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ORIGINAL ARTICLE

Predictors of poor response to urate-lowering therapy in patients with gout and hyperuricemia: a post-hoc analysis of a multicenter randomized trial

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Abstract

Introduction Clinical guidelines have recommended a target of serum uric acid (SUA) level below 6.0 mg/dL for the urate-lowering therapy (ULT) of gout patients, but there are still a high proportion of patients failing to achieve the therapeutic target above. This study aimed to identify possible predictors of poor response to ULT in gout patients.

Methods We performed a post-hoc analysis of a multicenter randomized double-blind trial which assessed the efficacy of febuxostat in patients with hyperuricemia (serum urate level ≥ 8.0 mg/dL) and gout. Demographic characters and baseline data including SUA levels were collected. Poor response to ULT was defined as average SUA after ULT was more than 6.0 mg/dL. Factors associated with poor response to ULT in gout patients were analyzed, and multivariate logistic regression analysis was also carried out to find out those independent predictors.

Results A total of 370 patients were enrolled in this post-hoc analysis. Compared with those with good response to ULT, patients with poor response to ULT had younger age ($P < 0.001$), higher proportion of obesity ($P = 0.003$), higher proportion of statins use ($P = 0.019$), higher body mass index (BMI) ($P < 0.001$), higher baseline SUA ($P < 0.001$), higher proportion of males ($P = 0.001$), higher alanine transaminase ($P < 0.001$), higher aspartate transaminase ($P = 0.017$), higher total cholesterol ($P = 0.005$), higher triglyceride ($P = 0.042$), and higher low density lipoprotein ($P = 0.037$). Multivariate logistic regression analysis showed that younger age (odds ratio (OR) = 0.965, 95% CI 0.943–0.987, $P = 0.002$), higher BMI (OR = 1.133, 95% CI 1.049–1.224, $P = 0.001$), higher baseline SUA (OR = 1.006, 95% CI 1.002–1.009, $P = 0.001$), and no application of febuxostat therapy (OR = 0.41, 95% CI 0.25–0.68, $P < 0.001$) were independent predictors of poor response to ULT in patients with gout.

Conclusion In patients with gout and hyperuricemia, younger age, higher BMI, and higher baseline SUA are predictors of poor response to ULT. These findings could help physicians better identify patients who may fail in ULT and give individualized treatment precisely.

Trial registration The trial was registered at chinadrugtrials.org.cn in 2012 (CTR20130172).

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Key Points
- *A post-hoc analysis of a multicenter randomized double-blind trial which assessed the efficacy of febuxostat in patients with hyperuricemia and gout was performed.*
- *Multivariate logistic regression analysis showed that younger age, higher BMI, and higher baseline SUA are predictors of poor response to urate-lowering therapy.*

Keywords Gout · Predictors · Treatment outcomes · Urate-lowering therapy

Introduction

Gout is a disorder caused by deposition of monosodium urate in bone joints and other tissues as a result of the supersaturation of extracellular uric acid [1, 2]. Its prevalence is increasing significantly worldwide which may be related to increased frequency of obesity, hypertension, metabolic syndrome, type 2 diabetes mellitus (T2DM), chronic kidney disease, and so on [2–4]. Findings based on the latest nationally representative sample of the USA revealed that the prevalence of gout among US adults in 2007–2008 was up to 3.9% [5], and the annual hospitalization rate for gout increased from 4.4 to 8.8 per 100,000 US adults from 1993 to 2011 [6]. In China, about 1–3% of people suffer from gout and the number is still growing year by year [7]. The natural course of gout goes through asymptomatic hyperuricemia, acute gouty flares, and chronic polyarticular gout; and its manifestations include tophi, gouty nephropathy, and kidney stones [8]. High serum uric acid (SUA) level can accelerate the progression from asymptomatic hyperuricemia to advanced gout, and can also result in increased risk of comorbidities and worse prognosis [1, 9, 10].

When treating gout, excessive uric acid storage should be reduced by long-term reduction of SUA concentration with its level well below the threshold for urate saturation to achieve dissolution of monosodium urate crystals and prevent gouty flares [11]. Xanthine oxidase inhibitors including allopurinol and febuxostat are recommended as the first-line agents for urate-lowering therapy (ULT) in gout patients [2]. For gout patients with ULT, a target SUA level below 6.0 mg/dL was recommended by both American College of Rheumatology (ACR) and the European League Against Rheumatism (EULAR) [2, 12]. However, approximately more than 50% of the patients could not meet treatment target after a long period of ULT [13, 14]. In China, only about 30% gout patients had achieved the treatment target [15]. Therefore, it's critical to identify some predictors of poor response to ULT in gout patients, which may help physicians better identify patients who may fail in ULT and modify the ULT dosage to increase treatment response [16]. The aim of this study was to find predictors of poor response to ULT in Chinese patients with gout, so as to predict treatment outcomes precisely and provide individualized treatment suggestions.

Methods

Study design and population

Data from a multicenter randomized double-blind trial were used in our study, which was performed to assess the efficacy of febuxostat in patients with hyperuricemia (serum urate level ≥ 8.0 mg/dL) and gout. The trial was conducted at 8 hospitals in China and had a duration of 24 weeks and was registered at chinadrugtrials.org.cn (CTR20130172). This clinical trial conformed to principles of the Declaration of Helsinki and the Good Clinical Practice of China. All participants were voluntary and signed the written consent prior to any research procedure. Eligible participants were at the age of 18–70 with any sex. All patients were diagnosed with primary gout according to the criteria developed by the ACR/EULAR with SUA level of at least 8.0 mg/dL [17]. Patients experienced a 2-week washout time. During this period, subjects who were receiving ULT were asked to stop it. There was no acute gouty flare during the washout period and 2 weeks before it. Exclusion criteria included hepatic dysfunction with alanine aminotransferase (ALT) and aspartate aminotransferase (AST) exceed 1.5 times of the upper limit of normal range; impaired renal function with serum creatinine (Cr) above the reference range; serious heart disease such as unstable angina pectoris; pregnancy; any other physical problems which may affect the efficacy of ULT. According to the drug dosage recommended in the Chinese Expert Consensus on Hyperuricemia and Gout Treatment [18], 466 subjects enrolled into the study were randomized to receive febuxostat 40 mg ($n = 154$) or 80 mg ($n = 156$) once per day or allopurinol 100 mg three times per day ($n = 156$) for 24 weeks. Low-calorie and low-purine diet were required in order to achieve the target. Data from 96 patients were unable to be included in this post-hoc analysis, because they withdrew from trial, were lost to follow-up, had protocol deviations or had adverse events. Therefore, 370 patients were finally included into this post-hoc analysis (Fig. 1).

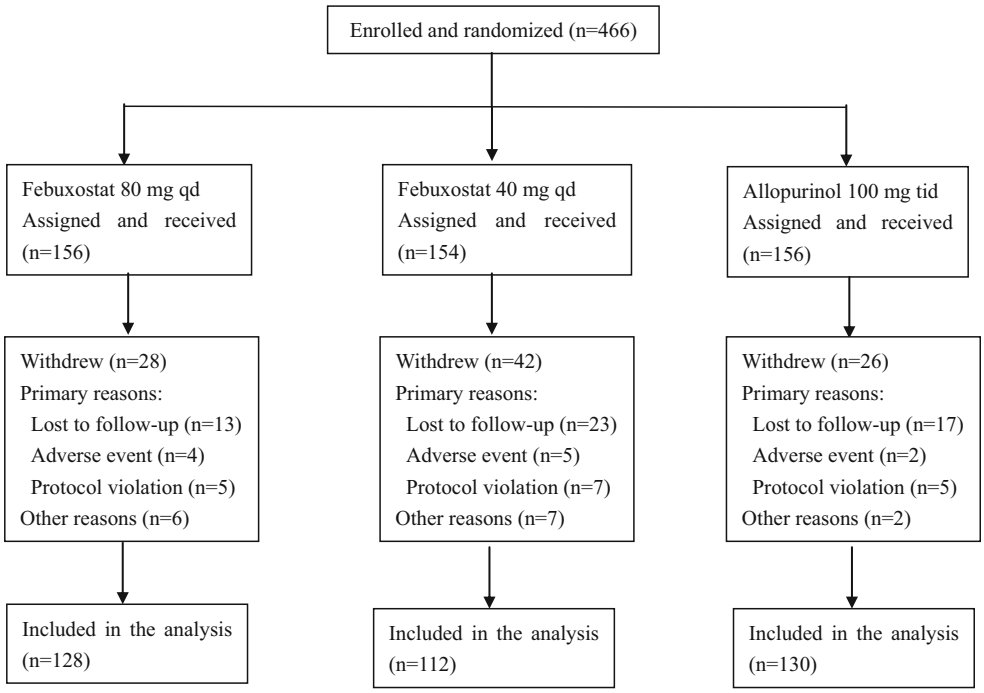

Fig. 1 Flow of participants through each stage of the study

Patient profile data and outcome definition

Patient profile data, such as demographic characteristics and clinical characteristics, were collected by the original investigators. SUA levels were measured at baseline, 2 weeks and 4 weeks after ULT treatment, and were then measured every 4 weeks until 24 weeks after ULT treatment. Poor response to ULT treatment was defined as the average SUA after ULT was more than 6.0 mg/dL (360 μmol/L).

Statistical analysis

Continuous data were described in mean ± standard deviation (SD) and were analyzed by Student's *t* test. Categorical data were described in number and percentages and were compared using the chi-squared test. To preliminarily identify factors associated with poor response to ULT in gout patients, difference in the demographic characteristics and clinical characteristics between gout patients with or without poor response to ULT were compared. Logistic regression analysis was then performed to find out those predictors of poor response to ULT. Variables in the univariate analysis with $P < 0.10$ entered the multivariate analysis, and confounding factors in the multivariate analysis included age, gender, hyperlipidemia, obesity, statins use, baseline SUA, diastolic blood pressure (DBP), ALT, AST, triglyceride (TG), total cholesterol (TC), low density lipoprotein (LDL), and febuxostat therapy. According to the results of univariate analysis, multivariate analysis was finally carried out to find out those independent predictors for poor response to ULT therapy. All data were processed by STATA (version 12.0). P value < 0.05 was considered as statistically significant.

Results

Characteristics of gout patients

Among those 370 subjects, 128 received febuxostat 80 mg once per day, 112 received febuxostat 40 mg once per day, and 130 received allopurinol 100 mg three times per day (Table 1). The mean baseline SUA levels for those three groups were 587.7, 580.5, and 577.1 μmol/L respectively, and no obvious difference was observed among those three groups ($P = 0.55$) (Table 1). There was no statistically significant difference in other profile data except for fasting blood glucose (FBG), LDL cholesterol, and if they had T2DM (Table 1).

Clinical and biological features by response to ULT

Among the 370 patients, 186 reached the therapeutic target of SUA level of less than 6.0 mg/dL while the other 184 had poor response to ULT. The difference in the clinical and biological features by response to ULT was shown in Table 2. There was difference in the percentages of ULT treatment, and patients with poor response to ULT had higher proportion of allopurinol therapy and lower proportion of febuxostat therapy ($P < 0.001$, Table 2). There was no significant difference in if they had T2DM or hypertension. The differences in systolic blood pressure (SBP), DBP, total bilirubin (TBIL), blood urea

Table 1 Baseline characteristics of those 370 participants in the post-hoc analysis

Variables	Febuxostat 80 mg	Febuxostat 40 mg	Allopurinol	*P* value
Number	128	112	130	–
Age (years)	46.1 ± 11.4	47.3 ± 11.9	46.8 ± 11.3	0.72
Men (%)	122(95.3%)	102(91.1%)	122(93.8%)	0.41
T2DM (%)	7(5.5%)	17(15.2%)	15(11.5%)	0.045
Hyperlipidemia (%)	16(12.5%)	12(10.7%)	12(9.2%)	0.70
Hypertension* (%)	26(20.3%)	32(28.6%)	29(22.3%)	0.29
Obesity# (%)	45(35.1%)	42(37.5%)	52(40.0%)	0.72
Statins use (%)	2(1.6%)	5(4.5%)	2(1.5%)	0.25
BMI (kg/m^2)	26.7 ± 3.1	27.1 ± 3.8	27.1 ± 3.3	0.57
Baseline SUA (μmol/L)	587.7 ± 80.4	580.5 ± 83.7	577.1 ± 74.4	0.55
SBP (mmHg)	130.1 ± 13.0	128.3 ± 10.4	130.2 ± 13.0	0.40
DBP (mmHg)	83.7 ± 8.1	83.7 ± 8.0	84.2 ± 9.0	0.85
ALT	30.6 ± 16.1	30.2 ± 15.0	32.6 ± 20.2	0.50
AST	24.2 ± 7.7	24.0 ± 7.4	25.7 ± 16.7	0.43
TBIL	13.8 ± 5.0	12.8 ± 5.1	14.0 ± 6.4	0.19
BUN	5.3 ± 1.7	5.1 ± 1.4	5.4 ± 2.3	0.58
Cr	96.7 ± 17.5	95.5 ± 17.6	92.6 ± 17.8	0.17
TG	2.7 ± 1.9	2.7 ± 1.8	2.3 ± 2.0	0.23
TC	5.1 ± 1.1	5.2 ± 0.9	5.3 ± 1.1	0.25
LDL	2.9 ± 0.8	3.0 ± 0.7	3.1 ± 0.8	0.02
FBG	5.3 ± 0.8	5.7 ± 1.0	5.7 ± 1.2	0.006

Data were shown as mean ± SD, or number (%)

* Hypertension was diagnosed by the previous diagnostic criteria (> 140/90 mmHg)

Obesity was defined as BMI ≥ 28 kg/m^2

nitrogen (BUN), Cr, and FBG between two groups were not significant. The average age of the subjects with poor response to ULT was younger (49.9 vs 43.5 years, $P < 0.001$). The proportion of male patients (89.2 vs 97.8%, $P = 0.001$) and obesity patients (30.1 vs 45.1%, $P = 0.003$) in the poor-response group was higher. The proportion of patients who had hyperlipidemia (15.1 vs 6.5%, $P = 0.008$) or patients with statins use (4.3% vs 0.5%, $P = 0.019$) was higher in adequate control group. Patients in poor response group were more likely to have higher body mass index (BMI) (26.3 vs 27.6 kg/m^2, $P < 0.001$), baseline SUA (559.6 vs 604.3 μmol/L, $P < 0.001$), ALT (26.9 vs 35.4 U/L, $P < 0.001$), AST (23.2 vs 26.1 U/L, $P = 0.017$), TG (2.4 vs 2.8 mmol/L, $P = 0.042$), TC (5.0 vs 5.3 mmol/L, $P = 0.005$), as well as LDL (2.9 vs 3.1 mmol/L, $P = 0.037$) (Table 2). The incidence rate of acute gout attacks at different follow-up times and adverse drug reactions were showed in Supplementary Table 1 and 2.

Independent predictors of poor response to ULT

The outcomes of logistic regression analysis were shown in Table 3. Younger age (odds ratio (OR) = 0.965, 95% CI 0.943–0.987, $P = 0.002$), higher BMI (OR = 1.133, 95% CI 1.049–1.224, $P = 0.001$), higher baseline SUA level (OR = 1.006, 95% CI 1.002–1.009, $P = 0.001$) and no application of febuxostat therapy (OR = 0.41, 95% CI 0.25–0.68, $P < 0.001$) were independently associated with poor response to ULT in patients with gout and hyperuricemia. Unexpectedly, hyperlipidemia was related to lower risk of poor response to ULT ($P = 0.033$).

Discussion

This post-hoc analysis explored predictors of poor response to ULT in patients with gout and hyperuricemia. To our knowledge, it is the first study which used data from a randomized trial to explore predictors of poor response to ULT in patients with gout and hyperuricemia. The results indicated that younger age, higher BMI, higher SUA, at baseline and no application of febuxostat therapy were independently related to poor response to ULT in patients with gout and hyperuricemia.

There were several previous studies on factors influencing the efficacy of ULT in patients with gout, but the results varied from different researches. In a retrospective cohort study containing 678 subjects, Sheer et al. followed the patients for

Table 2 Differences of clinical characteristics between patients with or without poor response to ULT

Variables	Adequate control (SUA ≤ 360 μmol/L)	Poor response (SUA > 360 μmol/L)	*P* values
Number	186	184	–
Age (years)	49.9 ± 11.2	43.5 ± 10.9	< 0.001
Men (%)	166(89.2%)	180(97.8%)	0.001
T2DM (%)	24(12.9%)	15(8.2%)	0.137
Hyperlipidemia (%)	28(15.1%)	12(6.5%)	0.008
Hypertension* (%)	46(24.7%)	41(22.3%)	0.579
Obesity# (%)	56(30.1%)	83(45.1%)	0.003
Statins use (%)	8(4.3%)	1(0.5%)	0.019
Use of febuxostat 80 mg	83(44.6%)	45(24.4%)	< 0.001
Use of febuxostat 40 mg	53(28.5%)	59(32.1%)	
Use of allopurinol	50(26.9%)	80(43.5%)	
BMI (kg/m^2)	26.3 ± 3.0	27.6 ± 3.7	< 0.001
Baseline SUA (μmol/L)	559.6 ± 70.6	604.3 ± 81.4	< 0.001
SBP (mmHg)	129.8 ± 12.0	129.4 ± 12.6	0.768
DBP (mmHg)	83.2 ± 7.5	84.6 ± 9.2	0.091
ALT	26.9 ± 12.8	35.4 ± 20.0	< 0.001
AST	23.2 ± 6.9	26.1 ± 14.8	0.017
TBIL	13.9 ± 5.0	13.2 ± 6.1	0.190
BUN	5.4 ± 2.1	5.1 ± 1.5	0.181
Cr	93.8 ± 18.9	96.0 ± 16.4	0.220
TG	2.4 ± 2.1	2.8 ± 1.7	0.042
TC	5.0 ± 1.0	5.3 ± 1.0	0.005
LDL	2.9 ± 0.8	3.1 ± 0.8	0.037
FBG	5.6 ± 1.0	5.6 ± 1.0	0.841

Data were shown as mean ± SD, or number (%)

* Hypertension was diagnosed by the previous diagnostic criteria (> 140/90 mmHg)

Obesity was defined as BMI ≥ 28 kg/m^2

365 days [19]. Similar to our findings, the results suggested that for gout patients received febuxostat, lower baseline SUA level was the significant predictor of achieving a SUA goal < 6.0 mg/dL [19]. In another study including 18,456 gout patients in which the follow-up lasted for 6 months, logistic regression analysis showed that patients with higher baseline SUA levels were less likely to reach the SUA goal [20]. Another study by Fei et al. pointed out that baseline SUA had no impact on the prognosis of ULT, which might be biased due to its small sample size ($n = 72$) [21].

It has been revealed that higher BMI is closely related to hyperuricemia, and successful weight management is associated with significant urate reduction [22, 23]. Compared with other tissues, xanthine oxidase, which is crucial for the production of uric acid, is proved to be highly expressed in adipose tissue. In obese state, enzyme activity of xanthine oxidase and its product uric acid are all increased [24]. Thus, xanthine oxidase in adipocytes may play an important role in hyperuricemia for obese patients. In line with the previous studies, our results revealed that patients with higher BMI were less likely to achieve ULT goals, which further outlined the important influence of obesity in the development of gout and hyperuricemia.

The findings in our study supported that younger age was an independent predictor of poor response to ULT in patients with gout and hyperuricemia. One possible explanation for the finding above is the adherence to ULT in older patients. A systematic review focusing on the medication adherence to ULT among gout patients revealed that the proportion of non-adherent patients ranged from 54% to 87% [25]. Previous studies had found that high adherence to ULT medicines was the predictor of reaching the SUA goal [19, 26], and suboptimal medication compliance could reduce the effectiveness of ULT [27]. Several studies had demonstrated that increased age was associated with increased adherence, and older patients were more persistent with ULT and they were more likely to reach the goal level [20, 28–31]. Therefore, the higher

Table 3 Predictors of poor response to ULT therapy in patients with gout and hyperuricemia from logistic analysis

Variables	Univariate analysis		Multivariate analysis*	
	OR (95%CI)	*P* value	OR (95%CI)	*P* value
Age (years)	0.949(0.931–0.968)	< 0.001	0.965(0.943–0.987)	0.002
Men (yes vs no)	5.42(1.82–16.19)	0.002	3.02(0.91–10.00)	0.070
T2DM (yes vs no)	0.59(0.30–1.18)	0.140	–	–
Hyperlipidemia (yes vs No)	0.39(0.19–0.80)	0.010	0.40(0.18–0.93)	0.033
Hypertension (yes vs no)	0.87(0.54–1.41)	0.579	–	–
Obesity (yes vs no)	1.91(1.24–2.92)	0.003	1.53(0.93–2.52)	0.090
Statins use (yes vs no)	0.12(0.02–0.98)	0.048	0.113(0.010–1.228)	0.073
BMI (kg/m^2)	1.134(1.062–1.211)	< 0.001	1.133(1.049–1.224)	0.001
Baseline SUA (μmol/L)	1.008(1.004–1.011)	< 0.001	1.006(1.002–1.009)	0.001
SBP (mmHg)	0.997(0.981–1.014)	0.768	–	–
DBP (mmHg)	1.021(0.996–1.047)	0.093	1.022(0.992–1.052)	0.148
ALT	1.036(1.021–1.053)	< 0.001	1.017(0.994–1.040)	0.140
AST	1.032(1.004–1.059)	0.021	0.997(0.961–1.033)	0.854
TBIL	0.975(0.939–1.012)	0.191	–	–
BUN	0.924(0.820–1.040)	0.190	–	–
Cr	1.007(0.996–1.019)	0.220	–	–
TG	1.126(1.000–1.268)	0.049	1.033(0.899–1.188)	0.644
TC	1.338(1.089–1.643)	0.005	1.429(0.917–2.225)	0.115
LDL	1.306(1.014–1.681)	0.038	0.778(0.458–1.321)	0.352
FBG	0.980(0.805–1.193)	0.840	–	–
Febuxostat therapy (yes vs no)	0.48(0.31–0.74)	0.001	0.41(0.25–0.68)	< 0.001

OR, odds ratio; *95%CI*, 95% confidence interval

*Variables in the univariate analysis with $P < 0.10$ entered the multivariate analysis, and confounding factors in the multivariate analysis included age, gender, hyperlipidemia, obesity, statins use, baseline SUA, DBP, ALT, AST, TG, TC, LDL, and Febuxostat therapy; BMI was not adjusted for obesity in the multivariate analysis

adherence to ULT in older patients may explain why patients with younger age are less likely to achieve urate lowering goals.

Our study found that male gender was related to poor response to ULT in patients with gout and hyperuricemia in the univariate analysis, but it was not statistically significant in multivariate analysis (Table 3). Morlock et al. demonstrated that female gender was one of the predictors of gout control [26]. In Hatoum's study, the results also showed that women patients were more likely to reach SUA goal level [20]. The non-significant in our study was more likely to be caused by the relatively low statistical power from one single study. More future studies are warranted to assess whether gender is independently relevant to the outcome of ULT in gout patients.

Large clinical trials have showed that compared with allopurinol, febuxostat was more effective at lowering SUA level [14, 32]. The proportion of patients who reached the SUA target at the end of the trials was significantly higher in febuxostat group than that in allopurinol group [14, 32]. Interestingly, those who switched to febuxostat from allopurinol had significantly higher likelihood of attaining SUA goal of lower than 6.0 mg/dL and 5.0 mg/dL compared with the patients who maintained on allopurinol [20, 33]. However, factors affecting the prognosis of ULT were not analyzed in those experiments. In accordance with previous researches, no application of febuxostat therapy was demonstrated to be one important predictor of poor response to ULT in this study. Febuxostat is a selective xanthine oxidase inhibitor, while allopurinol has effects on other enzymes involved in uric acid metabolism which may be associated with its side effects [34]. Therefore, febuxostat might be a promising alternative to allopurinol for the treatment of hyperuricemia and gout. However, febuxostat is not superior to allopurinol in all respects. One recent clinical trial concerning the cardiovascular safety of febuxostat and allopurinol showed that compared with allopurinol group, all-cause mortality and cardiovascular mortality were significantly higher in febuxostat group [35]. Therefore, different urate-lowering medicines should be chosen according to patients' different conditions.

The findings in our study indicated that hyperlipidemia was an independent predictor of lower risk of poor

response to ULT. Previous studies have found that cholesterol-lowering therapy with a statin could significantly lower serum uric acid levels in patients treated for primary hyperlipidemia or other diseases [36, 37]. It seemed to be the reason why hyperlipidemia was related to lower risk of poor response to ULT. However, the results of multivariate analysis showed that statins use was not statistically significant. It has been pointed out that not all kinds of statins have urate lowering effect. A meta-analysis evaluating the effect size of statins in modulating plasma uric acid concentrations showed that atorvastatin and simvastatin can reduce serum uric acid levels while pravastatin and rosuvastatin cannot [36]. The non-significant in the analysis was likely to be caused by differences in statins used by different patients. Moreover, the limited number of subjects using statins might also lead to the non-significant result. Studies with large sample size are needed in the future to further evaluate the effect of statins on patients with hyperuricemia and gout.

Based on the results above as well as the results of previous studies, for patients who may have poor response to ULT, special emphasis should be placed on patient education of diet and lifestyle first and foremost. Besides, other medicines such as uricosuric agent benzbromarone or probenecid could be prescribed in priority or added to the xanthine oxidase inhibitor in order to obtain an optimal treatment outcome. What's more, treatment of concomitant diseases or surgery should be provided in time whenever needed.

This study had several limitations. First, the number of subjects was not large enough, and only Chinese patients were enrolled in the study which may result in limited generalizability. Second, medicines used for ULT only included febuxostat and allopurinol. Whether other ULT medicines such as benzbromarone had impact on the outcome of ULT was not clear. Third, definite criteria for the evaluation of patient compliance were not established which may be related to the result of ULT. What's more, factors affecting the prognosis of ULT therapy in patients with specific diseases with regard to particular endpoints were not assessed in our study. Therefore, well-designed long-term clinical trials with adequate sample size concerning specific diseases and endpoints are needed to explore the predictors of ULT failure further.

In summary, the study suggests that younger age, higher BMI and higher baseline SUA are predictors of poor response to ULT in patients with gout and hyperuricemia. Since early detection of patients with high probability of ULT failure may help physicians to give professional advice timely and enable precise treatment strategy, the finding in our study represents a step towards personalized treatment for gout patients. Additionally, the findings from our study warrant further validation from more prospective and adequately powered studies.

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Authors' contributions All authors contributed to the study conception and design, data collection, analysis of the data, interpretation of the results, and drafting of the manuscript. All authors revised the manuscript and approved the final version.

Compliance with ethical standards

Disclosures None.

Ethical standards This clinical trial conformed to principles of the Declaration of Helsinki and the Good Clinical Practice of China and was approved by the Drug Clinical Trial Ethics Committee, Shandong Provincial Hospital. All participants provided written informed consent.

Abbreviations ACR, American College of Rheumatology; ALT, Alanine aminotransferase; AST, Aspartate aminotransferase; BMI, Body mass index; BUN, Blood urea nitrogen; Cr, Creatinine; DBP, Diastolic blood pressure; EULAR, European League Against Rheumatism; FBG, Fasting blood glucose; LDL, Low density lipoprotein; OR, Odds ratio; SBP, Systolic blood pressure; SUA, Serum uric acid; T2DM, Type 2 diabetes mellitus; TBIL, Total bilirubin; TC, Total cholesterol; TG, Triglyceride; ULT, Urate-lowering therapy

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