patients who reported either skin discomfort or no skin pain/discomfort were coded 0 on the 11-point NRS skin pain intensity score. For chronic pain, a 30% reduction in pain intensity on the 0–10 NRS is considered as clinically meaningful improvement (23).

Statistics

Data were analysed using the PASW for Windows version 17.0 (PASW Inc., Chicago, USA). Descriptive statistics were computed for demographic characteristics. Fisher's exact tests and *post hoc* contrasts were performed in order to explore the change in skin sensory symptom groups over time. Paired-samples *t*-tests were used to investigate differences in mean PASI and skin pain intensity over time. Although the PASI score was non-normally distributed, the non-parametric alternative test (i.e. Wilcoxon signed-rank test) was not used. The parametric and non-parametric tests both showed similar results, therefore the parametric test (i.e. paired samples *t*-test) was chosen as the most appropriate statistical test for exploring change in PASI over time. Analysis of covariance (ANCOVA) was used to explore differential change in mean pain intensity over time between patients with PASI 50 and those with less than 50% improvement in PASI.

The predictive value of PASI on pain intensity and possible confounders for this association were explored. A series of multiple regression analyses (general linear model in PASW) were performed in a hierarchical, predefined order using pain intensity at follow-up as the dependent variable (see Table II). None of the demographic characteristics were significantly associated with the dependent variable. Therefore, only baseline PASI and baseline pain intensity were used as control variables in the regression analyses.

The following blocks of independent variables were used to predict the effect of PASI on pain intensity over time (see Table III):

- Block 1: PASI at follow-up (causal factor).
- Block 2: PASI at follow-up (causal factor) and baseline PASI (control variable).
- Block 3: PASI at follow-up (causal factor), baseline PASI and baseline pain intensity (control variables).

RESULTS

Demographic and clinical characteristics

The majority of patients were female (57%), working (62%), cohabitant (77%), and had secondary education (40%). The mean age of the sample was 51.6 years (SD 13.1). At baseline the mean PASI score was 5.5 (SD 4.9), and the mean worst pain intensity of those who reported skin pain was 5.7 (SD 2.3). No differences were found in baseline demographic and clinical characteristics between the study sample and drop-outs (Table SI; available from http://www.medicaljournals.se/acta/content/?doi=10.2340/00015555-1456).

Change in symptom group over time

The majority of patients remained in their symptom group from baseline to 3 months follow-up (Table I). A significantly larger percentage of patients with skin pain at baseline reported skin pain at follow-up (49%) ($p<0.006$), rather than skin discomfort (33.3%) or no skin pain/discomfort (17.6%). Furthermore, a significantly larger percentage of patients with no skin pain/discomfort at baseline reported no skin pain/discomfort at follow-up (56.7%) ($p<0.006$), rather than skin discomfort (36.7%) or skin pain (6.7%).

Changes in PASI over time

In the total sample, the mean change in PASI score of –1.4 (SD 4.0) showed significant reduction from baseline to follow-up ($p=0.001$) (Table II). A total of 6% ($n=8$) had at least 75% reduction in PASI, 20%

Table I. *Change in skin sensory symptom groups from baseline to follow-up (n=129)*

		Baseline			
		Pain [1] (*n*=51) *n* (%)	Discomfort [2] (*n*=48) *n* (%)	No pain/discomfort [3] (*n*=30) *n* (%)	Statistics
Follow-up	Pain	25 (49.0)	10 (20.8)	2 (6.7)	χ^2=30.64 (p<0.001)
	Discomfort	17 (33.3)	29 (60.4)	11 (36.7)	
	No pain/discomfort	9 (17.6)	9 (18.8)	17 (56.7)	1>both 2 & 3*
	Total	51 (100)	48 (100)	30 (100)	Both 1 & 2<3*

*Statistically significant pairwise contrasts $p<0.006$.

(*n*=26) had at least 50% reduction in PASI, and 40% (*n*=52) had at least 25% reduction in PASI over time.

Changes in skin pain intensity over time

In the 51 patients who reported skin pain, the mean change in skin pain intensity score of –1.3 (SD 4.3) showed significant reduction by paired *t*-test from baseline to follow-up ($p=0.039$) (Table II). A total of 55% (*n*=28) had at least 30% reduction in skin pain intensity over time.

Prediction of PASI on pain intensity

Baseline skin pain intensity, baseline PASI (control variables), and follow-up PASI (independent variable) all showed significant bivariate associations with follow-up skin pain intensity (Table III).

In blocks 1 and 2 of the model, only baseline pain remained significantly associated with follow-up pain (beta=0.435, $p<0.001$).

In block 3 of the model, follow-up PASI was significantly associated with follow-up pain (beta=0.405, $p<0.001$), also when controlling for baseline pain and baseline PASI. Follow-up PASI alone explained 9% of the variance of follow-up pain (adjusted $R^2=0.278–0.192=0.086$).

Additional analyses that focused specifically on patients with skin pain and PASI 50 (*n*=10), showed that the mean pain intensity score for this group decreased by –3.0 (SD 5.2) compared to –0.9 (SD 4.0) among patients with skin pain and less than 50% improvement in psoriasis (*n*=41), which yielded a non-significant differential change when using PASI 50 as a factor in an analysis of covariance (ANCOVA) controlling for baseline pain ($p=0.86$).

DISCUSSION

This study showed that improvement in psoriasis severity predicted improvement in skin pain intensity. However, no difference in change in skin pain intensity was found between patients with or without clinically significant improvement in PASI. This finding indicates that the observed improvement in pain intensity associated with improved PASI scores occurs across the entire range of psoriasis affection and experience of skin pain. Previous research (4, 9, 14, 15) supports the findings of the present study by indicating an association between the severity of psoriasis and patients' experience of skin symptoms. Psoriasis-related pathological changes in the skin and the impact of these factors on the nervous system may contribute to the understanding of the present study's results. Psoriasis is a chronic inflammatory skin disease that causes tissue damage (i.e. sores, skin cracks) (1). Epidermal free nerve endings of pain sensitive nerve fibres are activated by mechanical stimuli from tissue damage, as well as inflammatory mediators and cytokines that are found in elevated levels in psoriasis skin lesions (i.e. prostaglandins, tumour necrosis factor alpha, interleukin-1β) (1, 11, 24, 25). Furthermore, a long-lasting inflammatory response from chronic psoriasis lesions may cause sensitization of the peripheral and central nervous system, which increase the patients' pain experience (11).

The present study showed that change in PASI alone explained as much as 9% of the variance of change in skin pain intensity. These findings indicate that skin pain intensity cannot be explained merely by erythema, induration, desquamation and affected body surface area. Some types and locations of psoriasis may involve

Table II. *Baseline-, follow-up-, and change scores of Psoriasis Area and Severity Index (PASI) and skin pain intensity*

	Baseline Mean ± SD	Follow-up Mean ± SD	Change score Mean ± SD	Statistics
PASI (*n*=129)[a]	5.5 ± 4.9	4.0 ± 3.7	–1.4 ± 4.0	*t*=–4.04 (*p*=0.001)
Skin pain intensity (*n*=111)[b]	2.0 ± 3.0	1.4 ± 2.6	–0.6 ± 2.9	*t*=2.09 (*p*=0.039)
Skin pain intensity (*n*=51)[c]	4.4 ± 3.0	3.1 ± 3.1	–1.3 ± 4.3	*t*=–2.13 (*p*<0.038)

[a]Total sample.
[b]Patients with complete data.
[c]Patients with complete data and pain at baseline and/or follow-up.
SD: standard deviation.

Table III. *Predicting skin pain intensity over time from Psoriasis Area and Severity Index (PASI) in patients with psoriasis (n=111)*

	Bivariate r (*p*)[a]	Block 1 Beta (*p*)[b]	Block 2 Beta (*p*)[b]	Block 3 Beta (*p*)[b]
Baseline pain intensity	0.452 (<0.001)	0.452 (<0.001)	0.435 (<0.001)	0.486 (<0.001)
Baseline PASI	0.205 (0.027)		0.053 ns	–0.230 (0.047)
Follow-up PASI	0.307 (0.001)			0.405 (<0.001)
Adjusted R^2		0.197	0.192	0.278

Dependent variable: follow-up skin pain intensity. For explanation of Block 1–3 see Material and Methods.
[a]Pearson's correlation (r) and exact *p*-values.
[b]Standardized multiple regression coefficients (betas) and exact *p*-values.
ns: non-significant.

more severe pain. For instance, palmo-plantar, inverse, and genital psoriasis are more prone to pressure and friction, which are stimuli that activate pain sensitive nerve fibres (i.e. nociceptors). In addition, genitalia are highly innervated by nociceptors. Furthermore, patients' report of pain may be better explained by individual differences, such as environmental factors, genetic predisposition, and cognitive/affective processing of the pain experience rather than disease pathology (26, 27). In the present study, age, gender, work-, residence- and relationship status, were not associated with skin pain intensity. However, other environmental factors not explored by the present study, such as seasonal changes from cold to warmer climate during the data collection, may have influenced the patients' experience of skin pain improvement. Previous studies have indicated that patients experience less severe psoriasis (1, 28) and pain (29) in warm, sunny climates. Additional factors, such as treatment and clinician follow-up, may also explain why patients in the present study showed improvement in psoriasis and skin pain over time. Research also shows that the experience of pain is associated with psychological distress (i.e. anxiety, depression, anger), withdrawal from social settings and work, negative beliefs about symptoms or disease, and poor coping strategies (30, 31). Therefore, future studies need to investigate physical, psychosocial, and cognitive factors' impact on changes in skin pain experience in patients with psoriasis.

Although the mean score changes were small, psoriasis severity and skin pain intensity improved significantly over 3 months (Table II). One-fifth and half of the patients, respectively, had a clinically significant improvement in psoriasis severity, and skin pain. Findings from the present study suggest that small improvements in psoriasis may be sufficient for considerable improvement in skin pain. Interestingly, previous studies have shown that skin symptoms, pain, and discomfort undergo pronounced improvement with psoriasis treatment (32–34). Taking this information into consideration, one might assume that treatment aimed at healing psoriasis lesions is sufficient as skin pain management. However, the present study also showed that psoriasis patients' sensory symptom profile was fairly stable. Even with potent local and systemic treatment, improvement in psoriasis lesions can take several days, weeks, or even months. In addition, some local treatments (e.g. tar products, emollients with urea, steroid creams, phototherapy) cause skin irritation, pain, and discomfort (35). Clinicians should consider analgesics as a supplement to psoriasis treatment in patients who report moderate to severe skin pain. Although no official recommendations of analgesics for psoriasis-related skin pain exist, short-term administration of paracetamol, non-steroidal anti-inflammatory drugs (NSAIDs), and/or mild opioids may be efficacious for relieving moderate psoriasis-related skin pain (36). Future research needs to establish the pain-relieving effect of analgesics and treatments for psoriasis.

Some methodological considerations and limitations of this study are addressed in e-supplement 2; available from http://www.medicaljournals.se/acta/content/?doi=10.2340/00015555-1456.

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