



Safety and efficacy of non-medical switch from innovator to generic tofacitinib: a 3-month observational study in rheumatoid arthritis patients

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Abstract

Aim: Rheumatoid arthritis (RA) is a chronic autoimmune disease characterized by systemic inflammation. Following the expiry of the patent for innovator tofacitinib (Xeljanz), generic tofacitinib formulations such as Tozib have become available. This study evaluated the impact of a non-medical switch from innovator tofacitinib to generic tofacitinib on disease activity and flare rates over 3 months in patients with RA.

Methods: This retrospective multicenter observational study in Malaysia included 36 patients with RA in remission or low disease activity who underwent a non-medical switch from innovator to generic tofacitinib. Disease activity was assessed at baseline and 3 months using the Disease Activity Score-28 erythrocyte sedimentation rate (DAS28-ESR). Flare was defined as an increase in DAS28-ESR of ≥ 1.2 , or ≥ 0.6 if the concurrent DAS28-ESR was ≥ 3.2 .

Results: Thirty-six patients with RA who switched from reference medication to generic tofacitinib were included; 88.9% were female, with a mean age of 64.1 ± 9.4 years. Patients had longstanding disease, with a median disease duration of 15.5 years (IQR 8.8–19.0), and had received originator tofacitinib for a mean duration of 3.48 ± 1.71 years prior to switching. At 3 months post-switch, disease activity remained stable, with no significant change in median DAS28-ESR from 2.17 (IQR 1.19) to 2.45 (IQR 1.03) ($p = 0.141$). Although 16.7% of patients showed a DAS28-ESR increase of ≥ 0.6 , none had DAS28-ESR ≥ 3.2 at 3 months. Only one patient demonstrated a DAS28-ESR change ≥ 1.2 after switching, with no new safety concerns observed.

Conclusions: Our findings suggest that non-medical switching from reference medication to generic tofacitinib did not significantly affect short-term disease control or safety in RA patients over a 3-month follow-up period. These results provide preliminary real-world evidence supporting generic substitution; however, further studies with larger sample sizes and longer follow-up are warranted.



Keywords

rheumatoid arthritis, generic tofacitinib, tozib, efficacy, non-medical switch

Introduction

Rheumatoid arthritis (RA) is a long-standing autoimmune disorder characterized by systemic inflammation. When not adequately managed, it may result in permanent joint destruction, functional impairment, and substantial socioeconomic burden [1]. The early 2000s marked a major shift in RA management with the introduction of biologic therapies targeting tumor necrosis factor (TNF). These TNF inhibitors (TNFi), together with other biologic disease-modifying antirheumatic drugs (bDMARDs) and Janus kinase inhibitors (JAKi), have become key second-line options for patients who do not respond sufficiently to conventional synthetic disease-modifying antirheumatic drugs (csDMARDs), significantly improving survival and clinical outcomes [2].

The introduction of advanced therapies, including biosimilars, over the past decades has helped reduce the economic burden associated with the treatment of rheumatology diseases [3]. More recently, generic JAKi have also emerged as potential candidates for non-medical switching, as they are generally available at a lower cost compared with their reference medication. Tofacitinib (Xeljanz; Pfizer Inc., New York, NY, USA) was the first JAK inhibitor approved by the United States Food and Drug Administration (USFDA) in 2012 for the treatment of RA [4]. Following the expiration of patent protection for Xeljanz, generic formulations of tofacitinib have been developed and produced in several countries, including China and India [5, 6].

Non-medical switching refers to the practice of changing a patient's medication for reasons that are not related to clinical considerations. In these situations, the decision to switch therapy is not due to poor treatment response, drug intolerance, or issues with medication adherence [7]. Instead, such changes are commonly driven by healthcare payers as part of broader cost-containment efforts. This practice is particularly relevant in rheumatology, where many patients require high-cost medications, including JAKi, to effectively control disease activity. When patients are switched between these treatments for non-medical reasons, it may affect the continuity and quality of care. Different medications can vary in their clinical effectiveness, side-effect profiles, and methods of administration [8]. As a result, even when the initial therapy is working well and is considered the most appropriate option, both physicians and patients may feel pressured to accept an alternative medication because of financial or insurance-related constraints.

Novugen Pharma is a pharmaceutical manufacturer whose facilities have been accredited by the USFDA since 2022 with FDA establishment identifier number 3017604745, making it the first and only company in Southeast Asia to develop products for United States markets [9]. Tozib, a generic JAKi produced by Novugen Pharma, was introduced in Malaysia in September 2024. An oral bioequivalence study comparing Tozib with the reference medication, Xeljanz, demonstrated that it met the required bioequivalence standards set by the national pharmaceutical regulatory agency (NPRA) under the Ministry of Health Malaysia [10].

In this study, we investigated the impact of a non-medical switch from Xeljanz to Tozib on the 3-month disease activity and flare rate in RA patients.

Materials and methods

This retrospective study was conducted at three major tertiary rheumatology centers across Malaysia. The study protocol was approved by the Malaysian Medical Research and Ethics Committee (MREC, NMRR ID: 25-03639-UE5). Due to the retrospective nature of this study and the use of anonymized patient data, the MREC granted a waiver of informed consent. This study was conducted in accordance with the ethical principles of the World Medical Association Declaration of Helsinki.

A total of 36 patients with RA who had previously been treated with Xeljanz and were subsequently switched to the generic formulation, Tozib, for non-medical reasons were included in the study. Prior to the switch, all patients were either in remission or had achieved at least low disease activity based on the Disease Activity Score-28 erythrocyte sedimentation rate (DAS28-ESR) [11]. Patients who had not achieved the predefined treatment target were not included in the study. The switch from innovator to generic tofacitinib was implemented as a mandatory institutional formulary change. The hospital discontinued procurement of the innovator tofacitinib and subsequently supplied only the generic formulation. In addition, patients who declined the non-medical switch were not included in the study cohort.

Baseline demographic and clinical characteristics, including age, sex, ethnicity, and concomitant medications, were recorded. Additional baseline data collected included DAS28-ESR scores, duration of prior tofacitinib therapy, and duration of remission prior to the switch. Disease activity was assessed using the DAS28-ESR, simplified disease activity index (SDAI), and clinical disease activity index (CDAI). Disease activity at the time of the switch and at 3 months following the switch was evaluated, and changes in disease activity over time were analyzed for each patient. Disease flare was defined as an increase in DAS28-ESR of ≥ 1.2 or ≥ 0.6 , if the concurrent DAS28-ESR was ≥ 3.2 [12].

Statistical analyses were conducted using IBM SPSS Statistics version 27 (IBM Corp., Armonk, NY, USA). Continuous variables were tested for normality and summarized as mean $\pm$ standard deviation or median (interquartile range [IQR]), as appropriate. Categorical variables were presented as frequency and percentage. Disease activity measures before switching from originator to generic tofacitinib and after 3 months of follow-up were compared using the Wilcoxon signed-rank test for paired non-parametric data. The proportions of patients with DAS28-ESR change ≥ 0.6 and ≥ 1.2 were also determined. Statistical significance was defined as p -value < 0.05 .

Results

A total of 36 patients with RA who were switched from reference medication to generic tofacitinib were included in the study. The majority were female (32/36, 88.9%), with a mean age of 64.1 ± 9.4 years. The cohort was predominantly Malay (47.2%), followed by Indian (30.6%) and Chinese (19.4%). Only one patient (2.8%) was an ever-smoker, while 13 patients (36.1%) were classified as obese. Most patients were seropositive, with 28 (77.8%) testing positive for anti-citrullinated protein antibody (ACPA) and 32 (88.9%) positive for rheumatoid factor. The median disease duration was 15.5 years (IQR 8.8–19.0), reflecting a long-standing RA cohort. Patients had received original tofacitinib (Xeljanz) for a mean duration of 3.48 ± 1.71 years prior to switching, and had maintained remission or low disease activity for a mean duration of 2.96 ± 1.61 years before transition to generic therapy (Table 1).

Table 1. Rheumatoid arthritis (RA) patients' characteristics and treatment received at the start of generic tofacitinib.

Category	Frequency (n = 36)
Gender, n (%)	
Male	4 (11.1%)
Female	32 (88.9%)
Age, y (mean $\pm$ SD)	64.1 $\pm$ 9.4
Ethnicity, n (%)	
Malay	17 (47.2%)
Chinese	7 (19.4%)
Indian	11 (30.6%)
Other	1 (2.8%)
Ever-smoker, n (%)	1 (2.8%)
Obese*, n (%)	13 (36.1%)
ACPA positive, n (%)	28 (77.8%)
RF positive, n (%)	32 (88.9%)

Table 1. Rheumatoid arthritis (RA) patients' characteristics and treatment received at the start of generic tofacitinib. (continued)

Category	Frequency (n = 36)
Duration of RA, y (IQR)	15.5 (8.8–19.0)
Treatment	
Duration of originator tofacitinib, y (mean ± SD)	3.48 ± 1.71
Duration in rem/lda pre-switch, y (mean ± SD)	2.96 ± 1.61
Concomitant csDMARDs, n (%)	
Methotrexate	20 (55.6%)
Sulphasalazine	1 (2.8%)
Leflunomide	1 (2.8%)
Not on any csDMARDs	14 (38.9%)
Comorbidities, n (%)	
Diabetes mellitus	6 (16.7%)
Hypertension	23 (63.9%)
Ischaemic heart disease	1 (2.8%)
Hyperlipidaemia	17 (47.2%)

ACPA: anti-citrullinated protein antibody; csDMARDs: conventional synthetic disease-modifying antirheumatic drugs; lda: low disease activity; rem: remission; RF: rheumatoid factor. *Obesity: body mass index ≥ 27.5 kg/m².

Regarding concomitant treatment, 20 patients (55.6%) remained on methotrexate, while smaller proportions were receiving sulfasalazine or leflunomide. Fourteen patients (38.9%) were on generic tofacitinib monotherapy. Common comorbidities included hypertension (63.9%), hyperlipidaemia (47.2%), diabetes mellitus (16.7%), and ischaemic heart disease (2.8%) (Table 1).

There were no statistically significant changes in disease activity following the switch from originator to generic tofacitinib over 3 months. Median DAS28-ESR remained stable, changing minimally from 2.17 (IQR 1.19) at baseline to 2.45 (IQR 1.03) at 3 months ($p = 0.141$). Although six patients (16.7%) showed an increase in DAS28-ESR of ≥ 0.6 , none had DAS28-ESR values ≥ 3.2 at 3 months post-switch. Only one patient demonstrated flare with a DAS28-ESR increase of ≥ 1.2 (Table 2). No adverse events were documented during the 3-month follow-up period following the switch from innovator to generic tofacitinib. No treatment discontinuation due to adverse events was reported.

Table 2. Comparison of disease activity before and after switching from innovator to generic tofacitinib during the 3-month follow-up.

Category	Baseline	3 months post-switch	Changes post-switch	p-value
PGA	12.00 (10.00–16.00)	13.50 (10.00–20.00)	0.00 (–1.00–2.00)	0.133
DAS28-ESR	2.17 (1.58–2.77)	2.45 (1.77–2.80)	0.10 (–0.10–0.20)	0.141
ESR	35.00 (22.00–46.00)	32.00 (24.75–47.00)	–2.00 (–6.00–3.25)	0.333
CRP	2.00 (1.18–4.90)	2.81 (1.29–6.00)	0.04 (–0.21–0.78)	0.167
SDAI	2.60 (2.10–4.75)	2.85 (2.27–6.40)	0.05 (–0.10–0.12)	0.546
CDAI	2.00 (1.53–3.00)	2.00 (0.98–3.10)	0.00 (0.00–0.13)	0.278
Changes in DAS28-ESR				
$\geq 0.6^*$, n (%)	-	-	6 (16.7%)	-
≥ 1.2 , n (%)	-	-	1 (2.8%)	-

Numbers are medians (interquartile ranges) unless otherwise stated (%). CDAI: clinical disease activity index; CRP: C-reactive protein; DAS28-ESR: Disease Activity Score-28 erythrocyte sedimentation rate; PGA: patient global assessment; SDAI: simplified disease activity index. *Indicates none with DAS28-ESR ≥ 3.2 at 3 months post-switch.

Discussion

To the best of our knowledge, this is the first study to specifically examine a non-medical switch among RA patients previously maintained on the originator form of tofacitinib. In contrast, earlier research by Zhao et al. [13] primarily focused on direct comparisons between the reference medication and generic

formulations of tofacitinib. This single-centre study done in China showed comparable clinical efficacy and safety between the generic tofacitinib and Xeljanz with expected favourable cost-effectiveness [13].

With the expiration of patents for JAKi, generic tofacitinib has become increasingly available as a more affordable alternative to the innovator product. Unlike biosimilars, generic small-molecule drugs are approved based primarily on demonstration of pharmaceutical and bioequivalence rather than extensive clinical comparability studies [14, 15]. Despite this regulatory distinction, evidence supporting the maintenance of clinical efficacy and safety following a non-medical switch from innovator to generic tofacitinib remains limited. This highlights the importance of evaluating clinical outcomes following such switches, particularly in patients with RA who have already achieved stable disease control.

The manufacturing of tofacitinib citrate is complex, involving multiple synthetic steps, including the condensation of a piperidine amine intermediate with a pyrrolopyrimidine intermediate to generate the core structure [16]. Given this complexity, a more rigorous approval framework, similar to that required for biosimilars may be warranted for generic JAKi to ensure consistent quality, safety, and efficacy.

Tofacitinib demonstrates a relatively rapid onset of action, with clinical improvements often observed as early as 2 to 8 weeks after initiation [17]. Evidence suggests that many patients achieve meaningful reductions in disease activity within 3 months of treatment [18]. In the ORAL Start and ORAL Standard trials, failure to meet predefined improvement thresholds at 3 months, specifically a decrease from baseline of ≥ 6 in CDAI and ≥ 1.2 in DAS28-ESR, was associated with a low likelihood of achieving remission at 6 and 12 months. In light of these findings, we selected the 3-month time point as the cutoff for evaluating the efficacy of tofacitinib following the switch [19, 20].

In our cohort, disease control was largely maintained following the switch from innovator to generic tofacitinib. The median DAS28-ESR showed only a small, non-significant increase over 3 months, and although six patients had an increase of ≥ 0.6 , none had moderate or high disease activity at 3 months. Only one patient met the predefined criterion for a flare. This stability may partly reflect the fact that patients had already been maintained in remission or low disease activity for almost 3 years before the switch, suggesting that the change in formulation itself did not appear to result in an immediate loss of disease control. In addition, patients had been receiving innovator tofacitinib for a mean of more than 3 years before switching, providing a stable treatment background. However, the short follow-up and small sample size limit the ability to determine whether these findings represent sustained clinical equivalence between the two formulations.

This study has several limitations that should be acknowledged. First, the relatively short follow up period of three months may not be sufficient to fully evaluate safety and durability of response following the switch to generic tofacitinib. Second, the retrospective design may introduce potential biases, and the small sample size may limit the generalizability of the findings to a broader RA population. The safety findings should be interpreted cautiously given the short 3-month follow-up and retrospective design. Although no adverse events were documented, longer-term and uncommon adverse events may not have been captured. Larger prospective studies with longer follow-up and systematic safety monitoring are needed to confirm the long-term safety of generic tofacitinib.

Nevertheless, our study also has notable strengths, particularly its focus on RA patients who had already achieved EULAR-defined treatment targets, either remission or low disease activity prior to undergoing a non-medical switch to a generic formulation. With the expiration of tofacitinib patents in many countries, including the United States, an increasing number of patients who are stable on the originator drug may be required to transition to generic versions, largely driven by the need to reduce healthcare costs for both individuals and healthcare systems [21]. Importantly, this study provides valuable real-world evidence to support future transitions to generic tofacitinib, helping to build clinician and patient confidence in the safety and effectiveness of such switching practices.

Conclusions

In this real-world retrospective study, non-medical switching from originator to generic tofacitinib was not associated with clinically meaningful worsening of disease activity over 3 months in patients with RA. Most patients maintained low disease activity or remission after switching, supporting the short-term efficacy of generic tofacitinib and its potential role as a cost-effective treatment strategy. Larger prospective studies with longer follow-up are needed to evaluate long-term outcomes and safety.

Abbreviations

CDAI: clinical disease activity index

csDMARDs: conventional synthetic disease-modifying antirheumatic drugs

DAS28-ESR: Disease Activity Score-28 erythrocyte sedimentation rate

IQR: interquartile range

JAKi: Janus kinase inhibitors

MREC: Malaysian Medical Research and Ethics Committee

RA: rheumatoid arthritis

TNF: tumor necrosis factor

USFDA: United States Food and Drug Administration

Declarations

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Author contributions

PSO: Conceptualization, Methodology, Software, Formal analysis, Investigation, Data curation, Writing—original draft, Writing—review & editing, Visualization. MC: Data curation, Investigation, Validation. AKB: Data curation, Investigation, Validation. All authors read and approved the submitted version.

Conflicts of interest

The authors declare that there are no conflicts of interest.

Ethical approval

This study was approved by the Medical Research and Ethics Committee, Ministry of Health Malaysia (NMRR ID: 25-03639-UE5). This study was conducted in accordance with the ethical principles of the World Medical Association Declaration of Helsinki.

Consent to participate

Individual informed consent was waived by the Malaysian Medical Research and Ethics Committee due to the retrospective nature of the study and the use of existing medical records.

Consent to publication

Not applicable.

Availability of data and materials

The data that support the findings of this study are available from the corresponding author upon reasonable request

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