RECOMMENDATION

Tapering and discontinuation of methotrexate in patients with RA treated with TNF inhibitors: data from the DREAM registry

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To cite: Manders SHM, van de Laar MAFJ, Rongen-van Dartel SAA, et al. Tapering and discontinuation of methotrexate in patients with RA treated with TNFi and to analyse the effects of that adaption on disease activity and drug survival. Methods: Data were collected from the Dutch Rheumatoid Arthritis Monitoring (DREAM) registry. Patients who started their first TNFi were included in the study. Treatment effectiveness after MTX tapering or discontinuation was analysed using Disease Activity Score of 28 joints (DAS28). Drug survival of the TNFi was analysed using the Cox proportional hazard model with a time-dependent covariate.

Results: In 458 patients (34%), MTX was tapered, 126 patients (10%) discontinued MTX and 747 patients (56%) continued MTX at the same dose. On average, DAS28 improved after tapering MTX (−0.40, −0.45) and after stopping MTX (−0.28, −0.12) at 6 and 12 months. In the taper group, 21% of the patients relapsed (DAS28 increase >0.6), and in the discontinuation group this was 21% and 24% at 6 and 12 months, respectively. Patients who taper and discontinue MTX have a similar DAS28 score over time as patients who continue MTX. Moreover, there was no influence of tapering or discontinuation of MTX on long-term drug survival of TNFi. Conclusions: In daily practice, tapering or discontinuation of concomitant MTX in patients with RA treated with TNFi frequently occurs and it does not seem to influence the average DAS28 over time or the long-term TNFi drug survival. It appears that in daily clinical practice the correct patients are selected to taper or discontinue MTX.

ABSTRACT

Objectives: To study the number of patients that taper or discontinue concomitant methotrexate (MTX) in daily practice in patients with rheumatoid arthritis (RA) treated with tumour necrosis factor inhibitor (TNFi) and to analyse the effects of that adaption on disease activity and drug survival.

Methods: Data were collected from the Dutch Rheumatoid Arthritis Monitoring (DREAM) registry. Patients who started their first TNFi were included in the study. Treatment effectiveness after MTX tapering or discontinuation was analysed using Disease Activity Score of 28 joints (DAS28). Drug survival of the TNFi was analysed using the Cox proportional hazard model with a time-dependent covariate.

Results: In 458 patients (34%), MTX was tapered, 126 patients (10%) discontinued MTX and 747 patients (56%) continued MTX at the same dose. On average, DAS28 improved after tapering MTX (−0.40, −0.45) and after stopping MTX (−0.28, −0.12) at 6 and 12 months. In the taper group, 21% of the patients relapsed (DAS28 increase >0.6), and in the discontinuation group this was 21% and 24% at 6 and 12 months, respectively. Patients who taper and discontinue MTX have a similar DAS28 score over time as patients who continue MTX. Moreover, there was no influence of tapering or discontinuation of MTX on long-term drug survival of TNFi.

Conclusions: In daily practice, tapering or discontinuation of concomitant MTX in patients with RA treated with TNFi frequently occurs and it does not seem to influence the average DAS28 over time or the long-term TNFi drug survival. It appears that in daily clinical practice the correct patients are selected to taper or discontinue MTX.

INTRODUCTION

Insufficient effect of methotrexate (MTX) is most often the reason to add a tumour necrosis factor inhibitor (TNFi) to the treatment strategy of patients with rheumatoid arthritis (RA). The combination of TNFi with MTX provides better results than TNFi monotherapy1–3 and is therefore recommended in clinical guidelines.4 However, MTX can cause mild adverse events like gastrointestinal problems in about 50% of the patients, with nausea as the main symptom. Also, headaches, dizziness and oral ulcers are often heard symptoms.5,6 This observation fits with the clinical experience that treatment with MTX is often a burden for patients. Owing to this burden, it might be the patient’s wish to taper or discontinue MTX when the combination with TNFi results in significant improvements rather than taper or discontinue TNFi. However, no data are available whether or not
concomitant MTX can be tapered or discontinued in daily clinical practice. Therefore, the objective of this study was to explore how frequently MTX is tapered or discontinued in daily clinical practice and the effects of that on disease activity in the short term, and on the TNFi drug survival in the long term.

**PATIENTS AND METHODS**

**Design**

This is a cohort study using data from the biologic register of the Dutch Rheumatoid Arthritis Monitoring (DREAM) project. Since February 2003, all patients with RA who started on one of the biological agents for the first time in one of 12 centres in the Netherlands have been included in the DREAM biologic register. Patients in this study were not randomised to a specific treatment and data collection continued even when patients stopped using biological agents. Since the study protocol is in line with the advice on safety and effectiveness monitoring of the Dutch guideline for diagnosis and treatment of patients with RA, this register does not need extended ethical approval. This was confirmed by the regional ethical committee Arnhem-Nijmegen. Patients signed informed consent on gathering their data in an electronic database and using their data for research purposes.

**Inclusion/exclusion criteria**

All patients had a diagnosis of RA according to the 1987 American College of Rheumatology classification criteria and a Disease Activity Score of 28 joints (DAS28) >3.2. Prior treatments with at least two other disease-modifying antirheumatic drugs (DMARDs) including MTX and absence of an absolute contraindication for a TNFi (eg, pregnancy, presence of a serious infection) were required. Inclusion criteria for the DREAM biologic registry were assessed at the scheduled clinical visits.

**Assessments**

Patients were assessed at the start of TNFi treatment (baseline) and every 3 months thereafter. The following baseline measurements were collected: age, gender, rheumatoid factor (RF), disease duration (since the time of diagnosis), presence of erosive disease, previous and/or current antirheumatic treatment, DAS28, Health Assessment Questionnaire Disability Index (HAQ-DI) and medication consumption. The clinical assessments used to determine DAS28 were performed by trained nurses, and the HAQ-DI was completed by the patients themselves. DAS28, HAQ-DI, medication history and the presence of comorbidities were reassessed at the scheduled clinical visits.

**Statistical analyses**

For this study, patients with RA and using their first TNFi with concomitant MTX were eligible for the analyses. First, the percentages of patients who tapered and discontinued MTX were analysed. Patients who tapered MTX during the TNFi treatment were included in the taper group. Patients who stopped MTX directly, without tapering first, were included in the discontinuation group. All other patients were analysed in the continuation group. Second, comparisons between these three groups were analysed. The intention-to-treat principal was used for these analyses.

To detect baseline differences in age, gender, RF positivity, presence of erosions, disease duration, type of TNFi treatment, amount of previous DMARDs, DAS28 at baseline, HAQ-DI at baseline and co-medication, univariate analyses of baseline variables were performed using analysis of variance, a Kruskal-Wallis test and a $\chi^2$ test, depending on the distribution and type of data.

Patient characteristics were compared between those who had a relapse (defined as an increase in disease activity $>0.6$ on DAS28) and those who did not have a relapse by using a t-test, a Mann-Whitney U test and a $\chi^2$ test, as appropriate. The change in DAS28 scores at 6 and 12 months after tapering and discontinuation of MTX was calculated. Patients with missing DAS28 data at baseline or the follow-up measurement could not be included. Linear mixed models with the interaction term between time and tapering MTX (yes/no) were used to analyse if the course of DAS28 over time is different in the MTX taper group compared to the patients who discontinued MTX and continued MTX. Using the linear mixed model approach for the repeated measures within the patients has the advantage that all available data could be used despite some missing values. The missing data are assumed to be missing at random. For the mixed model analyses, the first-order autoregressive (AR(1)) covariance structure was used. This structure was the best fit for these outcome measures ($-2$ restricted log likelihood). To analyse if there is a difference in long-term drug survival of TNFi between the groups, Cox proportional hazard modelling was used in which the time till tapering and discontinuation was defined as a time-dependent covariate. A hazard ratio significantly higher than one means that the patients who discontinue or taper have worse TNFi drug survival than those in the continuation group. In the mixed model and Cox regression analyses, a correction was made for all possible confounders. Patients using golimumab and certolizumab could not be taken into account because the number of patients in these groups were too small.

**RESULTS**

Between February 2003 and June 2012, a total of 1933 patients with RA started their first TNFi therapy. Sixty-nine per cent (1331/1933) of these patients used TNFi in combination with MTX. For the patients treated with infliximab, the percentage of MTX users was 71, for patients treated with adalimumab the percentage was 72, and for patients treated with etanercept this was 66%.

Table 1 shows the clinical characteristics of patients in whom MTX was tapered and discontinued during
treatment with TNFi and of patients who continued MTX. The patients who tapered had a less number of previous DMARDs and higher MTX doses than patients who continued and discontinued MTX.

Tapering of MTX
There were 34.4% (458/1331) patients with concomitant MTX in whom MTX was tapered during follow-up. In half of the patients, the dose was tapered within 6 months (median=149 days (IQR 84–325)) after the start of their TNFi. MTX tapering occurred in 33% of the patients using infliximab, in 38% of patients using adalimumab, and in 35% of patients using etanercept. Most patients who tapered MTX had a dose of 25 mg MTX at the start: 50%. After this first MTX dose tapering, 41.3% (189) patients tapered their MTX dose further (median=180 days (IQR 91–354)) and 12.2% (56) increased their MTX dose again (median=99 days (IQR 77–240)).

Table 2 presents the effects after tapering MTX at the group level. The average DAS28 score after MTX tapering decreased at 6 and 12 months.

Relapse rates
In 21% of the patients, DAS28 increased more than 0.6 at 6 and 12 months, table 2. Patients who relapsed at 6 months had significantly (p=0.004) more patients on <10 mg MTX after tapering (19.1%) than patients who did not relapse (7.4%). Moreover, DAS28 at the time of taper was lower (mean difference=1.20, p<0.001), the patients tapered later in time (mean difference=77 days, p=0.003), they used more previous DMARDs in the past (p=0.009) and had lower MTX doses before taper (p=0.016) in patients who relapsed compared to those who did not. At 12 months, patients who relapsed had lower DAS28 scores at the moment of taper (mean difference=1.25, p<0.001).

Discontinuation of MTX
In 9.5% (126/1331) of the patients, MTX was discontinued during follow-up. Half of those patients did so within 9 months (median=261 days (IQR 97–552)) after the start of their TNFi. MTX discontinuation occurred in 7.8% of the patients using infliximab, in 8.7% of patients using adalimumab, and in 10.3% of patients using etanercept. The largest group of patients used 15 mg of MTX before discontinuation (30.6%). Those patients discontinuing their MTX treatment had an average DAS28 at discontinuation of 3.6 (SD=1.4). The improvement in DAS28 at 6 and 12 months was 0.28 and 0.12, respectively.

Relapse rates
Six and 12 months after discontinuation of MTX, a >0.6 increase in DAS28 was observed in 21% and 24%, respectively.
respectively, of the patients (see Table 2). There were no significant differences in patient characteristics in patients who relapsed and those who did not.

DAS28 course over time
DAS28 over time from start of the TNFi treatment was evaluated with linear mixed models between discontinuation, tapering and continuation (Figure 1). The results show that patients who taper have the lowest DAS28 over time. However, the three groups all have the same course over time after the initial improvement in DAS28. The interaction between taper (yes or no) and time (follow-up in months) is not significantly different ($\beta = 0.006; CI -0.001 to 0.013, p=0.071$). The same accounts for the interaction between discontinuation and time ($\beta = 0.002; CI -0.008 to 0.013, p=0.660$). (See Figure 1).

TNFi drug survival
The long-term drug survival is significantly different between the patients tapering and the patients continuing with a hazard rate (Hr) of 0.744 (0.606 to 0.913; Table 3). This means that patients’ risk of stopping TNFi decreased by 25.6% if patients tapered their MTX treatment. So, even with correction for the time-dependent variable of time of tapering MTX and other confounding factors, patients who taper MTX have a better drug survival of TNFi. The long-term drug survival of the TNFi is not significantly different between patients who discontinued MTX and patients who continued MTX (Hr=1.046; CI 0.760 to 1.440; p=0.660) (Table 4).

DISCUSSION
The main objective of this observational study was to evaluate how many patients with RA treated with TNFi and concomitant MTX taper or discontinue their MTX.
62% of the patients decreased or discontinued clinical trial where concomitant medication could not MTX. These patients were MTX in patients with RA that used etanercept with the study of Kremer MTX in our cohort study was somewhat lower than in better than that in the continuation group. TNFi drug survival of the taper group even tends to be TNFi was not worse from patients that continued. The in addition, we analysed the effect on disease activity and long-term TNFi drug survival of tapering or discontinuation of MTX. This study revealed that 34.4% of the patients starting with TNFi plus MTX taper their MTX taper MTX. In these patients, the MTX dose was decreased from 15 to 5 mg. In 79% of the responders, this tapering of MTX did not increase the disease activity. On the contrary, the Canadian randomised trial of Pope et al14 showed an increase of DAS28 after discontinuation of MTX. These results are different from our non-controlled setting, and it is possible that in our daily practice the correct patients are selected to taper or discontinue MTX.

This study has some limitations that should be mentioned. The first limitation is the possible confounding by indication due to the study design. These were corrected for all measured confounders; however, in addition other, unmeasured factors might differ between the groups. Although it is good to see the differences between patients who taper, discontinue and continue MTX, the comparison between the groups should be carefully interpreted. Second, it was not possible to differentiate between TNFi treatments in the analyses in the patients who discontinued MTX. Here, the number of patients with complete data was too small to make valid conclusions. Moreover, the difference in patients characteristics in patients that relapsed compared to patients that did not relapse in the discontinuation group are performed on small amounts of patients. This could be a reason why no significant differences were found between those groups. Also, other analyses in subgroups, like different doses of MTX, will not result in valid conclusions due to the small number of patients.

By studying our observational data, some remarkable results were found that need some discussion. On the basis of the literature that TNFi in combination with MTX provides better drug survival,16 17 we hypothesised that if patients tapered their MTX, they would have a worse drug survival of the TNFi. This does not seem to be the case. Despite the correction for the time-dependent covariate, the start of tapering MTX, the long-term drug survival is still better in the patients who taper MTX. Perhaps this is because the patients still use a low dose of MTX and only a small percentage <10 mg MTX. Burmester et al18 show in a clinical trial that TNFi plus 20 mg MTX provides the same results as TNFi plus

| Table 3 Cox proportional regression hazard model with a time-dependent covariate |
|--------------------------------|-----------------|-----------------|
|                                | HR (95% CI)     | p Value         |
| Taper MTX                      | 0.744 (0.606 to 0.913) | 0.005          |
| Female gender                  | 1.048 (0.662 to 1.268) | 0.628          |
| RF positive                    | 0.922 (0.748 to 1.137) | 0.448          |
| Erosions present               | 1.393 (1.144 to 1.697) | 0.001          |
| Age                            | 0.996 (0.899 to 1.003) | 0.250          |
| Disease duration               | 1.001 (0.988 to 1.014) | 0.874          |
| Co-medication                  | 1.028 (0.866 to 1.220) | 0.751          |
| Number of previous DMARDs      | 1.048 (0.965 to 1.138) | 0.265          |

DMARDs, disease-modifying antirheumatic drugs; MTX, methotrexate; ref, reference variable; RF, rheumatoid factor; TNFi, tumour necrosis factor inhibitor.

| Table 4 Cox proportional regression hazard model with time-dependent covariate |
|--------------------------------|-----------------|-----------------|
|                                | HR (95% CI)     | p Value         |
| Discontinuation of MTX         | 1.046 (0.760 to 1.440) | 0.783          |
| Female gender                  | 0.930 (0.750 to 1.155) | 0.512          |
| RF positive                    | 0.841 (0.660 to 1.073) | 0.164          |
| Erosions present               | 1.493 (1.185 to 1.880) | 0.001          |
| Age                            | 0.998 (0.989 to 1.006) | 0.557          |
| Disease duration               | 0.998 (0.984 to 1.013) | 0.787          |
| Co-medication                  | 1.055 (0.870 to 1.281) | 0.585          |
| Number of previous DMARDs      | 1.002 (0.914 to 1.098) | 0.973          |

DMARDs, disease-modifying antirheumatic drugs; MTX, methotrexate; ref, reference variable; RF, rheumatoid factor; TNFi, tumour necrosis factor inhibitor.
In daily practice, patients with RA do taper and discontinue MTX treatment. In these patients, the discontinuation of the MTX drug survival, which might indicate that in daily practice the physicians selected the correct patients to taper or discontinue MTX treatment. In these patients, the discontinuation of the MTX drug use can be reduced. However, it is difficult to generalise these findings to all patients starting TNFi with MTX treatment, because the reason to choose specially these patients is unknown. To study in which patients MTX can be tapered and discontinued, other and larger studies should be performed.

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Acknowledgements

The authors would like to thank all research nurses and rheumatologists of the 12 departments of rheumatology from the Netherlands for their participation in the data collection. They also acknowledge Thea van Gaalen, Lia Schalkwijk and Marjolijn de Lange-Brandt for data processing and Jaap Fransen for his analytical input.

Funding

Funding for the general data collection for the DREAM cohort was obtained from the Dutch affiliations of Pfizer Pharmaceuticals, Abbott Pharmaceuticals, Roche Pharmaceuticals, UCB Pharma and Bristol-Myers Squibb.

Competing interests

None declared.

Patient consent

Obtained.

Provenance and peer review

Not commissioned; externally peer reviewed.

Data sharing statement

Data in the DREAM register provide more than are presented in this manuscript. More information about the available data and contact information can be found on the following website: http://www.dreamregistry.nl/en-US/

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RMD Open 2015 1:
doi: 10.1136/rmdopen-2015-000147

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