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ORIGINAL PAPER

Investigation of the effect of oral ivermectin on systemic inflammatory response and quality of life in scabies patients

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Abstract

Scabies is a prevalent ectoparasitic infectious disease, caused by the mite Sarcoptes scabiei. As a consequence of the infestation, localised cutaneous inflammation, pruritus and polymorphic skin lesions develop. The primary symptoms of scabies manifest as hypersensitivity-like reactions and immune responses, the precise mechanisms of which remain poorly defined. The objective of this study was to evaluate the effects of oral ivermectin treatment in patients with scabies on the systemic immune response and the patient's quality of life (QoL). Patients admitted to the dermatology outpatient clinic and diagnosed with scabies were administered oral ivermectin treatment following diagnosis at week 0 and 2. Laboratory tests were conducted to measure complete blood count (CBC), erythrocyte sedimentation rate (ESR), and C-reactive protein (CRP) levels before treatment and at week 4. The systemic immune-inflammation index (SII) was calculated using the platelet, neutrophil and lymphocyte counts. Additionally, data pertaining to the Dermatological Life Quality Index (DLQI) were recorded. In 119 patients (51 males) diagnosed with scabies, increases in ESR, CRP, and SII values and decreases in inflammatory cell counts and DLQI scores were observed one month after treatment with oral ivermectin. The results of the study showed that the use of oral ivermectin, a scabicidal agent, triggered the inflammatory response and improved the QoL of the patients.

Keywords Scabies · Systemic inflammation · Life quality · Antiscabies treatment

Introduction

Scabies is a highly contagious parasitic dermatosis caused by the mite Sarcoptes scabiei.

Scabies epidemics persist as a significant public health problem, particularly in resource-limited regions. Additionally, they manifest as a treatment-resistant dermatological condition in care home for the elderly, as well as other situations, in affluent countries.

In addition to the dermatological manifestations and the potential for secondary infections, scabies also gives rise to social stigma and a reduction in quality of life(QoL). [1, 2] Those affected by scabies frequently experience social stigmatisation due to the visible lesions that result from direct person-to-person contact, which is often required for transmission. Therefore, the QoL of patients suffering from scabies is affected and there are many studies on this in the literature [1, 3–5]. The Dermatology Life Quality Index (DLQI) is a validated measure of QoL that has been used in a wide range of dermatological diseases and is available in 55 languages and is used in 33 different skin diseases [6] The DLQI is a 10-item instrument that includes questions on daily activities, symptoms and emotions, leisure time, work and school, personal relationships and treatment, and gives a total score between 0 and 30 [7]. Infestation leads to localised cutaneous inflammation, generalized pruritus that is often more intense at night, and the development of morbilliform inflammatory skin lesions. The pathognomonic lesions of the disease are burrows, which are frequently encountered in the interdigital webs, elbows, the sides of

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the fingers, on the genitalia and nipples [8]. The main skin findings and other symptoms of scabies are thought to occur through hypersensitivity-like reactions and immunity, the precise nature of which is not yet well defined and poorly understood [9].

The systemic immune-inflammation index (SII) is a recently proposed novel inflammatory biomarker that indicates systemic inflammation based on platelet counts and immune cell subpopulations [10]. This biomarker has been widely used in studies and has been associated with a number of diseases, including metabolic disorders, cardiovascular diseases, depression, cancer development risk, and also skin diseases (e.g., hidradenitis suppurativa, acne vulgaris, psoriasis) [10–16].

Oral ivermectin represents an alternative treatment for human scabies infection, offering a convenient mode of administration, ready availability, and an acceptable safety profile [17].

The aim of this study was to investigate the systemic inflammatory response by assesment of SII and also QoL changes secondary to oral ivermectin treatment in scabies patients.

Methods and materials

Study design

This prospective observational study included 119 patients who were initiated on oral ivermectin treatment (200 µg/kg or 400 µg/kg) for scabies. Approval for this prospective study was obtained from the Lokman Hekim University (approval number:2023223). The participants were required to provide written consent.

Patients

Patients presenting with widespread pruritus on the body, especially at night, with similar symptoms in contacts or family members, and with direct detection of mites, larvae, mite eggs or faecal pellets on dermatological examination by direct microscopy were included in the study. Furthermore, the presence of characteristic lesions in predilection sites (e.g., between the fingers, wrists, periumbilical region, genital area) and the identification of a mite burrow on the skin were also included in the inclusion criteria. Patients below the age of 18, pregnant women, individuals undergoing another anti-scabies treatment at the time of presentation, those with crusted scabies, those with an uncontrolled chronic disease and those with a secondary infection were excluded from the study.

Treatment

The patients were administered oral ivermectin treatment at a dosage of either 200 µg/kg or 400 µg/kg at the time of diagnosis (week 0). A second course of treatment was administered two weeks later. Oral ivermectin was administered before meals at a dosage appropriate to the patient's weight. Those who had been in close contact with the infected individual were advised to accept treatment simultaneously. It was recommended that clothing and bedding be washed with hot water.

Evaluations

The demographic data of the participants, including age, gender, social status, address and work status of the participants were obtained. In the blood test, complete blood count (CBC), erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP) were measured. These laboratory tests were repeated at week 4. SII was calculated using the data obtained from CBC; SII = platelet count ($x10^3$ /µL) X neutrophil count ($x10^3$ /µL) / lymphocyte count ($x10^3$ /µL) [18]. The DLQI, comprising of 10 questions, is a tool for measuring the health-related QoL of adult patients with a skin disease [6]. It was administered to the participants at weeks 0 and 4, and the results were recorded. The efficacy and safety of the treatment were evaluated at weeks 2 and 4. The efficacy of the treatment was assessed based on the cure rate at week 4. The absence of mites upon examination, the resolution of existing and historical lesions, and the absence of new lesions were collectively deemed indicative of successful treatment outcomes [19].

Statistical analysis

The statistical analysis was conducted using the Statistical Package for the Social Sciences (SPSS) 26.0 (IBM SPSS Statistics for Windows, Armonk, New York). All variables were found to be normally distributed in the Shapiro-Wilk test. The frequency, percentage and mean (min-max) values of the variables were calculated in the relevant sections of the software. The relationship between sex and age was investigated using the independent samples T-test function. The paired samples T-test function was employed to identify changes in laboratory test results and DLQI data in both sexes before and after treatment. P values of < 0.05 were considered to reflect statistical significance.

Results

A total of 145 patients were included in the study. The study was completed with 119 participants, as the remaining individuals either did not comply with the treatment, did not attend follow-up visits, or expressed a desire to withdraw from the study. A total of 100 patients (84.03%) were considered to have achieved a cure by the conclusion of the study. The mean age of the study population was 32.78 ± 17.96 years in males ($n = 51$) and 33.96 ± 16.31 years in females ($n = 68$). All participants had previously undergone treatment with a topical anti-scabies agent. The overall mean DLQI scores demonstrated a statistically significant reduction in the fourth week of treatment compared to the baseline (8.68 ± 2.60 vs. 27.71 ± 2.87). A significant decrease in eosinophils was observed in both sexes during the fourth week of treatment (0.24 ± 0.09 vs. 0.43 ± 0.24). A non-significant increase in SII levels was observed at week 4 compared to the baseline (649.02 ± 148.43 vs. 595.06 ± 277.27). Significant increases in CRP (4,12 ± 0,52 vs. 3,37 ± 1,96) and ESR (11,70 ± 2,83 vs. 9,64 ± 4,78) levels were detected with treatment in male gender. (Table 1). No subjective symptoms, such as fever, malaise, fatigue, gastroenterological side effects (nausea, vomiting, diarrhea, dyspepsia, etc.) or rash due to oral ivermectin, were observed in any patient during the study. One patient did, however, experience mild neurologic symptoms (headache) and respiratory side effects (transient wheezing).

Discussion

This is the inaugural study to quantify the influence of oral ivermectin therapy on QoL and the inflammatory response in scabies. Oral ivermectin represents a viable alternative therapeutic option for the treatment of human scabies infection, offering a convenient mode of administration and a favourable safety profile. Ivermectin is a macrocyclic lactone that shares structural similarities with macrolide antibiotics, yet lacks intrinsic antibacterial activityIvermectin has been demonstrated to exhibit a selective binding affinity for glutamate-gated chloride ion channels, which are prevalent in the nerve and muscle cells of the mite. This binding event results in a discernible alteration in the permeability of the cell membrane. This results in the hyperpolarisation of the cells, which ultimately leads to the paralysis and death of the mite [17]. Although the precise mechanism remains to be elucidated, an inflammatory response is thought to play a role in the pathophysiology of scabies, as well as in numerous other dermatological conditions. The number of leukocytes, ESR and CRP are among the inflammatory indicators that are employed in the diagnosis and follow-up of these

Table 1 Mean values of the laboratory tests and the other variables due to time

	Male ($n = 51$)			Female ($n = 68$)			Both Sexes		
Laboratory tests and other variables	Week 0	Week 4	*P*-value	Week 0	Week 4	*P*-value	Week 0	Week 4	*P*-value
DLQI	27,75 ± 2,91	8,57 ± 2,35	**0,000**	27,69 ± 2,87	8,76 ± 2,79	**0,000**	27,71 ± 2,87	8,68 ± 2,60	**0,000**
WBC (x10^3/mm^3)	7,36 ± 1,97	7,40 ± 1,94	0,806	7,45 ± 1,66	7,50 ± 1,62	0,753	7,41 ± 1,79	7,46 ± 1,75	0,688
PLT (x10^3/mm^3)	252,76 ± 48,32	249,78 ± 29,85	0,711	255,31 ± 65,33	246,51 ± 36,82	0,342	254,22 ± 58,43	247,92 ± 33,91	0,316
NEU (x10^3/mm^3)	4,28 ± 1,51	4,06 ± 0,48	0,294	4,43 ± 1,05	3,92 ± 0,48	**0,000**	4,36 ± 1,26	3,98 ± 0,48	**0,002**
LYM (x10^3/mm^3)	2,00 ± 0,69	1,52 ± 0,21	**0,000**	1,98 ± 0,66	1,57 ± 0,24	**0,000**	1,99 ± 0,67	1,55 ± 0,23	**0,000**
EOS (x10^3/mm^3)	0,51 ± 0,25	0,23 ± 0,10	**0,000**	0,38 ± 0,21	0,26 ± 0,09	**0,000**	0,43 ± 0,24	0,24 ± 0,09	**0,000**
CRP	3,37 ± 1,96	4,12 ± 0,52	**0,010**	4,58 ± 4,84	3,88 ± 0,74	0,242	4,06 ± 3,91	3,99 ± 0,66	0,842
ESR	9,64 ± 4,78	11,70 ± 2,83	**0,008**	11,41 ± 5,16	11,85 ± 3,00	0,564	10,65 ± 5,06	11,78 ± 2,92	**0,038**
SII	599,02 ± 378,99	675,60 ± 142,64	0,174	592,08 ± 167,90	629,09 ± 150,59	0,149	595,06 ± 277,27	649,02 ± 148,43	0,054

DLQI, Dermatology life quality index; WBC, White blood cell; PLT, platelets; NEU, neutrophil; LYM, lymphocytes; EOS, eosinophils; CRP, C-reactive protein; ESR, erythrocyte sedimentation rate; SII, Systemic immune-inflammation index

Data are presented as mean ± standard deviation. $P < 0,05$ is considered statistically significant and marked in bold

diseases [20]. The immune responses and immunomodulation against Sarcoptes scabiei might be affected by the sex of the host. According to the values we found in our study, the relative increase in CRP, ESR and SII in males compared to response to the treatment is more active in males [22, 23].

A study has been conducted to determine the inflammatory and immune response during scabies infestation. The results demonstrated that blood IgE, superoxide dismutase (SOD) and some serum cytokines (IL-1B, TNF-a, IL-4 and IL-5) levels were higher in patients with scabies compared to healthy controls. Furthermore, the host immune response was observed to exhibit characteristics of a TH2 allergic response during the initial stages of infestation, followed by a shift towards a TH1 cell-mediated protective response in the later stages [8]. In a study conducted by Abd El Aal et al. on patients with scabiasis, a negative correlation was observed between IL-10, an anti-inflammatory cytokine, and total IgE, specific IgG, INF-γ and the severity of symptoms [9]. In the course of our study, we observed an increase in the levels of white blood cells (WBC), erythrocyte sedimentation rate (ESR), C-reactive protein (CRP) and systemic inflammation index (SII) in the fourth week of the treatment period, accompanied by a decrease in the number of neutrophils (NEU), lymphocytes (LYM) and eosinophils (EOS). This indicates that the inflammatory process persists through monocytes throughout the disease, and that oral ivermectin treatment results in a reduction in other inflammatory cell numbers concomitant with clinical improvement due to the scabicidal effect.

In a study of 96 patients with scabies, sulphur (10%) was selected as the topical treatment agent, and QoL index data were analysed. The authors reported a significant improvement in QoL after treatment, and no strong correlation was found between disease-related characteristics and QoL [1]. The findings of our study indicate that DLQI scores, which were elevated in individuals with a longer history of scabies, demonstrated a notable improvement and reduction following the administration of treatment courses. There was a notable improvement in QoL with a decrease in complaints of itching following treatment, particularly among male patients.

In conclusion, scabies had a detrimental impact on the QoL of the patients. Despite the lack of life-threatening implications, greater attention should be paid to this contagious disease. Oral ivermectin is a promising treatment option for patients with scabies, offering a convenient and safe alternative. However, future studies should consider incorporating a longer study period and a larger sample size to gain a more comprehensive understanding of scabies.

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Data availability No datasets were generated or analysed during the current study.

Declarations

Reprint requests None.

Competing interests The authors declare no competing interests.

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