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Determinants of quality of life changes with plasmapheresis in patients with myasthenia gravis

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Abstract

Background: Immunomodulation, including IVIG and plasma exchange, is useful for a crisis or severe exacerbation. Plasma exchange may be slightly faster and more effective in a myasthenic crisis than IVIG. The aim of the current study was to determine the changes in the quality of life (QOL) after plasmapheresis and factors influencing these changes.

Results: This study was conducted on 98 MG patients diagnosed as moderate to severe myasthenia gravis (according to Myasthenia Gravis Foundation of America classification), 81 patients received alternate day 5 sessions plasmapheresis (TPE group) and 17 patients were on medical treatment only (control group). All patients were subjected to full history, through clinical neurological evaluation and scored with quantitative myasthenia gravis (QMG) score for MG severity at start and after 1 m. Both groups completed the QOL questionnaire at baseline and after 1 month. The MG-QOL-15 scores were computed and we analyzed the change in the QOL scores from baseline to after plasmapheresis groups and compared it with the results for the control group. The scores in QOL scales had significantly decreased after plasmapheresis, and the improvement in QOL scores had a good correlation with the decrease in QMGS. The improvement in QOL and QMG was significantly correlated with younger age, female gender, shorter duration of the illness, presence of AchR antibodies, antibody titer, and thymus hyperplasia.

Conclusion: Plasmapheresis is effective in improving quality of life in myasthenia gravis patients and this improvement influenced by age, gender, duration of illness, presence of AchR antibodies and their titer, and the thymus pathology.

Keyword: Myasthenia gravis, Plasmapheresis, Quality of life

Background

Myasthenia gravis (MG) is characterized by fluctuating muscle weakness and fatigability, with great clinical variability [1–3], and due to its fluctuating course and clinical heterogeneity, many approaches to evaluate the clinical profile and treatment outcomes of MG have been discussed [4].

Quality of life (QOL) is a measure of general well-being of individuals and societies. Its score measurement enables assessment of impact of various diseases or therapeutic interventions on the patient's life [5]. Measures of quality of life (QOL) have been widely used to follow patients with neuromuscular disorders, including MG [6]. Assessment of patients' perception of QOL may improve their care by promoting greater adherence to treatment and leading to better clinical control and outcome [7].

Many variables may impact QOL in MG patients such as demographic variables such as age and gender; clinical variables such as disease duration, main symptoms, MG classification, and treatments; and anxiety and depressive symptoms [8].

Ghonemy TA and colleagues [9] noted that therapeutic plasmapheresis is almost safe and effective adjuvant treatment for several diseases especially autoimmune diseases,

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like MG. Plasmapheresis achieved immediate improvement of MG symptoms, and, while it made patients attentive to the course of their disease, it also helped them realize that there was a possibility of relief.

In this study, we aim to determine the changes in the quality of life (QOL) after plasmapheresis in MG patients and factors influencing these changes.

Methods

Between September 2016 and July 2018, 98 MG patients diagnosed as moderate to severe myasthenia gravis, aged from 18 to 60 years old, were recruited from our hospital and outpatient clinic. The local ethics committee approved this study, and all patients signed a written consent form.

The following diagnostic criteria for MG were used: (a) clinical manifestations of myasthenia gravis, (b) positive AChR-ab, (c) positive response to anticholinesterases, and (d) abnormal neurophysiological findings (repetitive nerve stimulation and single-fiber electromyography). MG was diagnosed in patients fulfilling at least two of the four criteria.

Only patients with moderate to severe MG were enrolled (classified according to Myasthenia Gravis Foundation of America classification) [10] who are conscious, cooperating, and able to fulfill the questionnaire subjects.

Patient with congenital myasthenic syndrome, progressive restricted myopathies, steroid, and inflammatory myopathies, motor neuron disease, multiple sclerosis, variants of Guillain-Barré syndrome (such as Miller-Fisher syndrome), organophosphate toxicity, botulism, black widow spider venom, Eaton-Lambert syndrome, stroke and drug-induced myasthenia-like syndromes: neuromuscular blocking agents, aminoglycosides, penicillamine, antimalarial drugs, colistin, streptomycin, polymyxin B, and tetracycline were excluded from this study. Also, patients with contraindication to plasmapheresis, such as presence of a hemorrhage or surgical bleeding, tumors, acute inflammatory and infectious processes, extreme degree of heart failure, and significant hypotension, were excluded.

All patients were subjected to history taking including duration of their disease, symptoms, disability, and frequency of relapse and severity of their disease, number of crises, therapeutic interventions including thymectomy, use of cholinesterase inhibitors, steroids, and other immunosuppressant, the daily doses of various medications administered, comorbidities, history of other autoimmune diseases, and drug history.

Full neurological examination was done to all patients and repeated after 1 month and their quantitative MG (QMG) scores were calculated. The quantitative MG (QMG) score is used in clinical studies as a measure of disease severity. The validated scale is clinician administered and comprises 13 items that quantitatively assess the endurance or fatigability of different muscle groups, 27 taking into account the fluctuating nature of the disease. The items are as follows: ptosis, diplopia, orbicularis oculi weakness, swallowing a cup of water, speech, percent predicted forced vital capacity, grip strength (2 items), arm endurance (2 items), leg endurance (2 items), and neck flexion endurance. All items are scored on a scale of 0 to 3, and total scores range from 0 to 39; higher scores indicate greater disease severity. A ⩾3-point difference in the QMG score is considered clinically meaningful and scores of 10–16 and >16 indicate mild and moderate disease, respectively. 35 A change of 3.5 points in the total score is considered a clinically meaningful improvement for patients with MG.

Laboratory work was done including thyroid functions, other autoimmune disorders workup (erythrocyte sedimentation rate (ESR), antinumclear antibodies (ANA), anti-cytoplasmic nuclear antibodies (ANCA) anto RO, anti La, SLE, anticardiolipin antibodies), acetylcholine receptor antibodies (AChR-ab) using the enzyme-linked immunesorbent assay technique. Computed tomography (CT) of the mediastinal region was also performed in all cases to search for thymus hyperplasia or thymoma.

Neurophysiological studies were done using Nemus, Biomedica, Model number 00655, Galileo NT software version 3.71/00, Italy, including repetitive nerve stimulation (RNS), single fiber EMG (SFEMG), and electromyography (EMG).

For RNS, surface electrodes are used, one over the belly of the muscle, the other at a position remote from the muscle. Low frequency stimulation is given by a surface electrode on the corresponding nerve at a rate of 2-3 Hz. Movements induced by the muscle contraction have to be prevented by convenient fixation. The negative amplitude of the first response is measured together with the relative difference between the fourth (or fifth) and first response. Test was considered abnormal when a "decremental pattern" was observed (decrement >11% of the fifth compound muscle action potential (CMAP) with respect to the first CMAP) of at least one proximal and one distal nerves innervating weak muscles [11].

Single fiber EMG (SFEMG) done in case RNS gave normal result. A needle electrode with a recording surface of 25 μm in diameter in a side port of the cannula is positioned in the voluntarily activated muscle to record activity from a few adjacent muscle fibers. We generally use the SFEMG reference values published in 1994 by the Ad Hoc Committee of the AAEM Single Fiber Special Interest Group [12].

Electromyography (EMG) done on proximal muscles of the limbs (deltoid, biceps brachii, rectus femori) was performed in all cases in order to evaluate myopathy.

Patients with moderate to severe MG were divided into two groups: (1) Patients admitted for a worsening of the disease (83 patients) and received plasmapheresis sets (five plasmapheresis procedures, performed every second day), but in this group, two patients had respiratory failure and died before completing the plasmapheresis sessions so only 81 patients included in the final statistical analysis. (2) Patients not receiving plasmapheresis sets and only on medical treatment, patients included in this group were patients who have a monthly follow-up schedule in outpatient clinics (17 patients).

A comprehensive explanation of both clinical efficacy and adverse effects of plasmapheresis was done to reduce the patients' anxiety for the procedure. Central venous access was performed using a temporary dual-lumen catheter (Mahukar), with gage depending on patient size. Each patient received up to 5 plasmapheresis procedures.

Membrane filtration types were performed. Fifty milliliters of plasma/kg body weight/session was removed and an equivalent amount of solution containing albumin, 5%; sodium, 145 mEq/L; potassium, 3 mEq/L; calcium, 5 mEq/L; magnesium, 1.9 mEq/L; chloride, 115 mEq/L, and lactate, 35 mEq/L was reinfused. Then 0.5 g of 10% calcium gluconate was added directly to each 500-ml 5% albumin bottle to prevent citrate reactions. A bolus of 7500 IU of heparin/session was used as the anticoagulant. Average duration of each session was 5 h. No serious events were observed.

Quality of life (QoL) was assessed using Myasthenia Gravis Quality Of Life 15 (MG-QOL-15) score with the assistance of neurology doctors. This is a self-administered disease-specific questionnaire consisting of 15 items. Response to each item was scored on a scale of "0," "1," "2," "3," and "4" representing "not at all," "a little bit," "somewhat," "quite a bit," and "very much," respectively. MG-QOL15 has a maximum score of 60, and there is no pre-specified cutoff for classifying the QOL of MG patients. The higher the MG-QOL15 score, the poorer the QOL [13–15]. Test was repeated after 1 month (2 weeks after finishing plasmapheresis) for the patient group.

The study was carried out in accordance with the Declaration of Helsinki and was approved by the Institute Ethics Committee before its commencement.

Data was collected, revised, coded, and entered to the Statistical Package for Social Science (IBM SPSS) version 23, Armonk, NY: IBM Corp. The quantitative data were presented as mean, standard deviations, and ranges when their distribution found parametric and median with interquartile range (IQR) when their distribution found non-parametric while qualitative data were presented as number and percentages. The comparison between two independent groups with qualitative data was done by using chi-square test**.** The comparison between two paired groups with quantitative data and parametric distribution was done by using paired *t* test while with non-parametric data was done by using Wilcoxon rank test. The comparison between more than two independent groups with quantitative data and parametric distribution was done by using one-way ANOVA while with non-parametric data was done by using Kruskal-Wallis test. Spearman correlation coefficients were used to assess the correlation between two quantitative parameters in the same group.

Results

This study included 98 patients diagnosed as moderate to severe myasthenia gravis (according to Myasthenia Gravis Foundation of America classification). These patients were divided into two groups, the first one included patients who had received plasmapheresis as a line of treatment (therapeutic plasma exchange (TPE) group), and the second group included patients who did not receive plasmapheresis and only on medical treatment (control group).

Comparison between the TPE group and the control group regarding demographics, duration of illness, AchR titer, thymectomy and thymus pathology, and other autoimmune diseases illustrated in Table 1.

In the TPE group, there was significant improvement in disease severity measured by QMG score after plasmapheresis (Table 2, Fig. 1). Subsequently, there was a significant improvement in QOL score after 1 month. On the contrary, there was deterioration in the clinical disease severity in the control group with subsequent decline in QOL score (Table 2, Fig. 1).

Regarding correlations between in QMG and Qol scores before and after plasmapheresis, with different demographic, clinical, and laboratory criteria, it was found that age and duration of illness are inversely related to changes in QMG and QOL scores after plasmapheresis but not with their initial score. While female sex, patients with AchR antibodies (Table 3, Fig. 2), elevated AchR antibody titer (Table 4, Fig. 2), thymus hyperplasia (Table 5) all have significant positive correlation with changes in QMG and QOL after plasmapheresis. Whether thymectomy done or not do not correlate with QOL change after plasmapheresis, however, thymectomy correlates with better improvement in QMG (Table 6). There was no significant correlation between presence of other autoimmune diseases and either QMG or QOL scores or their changes after plasmapheresis except for negative correlation with initial QOL score.

The clinical examination findings were significantly related to the physical aspects of QOL. Mental aspects of the quality of life were not progressively involved as muscle deficit progressed, but even in a mild clinical picture, the mental aspects were

Table 1 Comparison between control group and TPE group regarding demographics, clinical, and laboratory criteria

		Control group No. =17	TPE group No. =81	Test value	*P* value	Sig
Sex	Females	10 (58.8%)	58 (71.6%)	1.081[b]	0.299	NS
	Males	7 (41.2%)	23 (28.4%)			
Age	Mean ± SD	35.29 ± 11.65	35.69± 12.46	−0.121	0.904	NS
	Range	18-60	18-60			
Duration by month	Mean ± SD	42.47 ± 18.19	36.59 ± 20.18	1.109[a]	0.270	NS
	Range	18-80	12-96			
AchR antibodies	Negative	3 (17.6%)	16 (19.8%)	0.040[b]	0.842	NS
	Positive	14 (82.4%)	65 (80.2%)			
AchR titer	Median (IQR)	8 (6.7-9.2)	13.2 (9.2-19)	3.091	0.002	HS
	Range	4.3-16.3	4.6-80.6			
Thymectomy	Negative	7 (41.2%)	29 (35.8%)	0.175	0.676	NS
	Positive	10 (58.8%)	52 (64.2%)			
Thymus gland	Normal	5 (50.0%)	31 (59.6%)	2.451	0.294	NS
	Hyperplasia	5 (50.0%)	15 (28.8%)			
	Thymoma	0 (0.0%)	6 (11.5%)			
Other autoimmune	Negative	16 (94.1%)	73 (90.1%)	1.819	0.403	NS
	Thyrotoxicosis	0 (0.0%)	6 (7.4%)			
	Systemic lupus	1 (5.9%)	2 (2.5%)			

> 0.05 NS, non-significant; < 0.05 S, significant; < 0.01 *HS* highly significant, *TPE* therapeutic plasmapheresis, *SD* standard deviation, *AchR* acetylcholine receptor
[a]Independent *t* test
[b]Chi-square test

deteriorated. Patient-oriented measures proved that the patient's quality of life was impaired especially with regard to physical aspects with significant improvement in all these aspects after plasmapheresis (Table 7).

Discussion

Plasmapheresis has been widely used in the treatment of MG for many years. As it removes pathogenic antibodies and rapidly relieves the associated symptoms, resulting in short-term improvement of MG [16]. But in spite of

Table 2 Comparison between control group and TPE group regarding QMG and QOL score at initial, after 1 month, and percentage change

		Control group No.= 17	TPE group No.= 81	Test value	*P* value	Sig.
Initial QMG score	Mean ± SD Range	24.12 ± 2.00	25.64 ± 3.95	−1.547[a]	0.125	**NS**
QMG score after 1 month	Mean ± SD Range	21-27	18-34	7.818[a]	0.001	**HS**
QMG change	Median (IQR) Range	26.35 ± 3.20	18.05 ± 4.12	−6.404[b]	0.001	**HS**
Initial QOL score	Mean ± SD	43.06 ± 2.66	46.47 ± 4.86	−2.797[a]	0.006	HS
	Range	38-47	36-57			
QOL score after 1 month	Mean ± SD	46.12 ± 4.31	38.36 ± 6.69	4.579[a]	0.0001	HS
	Range	38-52	25-54			
QOL change	Median (IQR)	4.76 (0-13.95)	−15.38 (−27.08-−9.09)	−6.091[b]	0.0001	HS
	Range	−5-23.81	−50-8.16			

NS non-significant, *S* significant, *HS* highly significant, *TPE* therapeutic plasmapheresis, *SD* standard deviation, *QOL* quality of life
[a]Independent *t* test
[b]Mann-Whitney test

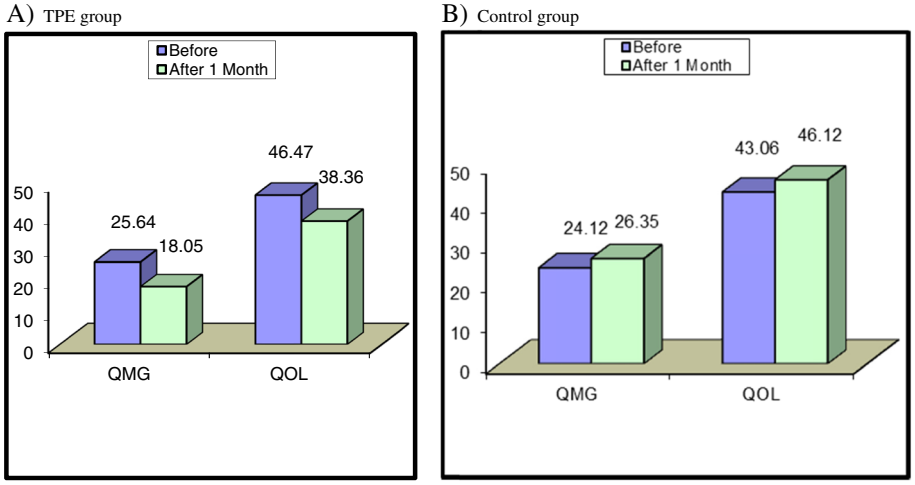

Fig. 1 QMG and QOL scores at initial after 1 month in TPE and control groups

the increasing availability of this immunomodulatory treatment, little is known about factors predicting response to treatment [17].

In MG patients, there is a high prevalence of psychopathology and it is associated with quality of life [18]. Anxiety disorder and depression are frequent comorbid conditions in MG, and they can also influence quality of life [19]. MG symptoms may lead to important restrictions in everyday activities and participation in social life [20]. That is why MG patients often develop a behavioral pattern of advance planning as they have to preserve their muscle strength. Also, they avoid social contacts due to their muscular impairments. All these restrictions in motor activities and social interaction are associated with decreased life satisfaction [21].

Dahlan R and colleagues [22] found that plasmapheresis as well as intravenous immunoglobulin have been shown to achieve an improvement in the quality of life of MG patients. Chen YT and colleagues [23] investigated the effects of improvement in muscle strength

Table 3 Relation between Ach antibodies of the studied patients and QMG and QOL scores

		AchR antibodies		Test value	*P* value	Sig.
		Negative	Positive			
Initial QMG score	Mean ± SD	22.31 ± 3.03	26.46 ± 3.73	−4.126[a]	0.000	HS
	Range	18-27	19-34			
QMG score after 1 month	Mean ± SD	18.25 ± 2.41	18.00 ± 4.45	0.216[a]	0.829	NS
	Range	15-22	11-30			
QMG change	Median (IQR)	−14.86 (−24.08-−9.81)	−32 (−42.31-−20.83)	−3.518[b]	0.000	HS
	Range	−44.44-0	−58.06-0			
Test value		4.676	9.936	–	–	–
***P* value**		0.001	0.001			
Initial QOL score	Mean ± SD	43.25 ± 3.79	47.26 ± 4.79	−3.112[a]	0.003	HS
	Range	37-48	36-57			
QOL score after 1 month	Mean ± SD	38.44 ± 5.27	38.34 ± 7.03	0.053[a]	0.958	NS
	Range	30-48	25-54			
QOL change	Median (IQR)	−11.66 (−17.79-−4.79)	−16.33 (−29.27-−10.42)	−2.218[b]	0.027	S
	Range	−25-4.44	−50-8.16			
Test value		4.839	8.042	–	–	–
***P* value**		0.001	0.001			

NS non-significant, *S* significant, *HS* highly significant, *QOL* quality of life, *QMG* quantitative myasthenia gravis, *SD* standard deviation, *AchR* acetylcholine receptors
[a]Independent *t* test
[b]Mann-Whitney test

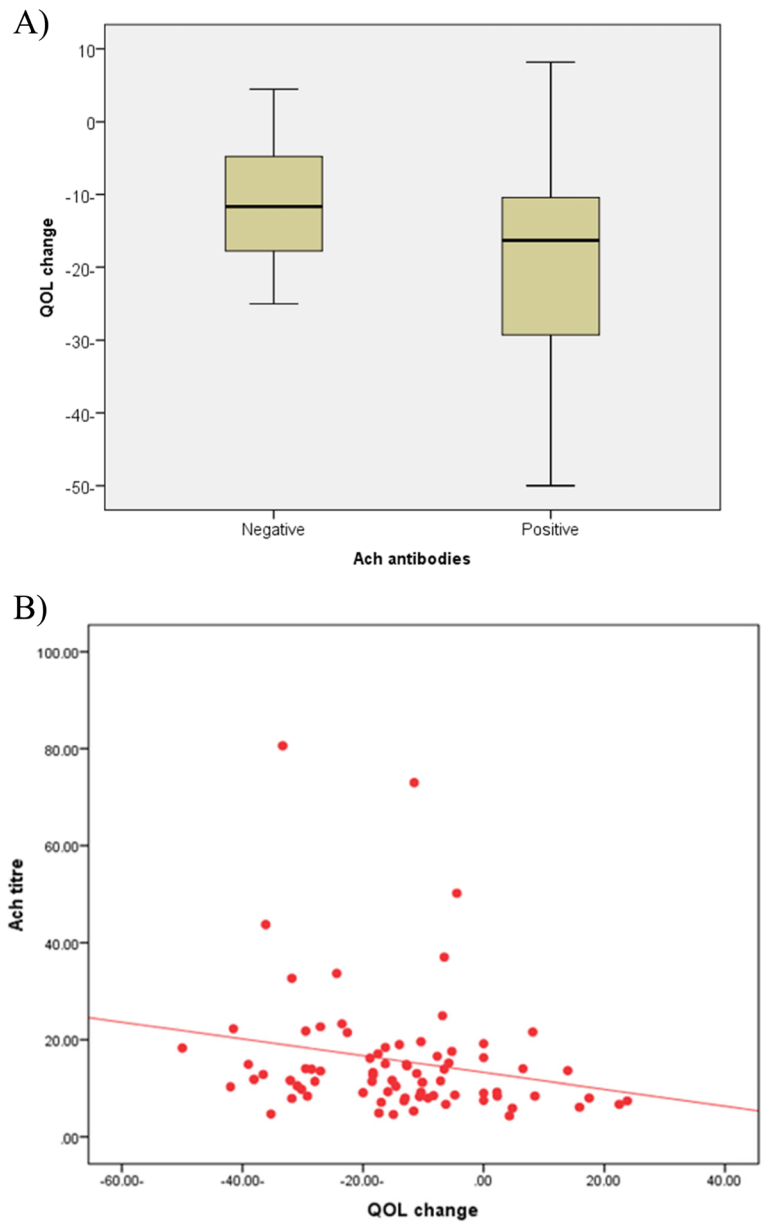

Fig. 2 Correlation between presence of AchR antibodies and antibody titer with QOL scores after plasmapheresis

Table 4 Correlation between AchR antibodies titer of the studied patients and studied scores

	AchR titer		
	r	*P* value	Sig.
Initial QMG score	0.371**	0.001	HS
QMG score after 1 month	−0.155	0.175	NS
QMG change	−0.306**	0.006	HS
Initial QOL score	0.285*	0.012	S
QOL score after 1 month	−0.123	0.285	NS
QOL change	−0.262*	0.021	S

NS non-significant, *=*S* significant, **=*HS* highly significant, *QOL* quality of life, *QMG* quantitative myasthenia gravis, *SD* standard deviation, *AchR* acetylcholine receptors

with plasmapheresis treatment on both QOL and psychological status of MG patients, and found that MG affects almost all aspects of patients' quality of life (QOL), including daily functioning and anxiety levels.

Usually MG might be more severe in females than in males, as shown by the study of Dong and colleagues where Chinese female patients with MG consistently scored less than males on physical, social, and emotional domains of health-related quality of life HRQoL and identified that the number of comorbidities interacted with gender and could modulate the relationship between gender and HRQoL [24]. Also, in the study done by Twork S and colleagues [21] on German myasthenia

Table 5 Relation between thymus gland pathology of the studied patients and studied scores

Total (52 patients)		Thymus gland			Test value	*P* value	Sig.
		Normal (31 patients)	Hyperplasia (15 patients)	Thymoma (6 patients)			
Initial QMG score	Mean ± SD	25.10 ± 3.48	28.87 ± 2.23	31.50 ± 1.52	15.770[a]	0.001	HS
	Range	19-31	24-32	30-34			
QMG score after 1 month	Mean ± SD	16.32 ± 3.50	19.40 ± 3.50	25.67 ± 5.47	16.565[a]	0.001	HS
	Range	11-23	11-24	15-30			
QMG change	Median (IQR)	−34.62 (−43.48-−23.81)	−31.25 (−35.71-−25)	−15.08 (−19.35-−6.67)	6.488	0.039	S
	Range	−58.06-−13.64	−58.06-−8.33	−53.13-0			
Test value		9.011	3.528	2.403			
***P* value**		0.001	0.002	0.061			
Initial QOL score	Mean ± SD	45.71 ± 3.93	49.93 ± 4.22	52.83 ± 2.64	11.676[a]	0.001	HS
	Range	39-54	44-57	49-57			
QOL score after 1 month	Mean ± SD	35.52 ± 6.47	41.33 ± 5.07	48.50 ± 6.83	13.166[a]	0.001	HS
	Range	25-49	30-48	36-54			
QOL change	Median (IQR)	−20 (−30.23-−10.64)	−14.58 (−18.87 – −11.11)	−5.52 (−11.54-0)	7.080	0.029	S
	Range	−50-−4.76	−41.51-−4.44	−33.33-8.16			
Test value		7.360	2.517	1.415			
***P* value**		0.001	0.021	0.216			

NS non-significant, *S* significant, *HS* highly significant, *QOL* quality of life, *QMG* quantitative myasthenia gravis, *SD* standard deviation
[a]One-way ANOVA

Table 6 Relation between thymectomy of the studied patients and studied scores

Total (81 patients)		Thymectomy		Test value	*P* value	Sig.
		Negative (29 patients)	Positive (52 patients)			
Initial QMG score	Mean ± SD	23.34 ± 3.15	26.92 ± 3.78	−4.322[a]	0.001	HS
	Range	18-30	19-34			
QMG score after 1 month	Mean ± SD	17.62 ± 2.65	18.29 ± 4.75	−0.697[a]	0.488	NS
	Range	12-22	11-30			
QMG change	Median (IQR)	−19.23 (−33.33-−11.11)	−32.07 (−42.21-−21.13)	−2.660[b]	0.008	HS
	Range	−55.56-0	−58.06-0			
Test value		5.888	9.011			
***P* value**		0.001	0.001			
Initial QOL score	Mean ± SD	44.17 ± 4.44	47.75 ± 4.65	−3.374[a]	0.001	HS
	Range	36-53	39-57			
QOL score after 1 month	Mean ± SD	37.76 ± 5.05	38.69 ± 7.47	−0.600[a]	0.550	NS
	Range	30-48	25-54			
QOL change	Median (IQR)	−12.5 (−20.93-−8.33)	−17.21 (−29.41-−10.42)	−1.734[b]	0.083	NS
	Range	−35.29-4.44	−50-8.16			
Test value		5.150	7.360			
***P* value**		0.001	0.001			

NS non-significant, *S* significant, *HS* highly significant, *QOL* quality of life, *QMG* quantitative myasthenia gravis, *SD* standard deviation
[a]Independent *t* test
[b]Mann-Whitney test

Table 7 shows the individual QOL items changes after plasmapheresis

	Group	N	Mean	Std. deviation	Std. error mean	*t*	Sig. (2-tailed)
Frustrated by my condition	Pre	81	3.3210	0.54376	0.06042	3.801	0.0001
	Post	81	2.9753	0.61187	0.06799		
Troubles using my eyes	Pre	81	3.4321	0.56873	0.06319	8.100	0.0001
	Post	81	2.5556	0.79057	0.08784		
Trouble eating	Pre	81	3.5062	0.57279	0.06364	8.910	0.0001
	Post	81	2.5802	0.73933	0.08215		
Limited social activities because of MG	Pre	81	3.0494	0.54546	0.06061	4.655	0.0001
	Post	81	2.6296	0.60093	0.06677		
Limited abilities to enjoy hobbies and fun	Pre	81	3.1728	0.60807	0.06756	4.564	0.0001
	Post	81	2.7037	0.69722	0.07747		
Trouble meeting the needs of my family	Pre	81	3.0864	0.63635	0.07071	4.854	0.0001
	Post	81	2.6049	0.62608	0.06956		
Have to make plans around my condition	Pre	81	2.8765	0.53345	0.05927	4.036	0.0001
	Post	81	2.5185	0.59395	0.06599		
My skills and job status have been negatively affected	Pre	81	3.3951	0.66481	0.07387	3.753	0.0001
	Post	81	2.9877	0.71578	0.07953		
Difficulty in speaking	Pre	81	3.2840	0.59654	0.06628	8.472	0.0001
	Post	81	2.3704	0.76558	0.08506		
Trouble in driving	Pre	81	3.0247	0.54716	0.06080	8.636	0.0001
	Post	81	2.2222	0.63246	0.07027		
Depressed about my condition	Pre	81	3.3951	0.49191	0.05466	4.453	0.0001
	Post	81	2.8776.	0.52054	0.06544		
Trouble in walking	Pre	81	2.7654	0.55389	0.06154	8.837	0.0001
	Post	81	1.9630	0.60093	0.06677		
Have trouble getting around public places	Pre	81	2.9753	0.44652	0.04961	6.323	0.0001
	Post	81	2.4321	0.63123	0.07014		
Feel overwhelmed by my condition	Pre	81	3.0247	0.47369	0.05263	2.666	0.008
	Post	81	2.8148	0.52705	0.05856		
Have trouble performing my personal grooming needs	Pre	81	2.1728	0.54291	0.06032	3.504	0.001
	Post	81	1.8765	0.53345	0.05927		

MG myasthenia gravis

gravis patients, they revealed that male and female differed significantly in physical functioning, vitality, and mental health; the values for these three categories were lower among women, as changes in QOL scores not depending only on physical changes but also on mental and psychosocial changes. This could be possibly because MG symptoms can be affected by menses, pregnancy, and postpartum changes in hormone, sex-related differences in drug pharmacokinetics and pharmacodynamics attributed to differences in body composition and physiology, and insufficient treatment with the relatively low dosage of drugs [25, 26].

Also, in our study, the initial QOL score in females was worse than males, although improvement in QOL scores after TPE was significantly relatively better in females.

Regarding age, Jeong and colleagues [27] stated that age was a significant factor for the patient's physical QOL with older persons with MG experienced lower physical QOL. Also, we found that younger age is correlated with better outcome in QOL after plasma exchange.

In a study done by Basta IZ and colleagues [7] for assessment of QOL in patients with myasthenia gravis in Belgrade (Serbia), there was no correlation between the duration of MG and QOL scores. Also, in our study, the duration of the disease had no significant correlation with the initial QOL scores, but it was found that patients with shorter duration of the disease have high significant improvement in QOL score after plasmapheresis. This may be due to rapid physical improvement and patients regaining their usual daily activities all give them improvement

in social and psychological parameters of quality of life. However, in a study by Szczudlik and colleagues, late-onset MG patients had worse QoL than early onset MG in physical score domain PCS [28].

In our tested group, we found that patients who have AchR antibodies had significantly higher initial QOL scores and significant improvement in QOL scores after plasmapheresis, than AchR antibodies negative patients. Which is relatively similar to study by Guptill JT and colleagues who stated that improvement after plasmapheresis is related to maximum decrease in all immunoglobulins, including AchR-abs, which achieved on the final day of the plasmapheresis course (approximately 60–70% reduction) [29]. This also comes in agreement with the study by Alemam and colleagues who reported that both sero-positive and sero-negative groups responded to TPE but the sero-positive group had a better response [30]. Considering the AchR antibodies titer, we also found that the initial QOL scores are highly correlated with the elevation of the titer and also correlated with QOL score improvement.

However, in a study by Raja and colleagues, there was poor correlation between between AChR antibody titer and MG-composite score at baseline (R^2 = 0.022) and at 2 weeks post-TPE (R^2 = 0.093) and between AChR antibody titer and MG-ADL at baseline (R^2 < 0.0001) and at 2 weeks post-TPE (R^2 = 0.198) [31].

In our study, 64% of patients in the tested group had thymectomy operation (52 patients), with significantly higher initial QMG and QOL scores compared with the non-thymectomy patients, and also showed significant improvement in QMG in patients with thymectomy compared with non-thymectomy patients. But with no significant changes after plasmapheresis in QOL scores in both thymectomy and non-thymectomy patients. And regarding patient quality of life, patients with thymoma were found to have significantly poor initial QOL score and markedly less liable to show significant improvement in QOL score after plasmapheresis on contrary to patients with thymus hyperplasia who show more improvement in QOL after plasmapheresis.

In a recent study by Zheng Y and colleagues [32]. Thymic abnormality plays a key role in the pathogenesis of MG, and 50–60% of MG patients have concomitant thymic hyperplasia and 10–20% have thymoma, and in 2010, Kulkantrakorn K and colleagues [33] noted that thymectomy did not have an impact on QOL in all patient disease severity groups. But in 2012, Basta IZ and colleagues [7] noted that the comparison of QOL scores in thymectomized and non-thymectomized patients showed no significant differences. Also, Mourão AM and colleagues [8] searched the determinants of quality of life in Brazilian patients with myasthenia gravis, and found that there was no difference in QOL between thymectomized and non-thymectomized patients.

Conclusion

Plasmapheresis can significantly improve the quality of life of patients with moderate to severe myasthenia gravis and this effect can be modulated by many factors. Younger age, female gender, shorter duration of illness, presence of AchR antibodies, high antibody titer, and patients with thymus hyperplasia, all correlate with better improvement in QMG and QOL after plasmapheresis. Whether more studies should be done to confirm these determinants and explore more clinical, laboratory, and electrophysiological factors are able to guide patient selection for plasmapheresis.

Abbreviations

MG: Myasthenia gravis; QOL: Quality of life; QMGS: Quantitative myasthenia gravis score; RNS: Repetitive nerve stimulation; CMAP: Compound muscle action potential; SFEMG: Single-fiber electromyography; AChR-ab: Acetylcholine receptors antibodies; HRQoL: Health-related quality of life

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Authors' contributions

I. A.: Study design, literature review, data acquisition, manuscript preparation. H. E.: Literature search, data acquisition and analysis, manuscript preparation and editing. The authors read and approved the final manuscript.

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Availability of data and materials

The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

The study was approved by the ethics committee of Menoufia University, August 2016. Committee's reference number is not applicable. Written informed consent was obtained from all patients.

Consent for publication

Not applicable

Competing interests

The authors declare that they have no competing interests.

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