Cost-effectiveness analysis of rhTPO and rhIL-11 in the treatment of chemotherapy-induced thrombocytopenia in hematological tumors based on real-world data

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Background: Chemotherapy-induced thrombocytopenia (CIT) is a common adverse reaction to chemotherapy that can lead to treatment delay, platelet transfusion, thereby increasing treatment costs, reducing chemotherapy effectiveness and affecting prognosis. Based on real-world data, this study analyzed the safety, efficacy, and economic of recombinant human thrombopoietin (rhTPO) and recombinant human interleukin-11 (rhIL-11) in the treatment of CIT in hematological tumors from the perspective of the health care system.

Methods: We retrospectively collected the data of hematological tumor patients treated with rhTPO and rhIL-11 due to thrombocytopenia caused by chemotherapy. The propensity score matching (PSM) method was used to balance the baseline information of the two groups and they were further stratified according to the degree of thrombocytopenia (grade I–II and grade III–IV). The platelet compliance rate at 2 weeks of treatment was used as the efficacy evaluation index, and the cost-effectiveness method was used to evaluate the economic value of the two drugs in the treatment of thrombocytopenia based on drug effectiveness. Univariate and probabilistic sensitivity analyses were performed.

Results: A total of 1,571 patients met the inclusion and exclusion criteria, and 476 patients were included after 1:1 PSM. For patients with grade I–II thrombocytopenia, no significant difference in the platelet compliance rate was found between the two groups after 1 and 2 weeks of treatment. The platelet compliance rate in the rhTPO group was higher than that in the rhIL-11 group for patients with grade III–IV thrombocytopenia. Cost-effectiveness analysis (CEA) showed that the incremental cost-effectiveness ratio (ICER) for the rhTPO and rhIL-11 groups was 226,615.8. The ICER value was sensitive to the platelet compliance rate of the two groups, the cost of rhTPO, the cost of platelet transfusion in the rhTPO group. Probabilistic sensitivity analysis showed that when willingness to pay was less than approximately 220,000 yuan, rhIL-11 economy presented 100% better than that of rhTPO.

Conclusions: In CIT treatment for hematological tumors, rhTPO yielded a higher platelet compliance rate than rhIL-11 treatment, especially for patients with grade III–IV thrombocytopenia. However, whether rhTPO has economic advantages still requires further exploration.

Keywords: Recombinant human thrombopoietin (rhTPO); recombinant human interleukin-11 (rhIL-11); hematological tumors; thrombocytopenia; cost-effectiveness analysis (CEA)

Introduction

Chemotherapy-induced thrombocytopenia (CIT) results from the inhibitory effect of antitumor drugs on bone marrow megakaryocytes, leading to a platelet count in peripheral blood lower than 100×10^9/L (1). CIT, one of the most common chemotherapy-related hematological toxicities, can increase the risk of bleeding, prolong hospitalization, increase medical costs, reduce chemotherapy effectiveness, impact patients' quality of life, affect prognosis, and in severe cases, lead to death (1,2). The incidence of CIT is reported to be related to the type of chemotherapeutic drug, combination therapy, and tumor (3-5). Primary and secondary prevention for high-risk patients can help reduce the incidence and severity of CIT (1).

The treatment of CIT mainly includes platelet transfusion and the administration of platelet-promoting growth factors (1,6). Platelet transfusion is the fastest and most effective method for the treatment of severe CIT and can effectively reduce the risk of major hemorrhage and mortality. However, the clinical use of platelets is limited due to the possibility of transfusion-related viral and bacterial infections, allogeneic immune responses, and a tight blood supply. Recent studies have shown that the use of platelet growth factors can effectively increase platelets, reduce the risk of bleeding, reduce the need for platelet transfusion, and ensure that chemotherapy is carried out on schedule and in sufficient quantities (6). Recombinant human thrombopoietin (rhTPO) and recombinant human interleukin-11 (rhIL-11) have been approved by the Food and Drug Administration (FDA) of China for CIT treatment. After long-term clinical application, both have been shown to reduce the extent of platelet count decline after chemotherapy for solid tumors such as lung, breast, and ovarian cancers, shorten the duration of thrombocytopenia, and reduce the number of platelet transfusions (6-8).

In recent years, there has been gradual recognition of the therapeutic effectiveness of rhTPO and rhIL-11 in hematological tumors. However, since rhTPO in the treatment of thrombocytopenia in patients with hematological tumors is off-label use, most of the existing research conclusions come from real-world data. In fact, more and more attention has been paid to real world study at home and abroad (9,10). In 2016, the United States passed the 21st Century Cures Act, which authorized research using real-world evidence for expanded drug indications (11). In December 2018, FDA announced the Real World Evidence Protocol Framework, which provided a relatively clear roadmap for achieving the Real World Evidence's goal of supporting drug approval decisions (12). Unfortunately, the sample size of the existing studies on the treatment of CIT by rhTPO and rhIL-11 in patients with hematological tumors is generally small, and there is a large bias between different studies. In addition, the treatment costs of the two drugs vary several times, so the comprehensive evaluation of the two drugs is not consistent (1,13-15). A meta-analysis showed that compared with rhIL-11, rhTPO could increase the maximum value of platelet recovery, shorten the duration of platelet $\leq 50 \times 10^9$/L, shorten the time to platelet recovery to $\geq 75 \times 10^9$/L, and reduce the incidence of adverse reactions (15). However, no significant difference was found between the two in improving the minimum value of platelets after chemotherapy and the time for patients to recover to platelets $\geq 100 \times 10^9$/L. In addition, from an economic perspective, the unit price and the price per treatment course of rhTPO are both higher than that of rhIL-11. The more cost-effective regimen of the two for the treatment of CIT requires further investigation. In fact, relatively few studies are available on the pharmacoeconomics of rhTPO and rhIL-11 in the treatment of CIT at home and abroad, and the conclusions are inconsistent (16-18). Chen *et al*. (16) showed that rhIL-11 and rhTPO were similar in the treatment of thrombocytopenia caused by gemcitabine-based combination chemotherapy in patients with lung cancer. Measured by the least-cost method, rhIL-11 has certain advantages in terms of economics. Yang *et al*. (17) used cost-effectiveness analysis (CEA), combined with literature reports and expert consultation, to carry out an economic evaluation of rhIL-11 and rhTPO in the treatment of CIT. The results showed that rhTPO was more cost-effective in treating CIT than rhIL-11.

In summary, there are certain differences in clinical efficacy, safety, and economics between rhIL-11 and rhTPO

in the treatment of different diseases. In this study, we retrospectively analyzed clinical data for CIT in patients with hematological malignancies at our hospital from the past 7 years. Propensity score matching (PSM) was used to eliminate confounding factors. At the same time, the efficacy and economy of rhIL-11 and rhTPO in the treatment of CIT in the real world were evaluated from the perspective of the health care system. This study aimed to provide a basis for the rational selection of CIT treatment drugs for patients with hematological tumors. We present the following article in accordance with the CHEERS reporting checklist (available at https://apm.amegroups.com/article/view/10.21037/apm-22-880/rc).

Methods

Data sources

We retrospectively collected the data of hematologic oncology patients treated for CIT with rhTPO (TPIAO, 3SBIOINC., SFDA Approval No. S20050048) or rhIL-11 (Jijufen, Hangzhou Jiuyuan Gene Engineering Co., Ltd., SFDA Approval No. S20063110; Juhe granules, Qilu Pharmaceutical Co., Ltd., SFDA Approval No. S20030016) at our hospital between January 2014 and December 2020. The patients' basic information, disease diagnosis, medications, laboratory test results, disease course records, and treatment costs were collected. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). As a retrospective study, the patients did not provide informed consent. The study was approved by the Medical Ethics Committee of The First Affiliated Hospital of Soochow University (Ethics Approval No. 258, 2022).

The inclusion criteria were: (I) aged 18–65 years, (II) a pathological diagnosis of hematological tumors, and (III) a reduction in platelets caused by chemotherapy (platelet $<100\times10^9$/L).

The exclusion criteria were: (I) combined radiotherapy; (II) other nonchemotherapeutic factors that may have caused thrombocytopenia; (III) no follow-up blood test report; (IV) no continuous drug use; (V) cross user of rhIL-11 and rhTPO in the same cycle; (VI) the use of other platelet-elevating drugs; (VII) severe heart, liver, or kidney failure, especially with a history of organic heart disease; (VIII) a history of active bleeding and thrombosis; and (IX) incomplete records with key information missing.

PSM was used to eliminate confounding factors. PSM was a method to match individuals in the treatment group and the control group based on propensity score. The difference in outcome could be expressed by calculating the average treatment effect of the two groups, which can effectively reduce the confounding effect. Therefore, non-randomized data could be used to estimate the relationship between treatment factors and outcomes, making real-world data studies close to the most realistic randomized controlled trial (RCT) studies (18). The observational variables included gender, age, body mass index (BMI), liver function, renal function, disease classification, chemotherapy regimen, CIT grade, target drug application time, length of hospital stay and so on, were included as covariates in the logistic regression model, the confounding bias of nonrandomized controlled subjects was balanced by 1:1 PSM, and a certain number of cases were obtained for analysis (19,20).

Treatment regimens

The rhTPO group received a daily intravenous injection of 1.5×10^4 U, and the rhIL-11 group received a daily intravenous injection of 1.5 mg.

According to the World Health Organization (WHO), thrombocytopenia after chemotherapy is classified as grade I to grade IV, with grade I corresponding to 100×10^9/L > platelet $\geq75\times10^9$/L, grade II to 75×10^9/L > platelet $\geq50\times10^9$/L, grade III to 50×10^9/L > platelet $\geq25\times10^9$/L, and grade IV to platelet $<25\times10^9$/L.

The patient population was divided into a grade I–II thrombocytopenia group and grade III–IV thrombocytopenia group.

Efficacy evaluation criteria

Routine blood tests were performed for all enrolled patients with hematologic diseases. Platelet data of the two groups were collected before implementation of the platelet-elevating regimen and on day 7 and 14 after implementation of the platelet-elevating regimen. The platelet compliance rate of patients with different CIT grades on day 7 and 14 after implementation of the platelet-elevating regimen were evaluated as an indicator of efficacy. In addition, bleeding in the two groups of patients was evaluated within 14 days of platelet-elevating treatment.

Platelet compliance was defined as platelet $\geq100\times10^9$/L or an increase of 50×10^9/L compared to the original level. The platelet compliance rate was the number of patients

with platelet compliance divided by the total number of patients.

Economic analysis

Cost calculation

This study conducted an economic evaluation of rhTPO and rhIL-11 in the treatment of CIT in patients with hematological tumors from the perspective of the health care system. Direct nonmedical costs, indirect costs, and hidden costs were not incorporated into the calculations due to measurement difficulties. Therefore, this study included only direct medical costs. Because the treatment time of platelet-elevating drugs in the two groups was balanced, hospitalization and nursing expenses were not included. This study included the cost of rhIL-11 or rhTPO drugs, the cost of platelet transfusion, the cost of hemostasis, and the cost of other platelet-elevating drugs. The cost of drugs was based on the bid price of the drugs on the Sunshine Procurement Platform in 2022. The bid price for rhTPO was 789 yuan (1.5×10^4 U/tube), and for rhIL-11, which has two specifications, it was 125.73 yuan (1.5 mg/tube) and 218.45 yuan (3 mg/tube).

Study time and discounting

In this study, platelet-elevating treatment was a short-term process. The study time extended from the initiation of rhTPO and rhIL-11 platelet-elevating treatment to the 14th day after continuous treatment. Thus, there was no involvement of discounting.

Economic evaluation methods

If no significant difference in effectiveness was identified between the two groups, the total cost of the treatment regimens in the two groups was directly compared using the minimum cost analysis method to determine the economy of the treatment regimens.

If a significant difference in effectiveness was found between the two groups, the CEA method was used, and the incremental cost-effectiveness ratio (ICER) was used as the evaluation indicator (21).

Statistical methods

The XGBoost algorithm was used for modeling (22). The importance of each variable's impact on drug efficacy was calculated and sorted in descending order. Important variables were selected as covariates, including basic patient information, CIT grade before target drug use, target drug use time, length of hospital stay, sex, age, disease classification, and chemotherapy regimen. Furthermore, 1:1 PSM was performed using R software, and the caliper value was set to 0.1 to control for confounding factors between the rhIL-11 and rhTPO groups.

Univariate sensitivity analysis was used to evaluate the impact of changes in factors such as drug price and clinical efficacy on economic results. At the same time, in order to evaluate the uncertainty effect of all variables simultaneously, Monte Carlo simulation was used to conduct probabilistic sensitivity analysis. This study assumed that the cost was normally distributed, the effect followed a triangular distribution, and the probability followed a beta distribution. The simulation was run with 1,000 samples and the results of the uncertainty analysis were represented using cost-effectiveness acceptability curves.

The quantitative indicators did not satisfy a normal distribution, and the median and upper and lower quartiles were calculated. The Wilcoxon rank sum test was used to compare index values between the two groups. The frequency and its percentage were used in the statistical description of qualitative indicators or grade indicators. Unordered categorical indicators were compared using the χ^2 test or Fisher's method. All statistical tests were performed using two-sided tests, and $P < 0.05$ was considered statistically significant.

Results

Basic information

In this study, a total of 1,571 patients met the inclusion and exclusion criteria, and 476 patients were included after 1:1 PSM, including 238 patients in the rhIL-11 group and 238 patients in the rhTPO group. After PSM, no significant difference in any of the basic data was noted between the two groups (Table 1).

Clinical efficacy

Analysis of overall efficacy

The platelet compliance rates of the two groups of patients after platelet-elevating treatment are shown in Table 2. The results showed no significant difference in the platelet compliance rate between the two groups in the first week after treatment (7.1% vs. 9.7%, P=0.322). The platelet

Table 1 Comparison of baseline data for the two groups of patients after PSM

Variables	rhIL-11 group (n=238)	rhTPO group (n=238)	P value
Sex, n (%)			0.270
Male	135 (56.7)	123 (51.7)	
Female	103 (43.3)	115 (48.3)	
Age (years), mean (25th–75th)	41.0 (29.0–51.0)	41.0 (31.0–51.0)	0.619
BMI (kg/m^2), mean (25th–75th)	22.7 (20.5–24.9)	22.5 (20.6–24.5)	0.682
Disease classification, n (%)			0.099
Leukemia	194 (81.5)	198 (83.2)	
Nonleukemia*	44 (18.5)	40 (16.8)	
Chemotherapy regimen#, n (%)			0.921
≤3	165 (69.3)	164 (68.9)	
>3	73 (30.7)	74 (31.1)	
CIT classification, n (%)			0.374
I	16 (6.7)	8 (3.4)	
II	27 (11.3)	32 (13.4)	
III	89 (37.4)	90 (37.8)	
IV	106 (44.5)	108 (45.4)	
Target drug application time (days), mean (25th–75th)	12.0 (8.0–15.0)	12.0 (10.0–15.0)	0.557
Length of hospital stay (days), mean (25th–75th)	29.0 (25.0–34.0)	29.0 (26.0–35.0)	0.104
Liver function, n (%)			0.270
Normal	134 (56.3)	122 (51.3)	
Abnormal	104 (43.7)	116 (48.7)	
Renal function, n (%)			0.338
Normal	221 (92.9)	226 (95.0)	
Abnormal	17 (7.1)	12 (5.0)	

*, includes lymphoma, multiple myeloma, and myelodysplastic syndrome; #, refers to the number of drugs with high bleeding risk included in the chemotherapy regimen. PSM, propensity score matching; BMI, body mass index; CIT, chemotherapy-induced thrombocytopenia; rhIL-11, recombinant human interleukin-11; rhTPO, recombinant human thrombopoietin.

Table 2 Overall clinical efficacy evaluation results of the two drugs

Platelet compliance	rhIL-11 group (n=238), n (%)	rhTPO group (n=238), n (%)	P value
Week 1			0.322
Yes	17 (7.1)	23 (9.7)	
No	221 (92.9)	215 (90.3)	
Week 2			0.016
Yes	59 (24.8)	83 (34.9)	
No	179 (75.2)	155 (65.1)	

rhIL-11, recombinant human interleukin-11; rhTPO, recombinant human thrombopoietin.

Table 3 Comparison of bleeding after the two drug treatments

Bleeding	rhIL-11 group (n=238), n (%)	rhTPO group (n=238), n (%)	P value
Yes	55 (23.1)	32 (13.4)	0.006
No	183 (76.9)	206 (86.6)	

rhIL-11, recombinant human interleukin-11; rhTPO, recombinant human thrombopoietin.

Table 4 Evaluation of the platelet compliance rate in patients with grade I–II CIT

Platelet compliance	rhIL-11 group (n=43), n (%)	rhTPO group (n=40), n (%)	P value
Week 1			0.435
Yes	5 (11.6)	2 (5.0)	
No	38 (88.4)	38 (95.0)	
Week 2			0.657
Yes	10 (23.3)	11 (27.5)	
No	33 (76.7)	29 (72.5)	

CIT, chemotherapy-induced thrombocytopenia; rhIL-11, recombinant human interleukin-11; rhTPO, recombinant human thrombopoietin.

Table 5 Evaluation of the platelet compliance rate in patients with grade III–IV CIT

Platelet compliance	rhIL-11 group (n=195), n (%)	rhTPO group (n=198), n (%)	P value
Week 1			0.112
Yes	12 (6.2)	21 (10.6)	
No	183 (93.8)	177 (89.4)	
Week 2			0.016
Yes	49 (25.1)	72 (36.4)	
No	146 (74.9)	126 (63.6)	

CIT, chemotherapy-induced thrombocytopenia; rhIL-11, recombinant human interleukin-11; rhTPO, recombinant human thrombopoietin.

compliance rate was higher in the rhTPO group than in the rhIL-11 group 2 weeks after treatment, and the difference was statistically significant.

The bleeding rates of the two groups of patients within 2 weeks of treatment is shown in *Table 3*. The results showed that the proportion of patients bleeding in the rhIL-11 group was significantly higher than that in the rhTPO group.

Efficacy analysis of patients with different CIT grades

A total of 83 patients had grade I–II CIT. No significant difference in the platelet compliance rate was found between the two groups at the first and second week after platelet-elevating treatment (*Table 4*).

A total of 393 patients had grade III–IV CIT. After the

first week of platelet-elevating treatment, no significant difference in the platelet compliance rate was noted between the two groups of patients. However, the platelet compliance rate at week 2 was significantly higher in the rhTPO group than in the rhIL-11 group (*Table 5*).

Economic analysis

CEA

In this study, the total platelet compliance rate in the second week after platelet-elevating treatment was used as the efficacy indicator, and the cost-effectiveness method was used to evaluate the economy of the two drugs in the treatment of CIT in patients with hematological tumors. Because the treatment time of platelet-elevating drugs in the two groups was balanced, the hospitalization and

Table 6 CEA of CIT treatment for patients with hematological tumors using the two drugs

Group	C (yuan)	ΔC (yuan)	E	ΔE	ICER
rhIL-11 group	4,806.8	22,888.2	0.248	0.101	226,615.8
rhTPO group	27,695.0		0.349		

CEA, cost-effectiveness analysis; CIT, chemotherapy-induced thrombocytopenia; rhIL-11, recombinant human interleukin-11; rhTPO, recombinant human thrombopoietin; C, cost; ΔC, incremental cost; E, effectiveness; ΔE, incremental effect; ICER, incremental cost-effectiveness ratio.
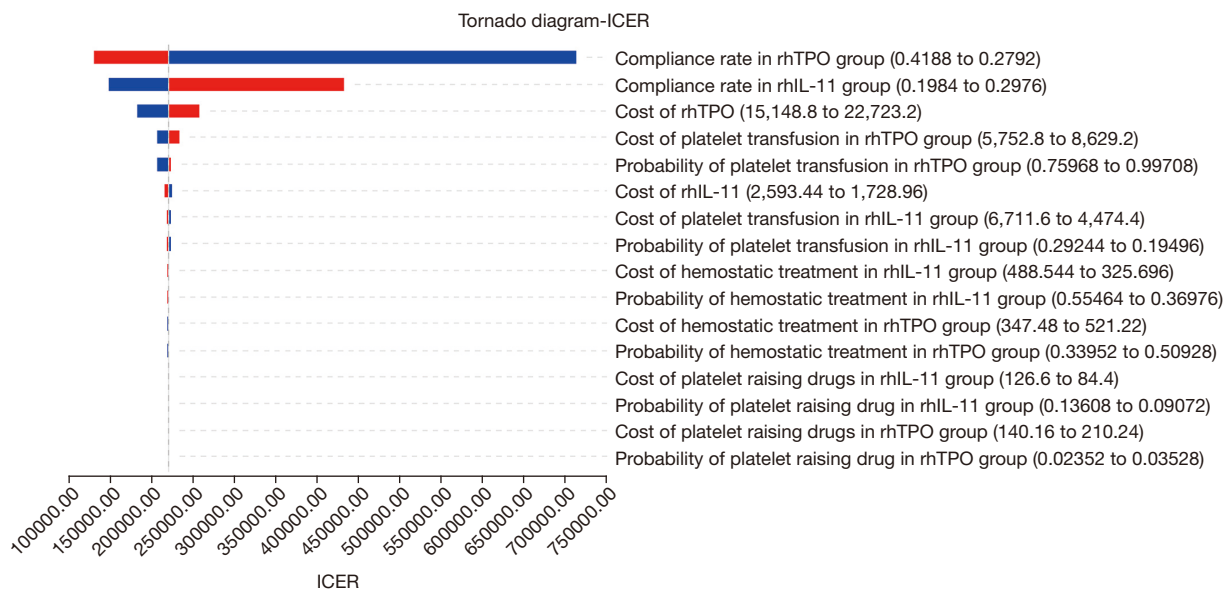
Figure 1 Univariate sensitivity analysis. The vertical dotted line represents the ICER value in the current study. ICER, incremental cost-effectiveness ratio; rhTPO, recombinant human thrombopoietin; rhIL-11, recombinant human interleukin-11.

nursing expenses of the two groups of patients were not included in the cost statistics. The costs in this study included the cost of rhIL-11 or rhTPO drugs, the cost of platelet transfusion, the cost of hemostasis, and the cost of other platelet-elevating drugs.

Table 6 shows that the actual clinical treatment costs in the rhTPO group and the rhIL-11 group were 27,695.0 and 4,806.8 yuan, respectively. The effectiveness values of the rhTPO group and rhIL-11 group were 0.349 and 0.248, respectively. The ICER was 226,615.84, indicating that patients in the rhTPO group paid a further 226,615.80 yuan for each additional increase in effectiveness value compared to the rhIL-11 group.

Univariate sensitivity analysis
Univariate sensitivity analysis was used to evaluate the impact of changes in factors such as drug price and clinical efficacy on economic results. A sensitivity analysis was performed based on the assumption that all factor changes were within the upper and lower 20% range. As shown in *Figure 1*, the ICER value was sensitive to the platelet compliance rate in the rhTPO group and the rhIL-11 group, the cost of rhTPO, the cost of platelet transfusion in the rhTPO group, and the probability of platelet transfusion in the rhTPO group.

Probabilistic sensitivity analysis
The results of probabilistic sensitivity analysis of 1,000 simulation samples are shown in *Figure 2*. When the willingness to pay was less than approximately 220,000 yuan, rhIL-11 economy was 100% better than that of rhTPO. When the willingness to pay was greater than approximately 220,000 yuan, rhTPO economy was 100% better than that of rhIL-11.
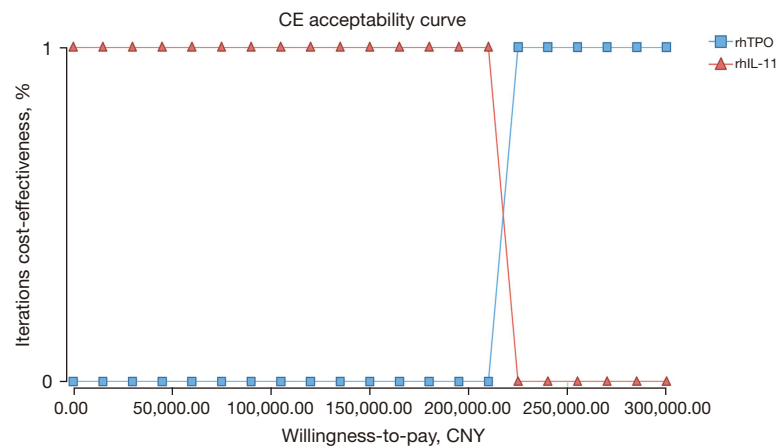
Figure 2 Cost-effectiveness acceptability curve. CE, probability of cost-effectiveness advantage; rhTPO, recombinant human thrombopoietin; rhIL-11, recombinant human interleukin-11; CNY, Chinese yuan renminbi.

Discussion

rhTPO is a genetically engineered protein drug with good clinical tolerance and safety. It can increase the number of peripheral platelets by stimulating platelet formation and promote the recovery of platelets after chemotherapy. The effectiveness can be achieved within 1 week of application (19,23). rhIL-11 is secreted by human bone marrow stromal cells and interstitial cells. By increasing the number of peripheral platelets and maintaining their functions, rhIL-11 shortens the duration of platelet reduction and accelerates the recovery of platelets to normal levels. Since it acts only in the early stages of megakaryocyte differentiation, the onset of action should be approximately 3 weeks after application (24). The "*Consensus on the clinical diagnosis, treatment, and prevention of chemotherapy-induced thrombocytopenia in China*" recommends that both rhTPO and rhIL-11 be used as drugs for the treatment of CIT (1).

This study was a retrospective analysis. To make the samples as close as possible to the results generated by randomization, PSM was used to select appropriate cases, and differences in the efficacy and economy of the two drugs were analyzed. The XGBoost model achieves the best predictive modeling among machine learning models and traditional regression models (22). The strengths of this study included the use of the XGBoost calculation model to analyze the importance of each variable in the two groups of patients to the efficacy of the drug and the scientific selection of covariates by PSM to effectively control confounding factors between the rhIL-11 group

and the rhTPO group while minimizing sample loss (20). Ultimately, a total of 476 cases were included in this study after PSM, which is greater than the case numbers of previous retrospective studies.

The results of this study showed that at 2 weeks after platelet-elevating treatment, the platelet compliance rate of the CIT patients in the rhTPO group was 34.9%, which was 1.4 times that of the rhIL-11 group (24.8%), and the difference was statistically significant (P=0.016). At the same time, the bleeding rate of patients in the rhTPO group was 42.0% lower than that in the rhIL-11 group (23.1% *vs.* 13.4%, P=0.006), indicating that in patients with hematological tumors, the efficacy and safety of rhTPO in the treatment of CIT were better, which was similar to the results of previous studies (14,25,26). Subgroup analysis showed no significant difference in the efficacy of the 2 drugs in patients with grade I–II CIT (23.3% *vs.* 27.5%, P>0.05). However, in patients with grade III–IV CIT, the platelet compliance rate in the rhTPO group was 36.4%, which was significantly higher than that in the rhIL-11 group (25.1%). These patients also had a higher platelet compliance rate than patients with grade I–II CIT (27.5%), which confirmed the results of Chen *et al.* (21), suggesting that rhTPO may have better therapeutic effectiveness on platelet elevation in patients with severe CIT, which may be related to the effect of rhTPO on improving platelet function. Notably, however, in this study, the platelet compliance rate of patients with hematological tumors after 2 weeks of CIT treatment with rhTPO and rhIL-11 was still lower than 40%, which was much lower than that of patients with other solid tumors. This finding may

be related to the disease characteristics of hematological diseases themselves (26).

Although the efficacy and safety of rhTPO in the treatment of CIT in patients with hematological tumors are superior to those of rhIL-11, due to the high price of rhTPO, its clinical application is still subject to certain limitations (16,17). In this study, the platelet compliance rate at 2 weeks of treatment was used as an efficacy indicator. The CEA showed that the actual clinical treatment costs in the rhTPO group and the rhIL-11 group were 27,695.0 yuan and 4,806.8 yuan, respectively. The effectiveness values in the rhTPO group and rhIL-11 group were 0.349 and 0.248, respectively. The ICER was 226,615.8. Despite a temporary lack of payment threshold, this value was nearly 3 times higher than China's gross domestic product (GDP) per capita in 2021 (80,976 yuan), which seemed to imply that under current conditions, rhTPO economy is poor. However, this study used the platelet compliance rate as an indicator of efficacy, and although it has a certain correlation with long-term prognosis, survival time, and quality of life of cancer patients, quantitative analyses are lacking. Therefore, further investigation is needed to determine which is the more economic treatment regimen of the two. The results of this study can provide a reference for the clinical treatment of patients in the real world. Chen *et al.* (21) also analyzed the economy of CIT treatment with rhIL-11 and rhTPO in patients with tumors based on retrospective data using the least-cost method and the cost-effectiveness method. The results showed comparable therapeutic effectiveness for both drugs in patients with mild CIT (grade I–II), and rhIL-11 had a greater economic advantage, while rhTPO had a cost-effectiveness advantage over rhIL-11 in patients with grade III–IV CIT. However, this conclusion was based on the assumption that the average total cost of the two drugs is used as the willingness-to-pay threshold. Whether this is a scientific assumption is not known.

This study had the following limitations. First, fewer than 60% of the patients with hematological tumors did not reach the platelet standard after 2 weeks of treatment. Therefore, during the study period, calculating the time required for the platelets to return to normal in all patients and the duration after reaching the standard was impossible. Therefore, the 2-week platelet compliance rate was used as an indicator of efficacy. Because this study was a retrospective analysis, analyzing adverse reactions such as fatigue, fever, chills, and edema caused by CIT treatment was difficult. Therefore, the treatment cost of adverse reactions was not included in the cost calculation. Notably, however, these adverse effects are mostly self-reversible, and the cost of treatment is largely negligible. However, this cost may affect the results of an economic evaluation of drugs (7,27). In addition, the cost and effectiveness evaluations of this study were all defined by the treatment time of the study drug, and a follow-up of the patients was not performed. It was worth noting that the conclusions in this paper were based on the PSM-matched study samples, which might not be extended to the patients, not matched in PSM, who might also be a group of clinical concern. The sample was obtained from one hospital only was also a limitation of this study.

In summary, in the treatment of CIT in patients with hematological tumors, rhTPO elevated platelets more effectively than rhIL-11, especially for severe CIT (grade III–IV). However, CEA showed that compared to patients receiving rhIL-11, patients in the rhTPO group needed pay a further 226,615.80 yuan for each additional increase in effectiveness value, which was nearly 3 times higher than China's GDP per capita in 2021 (80,976 yuan). This finding seemed to imply that the rhTPO regimen is less economical under current conditions. The platelet compliance rate in the two groups, the cost of rhTPO, the cost of platelet transfusion in the rhTPO group, and the probability of platelet transfusion in the rhTPO group had a significant impact on economics. However, many of the limitations mentioned above still existed in this paper. Therefore, the status of the two drugs in the treatment of CIT in patients with hematologic tumors needs to be further demonstrated in real-world studies with larger sample sizes from multiple centers.

Acknowledgments

Footnote

Reporting Checklist: The authors have completed the CHEERS reporting checklist. Available at https://apm.amegroups.com/article/view/10.21037/apm-22-880/rc

Data Sharing Statement: Available at https://apm.amegroups.com/article/view/10.21037/apm-22-880/dss

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at https://apm.amegroups.com/article/view/10.21037/apm-22-880/coif). RWW is from Beijing Medicinovo Technology Co., Ltd., Beijing, China. The other authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). As a retrospective study, the patients did not provide informed consent. The study was approved by the Medical Ethics Committee of The First Affiliated Hospital of Soochow University (Ethics Approval No. 258, 2022).

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