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The analysis of factors affecting medication adherence in patients with myasthenia gravis: a cross-sectional study

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Abstract

Background: Clinically, patients with myasthenia gravis are generally treated with drugs to improve their physical condition, and poor medication adherence can hinder their recovery. Many studies have shown the importance of medication adherence for effective treatment. Various factors may affect a patient's medication adherence; however, studies concerning medication adherence in patients with myasthenia gravis are rare.

Objectives: This study aimed to identify the factors related to medication adherence in patients with myasthenia gravis, and determine the possibility of predicting medication adherence.

Methods: This cross-sectional observational study was conducted among inpatients and outpatients with myasthenia gravis of the First Affiliated Hospital of Guangzhou University of Chinese Medicine in China. Data on patient demographics, disease-related characteristics, and medical treatment were collected. We evaluated medication adherence of the patients using the Morisky Medication Adherence Scale-8, Beliefs about Medicines Questionnaire, and the Self-efficacy for Appropriate Medication Use Scale.

Results: We distributed 200 questionnaires and finally retrieved 198 valid questionnaires. A total of 139 (70.2%) women participated in this study, and 81 (40.9%) among the 198 participants were aged 40–59 years. In total, 103 (52.0%) participants exhibited bad adherence to pharmacological treatment, and factors such as taking medication irregularly [odds ratio (OR) = 0.242, 95% CI = 0.093–0.627], the necessity of taking medicine (OR = 1.286, 95% CI = 1.142–1.449), the concerns of taking medicine (OR = 0.890, 95% CI = 0.801–0.988), and the self-efficacy for taking medications under difficult circumstances (OR = 1.194, 95% CI = 1.026–1.389) had statistically significant impacts on medication adherence.

Conclusion: Our study shows that taking medication irregularly and concerns of taking medicine are the risk factors for medication adherence. Meanwhile, the necessity of talking medicine and self-efficacy for taking medications under difficult circumstances are the protective factors for medication adherence. Our findings can help medical staff to enhance patients' medication adherence by informing patients necessary medical knowledge, emphasizing the necessity for medication, relieving patients' concerns regarding medication, and improving the self-efficacy for taking medications under difficult circumstances.

Keywords: autoimmunity, medication adherence, myasthenia gravis, neuromuscular

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Introduction

Myasthenia gravis is a chronic autoimmune disorder of the neuromuscular junction[1] that predominantly manifests as muscle weakness. The overall prevalence of myasthenia gravis is 150–250 cases per million individuals, with an estimated annual incidence of 8–10 cases per million person-years.[2]

With the exploration and advanced understanding of myasthenia gravis, effective drug treatments have been developed. Several immunosuppressive and immunomodulator drugs are commonly used to treat the disease.[3,4] Drug therapy has improved the symptoms of myasthenia gravis – the prognosis is good and most patients can achieve a normal life expectancy.[5,6] Therefore, long-term medication use is essential for most patients with myasthenia gravis.[7] Adherence to physician-prescribed treatment and medication regimes is essential to ensure treatment effectiveness. Improving medication adherence may benefit the health of the population more than any new medical discovery.[8]

However, not all the benefits of the medications are realized, as the majority of patients do not adhere to prescription instructions.[9,10] Long-term use of daily oral therapy for chronic diseases of the nervous system may lead to reduced adherence to treatment.[11] Adherence problems have become a huge barrier to optimal treatment,[12] and non-adherence to treatment may cause adverse drug events, increased hospitalization, increased readmission, and reduced quality of life.[10,13] Research has shown that patients with myasthenia gravis have poor medication adherence,[11,14] and failure to take medication on time and in the correct dosage may lead to relapse and myasthenia gravis crises.

At present, literature on drug adherence in myasthenia gravis is limited, and there are only two known studies with small sample sizes[11,14]; thus, the advancement of research in this field is essential. Moreover, clarifying the factors related to patient adherence would be conducive to formulating targeted measures to improve the effectiveness of treatment. Therefore, this study aimed to determine the factors related to medication adherence in patients with myasthenia gravis using a larger sample size to provide a relevant basis for the development of measures to improve adherence.

Methods

This cross-sectional study collected data relevant to medication adherence among patients with myasthenia gravis at the First Affiliated Hospital of Guangzhou University of Chinese Medicine from June 2021 to November 2022. Self-report questionnaires were distributed in the outpatient department and in the wards. The patients were selected for enrolment randomly. The sample size is 10–15 times the number of independent variables, and a 10% no-effect response rate was considered. The researchers were trained before collecting cases and used unified utterances to explain the content of the questionnaire to participants if necessary.

Inclusion criteria and exclusion criteria

Inclusion criteria: Patients older than 18 years with an established diagnosis of myasthenia gravis.

Exclusion criteria: (1) Patients with an initial diagnosis of myasthenia gravis or who had not taken relevant drugs within 6 months; (2) Patients with other serious illnesses, such as heart failure, liver failure, kidney failure, malignant tumors, etc.; (3) Patients with hearing impairment or obvious visual impairment; (4) Patients with severe mental illness or disrupted consciousness.

Demographic information

The following patient demographic information was collected: sex, age, occupation, education level, living arrangement, and financial burden. We also collected disease-related information, including the duration of disease and types of daily medicines used (including cholinesterase inhibitors, immunosuppressants, traditional Chinese medicine for myasthenia gravis, and drugs for treating other diseases), aggravation, experiences of myasthenic crisis and Myasthenia Gravis Foundation of America (MGFA) classification, taking medication irregularly (including cholinesterase inhibitors, immunosuppressants, and traditional Chinese medicine for myasthenia gravis), and presence of comorbidity. All the medications we investigated were oral drugs. All information was provided in the questionnaire. Of note, traditional Chinese medicine included the Qiangji Jianli capsule, the primary components of which include *Astragalus membranaceus*, *Codonopsis pilosula*, *Atractylodes macrocephala*, *Angelica sinensis*, *Radix liquiritiae*, etc.

Medication adherence

The Morisky Medication Adherence Scale-8 (MMAS-8)[15] is widely used in estimating medication compliance in chronic diseases. Medication adherence was assessed for cholinesterase inhibitors, immunosuppressants, or traditional Chinese

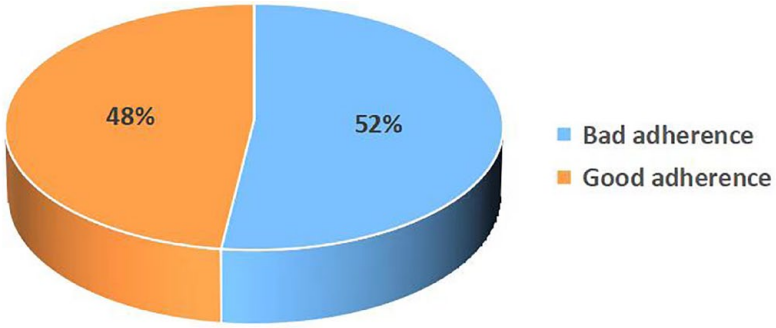

Figure 1. The status of medication adherence of myasthenia gravis patients (total study population = 198).

medicine for myasthenia gravis. Patients with an MMAS-8 score >6 were defined to have good adherence. The scale's Cronbach α coefficient was 0.616. We also used the Beliefs about Medicines Questionnaire (BMQ)[16] and the Self-efficacy for Appropriate Medication Use Scale (SEAMS)[17] to better reflect the patients' medication compliance. The higher the BMQ score, the stronger the patient's medication belief. The Cronbach α coefficient was 0.681. Higher SEAMS score corroborated with higher patient confidence in taking medication as well as stronger sense of self-efficacy. The Cronbach α coefficient was 0.897.

Statistical analyses

IBM SPSS Statistics, Version 26.0 (IBM Corp., Armonk, NY, USA) was used to analyze the collected data. Quantitative variables are expressed as mean and SD, while qualitative variables are described as frequency and percentage. The chi-square test and univariate analyses were used to compare the difference between the general data and medication compliance of patients with myasthenia gravis. The influencing factors of medication compliance were analyzed using binary logistic regression. Differences with $p \leqslant 0.05$ were considered statistically significant.

Data availability

Anonymized data not published within this article will be made available by request from any qualified investigator.

Results

Among the 198 patients with myasthenia gravis included in this study, 103 (52%) had poor medication adherence (Figure 1). The mean MMAS-8 score was 5.76 ± 1.69. We analyzed the score of MMAS of each item of the MMAS-8, and more than half (53.5%) of the participants indicated that they sometimes forgot to take their medication. The details of the MMAS-8 are shown in Table 1.

A total of 139 (70.2%) women participated in this study. Eighty-one (40.9%) among the 198 participants were aged 40–59 years, and 79 (40%) attended junior middle school or below. The majority (80.8%) lived with their family. In total, 148 (74.8%) participants could not completely afford the financial burden imposed by myasthenia gravis. More than half (58.1%) of the participants had an MGFA classification of IIb, and the average duration of myasthenia gravis was 7.53 ± 8.44 years. And 73(36.9%) patients were investigated in the wards. In terms of drug types, nearly three quarters of the participants (73.7%) used more than two types of medications daily. We have created Figure 2 showing the number of patients taking each type of medication. Of the 198 patients, 193 were on cholinesterase inhibitors, 158 were on immunosuppressants, 165 were on traditional Chinese medicine, and 49 were on other medication. Comparison between participants with bad adherence and those with good adherence using chi-square test showed that financial burden, duration of myasthenia gravis, experience of *a prior* myasthenic crisis, MGFA classification, taking medication irregularly, types of pills taken daily, and presence of comorbidity was associated with the medication adherence of patients with myasthenia gravis ($p < 0.05$) (Table 2).

The mean total BMQ score was 1.28 ± 5.67. For the necessity dimension, the mean score was 18.88 ± 3.60 and for the concerns dimension, the

Table 1. Responses to each question in the MMAS-8 scale ($N = 198$).

Items	Answered 'yes'	%	$X \pm s$
1. Do you sometimes forget to take your pills?	106	53.5	0.47 ± 0.50
2. Thinking over the past 2 weeks, were there any days when you did not take your medicine?	39	19.7	0.80 ± 0.40
3. Have you ever cut back or stopped taking your medication without telling your doctor, because you felt worse when you took it?	49	24.7	0.75 ± 0.43
4. When you travel or leave home, do you sometimes forget to bring along your medication?	49	24.7	0.75 ± 0.43
5. Did you take your medicine yesterday?	13	6.6	0.93 ± 0.25
6. When you feel like your illness is under control, do you sometimes stop taking your medicine?	40	20.2	0.80 ± 0.40
7. Do you ever feel hassled about sticking to your treatment plan?	87	43.9	0.56 ± 0.50
8. How often do you have difficulty remembering to take all your medications?			0.70 ± 0.24
Never/rarely	53	26.8	
Once in a while	71	35.9	
Sometimes	40	8.4	
Usually	18	9.1	
All the time	1	0.5	

Yes = 1 point; No = 0 points.
MMAS-8, Morisky Medication Adherence Scale-8.

mean score was 17.60 ± 4.37. Furthermore, the total SEAMS score was 25.22 ± 6.79 – the score for the self-efficacy for taking medications under difficult circumstances was 12.24 ± 3.53 and that for the self-efficacy for taking medication under uncertain or changing circumstances was 12.98 ± 3.93 (Table 3). Univariate analysis was used to analyze the relationship between medication adherence and these variables. Notably, all the variables were related to medication adherence ($p < 0.05$).

Medication adherence was considered as the dependent variable, while independent variables comprised of demographic variables that were statistically significant in the chi-square test and the related variables that were statistically significant in the univariate analysis. Subsequently, binary logistic regression analysis was conducted. The omnibus test indicated that the logistic model was significant ($\chi^2 = 84.005$), and that it could correctly classify 76.3% of the cases. The results showed that taking medication irregularly, the necessity of taking medicine, the concerns of taking medicine and the self-efficacy for taking medications under difficult circumstances had significant effects on medication adherence (Table 4).

Discussion

According to the World Health Organization, approximately 50% of patients with chronic diseases do not take their medications as prescribed.[9] Poor adherence to pharmacological treatment has become a major public health problem

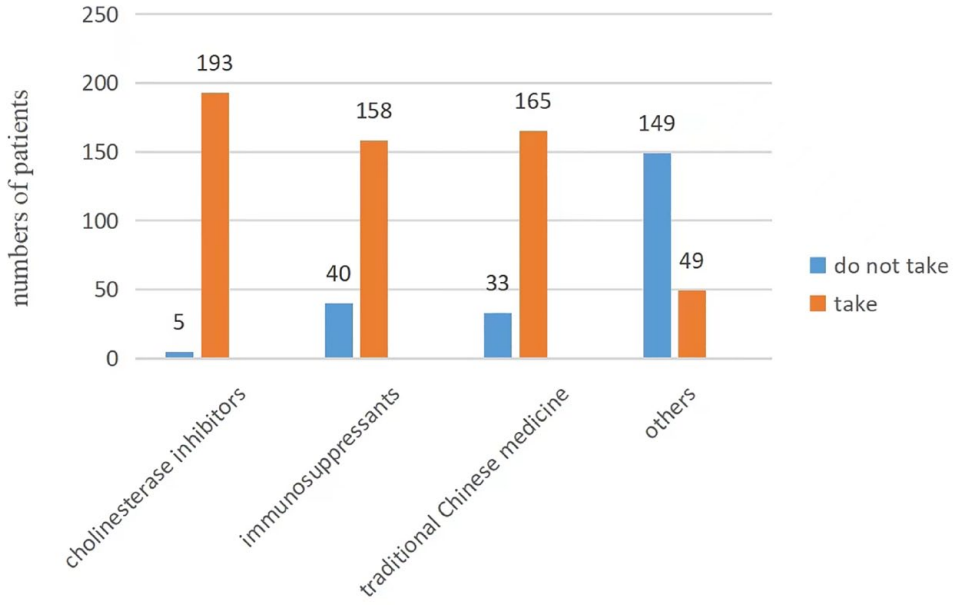

Figure 2. Different types of medications for treating patients.
Others = drugs for diseases other than myasthenia gravis.

Table 2. Chi-square test between demographic information and medication adherence ($N = 198$).

Variables	Group	Adherence		χ^2	*p*
		Poor adherence	Good adherence		
Sex	Male	27	32	1.318	0.251
	Female	76	63		
Age	⩽39 years	38	40	1.250	0.535
	40–59 years	46	35		
	⩾60 years	19	20		
Occupation	Unemployed	46	27	5.702	0.058
	Employed	37	46		
	Retired	20	22		
Education level	Junior middle school or below	46	33	2.216	0.330
	Senior high school or secondary specialized school	28	28		
	Junior college or above	29	34		
Living arrangement	Live alone	11	10	0.880	0.644
	Live with family	85	75		
	Others	7	10		

(Continued)

Table 2. (Continued)

Variables	Group	Adherence		χ^2	*p*
		Poor adherence	Good adherence		
Financial burden of MG	Can easily afford	18	32	9.023	0.011*
	Reluctantly afford	45	41		
	Can hardly afford	40	22		
Duration of MG	⩽1 year	20	33	6.835	0.033*
	1–5 years	27	25		
	⩾5 years	56	37		
Aggravation over the past 2 years	0	36	35	2.080	0.353
	1–5 times	63	52		
	>5 times	4	8		
Experienced prior MG crisis	Yes	54	36	4.210	0.040*
	No	49	59		
MGFA classification	Class I	16	28	10.170$	0.027*
	Class II	64	51		
	Class III	20	9		
	Class IV	1	2		
	Class V	2	5		
Taking medication irregularly	Yes	33	10	13.453	0.000*
	No	70	85		
Types of daily medicines	1	7	1	11.052$	0.010*
	2	16	28		
	3	58	55		
	⩾4	22	11		
Comorbidity	Yes	48	29	5.374	0.020*
	no	55	66		
Be hospitalized	Yes	39	34	0.091	0.762
	no	64	61		

*Statistically significant, $p < 0.05$.
$Fisher's exact test.
MG, myasthenia gravis; MGFA, Myasthenia Gravis Foundation of America.

Table 3. Univariate analysis of continuous variables and medication adherence.

Variables	Dimensions	$\bar{X} \pm s$	*B*	SE	Wald χ^2	df	*p*	OR	95% CI (OR)	
									Bader limit	Upper limit
BMQ	Overall	1.28 ± 5.67								
	Necessity	18.88 ± 3.60	0.207	0.047	19.422	1	0.000*	1.230	1.122	1.348
	Concerns	17.60 ± 4.37	−−0.155	0.037	17.586	1	0.000*	0.856	0.796	0.921
SEAMS	Overall	25.22 ± 6.79								
	Self-efficacy for taking medications under difficult circumstances	12.24 ± 3.53	0.209	0.045	21.171	1	0.000*	1.233	1.128	1.348
	Self-efficacy for taking medications under uncertain circumstances	12.98 ± 3.93	0.121	0.038	9.905	1	0.002*	1.129	1.047	1.217

*Statistically significant, $p < 0.05$.
BMQ, Beliefs about Medicines Questionnaire; OR, odds ratio; SEAMS, Self-efficacy for Appropriate Medication Use Scale.

worldwide. Our results regarding the proportion of patients with myasthenia gravis that exhibited poor medication adherence (52%) are consistent with (55.2%)[11] or lower than (61.5%)[13] those of two other studies; however, the sample sizes of these other studies were smaller, 58 and 26, respectively. Moreover, the current study findings were higher than those of certain chronic nervous system diseases requiring oral treatment, such as Parkinson's disease (44%),[18] and lower than those for others, namely, epilepsy (66.2%),[19] stroke (66.1%),[20] multiple sclerosis (64.5%),[21] and amyotrophic lateral sclerosis (66.6%).[22]

Demographic information and adherence

The chi-square test revealed that the economic burden imposed by myasthenia gravis, duration of myasthenia gravis, prior experience of a myasthenic crisis, presence of comorbidity, MGFA classification, types of pills taken daily, and taking medication irregularly were associated with the medication adherence of patients with myasthenia gravis.

Employment not only provides a sense of usefulness and personal satisfaction, but also provides financial resources,[23] which can ensure long-term access to drugs. However, many patients with myasthenia gravis have a poor socioeconomic status.[24] The unemployment rate of patients with myasthenia gravis in Brazil, Japan, Germany, and Australia varies from 28.3% to 39.4%.[23,25–27] Moreover, myasthenic crises and infections lead to more frequent and longer hospitalizations, impacting the overall socioeconomic burden.[28,29] Indeed, previous studies have shown that among patients with chronic diseases and those taking oral anticancer agents, a better economic status has a positive effect on medication adherence.[30–32] However, in Parkinson disease, hepatitis C, and cardiovascular conditions, the impact of economic status was uncertain.[33–35]

Regarding the impact of disease duration on medication adherence, a previous research on adherence of patients with myasthenia gravis showed that the longer the disease, the worse the drug compliance.[11] This was deemed to be primarily due to the patient's misunderstanding of their own disease.[11] Meanwhile, the impact of disease duration on various other chronic diseases, including diabetes, hepatitis C, chronic non-malignant pain, rheumatoid arthritis, is uncertain or overall negligible.[32,34,36–39] Hence, we speculated that some patients who have been ill for a longer period can effectively control the disease through long-term medication use. Because they may have perceived the significance of taking medication and then intend to follow the doctor's prescribed regimen. However, other patients may have poor compliance as a result of doubting the doctor and medication because of long-term disease progression and poor disease control.

Table 4. Binary logistic regression analysis between the medication adherence and factors.

	B	SE	Wald χ^2	df	*p*	OR	95% CI	
							Bader limit	Upper limit
Financial burden			2.327	2	0.312			
Financial burden (1)	−0.639	0.486	1.731	1	0.188	0.528	0.204	1.367
Financial burden (2)	−0.776	0.549	1.996	1	0.158	0.460	0.157	1.351
Duration of MG			2.007	2	0.367			
Duration of MG (1)	−0.409	0.513	0.635	1	0.426	0.665	0.243	1.816
Duration of MG (2)	−0.677	0.478	2.001	1	0.157	0.508	0.199	1.298
MGFA classification			2.424	4	0.658			
MGFA classification (1)	−0.313	0.499	0.393	1	0.531	0.732	0.275	1.944
MGFA classification (2)	−0.757	0.688	1.210	1	0.271	0.469	0.122	1.807
MGFA classification (3)	−1.492	1.788	0.696	1	0.404	0.225	0.007	7.483
MGFA classification (4)	0.489	1.114	0.192	1	0.661	1.630	0.184	14.475
Taking medication irregularly (1)	−1.419	0.486	8.526	1	0.004*	0.242	0.093	0.627
Comorbidity (1)	−0.274	0.460	0.355	1	0.551	0.760	0.308	1.874
Types of daily pills			2.852	3	0.415	2.852		
Types of daily pills (1)	1.891	1.279	2.187	1	0.139	6.629	0.540	81.322
Types of daily pills (2)	1.380	1.258	1.202	1	0.273	3.973	0.337	46.793
Types of daily pills (3)	1.617	1.369	1.395	1	0.238	5.036	0.344	73.645
Experienced prior MG crisis (1)	−0.390	0.399	0.957	1	0.328	0.677	0.310	1.480
Necessity	0.252	0.061	17.179	1	0.000*	1.286	1.142	1.449
Concerns	−0.117	0.053	4.784	1	0.029*	0.890	0.801	0.988
Self-efficacy for taking medications under difficult circumstances	0.177	0.077	5.244	1	0.022*	1.194	1.026	1.389
Self-efficacy for taking medications under uncertain circumstances	−0.047	0.069	0.468	1	0.494	0.954	0.832	1.092

Medication adherence: 0 = poor, 1 = good; Financial burden: 0 = can easily afford, 1 = reluctantly afford, 2 = can hardly afford; Duration of MG: 0 = ⩽1 year, 1 = 1–5 years, 2 = ⩾5 years; MGFA classification: 0 = type I, 1 = type II, 3 = type IV, 4 = type V; Taking medication irregularly: 0 = no, 1 = yes; Comorbidity: 0 = no, 1 = yes; types of daily pills: 0 = 1 type, 1 = 2 types, 2 = 3 types, 3 = more than 4 types; Experienced prior MG crisis: 0 = no, 1 = yes.
*Statistically significant, $p < 0.05$.
MG, myasthenia gravis; MGFA, Myasthenia Gravis Foundation of America.

Patients who have had a myasthenic crisis might have doubts about the medication scheme efficacy, amplifying their concerns, and leading to low adherence. A similar phenomenon has been reported in patients with cancer; that is, their past experience impacts medication belief, affecting their medication adherence.[40] In contrast, other patients with myasthenia gravis may take experiencing a crisis as a lesson they do not want to face again, resulting in improved medication adherence to improve their condition.

Medication compliance may also be influenced by drug regimen complexity.[41–43] An increase in comorbidities is often accompanied by increased medication regime complexity which in turn can negatively influence adherence.[44,45] However, positive and negative effects have been reported regarding general or physical comorbidities in patients with inflammatory arthritis,[39] hepatitis C, or chronic cardiovascular conditions, and those taking oral anticancer agents.[31–33,37,46] Hence, the associated results remain controversial and warrant further investigation.[30]

The number of daily medications can also impact adherence. That is, patients with fewer medications are less likely to exhibit low medication adherence.[47] Meanwhile, an increase in the types of medication taken may result in more daily pills. As the number of medications increases, the daily burden may increase, leading to lower patient compliance. The previous two studies on compliance with myasthenia gravis have also reported that an increased number of daily pills is related to decreased adherence.[11,13] Meanwhile, different MGFA classifications of patients require different treatment plans, resulting in different types of drugs taken by patients, which may lead to variable medication adherence. Similar results were reported for patients with cardiovascular conditions that require multiple medications.[32] Notably, subcutaneous zilucoplan and rozanolixizumab injection has proven effective in improving the conditions of patients with myasthenia gravis,[48,49] resulting in its increased use in clinical settings and by patients at home. However, subcutaneous injections may negatively impact patient compliance due to pain and itching at the injection site or anxiety about self-injection.[48–50] In fact, a previous study reported that the compliance rate of subcutaneous injections is only 57.5%.[51] Hence, further investigation into subcutaneous injection compliance for patients with myasthenia gravis is warranted.

This study indicated that taking medication irregularly was identified as a risk factor for medication adherence. In participants who took medication irregularly, adherence was 4.131 times worse than in those did not. It has also been shown that medication use can be affected by prior taking medication irregularly.[52] Taking medication irregularly may lead to a worsening of myasthenia gravis symptoms with painful outcomes for patients. This may cause the patients to become suspicious of the efficacy of the medication they are using, leading to a decrease in adherence. To circumvent this issue, medical staff can provide patients with the necessary medical knowledge in advance, to make them aware of the importance of medication treatment, ultimately reducing or even avoiding taking medication irregularly, and thus improving their compliance.

Beliefs about Medicines and Adherence

Various factors influence medication compliance, but medication belief is considered a controllable factor that can improve compliance.[53] In this study, binary logistic regression analysis showed that necessity of medication was a protective factor for medication adherence, indicating that the better the patient's belief regarding medication necessity, the higher was their medication adherence. On the contrary, concerns are a risk factor for medication adherence. The necessity dimension in BMQ reflects a person's cognition regarding the treatment of diseases using medications and the maintenance of current and future health status, while the concerns dimension reflects a person's concerns about the adverse effects of medication and its harmful effect on life.[54] Thus, the participants with myasthenia gravis in this study believed that it was necessary to use medication to treat myasthenia gravis and obtain benefits; however, they did have concerns. This may be because of insufficient knowledge of the disease and not being satisfied with the effect of drug treatment. Given the rarity of myasthenia gravis, most patients have a limited understanding of the disease. They do not realize that myasthenia gravis is a refractory autoimmune disease; hence, they are under the impression that there is a treatment plan or drug that can cure them permanently. Simultaneously, due to the influence of adverse drug reactions – considering both the financial burden and the outcomes of myasthenia gravis treatment – patients have a poor belief in taking medications, thereby leading to poor medication compliance. It is essential to enable patients to understand the necessity for medication and relieve their concerns.

Self-efficacy for Appropriate Medication Use and Adherence

Binary logistic regression analysis showed that the self-efficacy in taking medications under difficult

circumstances was shown to be a protective factor for medication adherence. It indicated that the higher score of the self-efficacy for taking medications under difficult circumstances, the better the patient's medication adherence. Self-efficacy is one's belief in their capability to complete a specific task, and has been shown to influence behavior, choice of activities, and level of achievement.[55] It has been proposed in a theoretical model that a patient's adherence to a prescribed program would increase by addressing self-efficacy initially.[56] Medical staff should inform patients comprehensively of the various possible issues with medication and provide consultation channels, so as to enable patients to solve unexpected situations, thereby improving their medication self-efficacy and further improving their medication compliance.

Limitations

This study is a single-center study. Although many patients with myasthenia gravis visit our hospital from all over China, our study may not be representative of a wider population. Additionally, we focused on evaluating the overall medication adherence in patients with myasthenia gravis without individually analyzing each medication. Nonetheless, this study included the largest sample size utilized to date to explore the medication compliance of patients with myasthenia gravis, and thus has value for clinical practice and future research.

Conclusions

Overall, our study shows that taking medication irregularly and concerns of taking medicine are the risk factors for medication adherence. Meanwhile, the necessity of talking medicine and self-efficacy for taking medications under difficult circumstances are the protective factors for medication adherence. Our research provides insights to medical staff to enhance patients' medication compliance. Medical staff may perhaps be less concerned about assessing and adopting adherence strategies for patients. Our study cautioned that medical staff should focus on the bad compliance of patients with medication. Adherence may be improved by informing patients necessary medical knowledge, emphasizing the necessity for medication, relieving patients' concerns regarding medication, and improving the self-efficacy for taking medications under difficult circumstances. In the future, we also suggest that more interventional research can be carried out to improve the clinical problem of bad drug compliance of patients.

Author's note

Bingxing Cai is now affiliated with the Second Affiliated hospital of Chongqing Medical University, Chongqing, China.

Declarations

Ethics approval and consent to participate

The Ethics Committee of the First Affiliated Hospital of Guangzhou University of Chinese Medicine approved the study (approval number: JY2021071). Written informed consent was obtained from all participants.

Consent for publication

Informed consent for publication was provided by the participants or a legally authorized representative.

Author contributions

Yining Su: Formal analysis; Project administration; Writing – original draft.

Xinxian Wang: Investigation; Validation.

Yuemeng Xing: Validation.

Zhenni Wang: Software.

Hailing Bu: Investigation.

Xiaoyan Cui: Resources.

Yunying Yang: Supervision; Writing – review & editing.

Bingxing Cai: Conceptualization; Data curation; Methodology.

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The MMAS-8 Scale, content, name, and trademarks are protected by US copyright and trademark laws. Permission for use of the scale and its coding is required. A license agreement is available from MMAR, LLC., www.moriskyscale.com

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Competing interests

The authors declare that there is no conflict of interest.

Availability of data and materials

The data are available from the corresponding author on reasonable request.

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