Open Access
Journal of the Faculty of Medicine Baghdad
Print ISSN: 0041-9419, Online-ISSN: 2410-8057
DOI: https://doi.org/10.32007/jfacmedbaghdad2930
Research Article

Evaluation of Serum IL-41 as a Potential Biomarker in a Group of Iraqi Patients with Rheumatoid Arthritis

Ayat F. Tawfeeq*[1], Hayfaa S. AL-Hadithi[1], Faiq I. Gorial[2]
[1]*Department of Microbiology, College of Medicine, University of Baghdad, Baghdad, Iraq.*
[2]*Department of Medicine, College of Medicine, University of Baghdad, Baghdad, Iraq.*

Received: Oct. 2024
Revised: Nov. 2024
Accepted: Dec. 2024
Published: April2025

Abstract:

Background: Most individuals with inflammatory arthritis are diagnosed with rheumatoid arthritis (RA), which is an immunological disorder characterized by the development of autoantibodies, particularly anti-cyclic citrullinated peptide (ACCP) antibodies, which play a significant role in initiating inflammatory responses. Recent studies have shown that the production of cytokines contributes to the progression and dissemination of RA.

Objectives: To assess the predictive capability of Interleukin 41 (IL-41) compared with ACCP and its correlation with disease activity and treatment response in a group of Iraqi patients afflicted with RA.

Methods: One hundred patients with RA and fifty healthy controls constituted the total number of participants in this case-control study. The research was conducted in Baghdad Teaching Hospital from November 2023 to February 2024. The American College of Rheumatology 2010 criteria were used for patient recruitment. In order to evaluate the role of the biomarkers, an enzyme-linked immunoassay (ELISA) technique was used.

Results: The level of IL-41 in RA patients (5.2 ± 2.65 ng/mL) was significantly higher than in healthy controls (3.0 ± 1.43 ng/mL). The mean serum IL-41 concentration was highest in the severe form (6.8 ± 2.91 ng/mL), followed by moderate and low disease activity. A positive correlation was also detected between the serum IL-41 level and the ACCP. Serum IL-41 was significantly higher among patients taking methotrexate (5.8 ± 3.30 ng/mL), more than both etanercept (5.1 ± 2.47 ng/mL) and etanercept + methotrexate (4.6 ± 1.82 ng/mL).

Conclusion: Elevated concentrations of IL-41 in the serum of RA patients potentially serve as diagnostic markers for RA. It helps as an indicator of disease activity and therapeutic response.

Keywords: Anti-CCP antibody; Etanercept; Interleukin IL-41; Methotrexate; Rheumatoid arthritis.

Introduction:

Rheumatoid arthritis (RA) is a prevalent autoimmune disease characterized by persistent inflammation of the joints. The condition impacts around 1% of the global population, with females accounting for 75% of the affected individuals (1). The pathogenic mechanisms of RA are affected by both genetic and environmental factors. However, the precise cause of the illness remains uncertain. The presence of high levels of inflammatory cytokines IL-1, IL-6, and Tumor Necrosis Factor-alpha (TNF-α) in both the synovial fluid and blood of individuals with RA indicates a potential connection with the etiology of the disease (2). Additionally, the existence of anti-cyclic citrullinated peptide (ACCP) antibodies, which include immunoglobulins (IgA, IgG, and IgM) isotypes, is associated with the deterioration of joints and raises the probability of developing the disease (3).

Disease-modifying anti-rheumatic drugs (DMARDs) are the first approach in the treatment plan for RA. If the DMARDs failed to induce remission, biological therapy is started. These are monoclonal antibodies that target specific molecules such as IL-6 and TNF-α (4). IL-41, also known as Metrnl, is a newly identified cytokine that functions in an immunomodulatory and is highly expressed in several human tissues, including the skin and mucosa (5). Investigations revealed that IL-41 may be involved in both innate and acquired immunity processes and is important in inflammatory responses (6). According to some studies, IL-41 is produced improperly in the cartilage tissue and synovium of people with diseases that affect the skeleton (7). IL-41 is expressed by various cell types, including monocytes, adipocytes, and myocytes (8). IL-41 originates primarily from barrier tissues and macrophages, and it has a role to play in wound healing, tissue remodeling, and the anti-inflammatory response that are all related to macrophages (7). Using a gene expression database of RA, it was found that IL-41 expression was increased in the joint membranes of people with RA. Further analysis confirmed this conclusion, as IL-41 levels were much higher in the synovial fluid of psoriatic arthritis (PsA) and patients diagnosed with RA. According to a recent investigation, the serum level of IL-41 was shown to be higher in patients with RA compared with patients with osteoarthritis

*Corresponding Author: ayat.fouad2210m@comed.uobaghdad.edu.iq

(OA) and healthy controls, and they linked favorably with disease activity indices. According to these findings, IL-41 may have a significant role to play in autoimmune-related arthritis (9).

This study aimed to assess the utility of IL-41 as a biomarker for disease activity in rheumatoid arthritis patients and its correlation with therapeutic response.

Patients and Methods

This is a case-control study conducted in the Rheumatology Consultation Clinic at Baghdad Teaching Hospital, Medical City, Baghdad, from November 2023 to February 2024. The Ethical Committee of the College of Medicine, University of Baghdad, approved this study according to document number (0244) dated September 29, 2023.

The study included the following groups: One hundred patients with RA were included in the study. A rheumatology specialist diagnosed RA based on the American College of Rheumatology 2010 criteria, which was further verified by clinical examination, laboratory tests, and radiographic imaging. The control group was carefully selected to ensure that they had similar age and sex characteristics.

The patients were further subdivided into three subgroups according to the type of treatment:

– Thirty-five patients were treated with DMARDs, methotrexate (MTX) in a dosage of 2.5 mg per week.

– Thirty-three patients were treated with biological DMARDs, etanercept in a dosage of 50 mg per week.

– Thirty-two patients were treated with DMARDs in a dosage of MTX 2.5 mg and biological DMARDs in a dosage of etanercept 50 mg per week.

Fifty healthy persons who were blood donors in the blood bank / Baghdad were used as the control group and were matched with patients for sex and age. They gave their informed consent to participate in the study after receiving a full explanation of the study aim.

Exclusion criteria: Patients excluded from this study were those with autoimmune diseases other than RA, pregnant women, patients younger than 18 years of age, patients with RA who have been treated with biological DMARDs other than etanercept 50 mg, and patients who have been treated with DMARDs other than MTX dosage of 2.5 mg.

Blood sample collection and serum separation: Using sterile techniques, 5 mL of venous blood samples were taken from both patients and controls. The blood samples were incubated at room temperature for 30 minutes, followed by centrifugation at 3000 revolutions per minute for 15 minutes. Sample serum was kept at -20 Cº in Eppendorf tubes until testing by ELISA for ACCP and IL-41 (Sunlong-Biotech, China). Erythrocyte sedimentation rate (ESR) was measured using the conventional Westergren technique.

Statistical analysis

The SPSS Statistical software (Version 26; SPSS, IBM) and Microsoft Office Excel (2010) were used for statistical analysis, except for the receiver operating characteristic (ROC) curve.

Independent samples of analysis of variation (ANOVA) F test, least significant difference (LSD) F test, and Student's t-test were conducted for comparisons of quantitative variables between the studied groups. Normally distributed data is expressed as (mean±SD). Also employed was the Chi-square ($\chi 2$) test for comparisons of qualitative variables between the studied groups.

Pearson correlation test detected the relationships between immunological assays and other parameters. The validity of the ELISA test was estimated with an ROC curve, cut-off value, area under the curve (AUC), sensitivity (%), specificity (%), and accuracy. The statistical significance threshold (P-value) was accepted at $P<0.05$.

Results

Among the RA group, 84 females and 16 males were compared to 44 females and 6 males among the controls. They had an age range of 25, and 75 years.

Table 1 shows the distribution of the two study groups according to age, sex, and body mass index. There were no significant associations between the study group and these variables. However, the mean BMI was significantly higher in the RA (29.3 ± 5.64) than in the control group (27.3±4.53).

Table 1: Distribution of the study groups by age, sex, and BMI

Parameters		Studied groups – No. (%)		P-value
		Control N= 50	Patients N= 100	
Sex	Males	6 (12)	16 (16)	0.514 NS
	Females	44 (88)	84 (84)	
Age groups / Year	20 - 40	12 (24)	27 (27)	0.615 NS
	41 - 60	31 (62)	54 (54)	
	61 - 80	7 (14)	19 (19)	
BMI Kg/m2 groups	Normal	14 (28)	13 (13)	0.075 NS
	Overweight	19 (38)	43 (43)	
	Obese	17 (34)	44 (44)	
Age / Year	Mean ± SD	48.5±11.79	48.7±12.63	0.926
BMI Kg/m2	Mean ± SD	27.3±4.53	29.3±5.64	0.033

Patients with RA were distributed according to the mean Disease Activity Score 28 (DAS28) into low ≤ 3.2, moderate 3.2 – 5.0, and severe ≥ 5.1, as shown in Figure (1). The mean of ESR mm/ hr for severe cases was (53.7 ± 31.83), higher than that of both moderate (41.1 ± 25.13) and low cases (26.6 ± 18.38), P = 0.001. Furthermore, the mean of ACCP Ab in the severe stage (22.3 ± 6.64) was higher than both moderate (17.8 ± 3.79) and low stages (16.2 ± 2.68), P = 0.009. Likewise, in IL – 41 assays, the mean for the severe stage was (6.8 ± 2.91), higher than both moderate (4.4 ± 1.55) and low stages (3.1 ± 0.34), P = 0.005.

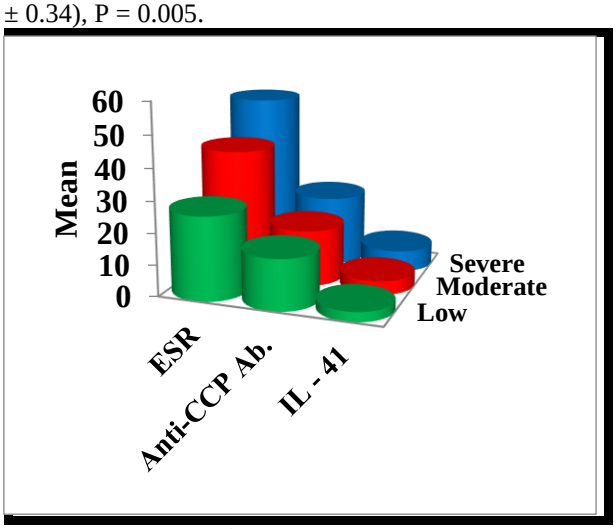

Figure 1: Distribution of RA cases by mean disease activity scores (DAS28 categories) and disease severity

Table 2 shows higher means of assays among patients with RA than the healthy controls with statistically highly significant differences as follows: ESR mm/ hr; patients with RA (43.7 ± 29.03) and control group (8.2 ± 5.00), P= 0.005. ACCP Ab U/ml; patients with RA (19.5 ± 5.74) control group (10.0 ± 2.83), P = 0.002. Lastly, IL-41 Ng/ml assays of patients with RA (5.2 ± 2.65) and control group (3.0 ± 1.43), P= 0.007.

Table 2: Mean ± SD of Assays in the study groups

Assays	Studied groups		P – value
	Control	RA Patient	
ESR mm/hr	8.2±5.00	43.7±29.03	0.005
ACCP Ab U/ml	10.0±2.82	19.5±5.74	0.002
IL – 41 Ng/ml	3.0±1.43	5.2±2.65	0.007

Table 3 shows that a non-statistically significant difference was detected in response to different kinds of medications in patients with RA when comparing the type of treatments in assays, ESR mm/hr, and ACCP Ab U/ml. However, there was a highly significant difference in assay IL-41 Ng/ml in RA patients on methotrexate (5.8 ± 3.30), which higher than both etanercept (5.1 ± 2.47) and etanercept + methotrexate (4.6 ±1.82), P=0.003.

Table 3: Mean ±SD of Assays among treatment groups of RA patient

Assays	Treatments			P – value
	Etanercept	Methotrexate	Etanercept – Methotrexate	
ESR mm/hr	38.6±27.63	48.3±30.52	44.0±28.80	0.391
ACCP Ab. U/ml	19.8±4.86	19.6±5.48	19.0±6.87	0.751
IL – 41 Ng/ml	5.1±2.47	5.8±3.30	4.6±1.82	0.003

The study showed highly significant positive correlations between ACCP Ab. and IL-41 (r=0.513, p<0.01), Figure 2.

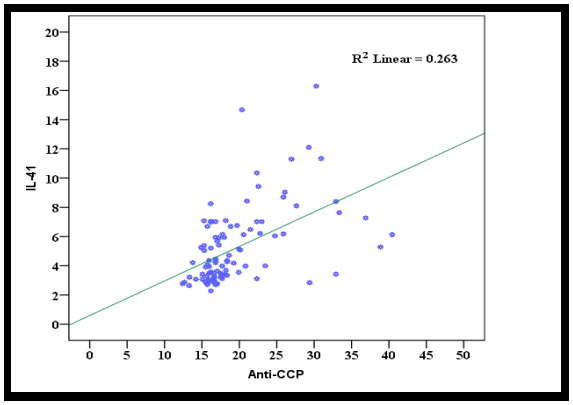

Figure 6: Correlation between ACCP Ab and IL-41 in RA parameters

The performance parameters for serum IL-41 and ACCP Ab validity as diagnostic tests in patients with RA were calculated. Figure 3 shows excellent validity for IL-41 at a sensitivity of 84%, specificity of 68%, AUC of 0.837, accuracy of 78.67%, cut-off value (3), and P-value of 0.009. The ACCP Ab had an AUC of 0.968, sensitivity of 96%, specificity of 84%, accuracy of 92%, cut-off value of 13.5, and a p-value of 0.003.

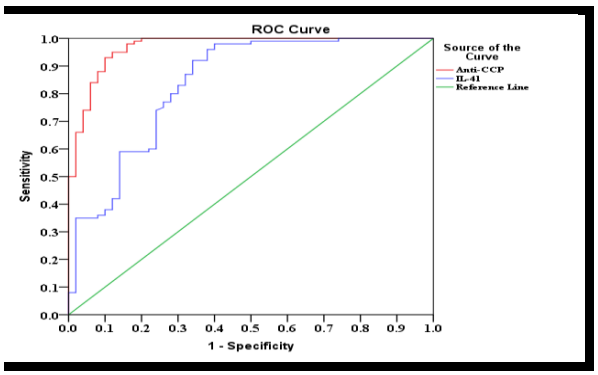

Figure 3: Validity tests of ACCP antibody and IL -41 by using ROC test in sera of RA patients and controls

Discussion

The female majority found in the current study is supported by studies conducted both domestically and internationally (10, 11). Most individuals with RA were above the age of 40 years. This might be attributed to the decline in humoral immunity and immunological defense mechanisms that occur with advancing age, which may increase susceptibility to autoimmune illnesses (12, 13). RA is worsened by inflammation, and the erythrocyte sedimentation rate (ESR), a laboratory measurement that is not unique to any particular condition, increases as inflammation advances. The results of our study corroborate a previous local investigation, which shows that patients with RA had elevated ESR levels compared with healthy controls (14). ACCP Ab has been identified as a good diagnostic test for RA. Antibodies that activate the enzyme involved in citrullination may also work with ACCP Ab to exacerbate the erosive consequences of the disease (15, 16). Our study confirms previous research by showing that the levels of ACCP Ab in the serum of patients with RA increase as the disease worsens. We observed that ACCP Ab levels were higher in patients with severe disease than those with moderate and low disease activity. Furthermore, we found that ACCP Ab levels were consistently higher in all patients with RA than in healthy individuals (17). According to the data, the levels of serum IL-41 were considerably elevated in patients with RA compared to healthy controls. There is a positive correlation between the levels of serum IL-41 and DAS28, which has been previously verified by other researchers (7, 18). Whereas IL-41 affects the synthesis of several pro-inflammatory chemokines and cytokines, including CCL2, CXCL1, and IL-6 (7). Although some studies indicate that the IL-41 acts as an anti-inflammatory agent, the exact role needs further investigation (19).

The lowest level of serum IL-41 was in the group that took both etanercept and methotrexate, followed by etanercept methotrexate. While the use of methotrexate enhances the production of adenosine, it will inhibit the divided immune cells and the production of cytokines, which promotes remission of the disease (20). The use of etanercept inhibits the TNF-α, resulting in a reduction of cell death and activation of other inflammatory mediators (21). IL-41 production in macrophages is regulated by a complex interaction between several cytokines including TNF-α (7). Etanercept inhibits the effect of TNF-α by binding with it. thus inhibiting the effects of TNF-α on its corresponding receptor expressed by the macrophages that produce IL-41. The combination of etanercept and methotrexate treatment was remarkably better in the reduction of disease activity, improvement of functional disability, and retardation of radiographic progression compared with methotrexate or etanercept alone.

Limitation

The study's limitations include sample size, single-center design, cross-sectional nature, lack of treatment-naive patients, and lack of molecular techniques like PCR

Conclusions

Elevated concentrations of IL-41 in the serum of RA patients, potentially serve as diagnostic marker for RA. It helps as an indicator for the disease activity and therapeutic response.

Authors' declaration

We confirm that all the Figures and Tables in the manuscript belong to the current study. Authors sign on ethical consideration's approval-Ethical Clearance: The project was approved by the local ethical committee in (Place where the research was conducted or samples collected and treated) according to the code number (0243) on (29/ 9/ 2024).

Conflict of interest: None

Funding: None

Authors' contributions

Study conception & design: (Ayat F. Tawfeeq, Hayfaa S. AL-Hadithi, and Faiq I. Gorial). Literature search: (Ayat F. Tawfeeq). Data acquisition: (Ayat F. Tawfeeq and Faiq I. Gorial). Data analysis & interpretation: (Ayat F. Tawfeeq). Manuscript preparation: (Ayat F. Tawfeeq). Manuscript editing & review: (Hayfaa S. AL-Hadithi).

References:

1. *Al-Rubaye MR. Anti-neutrophlic cytoplasmic antibody Elastase, Lactoferrin, Cathapsin G,and Lysozyme in a sample of Iraqi patients with Rheumatoid Arthritis. Journal of the Faculty of Medicine Baghdad. 2015 Apr 1;57(1):68-74.* https://doi.org/10.32007/jfacmedbagdad.571312

2. *Al-Karkhi MA, Al-Ani MM, Jassim NA. Development of Anti-bodies against Infliximab in Iraqi Patients with Rheumatoid Arthritis. Journal of the Faculty of Medicine Baghdad. 2015 Oct 1;57(3):241-3.* https://doi.org/10.32007/jfacmedbagdad.573372

3. *Qaisar F, Masood A, Ujala S. Frequency of Positive Anti-CCP Antibodies in Rheumatoid Arthritis Patients with Negative Rheumatoid Factor. Journal of Islamabad Medical & Dental College. 2024 Jan 9;12(4):242-7.* https://doi.org/10.32007/jfacmedbagdad.6431947

4. *Abdulameer A, Mohammed KIA, Alosami MH. A Comparative Study of Serum Amyloid A2 with Anti-cyclic Citrullinated Peptide antibody in the prognosis of a Group of Rheumatoid Arthritis Patients in Iraq. Journal of the Faculty of Medicine Baghdad. 2022 Oct 17;64(3):153-8.* https://doi.org/10.32007/jfacmedbagdad.6431947

5. *Cai X, Li K, Li M, Lu Y, Wu J, Qiu H, et al. Plasma interleukin-41 serves as a potential diagnostic biomarker for Kawasaki disease. Microvascular Research. 2023 May 1;147:104478.*

https://doi.org/10.1016/j.mvr.2023.104478
6. Gao X, Leung TF, Wong GWK, Ko WH, Cai M, He EJ, et al. Meteorin-β/Meteorin like/IL-41 attenuates airway inflammation in house dust mite-induced allergic asthma. Cellular and Molecular Immunology. 2021 Nov 30;19(2):245-59. https://doi.org/10.1038/s41423-021-00803-8
7. Liu N, Dong J, Li L, Zhou D, Liu F. The function and mechanism of Anti-Inflammatory Factor METRNL prevents the progression of Inflammatory-Mediated Pathological bone Osteolytic diseases. Journal of Inflammation Research. 2024 Mar 1;Volume 17:1607-19. https://doi.org/10.2147/JIR.S455790
8. Jung TW, Pyun DH, Kim TJ, Lee HJ, Park ES, El-Aty AMA, et al. Meteorin-like protein (METRNL)/IL-41 improves LPS-induced inflammatory responses via AMPK or PPARδ-mediated signaling pathways. Advances in Medical Sciences. 2021 Mar 1;66(1):155-61. https://doi.org/10.1016/j.advms.2021.01.007
9. Li Z, Gao Z, Sun T, Zhang S, Yang S, Zheng M, et al. Meteorin-like/Metrnl, a novel secreted protein implicated in inflammation, immunology, and metabolism: A comprehensive review of preclinical and clinical studies. Frontiers in Immunology. 2023 Feb 24;14. https://doi.org/10.3389/fimmu.2023.1098570
10. Mohammed AM, Zayni SM, Al-Anee MM, Corial FI, Rubaee AA. Diagnostic and Predictive Values of IL-6 in a Group of Iraqi Patients with Rheumatoid Arthritis. Journal of the Faculty of Medicine Baghdad. 2023 Jul 1;65(2). https://doi.org/10.32007/jfacmedbagdad.2044
11. Maranini B, Bortoluzzi A, Silvagni E, Govoni M. Focus on sex and gender: What we need to know in the management of rheumatoid arthritis. Journal of Personalized Medicine. 2022 Mar 20;12(3):499. https://doi.org/10.3390/jpm12030499
12. Al Imari MJ, Al-Kaif AI, Jaafar SA, Hayder AA, Trik Z. Evaluation of vitamin d level in serum blood of rheumatoid arthritis patients in babylon province. Systematic Reviews in Pharmacy. 2021 Jan 1;12(1):268-71. https://www.sysrevpharm.org/abstract/evaluation-of-vitamin-d-level-in-serum-blood-of-rheumatoid-arthritis-patients-in-babylon-province-67543.html
13. Buckman TA, Sakyi SA, Yeboah-Mensah K, Antwi MH, Darban I, Owusu-Brenya L, et al. Demographic, Clinical Profile of Rheumatoid Arthritis Patients and Their Association with Disease Severity in Ghana. International Journal of Rheumatology. 2024 Jan 12;2024:1-9. https://doi.org/10.1155/2024/6639079
14. Wu F, Gao J, Kang J, Wang X, Niu Q, Liu J, et al. B Cells in Rheumatoid Arthritis: Pathogenic mechanisms and treatment Prospects. Frontiers in Immunology. 2021 Sep 28;12. https://doi.org/10.3389/fimmu.2021.750753
15. Abdul-Qahar ZH, Mahmood HG, Rasheed MK. Measurement of Anti-Cyclic Citrullinated Peptide, Leptin Hormone, and Lipoprotein (a) In Iraqi Female Patients with Rheumatoid Arthritis. Journal of the Faculty of Medicine Baghdad. 2014 Oct 1;56(3):305-7. https://doi.org/10.32007/jfacmedbagdad.563507
16. Aggarwal R, Liao K, Nair R, Ringold S, Costenbader KH. Anti-citrullinated peptide antibody assays and their role in the diagnosis of rheumatoid arthritis. Arthritis Care & Research. 2009 Oct 29;61(11):1472-83. https://doi.org/10.1002/art.24827
17. Alwan IT, Ghali KH. The correlation between accp with developing, progression and activity of rheumatoid arthritis. Annals of the Romanian Society for Cell Biology. 2021 Apr 7:408-18. http://annalsofrscb.ro/index.php/journal/article/view/2476
18. Gong L, Zhou Y, Shi S, Ying L, Li Y, Li M. Increased serum IL-41 is associated with disease activity in rheumatoid arthritis. Clinica Chimica Acta. 2023 Jan 1;538:169-74. https://doi.org/10.1016/j.cca.2022.11.021
19. Shi R, He M, Peng Y, Xia X. Homotherapy for heteropathy: Interleukin-41 and its biological functions. Immunology. 2024 Apr 9. https://doi.org/10.1111/imm.13791
20. Hanoodi M, Mittal M. Methotrexate. [Updated 2023 Aug 16]. In: StatPearls. Treasure Island (FL): StatPearls Publishing; 2024 Jan. https://www.ncbi.nlm.nih.gov/books/NBK556114/
21. Pan A, Gerriets V. Etanercept. [Updated 2023 Jul 24]. In: StatPearls. Treasure Island (FL): StatPearls Publishing; 2024 Jan-. https://www.ncbi.nlm.nih.gov/books/NBK545252/Pan A, Gerriets V. Etanercept. StatPearls - NCBI Bookshelf. 2023. https://www.ncbi.nlm.nih.gov/books/NBK545252/

How to Cite this Article
Fouad A, AL-Hadithi H, Gorial F. Evaluating serum IL-41 as a potential biomarker for a group of Iraq patients with rheumatoid arthritis. J Fac Med Baghdad [Internet]. Available from: https://iqjmc.uobaghdad.edu.iq/index.php/19JFacMedBaghdad36/article/view/2930

تقييم الإنترلوكين 41 في المصل كمؤشر حيوي محتمل في مجموعة من مرضى إلتهاب المفاصل الروماتويدي في العراق

آيات فؤاد توفيق[1]، هيفاء سلمان الحديثي[1]، فائق ايشو كوريال[2]
[1]فرع الأحياء المجهرية، كلية الطب، جامعة بغداد، بغداد، العراق.
[2]فرع الطب الباطني، كلية الطب، جامعة بغداد، بغداد، العراق.

الخلاصة:
خلفية البحث: يتم تشخيص معظم الأفراد المصابين بالتهاب المفاصل بالتهاب المفاصل الروماتويدي، وهو اضطراب مناعي يتميز بتطور الأجسام المضادة الذاتية، وخاصة الأجسام المضادة للببتيد السيترولييني الحلقي، والتي تلعب دوراً مهماً في بدء الاستجابات الالتهابية. أظهرت الدراسات الحديثة أن إنتاج السيتوكينات يساهم في تطور وانتشار التهاب المفاصل الروماتويدي.
الأهداف: تقييم القدرة التنبؤية للأنترلوكين 41 مقارنة مع المضادات للببتيد السيترولييني الحلقي والتنبؤ بنشاط المرض والإستجابة للعلاج لدى المرضى العراقيين المصابين بالتهاب المفاصل الروماتويدي الذين يتلقون الميثوتريكسات أو الإيتانيرسيبت أو كليهما.
المرضى والمنهجية: بلغ عدد المشاركين في هذا البحث مائة مريض بالتهاب المفاصل الروماتويدي وخمسين انسان غير مريض كعينة ضابطة. أجرى البحث في مستشفى بغداد التعليمي من تشرين الثاني 2023 إلى شباط 2024. تم أستخدام معايير الكلية الأمريكية لأمراض الروماتيز 2010 لاختيار المرضى ومن أجل تقييم كميات المؤشرات الحيوية تم إستخدام تقنية اختبار الممتز المناعي المرتبط بالإنزيم ELISA.
النتائج: كانت مستويات الأنترلوكين41 في مرضى التهاب المفاصل الروماتويدي (2.65 ± 5.2 نانوجرام/مل) أعلى بشكل ملحوظ مقارنة بالاصحاء (1.43 ± 3.0 نانوجرام/مل). وكان متوسط تركيز الإنترلوكين41 في المصل أعلى في الشكل الحاد (2.91 ± 6.8 نانوجرام/مل)، يليه نشاط مرضي متوسط والمنخفض. كما تم الكشف عن ارتباط إيجابي بين مستوى الأنترلوكين 41 و المضادات للببتيد السيترولييني الحلقي في المصل. كان مستوى الأنترلوكين 41 أعلى بشكل ملحوظ بين المرضى الذين يتناولون الميثوتريكسات (3.30 ± 5.8 نانوجرام/مل)، وهو أعلى من كل من إيتانرسبت (2.47 ± 5.1 نانوجرام/ مل) وإيتانيرسيبت مع ميثوتريكسات (1.82 ± 4.6 نانوجرام/مل).
الإستنتاجات: إن التركيزات المرتفعة من الأنترلوكين 41 في مصل المرضى قد تعمل كعلامات تشخيصية لالتهاب المفاصل الروماتويدي ومؤشرات لنشاط المرض واستجابة العلاج.
الكلمات الرئيسية: التهاب المفاصل الروماتويدي، الميثوتريكسيت، إيتانيرسيبت، إنترلوكين 41، الأجسام المضادة للببتيد السيترولييني الحلقي.