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ORIGINAL RESEARCH

Real-World Safety and Effectiveness of Golimumab in Rheumatic Diseases: Post-Marketing Surveillance in Korea

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ABSTRACT

Introduction: Golimumab is a human monoclonal antibody that inhibits tumor necrosis factor-α (TNF-α). Inhibition of TNF-α by golimumab inhibits the inflammatory response, thereby modulating the immune response in immune-mediated inflammatory diseases. Although the efficacy of golimumab has been demonstrated in randomized controlled trials (RCTs), various patient populations, such as those at high risk of infection, including those with latent tuberculosis and various comorbidities, or on co-administered medications, were excluded from the RCTs. Therefore, safety cannot be sufficiently evaluated by RCTs in the patient group with heterogenous characteristics. The aim of this study was to assess the safety and effectiveness of golimumab in patients with rheumatoid arthritis (RA), psoriatic arthritis (PsA), and ankylosing spondyloarthritis (AS) in a real-world setting in Korea.
Methods: We conducted an open-label, prospective, non-interventional study as post-marketing surveillance. Safety was evaluated by collecting and recording adverse events, and effectiveness was evaluated by assessing disease activity using DAS28-CRP, DAS28-ESR, ACR20, and ASAS20 outcome measures. Multiple logistic regression was performed to identify factors associated with the incidence of adverse events, and changes in disease activity scores from baseline were analyzed using the Wilcoxon signed-rank test.
Results: A total 673 patients were enrolled, of whom 621 were included in the safety analysis. During the study, 97 adverse drug reactions (ADRs) were reported in 62 patients (10.0%). The most frequently reported ADRs were related to infection, including nasopharyngitis (0.8%), upper respiratory tract infection (0.6%), and herpes zoster (0.5%). The mean (± standard deviation) changes from baseline in global disease activity at weeks 12 and 24 were − 3.37 ± 2.529 and − 3.68 ± 2.404, respectively, with statistical significance. In those patients with RA, 72.5 and 47.0% of individuals had a good response based on DAS28-CRP and DAS28-ESR outcomes at week 24. At week 24, 71.4% of patients with PsA had an ACR20 response and 72.9% of patients with AS had an ASAS20 response.
Conclusion: In the real-world setting, golimumab was safe and effective in Korean patients with RA, PsA, and AS.

Keywords: Arthritis; Effectiveness; Golimumab; Immune-mediated disease; Post-

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marketing surveillance; Safety; Tumor necrosis factor; Rheumatoid arthritis; Psoriatic arthritis; Ankylosing spondyloarthritis

Key Summary Points

Why carry out this study?

Although golimumab has been approved through randomized controlled trials, there is a necessity to evaluate safety because of heterogenous patients' characteristics in real clinical practice.

Post-marketing surveillance (PMS) is a prospective observational study design that can be used to investigate the safety and effectiveness in real-world clinical settings in Korea.

What was learned from the study?

Golimumab had an acceptable safety profile in the real-world clinical setting in Korea.

Golimumab had a favorable effectiveness profile in lowering disease activity of rheumatoid arthritis, psoriatic arthritis, and ankylosing spondyloarthritis.

INTRODUCTION

Key Summary Points:

Why carry out this study?

Golimumab, a human monoclonal antibody, inhibits tumor necrosis factor-alpha (TNF-α). It binds with high affinity to both the soluble and membrane-bound forms of TNF-α, creating stable complexes and preventing TNF-α from binding to its receptors [1, 2]. TNF-α promotes an inflammatory response, and abnormally high levels of TNF-α have been observed in several immune-mediated inflammatory diseases, such as rheumatoid arthritis (RA), psoriatic arthritis (PsA), and spondyloarthritis, including ankylosing spondylitis (AS) [3–7]. Inhibition of TNF-α by golimumab inhibits downstream signaling cascades of excessive inflammatory response and consequently modulates the immune response in these immune-mediated inflammatory diseases.

Several randomized controlled trials (RCTs) hav demonstrated the efficacy of golimumab in reducing disease activity, preventing radiologic progression, and improving physical function, with a favorable safety profile [8–13]. In Korea, golimumab has been approved since 2012 to treat patients with moderate-to-severe RA, active PsA, or axial spondyloarthritis who have not responded adequately to conventional therapy. Because of the exclusion of various patient populations at high risk of infection, including those with latent tuberculosis and various comorbidities, or those with co-administered medications in the pivotal RCTs, the prospective observational study presented here was conducted as post-marketing surveillance (PMS) with the aim to investigate the safety and effectiveness of golimumab in real-world clinical settings in Korea.

METHODS

Study Design and Patients

This study was a prospective, multi-center, open-label, non-interventional study conducted in Korea. Patients eligible for inclusion were aged ≥ 18 years, had received golimumab for the treatment of moderate-to-severe active RA, active PsA, or and moderate-to-severe active AS, and had experienced inadequate response to conventional therapies, such as disease-modifying antirheumatic drugs (DMARDs) for RA/PsA and non-steroidal anti-inflammatory drugs (NSAIDs) for AS. Patients who had severe active infections, opportunistic infections, or moderate-to-severe renal insufficiencies were excluded based on the locally approved label. The dosage of golimumab administered was in accordance to the label for each disease. Patients were observed for up to 24 weeks, with an additional 4 weeks for the safety follow-up, after the last dose of golimumab.

The study protocol, including all ethical aspects, was reviewed and approved by the institutional review board of each participating medical institution (see Electronic Supplementary Material 1). All patients provided written informed consent to participate and have their data collected. This study was approved by the Korean Ministry of Food and Drug Safety and was conducted under the Korean regulation for re-examination of new drugs and the Declaration of Helsinki 1964 and its later amendments.

Measurements

This study collected data to evaluate the safety and effectiveness of golimumab, including its administration. Demographic data, including patients' age, sex, height, and weight, were collected. In addition, the date of diagnosis, duration of disease, medical history of rheumatic and other diseases, and accompanying functional impairment of the liver or kidney were recorded. Regarding the administration status of golimumab, data on the indication, daily dose, administration date, and dose change (along with the reason) were collected.

Safety

Safety assessment was performed by examining the incidence of any adverse events (AEs) and serious adverse events (SAEs) in terms of their severity and association with golimumab. The severity of AEs was categorized into three levels: "mild," "moderate," or "severe." The causal relationship with golimumab was categorized by participating physicians as: "certain," "probable/likely," "possible," "unlikely," "conditional/unclassified," and "unassessable/unclassifiable." Adverse drug reactions (ADRs) were defined as all AEs except those for which the causal relationship was classified as "unlikely." All AEs collected were coded according to System Organ Class (SOC) using the Medical Dictionary for Regulatory Activities (MedDRA).

Effectiveness

Effectiveness was assessed using both global assessment and disease-specific evaluations at each visit. Global assessment for disease activity was performed by the patients themselves using a 0– to 10-point Visual Analogue Scale (VAS). The effectiveness of golimumab in RA was evaluated using the Disease Activity Score 28-joint counts (DAS28), which was calculated separately using both C-reactive protein (CRP) and erythrocyte sedimentation rate (ESR) as variables [14, 15]. The treatment response was classified in accordance with The European League Against Rheumatism (EULAR) criteria [16]. The effectiveness of golimumab in PsA was evaluated based on the proportion of patients achieving $\geq$ 20% improvement from baseline per the American College of Rheumatology (ACR) response (ACR20) criteria [14]. The disease-specific endpoint for AS was the proportion of patients who achieved an improvement of $\geq$ 20% from baseline according to the Assessment of SpondyloArthritis International Society (ASAS20) criteria [17].

Statistical Analyses

The safety set (SS) was defined as the patients who had received at least one dose of golimumab and had completed the safety follow-up; patients were excluded from the SS if they previously received golimumab monotherapy for RA, did not receive treatment for latent tuberculosis infection (LTBI), did not provide informed consent, were foreign patients who did not qualify for statutory health coverage, or had been treated with golimumab before the start of this study. The effectiveness set (ES) included patients in the SS group who were evaluated for effectiveness at least once.

Descriptive statistics for continuous variables were presented as means $\pm$ standard deviation (SD), and dichotomous variables were presented as frequencies with percentages in parentheses. AEs were summarized in terms of the number of patients (with percentages). In addition, multiple logistic regression was performed to determine the clinical predictors (sex, age, hepatic

impairment, renal impairment, golimumab formulation, golimumab indication, comorbidity, and prior treatment) for AE incidence. Change in the global VAS score from baseline by each patient to each time point was analyzed using the Wilcoxon signed-rank test. The number of patients who experienced a response to treatment for each disease was analyzed based on the available results at each visit. All statistical tests were performed using two-sided tests, and p values < 0.05 were considered to be statistically significant. All analyses were performed using the statistical software package SAS version 9.4 (SAS Institute, Cary, NC, USA).

RESULTS

Demographics and Baseline Characteristics

A total of 673 patients were enrolled between August 2012 and August 2018, of whom 621 patients were ultimately included in the SS group analyzed for safety assessments and 52 were excluded due to uncertainty regarding whether the safety assessments were appropriate for golimumab off-label cases (Fig. 1). Of the 621 patients included in the SS group, 201 had RA, 14 had PsA, and 406 had AS; the baseline characteristics of these patients are given in Table 1. Among the SS group, 192 patients were excluded from the effectiveness evaluation due to missing effectiveness outcomes and early discontinuation of the study (< 24 weeks) (Fig. 1).

673 patients enrolled

Patients excluded from the SS: 52

Reason	No. of patients
Not treated with methotrexate in RA	36
No treatment for LTBI before golimumab treatment	12
Informed consent obtained earlier than the site contract date	2
Foreign patients who did not qualify for statutory health coverage	1
Previously golimumab used before the study	1

Safety Set: 621

Patients excluded from the ES: 192

Reason	No. of patients
Missing all effectiveness results after golimumab treatment	139
Early discontinuation	53
Consent withdrawal	17
Lack of effectiveness	11
Study period expiration	9
Adverse events	9
Lost to follow up	7

Effectiveness Set: 429

Fig. 1 Flow chart of patient enrollment. *ES* Effectiveness set, *LTBI* latent tuberculosis infection, *RA* rheumatoid arthritis, *SS* safety set

In the SS group, the mean (± SD) age of patients was 44.0 ± 13.9 years, and 57.3% of patients were male. More than half of the patients (65.4%) were treated with golimumab for AS and 32.4% were treated with golimumab for RA. Prior to golimumab treatment, most patients (97.4%) were treated with DMARDs, NSAIDs, and/or steroids, and a few patients (2.3%) underwent surgical treatment, such as hip arthroplasty, for their rheumatic disease. In addition, 20.3% of patients were previously exposed to other biologics, mainly TNF inhibitors (adalimumab, infliximab, etanercept); most of these patients discontinued these agents due to lack of effectiveness. There were 330 patients (53.1%) in the SS group with comorbidities, such as hypertension, hyperlipidemia, osteoporosis, gastroesophageal reflux disease, and uveitis. All enrolled patients were screened for latent tuberculosis using a tuberculin test, and 103 patients (16.6%) with latent tuberculosis had prophylactic treatment prior to initiation of golimumab.

Safety

A total of 265 AEs were reported in 162 patients (26.1%) and 97 ADRs in 62 patients (10.0%). Unexpected AEs (n = 170 events) were reported in 110 patients (17.7%) and 14 SAEs including death were reported in 11 patients (1.8%) (Table 2). The most frequently reported ADRs were related to infection and infestations (3.1%). Among the infection and infestation ADRs, nasopharyngitis (0.8%) was the most frequently reported, followed by upper respiratory tract infections (0.6%) and herpes zoster (0.5%). Other than infection, pruritus (1.3%) was the most common ADR, followed by elevated alanine aminotransferase level (0.6%), rash, arthralgia, back pain, injection site rash, and elevated aspartate aminotransferase level

Table 1 Baseline characteristics of patients enrolled in the safety set group of the study

Category	All (N = 621)	RA (N = 201)	AS (N = 406)	PsA (N = 14)
Age, years (mean ± SD)	44 ± 13.9	53.3 ± 13.06	39.1 ± 11.73	52.8 ± 12.76
Male, *n* (%)	356 (57.3)	28 (13.9)	317 (78.1)	11 (78.6)
Disease duration, months (mean ± SD)	69.7 ± 83.2	84.1 ± 88.57	63.4 ± 80.12	47.8 ± 69.58
Previous treatment, *n* (%)				
Surgery	14 (2.3)	5 (2.5)	8 (2.0)	1 (7.1)
Biologics	126 (20.3)	38 (18.9)	84 (20.7)	4 (28.6)
Adalimumab	49 (7.9)	10 (5.0)	37 (9.1)	2 (14.3)
Infliximab	42 (6.8)	10 (5.0)	31 (7.6)	1 (7.1)
Etanercept	31 (5.0)	11 (5.5)	19 (4.7)	1 (7.1)
Tocilizumab	4 (0.6)	4 (2.0)	0 (0.0)	0 (0.0)
Abatacept	2 (0.3)	2 (1.0)	0 (0.0)	0 (0.0)
Certolizumab pegol	2 (0.3)	2 (1.0)	0 (0.0)	0 (0.0)
Ustekinumab	1 (0.2)	0 (0.0)	0 (0.0)	1 (7.1)
DMARDs, NSAIDs, steroids	605 (97.4)	201 (100.0)	390 (96.1)	14 (100.0)
Common comorbidities (≥ 1%), *n* (%)	330 (53.1)	128 (63.7)	191 (47.0)	11 (78.6)
Hypertension	88 (14.2)	42 (20.9)	43 (10.6)	3 (21.4)
Hyperlipidemia	42 (6.8)	17 (8.5)	25 (6.2)	0 (0.0)
Osteoporosis	36 (5.8)	29 (14.4)	7 (1.7)	0 (0.0)
Gastroesophageal reflux disease	29 (4.7)	12 (6.0)	17 (4.2)	0 (0.0)
Uveitis	24 (3.9)	1 (0.5)	23 (5.7)	0 (0.0)
Hepatic impairment	7 (1.1)	1 (0.5)	5 (1.2)	1 (7.1)
Renal impairment	10 (1.6)	4 (2.0)	5 (1.2)	1 (7.1)
Baseline tuberculin test, positive, *n* (%)	103 (16.6)	34 (16.9)	66 (16.3)	3 (21.4)

AS Ankylosing spondylitis. *DMARDs* Disease-modifying antirheumatic drugs, *NSAIDS* non-steroidal anti-inflammatory drugs, *PsA* psoriatic arthritis, *RA* rheumatoid arthritis, *SD* standard deviation

(0.5% each). One case of death by cardiac arrest was reported in one patient with a history of dyslipidemia, hypertension, arrhythmia, and osteoporosis; this death was judged to be without causality to golimumab.

Seven patients had a reported history of tuberculosis prior to golimumab initiation; of these, three had tuberculosis, three had pulmonary tuberculosis, and one had lymph node tuberculosis. However, there was no worsening of tuberculosis reported during the study. There were 103 patients with latent tuberculosis at baseline, and all of them received tuberculosis prophylaxis prior to golimumab initiation according to the Korean Guidelines for Tuberculosis [18]. There was no activation of tuberculosis in these patients throughout the study period.

Table 2 Summary of adverse events

Category	Number of patients (%)	Number of events
Adverse event (AE)	162 (26.1)	265
Adverse drug reaction (ADR)	62 (10.0)	97
Unexpected AE	110 (17.7)	170
Unexpected ADR	32 (5.2)	52
Serious adverse event	11 (1.8)	14
Serious ADR	4 (0.6)	6
Death	1 (0.2)	1
Common ADRs (≥ 0.5%)		
Pruritus	8 (1.3)	
Nasopharyngitis	5 (0.8)	
Upper respiratory tract infection	4 (0.6)	
Elevated ALT	4 (0.6)	
Herpes zoster	3 (0.5)	
Rash	3 (0.5)	
Arthralgia	3 (0.5)	
Back pain	3 (0.5)	
Injection site rash	3 (0.5)	
Elevated AST	3 (0.5)	

ALT Alanine aminotransferase, *AST* aspartate aminotransferase

To explore if there was any association between patient demographics and clinical features and the incidence of AEs during the study, we performed a multiple logistic regression analysis (Table 3). This analysis showed that patients with uveitis had 3.29-fold higher odds (95% confidence interval 1.397, 7.762) of experiencing an AE than those without uveitis ($p = 0.090$).

Effectiveness

The mean change (± SD) in VAS scores, which indicates patients' global disease activity from baseline at week 12 ($n = 366$) and week 24 ($n = 295$), were -3.37 ± 2.529 and -3.68 ± 2.404, respectively, showing a statistically significant reduction ($p < 0.0001$) (Table 4).

In the effectiveness assessment for RA, the proportion of patients with good response in DAS28-CRP and DAS28-ESR were 48.1% ($n = 37/77$) and 36.1% ($n = 26/72$), respectively, at week 12. At week 24, the proportions of patients with good response in DAS28-CRP and DAS28-ESR were 72.5% ($n = 58/80$) and 47.0% ($n = 39/83$), respectively (Fig. 2a).

In the effectiveness assessment for PsA, the ACR20 responder rate was 66.7% ($n = 4/6$) and 71.4% (5/7) at weeks 12 and 24, respectively (Fig. 2b). For AS patients, the ASAS20 responder rates were 68.6% ($n = 118/172$) and 79.2% ($n = 118/149$) at weeks 12 and 24, respectively (Fig. 2c).

DISCUSSION

In this study, we evaluated the safety and effectiveness of golimumab treatment using the locally approved label in Korea.

The composition of the patient population in our study is consistent with that reported in previous observational studies conducted in Korea [19, 20]. Our study shows that RA occurs at a relatively old age, similar to findings from Japan [21–24]. In comparison, the mean age of patients with AS in our study was 39.1 years, which was considerably younger than that of the RA patients (53.3 years). This finding is similar to that of other studies which also confirmed that AS patients are relatively younger. [25, 26]

Most of the patients included in our study had previous experience with conventional treatments due to the Korean reimbursement guidelines which allows biologic treatment only after evidence of intolerance or failure of conventional treatments.

Table 3 Multiple logistic regression of association between adverse events associated with golimumab and patient demographic/clinical characteristics

Variables	Reference	Incidence of AE		
		OR	95% CI	*p* value
Sex, male	Female	0.92	[0.577, 1.471]	0.732
Age, ≥ 65 years	≥ 18, < 65 years	1.03	[0.518, 2.034]	0.940
Hepatic impairment, yes	No	0.79	[0.155, 4.000]	0.772
Renal impairment, yes	No	0.92	[0.228, 3.727]	0.909
Golimumab formulation, intravenous	Subcutaneous	0.69	[0.184, 2.601]	0.586
Indication				
PsA	RA	0.85	[0.215, 3.354]	0.815
AS		1.10	[0.654, 1.838]	0.727
Hypertension, yes	No	1.09	[0.638, 1.846]	0.764
Hyperlipidemia, yes	No	1.18	[0.581, 2.383]	0.652
Osteoporosis, yes	No	1.86	[0.874, 3.953]	0.108
Gastroesophageal reflux disease, yes	No	1.1	[0.476, 2.555]	0.819
Uveitis, yes	No	3.29	[1.397, 7.762]	0.007
Prior surgical therapy, yes	No	2.62	[0.861, 7.984]	0.090
Prior biologics	No	1.06	[0.675, 1.673]	0.794
Prior DMARDs, NSAIDs and steroids, yes	No	4.84	[0.629, 37.217]	0.130

CI Confidence intervals, *OR* odds ratio

Since this study included only patients who were treated with methotrexate (MTX) used in combination with golimumab, the safety and effectiveness of golimumab monotherapy in real-world practice remains unconfirmed. In accordance with the results of PMS studies conducted in Japanese patients with RA, the incidence of SAEs among our study population was significantly lower in patients who were treated only with MTX compared to patients receiving golimumab or adalimumab monotherapy. However, these PMS studies were conducted in Japan at a time when the maximum approved MTX dose for RA was 8 mg/week, which could have contributed to lower numbers of reported SAEs [23, 24]. The authors of these studies interpreted this result in the golimumab and adalimumab monotherapy groups to be due to older age and longer disease duration, which would increase the risk for SAEs. In a meta-analysis, there were higher discontinuation rates among patients receiving combination therapy with golimumab + MTX, due to AEs, than among those receiving MTX monotherapy, but the difference was not statistically significant [27]. Based on this result, it would appear that MTX is more likely to be tolerated, but there is no clear evidence that the golimumab + MTX combination increases the risk of AEs.

In one of the above-mentioned Japanese study [24], there was no significant difference in the incidence of total ADRs between patients receiving 50 or 100 mg of golimumab with concomitant use of MTX and those receiving 50 or 100 mg of GLM monotherapy (4 groups of patients categorized according to treatment). The incidence of ADRs in the present study

Table 4 Global disease activity score (only including subcutaneous formulation)

Visit	Statistics	Global disease activity score (VAS)		
		Value	Baseline	Change[a]
Week 0 (baseline)	n'	427		
	Mean ± SD	6.44 ± 2.020		
	Median	7.00		
	Min–max	0.0–10.0		
Week 4	n'	267	267	267
	Mean ± SD	4.12 ± 2.213	6.27 ± 2.003	− 2.14 ± 2.483
	Median	4.00	7.00	−2.00
	Min–max[b]	0.0–10.0	0.0–10.0	−9.0 to 4.0
	p value[c]			< 0.0001
Week 12	n'	366	366	366
	Mean ± SD	3.05 ± 2.039	6.43 ± 2.017	−3.37 ± 2.529
	Median	3.00	7.00	−3.00
	Min–max[b]	0.0–10.0	0.0–10.0	− 9.0 to 6.0
	p value[c]			< 0.0001
Week 24	n'	295	295	295
	Mean ± SD	2.69 ± 1.887	6.37 ± 1.956	− 3.68 ± 2.404
	Median	2.00	7.00	− 4.00
	Min–max[b]	0.0–10.0	1.0–10.0	−9.0 to 3.0
	p value[c]			< 0.0001

max Maximum, *Min* minimum, *N* Number of patients administered by subcutaneous injection in each effectiveness set, n'' number of patients with available result at each visit, *VAS* Visual Analogue Scale

[a] Change = value at relevant visit − value at baseline

[b] Min–max values are approximated

[c] p values were based on the Wilcoxon signed-rank test

(10.0%) was similar to that of this Japanese study for golimumab (15.03%), Therefore, the use of golimumab and MTX in combination within the local approved label should be considered without major safety concerns.

The regression analysis of factors that could affect safety demonstrated that there was no significant effect of patient's age, previous treatment history, golimumab formulation, indication, and prior treatments. However, the odds of AEs were higher in patients with uveitis than those without uveitis. Uveitis is the most common, clinically important extra-articular manifestation of AS [28], and all except one patient with uveitis reported in this study were patients with AS. The higher rate of AEs reported in patients with uveitis in this study led to a significant result in the regression analysis. However, this result is simply based on the frequency of reported AEs, and it has not been confirmed whether the reported AEs are clearly related to golimumab. These results can be attributed to the fact that the overall health condition of patients with uveitis is generally

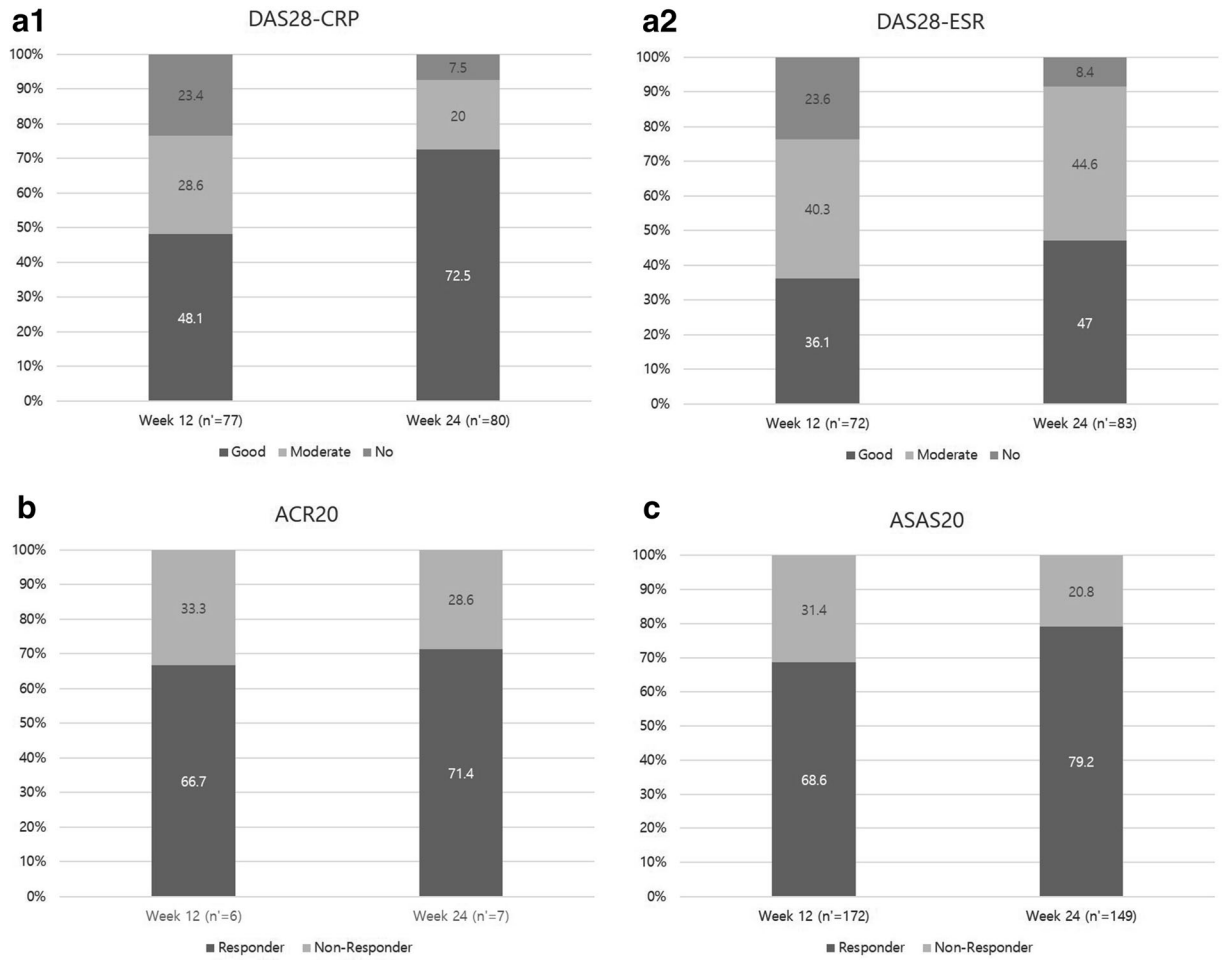

Fig. 2 Percentage of responders to therapy by disease specific index. **a**The response is categorized by EULAR classification using the DAS28 score with CRP or ESR. Good refers to responders (patients) with an improvement of > 1.2 and a present score of ≤ 3.2; Moderate refers to responders with an improvement of > 0.6 to ≤ 1.2 and a present score of ≤ 5.1, or an improvement of > 1.2 and a present score of >3.2; No refers to non-responders, i.e., any patient with an improvement of ≤ 0.6, or a patient with an improvement of > 0.6 to ≤ 1.2 and a present score of $>$ 5.1. **b** Response measured with the ACR20. A responder is defined as a patient who showed an improvement of $\geq$ 20% from baseline in swollen joint count, tender joint count, and ≥ 3 of patient's pain assessment, patient global assessment of disease activity, physician's global assessment of disease activity, health assessment questionnaire, and CRP. **c** Response measured with the ASAS20. A responder is defined as a patient who had an improvement of $\geq$ 20% from baseline and absolute improvement to 0/1 score in at least 3 global assessments: total back pain, bath ankylosing spondylitis functional index, and inflammation. *ACR20* Composite measure indicating 20% improvement from baseline per the American College of Rheumatology (ACR) response criteria, *ASAS20* Improvement of $\geq$ 20% from baseline according to the Assessment of SpondyloArthritis International Society (ASAS) criteria, *DAS28-CRP*, *-ESR* Disease Activity Score 28-joint counts calculated separately using both C-reactive protein (CRP) and erythrocyte sedimentation rate (ESR) as variables

worse, taking into account the use of different concomitant medications. Therefore, we suggest that this result indicates the need for further studies to evaluate the risk of golimumab in AS patients with uveitis.

There was no malignancy reported with and after treatment using golimumab. There is a

recent database study confirming that anti-TNF therapy is a safe therapeutic option in Korea [29]. However, the duration of the follow-up period of our study was insufficient to observe the onset of cancer; we therefore suggest that further studies are required to identify the risk of malignancy.

It has been reported that anti-TNFs increase the risk of reactivation of LTBI [30, 31]. Tuberculosis in Korea remains an important health problem, with a prevalence 49.4 per 100,000 people [32]. This study included seven patients who had a history of tuberculosis, but these patients did not exhibit tuberculosis reactivation. In addition, when latent tuberculosis was confirmed at baseline, appropriate chemoprophylactic treatment was administered and there were no cases of active tuberculosis during the study. Therefore, although golimumab belongs to the anti-TNF drug class, the risk of tuberculosis reactivation or infection can be reduced through proper screening for tuberculosis and patient monitoring while on golimumab treatment.

In this study, significant changes in global disease activity assessment were observed after golimumab treatment. In a disease-specific assessment, > 90% of RA patients had a moderate or good response, and treatment responder rate of PsA or AS also reached > 70%.

One limitation of this study is that there was no control group with which to directly compare the safety and effectiveness to golimumab. A second limitation is that this study had relatively short follow-up period, which limited observation of AEs which have a longer latency, such as malignancy.

CONCLUSIONS

In conclusion, the results of this study demonstrate that golimumab has favorable safety and effectiveness profiles for the treatment of RA, PsA, and AS in Korea. We suggest that golimumab can be considered as an appropriate drug to control disease activity since it demonstrated significant disease activity-lowering effects in this study population.

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Authors' Contributions. All authors contributed to the study conception and design. Material preparation and data collection and analysis were performed by Hyeongyeong Kim, Youngdoe Kim and YoungJa Lee. The first draft of the manuscript was written by Hyeongyeong Kim, and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Disclosures. Hyeongyeong Kim, Youngdoe Kim, and YoungJa Lee are full-time employees of Janssen Korea Ltd.

Compliance with Ethics Guidelines. The study was conducted according to the Declaration of Helsinki 1964 and its later amendments. The study protocol, including all ethical aspects, was reviewed and approved by the institutional review board of each participating medical institution (Electronic Supplementary Material 1). All patients provided written informed consent to participate and have their data collected.

Data Availability. The datasets generated during and/or analyzed during the current study are not publicly available due to privacy and ethical restrictions.

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