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The impact of pain on daily activities in patients with idiopathic inflammatory myopathies: Report from the OMERACT myositis working group

Didem Saygin [a,*], Helene Alexanderson [b], Dana DiRenzo [c], Joost Raaphorst [d], Marianne de Visser [d], Dianxu Ren [e], Malin Regardt [f], Ingrid de Groot [g], Catherine Sarver [h], Ju Yeon Kim [i], Karin Lodin [j,k], Kelly Beer [l], Merrilee Needham [m], Jin Kyun Park [i], Lisa Christopher-Stine [m], Christopher A Mecoli [m]

[a] Division of Rheumatology, Department of Medicine, University of Pittsburgh, USA
[b] Medical Unit Occupational Therapy and Physical Therapy, Karolinska University Hospital and Division of Rheumatology, Department of Medicine Solna, Karolinska Institutet, Stockholm, Sweden
[c] Division of Rheumatology, Department of Medicine, University of Pennsylvania
[d] Department of Neurology, Amsterdam UMC, University of Amsterdam, Amsterdam Neuroscience, Amsterdam, the Netherlands
[e] Health and Community Systems, University of Pittsburgh, Pittsburgh, PA, USA
[f] Department of Neurobiology, Care Sciences and Society, Division of Occupational Therapy, Karolinska Institutet and Medical Unit Occupational Therapy and Physical Therapy, Karolinska University Hospital, Stockholm, Sweden
[g] Patient Research Partner, Netherlands
[h] Patient Research Partner, USA
[i] Division of Rheumatology, Department of Internal Medicine, Seoul National University Hospital and College of Medicine, Seoul, Korea
[j] Department of Medicine, Division of Rheumatology, Karolinska Institutet, Solna, Stockholm, Sweden
[k] Department of Gastroenterology, Dermatology and Rheumatology, Karolinska University Hospital, Stockholm, Sweden
[l] Department of Neurology, Fiona Stanley Hospital, IIID Murdoch University and University of Notre Dame, Perth, Australia
[m] Division of Rheumatology, Department of Medicine, Johns Hopkins University, USA

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ABSTRACT

Background: International focus groups with patients with idiopathic inflammatory myopathies (IIM) conducted by the OMERACT Myositis Working Group over the years demonstrated the pain as an important symptom experienced by these patients. In this study, we aimed to examine the frequency and degree of pain interference, the aspects of daily life impacted by pain, and the factors associated with pain interference in adults with IIM.
Methods: This was a prospective observational study with two visits. The patients who fulfilled the probable/definite IIM (ACR/EULAR Myositis Classification Criteria) were enrolled. Pain interference was assessed with PROMIS pain interference form (6a). Myositis core set measures and PROMIS fatigue (7a) and physical function (8b) were obtained at both visits. Logistic regression and linear mixed models were performed to assess the association between pain interference and other parameters.
Results: A total of 129 patients with IIM (60 % females) were recruited from U.S., South Korea, Netherlands, Sweden, and Australia. Approximately 71 % reported pain interference. The patients in the greater pain interference group were more likely to be female, had significantly worse patient/physician global disease activity, fatigue, and physical function than those in the lower pain interference group. The most commonly impacted life aspect was household chores. Manual muscle testing, patient/physician global disease activity, fatigue, and physical function were all significantly associated with pain interference score >60.
Conclusion: The majority of the patients with IIM experience the impact of pain on their daily activities, particularly household chores. Myositis disease activity, duration, and subtype could be associated with greater pain interference.

* Corresponding author at: Division of Rheumatology, Department of Medicine, University of Pittsburgh, BST S707, 3500 Terrace St, Pittsburgh, PA 15261, USA.
E-mail address: saygind@pitt.edu (D. Saygin).

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Statement of Clinical Significance

Patients with idiopathic inflammatory myopathies (IIM) reported higher levels of pain compared to the general population in previous studies. This study showed that approximately 70% of patients with IIM experience pain that interferes with their daily activities, particularly with household chores. A significant association between myositis disease activity and pain interference was observed.

Introduction

Idiopathic inflammatory myopathies (IIM) are a heterogenous group of autoimmune diseases that include dermatomyositis (DM), immune-mediated necrotizing myopathy (IMNM), anti-synthetase syndrome (ASyS), overlap myositis (OM), and polymyositis (PM) [1]. The cardinal symptom of IIM is skeletal muscle weakness leading to functional limitations in the majority of the patients [2]. Therefore, outcomes used to assess patients with IIM naturally focus on domains of muscle weakness and physical function [3]. With a shift towards understanding the experiences of patients living with disease and providing a more patient centered approach over the last decade, other disease symptoms that are important to patients are being increasingly recognized.

The OMERACT Myositis Working Group started their work by conducting focus groups with patients with adult IIM to understand their living experiences with disease [4]. These international focus groups consistently showed pain as an important component of the disease experience [4,5]. Since IIM was traditionally thought to cause *painless* muscle weakness, pain has long been overlooked as a disease symptom. These studies were followed by a large international survey of 638 respondents including patients, heath care providers and caregivers, that asked to rank the symptoms according to their perceived importance [6, 7]. Expectedly, pain was ranked as one of the top five important symptoms by the patients (out of 24 symptoms/domains) [6,7] and was deemed mandatory to report in research studies [8]. The group agreed that the pain interference, the extent to which pain impacts daily functioning, more accurately reflected the patients' priorities than pain intensity in qualitative interviews [9]. In addition to the qualitative work performed by the OMERACT Myositis Working Group, several studies reported pain levels in patients with IIM as generally worse than the general population ranging between 42 and 78 (0–100 with lower score indicating a higher pain intensity according to Short Form 36 - Bodily Pain) [10-16]. Even though these studies were instrumental in highlighting the pain as a prevalent symptom among patients with IIM, no previous study focused on the pain interference and aspects of daily life impacted by pain in patients with IIM [17].

Pain intensity is usually measured by a visual analog scale asking respondents to rate their pain level from "no pain" to "the worst possible pain". However, this unidimensional construct provides only limited information about the patients' pain experience. Furthermore, not every patient with the same pain intensity experiences the same level of limitations in their daily activities due to pain (i.e., pain interference). Several psychological and social factors such as pain acceptance, self-efficacy and catastrophizing play a role in pain experience contributing to a variation in pain interference between individuals [18]. Therefore, pain interference provides a broader overview of the impact of pain on someone's life and likely better capture patients' experiences. Understanding of the type and level of pain interference among patients with IIM will provide opportunities for appropriate intervention.

In this study, our aims were to i) examine the frequency and degree of pain interference, ii) identify the aspects of daily life impacted by pain, and iii) explore the factors associated with presence of pain interference in patients with adult IIM.

Methods

Study design and participants

The study was designed as a prospective observational study with two visits. The patients who fulfilled the probable/definite IIM according to the ACR/EULAR Myositis Classification Criteria were recruited from multiple centers in the U.S., Netherlands, South Korea, Sweden, and Australia for a longitudinal study which was designed and executed by the OMERACT Myositis Working Group [19-21]. The participants included both newly diagnosed patients who were treatment naïve (the Netherlands) as well as those with established diseases on treatment for IIM (other countries of enrollment). The classification of IIM subgroups including DM, PM, ASyS, IMNM, and OM were determined by the treating center. The study was approved by the local institutional review board of all the participating sites, and all participants provided informed consent.

Outcome measures

The myositis core set measures (Manual muscle testing [MMT8, 0–80 with higher scores indicating better strength], physician global disease activity [physician global, 0–10 with higher scores indicating a higher disease activity], patient global disease activity [patient global, 0–10 with higher scores indicating a higher disease activity], Health Assessment Questionnaire Disability Index [HAQ-DI, 0–3 with higher scores indicating a higher level of disability], creatine kinase [CK; fold change: actual value divided by the upper limit of normal]) and PROMIS instruments (PROMIS Pain Interference [6a, v1.1], Fatigue [7a, v1.0], and Physical Function [8b, v2.0]) were obtained at both visits.

PROMIS Pain Interference has six questions that assess the self-reported consequences of pain on relevant aspects of one's life [22]. These six life aspects included day-to-day activities, work around the home, ability to participate in social activities, household chores, things that one usually does for fun, and enjoyment of social activities. The answer choices were the following: Not at all, a little bit, somewhat, quite a bit, and very much. T-score of PROMIS Pain Interference ranges from 41.1 to 76.3 with higher scores indicating higher pain interference [22]. The T-score of 50 for all the PROMIS instruments represents the mean T-score for the general population with 10 points corresponding to one standard deviation [22]. The recall period of PROMIS instruments is one week.

Statistical analyses

Demographics and disease characteristics of all patients were summarized using descriptive statistics. Descriptive statistics were presented as mean ± standard deviation (SD) for continuous variables and as frequency (percentage) for categorical variables. The patients were divided into two median groups based on their PROMIS pain interference score as $\leq$50 vs >50. A T-score of 50 was selected as the threshold due to representing the mean T-score for the general population [22]. The characteristics of the patients in the two median groups and PROMIS pain interference scores of women vs men, across age deciles, IIM subtypes, and countries of enrollment were compared using Mann Whitney U and Chi square tests, respectively. Answers to each of the six questions in the PROMIS Pain Interference instrument were summarized using descriptive statistics to assess the perceived impact of pain on the relevant aspects of one's life.

A two-step cluster analysis was conducted to identify clusters based on the clinical parameters of MMT, patient global, physician global, and pain interference score in order to understand whether the patients form groups according to their disease activity and pain interference. This method determines the optimal number of clusters through pre-clustering and hierarchical methods based on the best fit. Subsequently, we examined the derived clusters in regard to age, sex,

diagnosis duration, diagnosis, fatigue, and physical function using the Chi-square test for categorical variables or the Mann-Whitney U test for continuous variables.

Binary logistic regression models were performed to assess the relationship between pain interference (T-score of ≤60 vs >60) and each clinical parameter, controlling for age, sex, and diagnosis duration. T-score of 60 was selected for this analysis due to >60 representing individuals with pain interference levels that are 1 SD (equals to 10 T-score) worse than the general population [22]. Linear mixed models were utilized to evaluate the continuous outcome of pain interference over time and each clinical parameter, also controlling for age, sex, and diagnosis duration. All models considered the cluster effect of the enrolling country by using a robust standard error. All statistical analyses were performed using STATA version 17.0 for Windows (College Station, TX: StataCorp LLC) and SPSS version 28.0 for Windows (IBM Corp., Armonk, NY, USA). Two-tailed tests were employed, and statistical significance was defined as a p value ≤ 0.05.

Results

Study participants

A total of 129 patients (59.7 % females) were recruited from U.S. (n = 40), South Korea (n = 28), Netherlands (n = 27), Sweden (n = 18), and Australia (n = 16) (Table 1). The average age of the participants was 57.9 (SD 13.3, range 22 - 84). Diagnoses of the patients included DM (n = 63), IMNM (n = 28), PM (n = 15), ASyS (n = 14), and OM (n = 9) with an average diagnosis duration of 4.2 years (SD 6.1). The average pain interference score was 55.8 (SD 11.5) ranging between 41.1 and 76.2 T-score. Of all patients, 92 (71.3 %) reported pain interference.

Table 1
Demographic and clinical characteristics of the median PROMIS pain interference groups at baseline study visit.

	Pain Interference ≤50		Pain Interference >50		p value
	Mean ± SD or n (%)	n	Mean ± SD or n (%)	n	
Age	60.5 ± 13.4	42	56.7 ± 13.2	87	0.1
Sex (F%)	18 (43.0 %)		59 (68.0 %)		0.007
Country of enrollment					
USA	12 (28.6 %)		28 (32.2 %)		0.3 - 0.9
South Korea	8 (19.0 %)		20 (22.3 %)		
Netherlands	8 (19.0 %)		19 (21.8 %)		
Australia	8 (19.0 %)		8 (9.2 %)		
Sweden	6 (14.2 %)		12 (13.8 %)		
Diagnosis					
Anti-synthetase syndrome	5 (11.9 %)		9 (10.3 %)		0.7 - 0.9
Dermatomyositis	19 (45.2 %)		44 (50.6 %)		
Immune mediated necrotizing myopathy	11 (26.2 %)		17 (19.6 %)		
Overlap myositis	3 (7.1 %)		6 (6.9 %)		
Polymyositis	4 (9.6 %)		11 (12.6 %)		
Diagnosis duration (years)	3.7 ± 5.2	42	4.4 ± 6.5	85	0.9
Myositis Core Set Measures					
MMT (0–80)	72.3 ± 12.5	38	70.5 ± 10.7	76	0.1
Patient Global Disease Activity (0–10)	3.3 ± 2.8	33	4.9 ± 2.7	71	0.003
Physician Global Disease Activity (0–10)	3.2 ± 2.9	40	4.1 ± 2.4	74	0.03
CK (fold change)	7.6 ± 18.9	41	6.7 ± 16.5	87	0.4
HAQ-DI (0–3)	1.2 ± 1.1	13	1.2 ± 0.8	27	0.8
PROMIS instruments					
PROMIS Pain Interference	42.1 ± 2.7	42	62.4 ± 7.6	87	<0.0001
PROMIS Fatigue	48.5 ± 9.9	42	61.6 ± 10.1	87	<0.0001
PROMIS Physical Function	46.5 ± 11.1	42	35.9 ± 7.8	87	<0.0001

Abbreviations: F: Female, SD: Standard deviation, MMT: Manual muscle testing, CK: Creatine kinase, HAQ-DI: Health assessment questionnaire disability index.

Pain interference subgroups

Pain interference was comparable between women (56.3 [50.8 – 65.9]) vs men (54.0 [41.1 – 64.9], p = 0.1), among age deciles, IIM subtypes, and countries of enrollment (Supplementary Figure 1).

The patients in the greater pain interference group (T-score >50) were more likely to be female, had significantly higher patient and physician global disease activity, and fatigue, and worse physical function scores than those in the lower pain interference group (T-score ≤50) (Table 1). No significant differences were observed for age, MMT, CK, diagnosis duration, diagnosis type, and country of enrollment between the groups.

The patients who had no pain interference had significantly better patient global disease activity (p = 0.01), fatigue, and physical function (p < 0.0001 for both) compared to those who have pain interference (Supplementary Table 1). The other parameters (age, MMT, physician global disease activity, CK, diagnosis duration) did not reach statistical significance between the groups.

Patients from Netherlands, who were newly diagnosed and treatment-naïve, had a significant improvement in their pain interference score from 58.8 at the initial visit to 41.1 at the follow up visit (n = 27, p = 0.002; data not shown).

Life aspects affected by pain

Among the patients who had pain interference (n = 92), the life aspect that was most commonly perceived as impacted by pain was household chores with 94.5 % of the patients reporting at least a little bit of interference of pain with their household chores, which was followed by day-to-day activities (91.3 %) (Table 2). The life aspect that was the least commonly perceived as impacted was enjoyment of social activities with 78.3 % reporting at least a little bit of interference of pain.

Cluster analyses

There were two clusters identified in the cluster analyses: Cluster 1 (27.1 %) and cluster 2 (72.9 %) (Table 3). The most important predictor of the clusters was MMT, followed by patient global and physician global disease activity. Cluster 1 had significantly worse MMT, patient global and physician global disease activity, pain interference and fatigue scores and worse physical function scores than cluster 2. Cluster 1 had significantly higher number of patients from Netherlands, while cluster 2 had significantly higher number of patients from U.S. Clusters were comparable in terms of age (p = 0.8) and sex distribution (p = 0.1). There was a significantly higher number of patients with OM in cluster 1 (p = 0.02). Patients in cluster 1 had significantly shorter diagnosis duration than cluster 2 (2.3 vs 5.2 years, p < 0.0001).

Regression analyses

In univariate logistic regression analyses (adjusted for the cluster effect due to country of enrollment), MMT, patient global, physician global, fatigue, physical function, and HAQ-DI were all significantly associated with pain interference score >60 except CK (Table 4). The results were similar in multivariable model (adjusted for the age, gender, diagnosis duration, and county of enrollment).

In univariate linear mixed effects model using longitudinal data (adjusted for the cluster effect due to country of enrollment), MMT, patient global, fatigue, physical function and HAQ-DI were significantly associated with the change in pain interference except physician global and CK (Table 4). The results were similar in multivariable model (adjusted for the age, gender, diagnosis duration, and county of

Table 2
Distribution of answer choices showing the perceived interfering effects of pain on the frequency of six daily activities among the patients who had pain interference (n = 92).

	In the past 7 days, did pain interfere with your					
	Day-to-day activities	Work around the home	Ability to participate in social activities	Household chores	Things that you usually do for fun	Enjoyment of social activities
Pain interference on daily activities*	84 (91.3 %)	74 (80.5 %)	80 (85.9 %)	86 (93.5 %)	77 (83.8 %)	72 (78.3 %)
A little bit	24 (26.1 %)	22 (23.9 %)	23 (25.0 %)	31 (33.7 %)	25 (27.2 %)	22 (23.9 %)
Somewhat	21 (22.8 %)	17 (18.5 %)	20 (21.7 %)	17 (18.5 %)	11 (12.0 %)	9 (9.8 %)
Quite a bit	23 (25.0 %)	18 (19.6 %)	22 (23.9 %)	25 (27.2 %)	22 (23.9 %)	22 (23.9 %)
Very much	16 (17.4 %)	17 (18.5 %)	15 (16.3 %)	13 (14.1 %)	19 (20.7 %)	19 (20.7 %)

Results are presented as n (%).
* The number of patients who reported at least a little bit of pain interference on daily activities.

Table 3
Demographic and clinical characteristics of the clusters.

	Cluster 1, $N = 26$ (27.1 %) Mean ± SD	Cluster 2, $N = 70$ (72.9 %) Mean ± SD	p value
Age	59.2 ± 12.4	57.9 ± 13.2	0.8
Sex (F%)	46.1 %	62.9 %	0.1
Country of enrollment			
USA	3.8 %	55.7 %	<0.0001
South Korea	11.5 %	4.3 %	0.3
Netherlands	73.1 %	10.0 %	<0.0001
Australia	3.8 %	12.9 %	0.3
Sweden	7.7 %	17.1 %	0.3
Diagnosis			
Anti-synthetase syndrome	3.9 %	14.3 %	0.2
Dermatomyositis	50.0 %	50.0 %	>0.99
Immune mediated necrotizing myopathy	23.1 %	20.0 %	0.7
Overlap myositis	19.1 %	4.3 %	0.02
Polymyositis	3.9 %	11.4 %	0.3
Diagnosis duration (years)	2.3 ± 6.4	5.2 ± 6.5	<0.0001
Myositis Core Set Measures			
MMT (0–80)	58.7 ± 10.9	77.2 ± 4.4	<0.0001
Patient Global Disease Activity (0–10)	7.6 ± 1.8	3.1 ± 1.9	<0.0001
Physician Global Disease Activity (0–10)	6.4 ± 1.9	2.4 ± 1.7	<0.0001
CK (fold change)			
HAQ-DI (0–3)	1.9 ± 0.7	0.5 ± 0.4	<0.0001
PROMIS instruments			
PROMIS Pain Interference	60.5 ± 12.3	53.1 ± 9.6	0.002
PROMIS Fatigue	64.6 ± 9.9	53.9 ± 10.9	<0.0001
PROMIS Physical Function	29.2 ± 5.9	42.7 ± 8.7	<0.0001

Abbreviations: See Table 1.

enrollment).

Discussion

In this international cohort of patients with IIM, approximately 70 % reported pain interference greater than the general population with an impact on routine daily activities in over 90 % of the patients. The most frequently impacted aspect of daily life by pain was household chores. A significant relationship between myositis disease activity and pain interference was seen with higher pain interference observed among those with worse disease activity. Longitudinal follow-up of the patients revealed a significant association between change in pain interference and disease activity measures over time.

The majority of the patients with IIM reported interference of pain in at least one aspect of their daily life, while 28.7 % of the patients reported no pain interference. To our knowledge, no previous studies reported pain interference in patients with IIM apart from the previous work of the OMERACT Myositis Working Group [20]. However, frequency of myalgias has been reported in previous studies ranging from 64 to 81 % [12,23]. In a study from Germany, a decrease in the frequency of moderate to severe pain from 53 % to 27 % was observed between 1997 and 2017, possibly due to better disease control over the years [24]. The presence of pain and pain interference is likely affected by sex, the IIM subtype, disease duration, and disease activity based on our results. Thus, the observed variability in pain frequency in the literature may reflect the differences in cohort characteristics. Additionally, one may experience pain without any interference to any aspects of one's daily life [25]; therefore, the results of these studies may not be comparable to our study and further studies are required to understand the relationship between pain intensity and pain interference in patients with IIM.

Patients with greater pain interference had higher patient and physician global disease activity scores. Additionally, two distinct clusters of patients were observed with one cluster having significant weakness, high disease activity and high pain interference and the other cluster having minimal weakness, low disease activity and low pain interference. The group with high disease activity had pain interference that was one SD worse than the general population, had significantly shorter diagnosis duration and were enriched for patients from Netherlands who were newly diagnosed and treatment naïve. Overall, these findings suggest a notable relationship between myositis disease activity and pain interference. Similar to our results, a survey study showed that patients experience more pain during flare ups and those who experience more frequent flare ups report more pain [23]. A randomized controlled trial with early untreated IIM showed a significant improvement in pain levels over 18 months with treatment [12]. Patients with chronic progressive disease course had significantly greater bodily pain than those with relapsing remitting course [10]. These results highlight the relationship between pain and disease activity in IIM and suggest that the pain is likely a symptom related to the primary disease process.

Despite the results highlighting association between disease activity and pain, physician global was not significantly associated with change in pain interference over time in both univariate and multivariable models. Results are concordant with a previous study showing weak correlations between physician global and patient reported pain levels [26]. In the same study, pain was one of the significant drivers of the discordance observed between patient and physician global disease activity [26]. This accumulating evidence suggests that pain is frequently dismissed or possibly misattributed to other causes in evaluation of myositis disease activity by health care providers; however, further studies are required to better understand the relationship between myositis disease activity and pain.

No significant differences in pain interference levels were observed between women and men with IIM. However, women were more likely to experience pain interference levels that are greater than the general population. Results are also conflicting in the literature with studies showing comparable pain levels between women and men or higher levels of pain in women [11,13]. This is likely a result of direct comparison of women and men without accounting for other factors that

Table 4
Univariate and multivariable logistic regression and linear mixed effects models using longitudinal data to determine the predictors of pain interference >60 and change in pain interference over time, respectively.

	Logistic regression				Linear mixed effects model			
	Univariate model		Multivariable model*		Univariate model		Multivariable model*	
	OR (95 % CI)	p value	OR (95 % CI)	p value	β (95 % CI)	p value	β (95 % CI)	p value
MMT	0.96 (0.93 - 0.99)	0.01	0.95 (0.92 - 0.98)	<0.0001	−0.24 ((−0.44) - (−0.04)	0.02	−0.33 ((−0.56) - (−0.11))	0.004
Patient global disease activity	1.44 (1.28 - 1.62)	<0.0001	1.55 (1.44 - 1.66)	<0.0001	1.61 (1.12 - 2.09)	<0.0001	1.77 (1.22 - 2.31)	<0.0001
Physician global disease activity	1.39 (1.18 - 1.63)	<0.0001	1.46 (1.21 - 1.75)	<0.0001	1.21 ((−0.61) - 3.04)	0.19	1.32 ((−0.56) - 3.21)	0.17
CK fold change	1.00 (0.99 - 1.00)	0.07	1.00 (0.99 - 1.01)	0.18	0.0004 ((−0.31) - 0.31)	0.99	0.003 ((−0.31) - 0.32)	0.98
HAQ-DI	1.69 (1.67 - 1.70)	<0.0001	2.15 (1.72 - 2.71)	<0.0001	3.01 (2.07 - 3.96)	<0.0001	3.55 (2.85 - 4.25)	<0.0001
PROMIS Fatigue	1.19 (1.11 - 1.26)	<0.0001	1.19 (1.13 - 1.25)	<0.0001	0.68 (0.58 - 0.78)	<0.0001	0.67 (0.58 - 0.77)	<0.0001
PROMIS Physical function	0.87 (0.81 - 0.94)	<0.0001	0.87 (0.81 - 0.93)	<0.0001	−0.55 ((−0.89) - (−0.20))	0.002	−0.54 ((−0.86) - (−0.23))	0.001

* Adjusted for age, sex, disease duration, and country of enrollment.
Abbreviations: MMT: Manual muscle test, OR: Odds ratio, CI: Confidence interval, β: Regression coefficient, CK: Creatine kinase.

may be important in pain levels such as disease activity and IIM subtype. For example, overlap myositis is more commonly seen in women which could be associated with higher levels of pain. Despite the conflicting results in IIM, there is a substantial literature that supports clear sex differences in pain processing and shows enhanced pain sensitivity and risk for clinical pain among women [27,28]. On the other hand, there are studies showing comparable pain interference levels between men and women with rheumatoid arthritis despite higher levels of pain reported by women suggesting that higher levels of pain do not necessarily translate into poor pain related function [29]. The sex differences in pain interference were not the primary focus of our study; further studies should be performed to examine the effect of sex on pain interference in IIM.

In the cluster with higher levels of pain interference and disease activity, a significantly higher number of patients with OM was present. On the other hand, pain interference levels among different IIM subtypes were comparable to each other. While it may be expected for OM patients to experience more pain interference possibly due to more frequent arthritis/arthralgia, digital ulcers, and Raynaud's phenomenon seen in these patients compared to other IIM subtypes, the number of patients with OM was small in our study. In previous studies, there were generally no significant differences in pain levels among IIM subtypes; however, further studies with larger sample sizes are required to better understand the differences between the IIM subtypes [11,13,30,31]. Additionally, our study did not delve into the underlying causes or mechanisms of pain in these patients. However, our findings lay the groundwork for future research in this area, aiming to explore various aspects of pain experienced by patients with IIM.

This was a large multicenter prospective cohort of patients with IIM enrolled from different countries. To our knowledge, this study was the first to examine the impact of pain upon daily aspects of life of patients with IIM and one of the few studies providing a more in-depth examination of relationship between pain interference and other clinical parameters. Limitations of this work are the lack of i) an instrument to assess pain intensity, ii) information on other clinical manifestations such as arthritis, Raynaud's phenomenon, and digital ulcers that may contribute to pain in these patients, iii) comorbidities such as osteoarthritis in this cohort, and iv) information on attribution of pain to myalgias versus other clinical manifestations or comorbidities and analgesic use. Further, the assessment of muscle domain was limited to MMT and did not include other important muscle outcome measures such as the functional index 3. Nonetheless, the results of this study should inform future studies that will help to better understand pain in patients with IIM.

Conclusion

In conclusion, the majority of the patients with IIM experience pain interfering with their daily activities, particularly household chores. Myositis disease activity, duration, and subtype could be associated with greater pain interference. Building on what is already known about pain in IIM, results of this study advance the current understanding of pain in myositis and encourage health care providers to include pain interference in their assessment of patients with IIM.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.semarthrit.2024.152476.

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