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Original Article

Effects of microvascular decompression on quality-of-life in trigeminal neuralgia patients aged 70 years and older

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Received : 30 October 2022
Accepted : 19 January 2023
Published : 03 February 2023

DOI
10.25259/SNI_997_2022

Quick Response Code:

ABSTRACT

Background: Trigeminal neuralgia (TN) occasionally affects older adults, frequently worsens, and becomes refractory to medication. Older adult patients with TN may consider microvascular decompression (MVD) for their treatment. No study examines MVD effects on older adult TN patients' health-related quality of life (HRQoL). The present study evaluates the HRQoL of TN patients aged 70 years and older before and after MVD.

Methods: Adult TN patients who underwent MVD evaluated their HRQoL using the 36-Item Short-form (SF-36) Health Survey before and 6 months after MVD. The patients were divided into four groups according to their decade of age. The clinical parameters and operative outcomes were analyzed statistically. The SF-36 physical, mental, and role social component summary scores and eight domain scale scores were analyzed using a two-way repeated-measures analysis of variance (ANOVA) to compare the effects of age group and preoperative and postoperative time points.

Results: Among 57 adult patients (34 women, 23 men; mean age, 69 years; range, 30–89 years), 21 patients were in their seventies, and 11 were in their eighties. The SF-36 scores of patients in all age groups improved after MVD. Two-way repeated-measures ANOVA demonstrated a significant age group effect on the physical component summary and its physical functioning domain. A time point effect was significant on all component summaries and domains. There was a significant interaction between age group and time point effects on the bodily pain domain. These results suggested that patients 70 years and older had significant postoperative HRQoL improvement, but their improvement of physical-related HRQoL and multiple physical pain issues were limited.

Conclusion: Impaired HRQoL in TN patients aged 70 years and older can improve after MVD. Careful management of multiple comorbidities and surgical risks enables MVD to be an appropriate treatment for older adult patients with refractory TN.

Keywords: 36-Item short-form health survey (SF-36), Health-related quality of life, Microvascular decompression, Older adult, Trigeminal neuralgia

INTRODUCTION

Trigeminal neuralgia (TN), characterized by severe, unilateral, and brief electric shock-like facial pains, occasionally affects older adults.[9] The incidence of TN per 100,000 people each year increases from 4 to 5[2,35] in the general population to 18–26 in older adults.[11,12] TN frequently worsens and becomes refractory to medication.[2,35,37] Therefore, patients suffering from chronic

TN, including older adult patients, may choose surgical treatment. Microvascular decompression (MVD) is indicated if these patients have trigeminal nerve root neurovascular compression.[9] A growing body of literature suggests that MVD can provide long-term pain relief for older adult TN patients,[21,34,39] and there is an age-related risk of morbidity and mortality from MVD.[21,25,26,30]

Health-related quality of life (HRQoL) following treatment is another concern in evaluating the treatment modality, especially for older adult patients.[1,7,36] However, only few studies investigated the HRQoL in TN patients after MVD. No study examines MVD effects on HRQoL in older adult TN patients. Therefore, the present study aims to evaluate HRQoL in TN patients aged 70 years and older before and after MVD using the 36-Item Short Form (SF-36) Health Survey.

MATERIALS AND METHODS

Patient populations and demographics

We prospectively studied 57 consecutive patients with TN who underwent MVD surgery between January 2018 and December 2020. Written informed consent was obtained from all patients. The institutional review board approved this cohort study. The authors prepared the manuscript following the Strengthening the Reporting of Observational Studies in Epidemiology guideline.[29]

Inclusion criteria were a diagnosis of classical TN according to the International Classification of Headache Disorders 3rd edition,[9] age 18 years and older, demonstration of neurovascular compression on magnetic resonance imaging, and appropriate medical treatment before MVD. The patients were treated with carbamazepine at an acceptable dose. The patients allergic to carbamazepine were treated with pregabalin or gabapentin, as the regional drug administration approved oxcarbazepine for TN patients. We excluded patients who had undergone surgery for TN previously. We divided the patients into four age groups: those below 60 years, those between 60 and 69 years, those between 70 and 79 years, and those aged 80 years and older. All patients underwent MVD to mobilize the superior cerebellar artery (SCA) and other offending vessels from the trigeminal nerve root.[15,28] The follow-up period for recurrence and complication was 12–48 months.

The clinical parameters were as follows: age at operation, affected side, neuralgia type, preoperative comorbidity, operative findings of offending vessels, preoperative, and postoperative Barrow Neurological Institute (BNI) pain intensity score I, no trigeminal pain, no medication; II, occasional pain, not requiring medication; III, some pain, adequately controlled with medication; IV, some pain, not adequately controlled with medication; V, severe pain/no pain relief)[24] and carbamazepine dose, postoperative complications, and recurrence of neuralgia. The offending vessels were classified into four groups: (i) SCA alone (SCA); (ii) SCA and additional vessels (SCA-plus); (iii) non-SCA arterial compressions (other arteries); and (iv) transverse pontine, pontotrigeminal, or other veins (vein).

HRQoL SF-36 evaluation

We interviewed the TN patients about their HRQoL before and 6 months after MVD using SF-36 version 2 (Medical Outcomes Trust, Hanover, NH).[4,32] The SF-36 is a multidimensional self-report questionnaire measuring the subjective health state, including pain and other physical, mental, and social functioning.[4,32] The questionnaire comprised 36 items with different response scales from two- to five-point Likert scale. The scoring algorithm determined the scores of eight HRQoL domains: physical functioning, role-physical, bodily pain, general health, vitality, social functioning, role-emotional, and mental health domains. These eight domain scale scores determined the three component summary scores: physical (PCS), mental (MCS), and role-social (RCS) component summary scores. Each domain and component summary score ranged from 0 to 100, where a high score indicated a more favorable health state. A score below 40 indicated an impairment of the responsible HRQoL domain or component summary.[4,32]

Statistical analysis

Descriptive statistics for patient demographics and outcomes showed the numbers and percentages (%) for categorical variables, the mean with ranges or 95% confidence intervals (95% CI) for continuous variables, and the median with ranges for ordinal variables and dosage of carbamazepine.

The effect of age groups and time points on the categorical and ordinal patient demographic data was analyzed using Fisher's exact test and generalized linear models, respectively. A two-way repeated-measures analysis of variance (ANOVA) examined the effect of age group (30–59 years, 60–69 years, 70–79 years, 80–89 years; between-subjects) and time point (preoperative vs. postoperative 6 months, within-subjects) on the SF-36 three component summary scores and eight domain scale scores after eliminating outliers and checking normality. We examined a *post hoc* pairwise comparison between age groups at each time point and a comparison between time points in each age group. Bonferroni adjustments were applied for ANOVA analysis to avoid type I error. Bonferroni adjustments were set significance at $\alpha < 0.017$ (αadj = 0.05/3, [0.0033 for $P < 0.01$]) for the examination of three component summary scores and at

$\alpha < 0.0063$ (αadj = 0.05/8 [00142 for $P < 0.01$]) for the eight domain scales.

The correlation between the SF-36 component summary scores taken before and after MVD and BNI scores was measured using the Pearson correlation. All analyses were conducted using R version 4.0.2.[22]

The efforts to minimize biases in this study included a prospective study design for the chronology and selection bias and a standardized interview using the SF-36 for the interviewer bias.[20]

RESULTS

Patient characteristics, operative findings, and postoperative outcomes

Fifty-seven adult patients (34 women, 23 men; mean age, 69 years; range, 30–89 years) were eligible for statistical analysis [Table 1]. Twenty-one patients were in their seventies (14 women, seven men), and 11 (five women, six men) were in their eighties. Comorbidity was common in patients aged 60 years and older (36 of 45 [80%] patients) compared to the patients below 60 years (3 of 12 [25%] patients; $P < 0.001$). The preoperative carbamazepine dose was significantly lower in the patients aged 60 years and older (median, 400 mg) than in the patients below 60 years (median, 800 mg, $P < 0.001$). Pure venous compression was not seen in patients aged 70 years and older. Postoperative complete pain relief (BNI score I) was seen in 71–91% of patients with no age group effect [Table 1]. The median postoperative carbamazepine doses were 0 mg in any age group, as most patients could quit carbamazepine postoperatively. The postoperative BNI score improvement and the carbamazepine dose reduction were significant in any age group ($P < 0.001$, Table 1).

Nine of 11 patients aged 80 years and older had complete pain relief (BNI score I) with no significant complications [Table 1]. No stroke or thromboembolism occurred in any age group. Minor complications were facial numbness in a 59-year-old man and subdural effusion in a 65-year-old woman [Table 1]. Three patients had late neuralgia recurrences; an 81-year-old woman underwent gamma knife surgery with adequate pain control with medication (BNI score III), a 71-year-old woman had adequate pain control with medication (BNI score III), a 62-year-old woman underwent MVD again and had occasional pain, not requiring medication (BNI score II).

Preoperative and postoperative SF-36 scores

In all age groups, the SF-36 PCS, MCS, and RCS scores were low before MVD and considerably improved after MVD [Table 2 and Figure 1a]; however, the postoperative PCS scores were relatively low in the patients 70 years and older [Figure 1a]. The SF-36 domain scores were also poor before MVD in any age group [Table 2 and Figure 1b]. These scores significantly increased after MVD in patients below 70 [Figure 1b]. In patients 70 years and older, the physical functioning domain slightly improved, whereas other domain scores significantly increased [Figure 1b]. In patients 80 years and older, improvement of the general health and vitality domains was minimal [Figure 1b].

Two-way repeated-measures ANOVA and *post hoc* analysis examined the SF-36 results as follows. Two-way repeated-measure ANOVA demonstrated no significant interaction between age group and time point effects on any component summary scores [Table 3]. There was a significant simple main effect of the age group on the PCS score (F (3, 46) = 11.2, $P < 0.001$, partial eta square (pes) = 0.35, Table 3). The *post hoc* pairwise comparison of PCS scores found a significant difference between 30–59 years and 70–79 years preoperatively [Figure 1a]. It also found a substantial difference between below 70 years and 70 years and older postoperatively [Figure 1a]. There was a significant simple main effect of the time point on all component summary scores (PCS, F (1, 46) = 84.7, $P < 0.001$, pes = 0.34; MCS, F (1, 52) = 102.2, $P < 0.001$, pes = 0.40; RCS, (F (1, 46) = 47.4, $P < 0.001$, pes = 0.35, Table 3). The *post hoc* comparison of all component summary scores was significant between the time points in any age group [Figure 1a].

Among the eight domain scales, physical functioning was the domain with a significant age group effect (F (3, 46) = 4.7, $P < 0.001$, pes = 0.18) and a significant time point effect (F (1, 46) = 25.4, $P< 0.001$, pes = 0.13), but with no significant interaction between age group and time point effects [Table 4]. The *post hoc* pairwise comparison [Figure 1b] found a substantial difference between below 70 years and 70 years and older in postoperative physical functioning ($P < 0.001$). There were also significant differences between preoperative and postoperative physical functioning scores in patients below 70 years ($P < 0.001$) but not in patients 70 years and older.

Bodily pain was the only domain with a significant interaction between age group and time point effects (F (3, 48) = 5.3, $P = 0.003$, pes = 0.10). A simple main effect of the time point on the bodily pain domain scale score was significant (F (1, 48) = 709.8, $P < 0.001$, pes = 0.6284); however, the effect on the age group was not significant [Table 4]. The *post hoc* pairwise comparison found that bodily pain scores significantly differed between time points in any age group ($P < 0.001$, Figure 1b).

As briefly described above, general health and vitality domains were the domains in which postoperative improvements were significant in all age groups except for the patients 80 years and older [Figure 1b]. In the other

Table 1: Trigeminal neuralgia in age decade groups: characteristics, operative findings, and treatment outcomes.

Age group	Patients	Sex		Mean age in yrs, range	Affected side		Neuralgia type		Comorbidity	Offending vessel			
		Female	Male		Right	Left	Type I	Type II		SCA	SCA- Plus	Other arteries	Vein
30–59	12 (21)	5 (42)	7 (58)	57, 38–59	8 (67)	4 (33)	10 (83)	2 (17)	3 (25)	8 (67)	2 (17)	0 (0)	2 (17)
60–69	13 (23)	10 (77)	3 (23)	63, 61-67	9 (69)	4 (31)	12 (92)	1 (8)	9 (69)	6 (46)	4 (31)	1 (8)	2 (15)
70–79	21 (37)	14 (67)	7 (33)	73, 71–79	13 (62)	8 (38)	16 (76)	5 (24)	16 (76)	16 (76)	5 (24)	0 (0)	0 (0)
80–89	11 (19)	5 (45)	6 (55)	82, 80–89	7 (64)	4 (36)	9 (82)	2 (8)	11 (100)	6 (55)	4 (36)	1 (9)	0 (0)
P-value		0.32			0.97		0.74		0.001	0.24			

Age group	Median BNI score, range		Postop BNI score I, II	Median CBZ dose in mg, range		Complication	Recurrence
	Preop	Postop		Preop	Postop		
30–59	V, III–V	I, I–IV	9 (75), 1 (8)	800, 300–1200	0, 0–500	1 (8)	1 (8)
60–69	V, II–V	I, I–IV	11 (85), 0 (0)	400, 0–900	0, 0–600	1 (8)	0 (0)
70–79	V, III–V	I, I–III	15 (71), 1 (5)	400, 0–600	0, 0–200	0 (0)	1 (5)
80+	V, IV–V	I, I–III	10 (91), 0 (0)	400, 0–800	0, 0–100	0 (0)	1 (9)
P-value	0.62	0.66	0.89	< 0.001	0.54	0.39	>0.99
	<0.001*			<0.001†			

SCA: Superior cerebellar artery, SCA plus: SCA and other vessels, Preop: Preoperative, Postop: Postoperative, BNI: Barrow Neurological Institute pain intensity, CBZ: Carbamazepine. Unless otherwise indicated, the values are expressed as the number of patients (%). Fisher's exact test for analyzing sex, affected side, neuralgia type, comorbidity, offending vessel, postoperative BNI Grades I and II, complication, and recurrence. *Generalized linear models for analyzing the preoperative and postoperative BNI score measures. †Repeated measure analysis of variance for analyzing the preoperative and postoperative CBZ doses

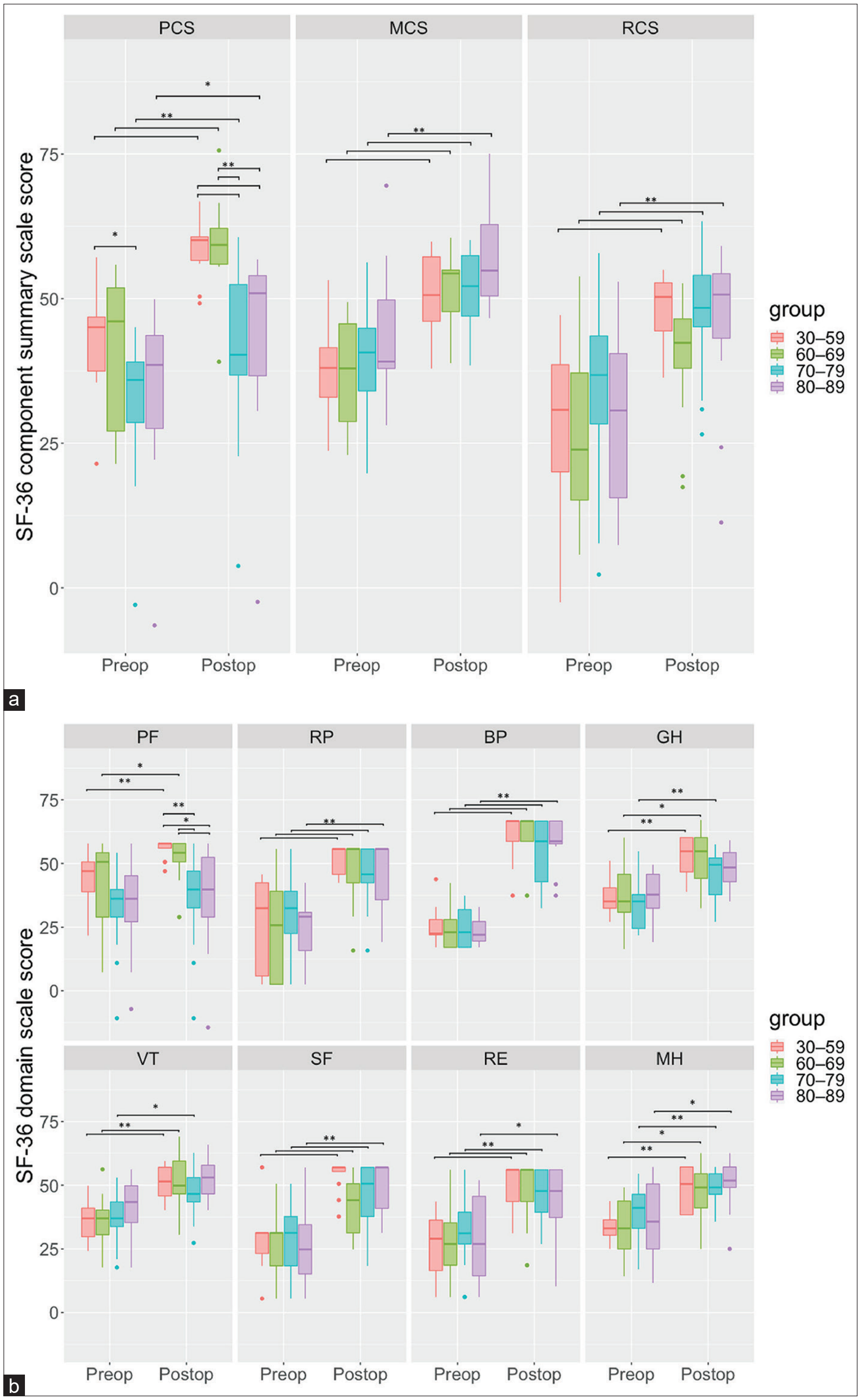

Figure 1: Box plots showing the 36-Item Short-form (SF-36) Health Survey component summary score (a) and domain scale scores (b) of the patients of 59 years or younger (red), those of 60–69 years (green), those of 70–79 years (blue), and those of 80 years and older (purple) in the preoperative and postoperative time points. The Bonferroni-adjusted p-value is set at 0.017 (*) and 0.0034 (**) for the three component summary scores (a) and at 0.00625 (*) and 0.00125 (**) for the eight domain scale scores (b). PCS, MCS, and RCS: Physical, mental, and role-social component summary, PF: Physical functioning, RP: Role physical, BP: Bodily pain, GH: General health, VT: Vitality, SF: Social functioning, RE: Role emotional, MH: Mental health, Preop: preoperative, Postop: postoperative.

Table 2: Descriptive statistics of SF-36 component summary and domain scale scores.

SF-36 CS/domain	Age group	Preoperative scores	Postoperative scores
		Means (95%CI)	Means (95%CI)
CS			
PCS	30–59	43.0 (37.1–48.9)	58.5 (55.3–61.7)
	60–69	41.9 (34.1–49.7)	59.5 (54.5–64.5)
	70–79	32.5 (27.4–37.6)	41.7 (35.7–47.7)
	80–89	33.8 (23.0–44.6)	43.1 (31.3–54.9)
MCS	30–59	38.2 (32.5–43.9)	50.9 (46.2–55.6)
	60–69	37.8 (32.2–43.2)	51.6 (47.9–55.3)
	70–79	40.1 (36.2–44.0)	51.1 (48.1–54.1)
	80–89	44.3 (36.4–52.3)	56.9 (51.0–62.9)
RCS	30–59	27.3 (17.3–37.3)	48.6 (44.9–52.3)
	60–69	27.1 (17.3–36.9)	39.9 (33.1–46.7)
	70–79	36.3 (29.8–42.8)	48.0 (43.5–52.4)
	80–89	28.0 (17.5–38.5)	45.0 (35.1–54.9)
Domain			
PF	30–59	44.3 (37.9–50.7)	55.7 (53.3–58.2)
	60–69	41.2 (30.8–51.6)	52.0 (47.1–56.9)
	70–79	33.1 (26.7–39.5)	36.9 (29.6–44.2)
	80–89	33.2 (20.2–46.3)	36.8 (22.3–51.4)
RP	30–59	26.1 (15.0–37.1)	51.8 (48.2–55.5)
	60–69	25.6 (13.4–37.7)	47.8 (40.0–55.6)
	70–79	30.2 (24.1–36.4)	45.6 (40.5–50.7)
	80–89	24.0 (14.7–33.3)	46.4 (36.9–55.8)
BP	30–59	25.5 (20.8–30.2)	61.3 (55.3–67.4)
	60–69	25.2 (20.0–30.3)	62.0 (57.0–67.0)
	70–79	25.2 (22.1–28.4)	53.6 (48.2–59.0)
	80–89	24.1 (20.1–28.0)	58.0 (51.3–64.6)
GH	30–59	36.2 (32.2–40.2)	52.4 (47.1–57.7)
	60–69	36.9 (29.2–44.6)	51.6 (45.4–57.9)
	70–79	33.7 (29.8–37.5)	45.3 (41.1–49.5)
	80–89	37.4 (30.9–43.9)	48.2 (42.9–53.5)
VT	30–59	36.2 (31.3–41.1)	51.4 (47.0–55.8)
	60–69	35.5 (28.7–42.3)	51.3 (45.5–57.1)
	70–79	37.4 (33.2–41.7)	46.3 (42.7–49.9)
	80–89	42.2 (34.8–49.7)	53.0 (47.3–58.8)
SF	30–59	28.6 (20.9–36.3)	53.8 (49.7–57.9)
	60–69	26.3 (18.0–34.6)	42.6 (35.3–50.0)
	70–79	28.5 (22.7–34.3)	46.3 (40.5–52.0)
	80–89	27.7 (15.7–39.7)	49.4 (41.5–57.3)
RE	30–59	26.2 (17.6–34.9)	50.9 (45.6–56.2)
	60–69	27.9 (18.4–37.4)	47.4 (39.6–55.2)
	70–79	33.5 (27.2–39.8)	47.2 (42.7–51.6)
	80–89	28.4 (16.6–40.3)	44.0 (33.7–54.2)
MH	30–59	34.2 (30.5–37.8)	48.5 (42.8–54.2)
	60–69	32.6 (25.9–39.3)	46.9 (40.6–53.1)
	70–79	39.0 (34.5–43.6)	49.5 (47.1–51.9)
	80–89	35.7 (24.3–47.1)	50.8 (43.4–58.2)

SF-36: Short form health survey, CS: Component summary, 95% CI: 95% Confident interval, PCS, MCS, and RCS: Physical, mental, role-social component summary, PF: Physical functioning, RP: Role physical, BP: Bodily pain, GH: General health, VT: Vitality, SF: Social functioning, RE: Role emotional, MH: Mental health

four domain scales, the time points effect was significant. However, the age group effect was not significant [Table 4 and Figure 1b]. The *post hoc* pairwise comparisons between time points in each age group were significant in the role physical and social functioning domains ($P < 0.05$, Figure 1b).

Correlation between BNI and component summary score

The mean SF-36 component summary and domain scale scores increased above 40 postoperatively, except for the physical functioning domain scale scores in patients 70 years and older [Table 2, Figures 1a and b]. The Pearson correlation coefficients between BNI scores and component summary scores suggested a weak to moderate correlation between BNI and PCS scores (−0.47), MCS scores (−0.59), and RCS (−0.51). The paired scatterplot illustrated that PCS and MCS improvements tended to be paralleled by BNI improvements [Figure 2]. In the RCS plots, five patients aged 70 years and older (16%) and two patients below 70 years (8%) had lower RCS scores while their BNI scores improved postoperatively [Figure 2].

Table 3: Repeated measures ANOVA for SF-36 component summary result.

Dependent variable	Independent variable	DFn	DFd	*F*	*P*	*pes*
PCS	Age group	3	46	11.2	<0.001	0.35
	Time point	1	46	84.7	<0.001	0.34
	Age group: Time point	3	46	1.9	0.15	0.03
MCS	Age group	3	52	0.9	0.47	0.03
	Time point	1	52	102.2	<0.001	0.40
	Age group: Time point	3	52	0.6	0.81	0.01
RCS	Age group	3	46	2.7	0.05	0.08
	Time point	1	46	47.4	<0.001	0.35
	Age group: Time point	3	46	1.1	0.35	0.04

ANOVA: Analysis of variance, SF-36: Short form health survey, DFn, DFd: Degrees of freedom in the numerator and denominator, *F*: F value, *P*: *P*-value, *pes*=Partial eta-squared measure of effect size, PCS, MCS, RCS: Physical, mental, role-social component summary

DISCUSSION

The present study showed that young and older adult TN patients suffer impaired physical, mental, and social functioning of HRQoL, and these HRQoL scores improved after MVD in any age group. Only few studies have investigated the HRQoL of MVD-treated TN patients at various postoperative time points.[10,18,27] No age-group stratified analysis is available from the previous studies. Jafree *et al.* performed the 12-Item Short Form Health Survey (SF-12) in patients treated with MVD or partial sensory rhizotomy.[10] In this study, these patients had

Table 4: Repeated measures ANOVA for SF-36 domain result.

Dependent VARIABLE (s)	Independent variable	DFn	DFd	*F*	*P*	*pes*
PF	Age group	3	46	4.7	<0.001	0.18
	Time point	1	46	25.4	<0.001	0.13
	Age group: Time point	3	46	2.2	0.10	0.04
RP	Age group	3	51	0.5	0.71	0.01
	Time point	1	51	69.1	<0.001	0.41
	Age group: Time point	3	51	0.8	0.50	0.02
BP	Age group	3	48	2.1	0.11	0.08
	Time point	1	48	709.8	<0.001	0.84
	Age group: Time point	3	48	5.3	0.003	0.10
GH	Age group	3	53	1.6	0.21	0.06
	Time point	1	53	80.7	<0.001	0.34
	Age group: Time point	3	53	0.7	0.55	0.01
VT	Age group	3	50	2.1	0.12	0.06
	Time point	1	50	55.7	<0.001	0.37
	Age group: Time point	3	50	1.9	0.14	0.06
SF	Age group	3	48	1.1	0.36	0.04
	Time point	1	48	82.2	<0.001	0.40
	Age group: Time point	3	48	1.1	0.35	0.03
RE	Age group	3	50	0.6	0.62	0.03
	Time point	1	50	86.6	<0.001	0.34
	Age group: Time point	3	50	3.2	0.03	0.05
MH	Age group	3	52	1.9	0.14	0.06
	Time point	1	52	61.1	<0.001	0.34
	Age group: Time point	3	52	0.5	0.70	0.01

ANOVA: Analysis of variance, SF-36: Short form health survey, DFn, DFd: Degrees of freedom in the numerator and denominator, *F*: F value, *P*: Bonferroni-adjusted *P*-value, *pes*: Partial eta-squared measure of effect size, PF: Physical functioning, RP: Role physical, BP: Bodily pain, GH: General health, VT: Vitality, SF: Social functioning, RE: Role emotional, MH: Mental health

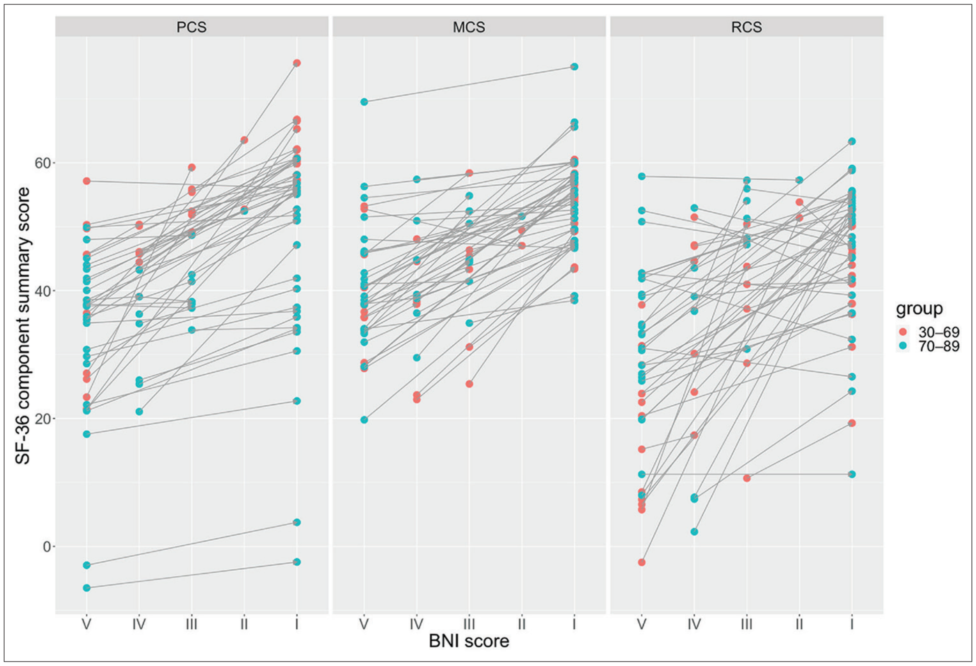

Figure 2: Paired scatter plots showing the Barrow Neurological Institute pain intensity score (BNI score) and SF-36 component summary score of the patients of 30–69 years (red) and those of 70–89 years (blue). The paired preoperative and postoperative time points are lined with arrows from the preoperative to the postoperative time point. The right upward arrow indicates improvement of both the BNI and component summary scores. In contrast, the right downward arrow suggests improvement of the BNI score and deterioration of the component summary score. PCS, MCS, and RCS: Physical, mental, and role-social component summary.

significantly lower SF-12 physical and mental component scores at five-year follow-up compared to the age-matched population. Furthermore, complication-related HRQoL impairment was more common in patients treated with rhizotomy than MVD.[10] Obermueller *et al.* evaluated the HRQoL of MVD-treated TN patients using the EuroQoL.[18] The postoperative EuroQoL scores illustrated that most patients had no problems in mobility, self-care, usual activity, and anxiety/depression but had a problem in pain/discomfort. Shibahashi *et al.* measured the postoperative SF-36 score in MVD-treated TN patients.[27] They reported that the postoperative SF-36 score was similar to that of the general population.[27]

The present study illustrated that aging per se does not interfere with the HRQoL improvement following MVD, although postoperative improvement of physical-related HRQoL is limited in older patients. A time point effect was significant on all SF-36 component summary and domain scores, suggesting that these HRQoL scores improve following MVD in both older and non-older groups. There was a significant interaction between age group and time point effects on the bodily pain domain. This significant interaction can be interpreted as a result of multiple bodily pain issues besides TN in older adults, as their TN improved significantly after MVD.

The results suggest that older adult patients can see their HRQoL improvement following MVD. Pain relief and medication reduction contribute to HRQoL improvement. The HRQoL of older adult patients does not deteriorate postoperatively as long as severe complications do not occur. The quantitative HRQoL data are compatible with our intuitive and empirical assessment of surgical outcomes in older adult patients.

In practice, older TN patients may consider ablation treatment using a gamma knife[19,23,34] and percutaneous rhizotomy[3] before undergoing MVD. Several systematic reviews have pointed out that older patients are at risk of morbidity and mortality from MVD.[5,8,21,26] As the present study shows, recovery of physical functioning is limited in older patients, partly because they are potentially frail.[23] Careful preoperative comorbidity and frailty assessment[23] are necessary. Some studies reported that MVD could provide better long-term pain relief and less facial sensory complication than gamma knife[13,14,31,38] and rhizotomy.[10,16] A single study demonstrated that complication-related HRQoL was more common in patients treated with rhizotomy than MVD.[10] With the present HRQoL results, offering MVD for fair older patients cannot be rejected. Appropriateness of careful management of the multiple comorbidities[6,33] and frailty[23] of older adult TN patients should be prospectively examined in various treatment modalities.

This study has several limitations. The present preliminary examination is a prospective but not randomized, single-center, small-scale, and single-modality study. Further research should compare the HRQoL effects of MVD with a gamma knife and other surgical modalities for older adult patients. In addition, a forthcoming study should estimate patients' frailty for their preoperative conditions and the surgical impacts on their frailty. Furthermore, the patients in the present study had no severe postoperative complications; therefore, the effects of surgical complications on HRQoL[10] remained unestimated. Prospective, multi-center, and large-scale studies comparing different treatment modalities are ideal for elucidating the effects of MVD on HRQoL in older adult TN patients. In addition, the SF-36 measures general HRQoL, including functioning factors less affected by TN improvement.[1,17] It may explain why postoperative BNI improvement does not accompany SF-36 component summary scores improvement such as RCS score in the present cohort.

CONCLUSION

Impaired HRQoL in TN patients aged 70 years and older can improve after MVD. Careful management of multiple comorbidities and surgical risks enables MVD to be an appropriate treatment for older adult patients with refractory TN.

Authors' contributions

Wataru Yoshizaki: Investigation, Writing-Original Draft; Yoshiki Fujikawa: Investigation, Writing-Original Draft; Sadaharu Torikoshi: Investigation; Toshiro Katayama: Software, Formal analysis, Data Curation; Koichi Iwasaki: Validation, Supervision; Hiroki Toda: Conceptualization, Methodology, Software, Writing-Original Draft, Writing-Review and Editing, Visualization, Supervision.

Declaration of patient consent

Institutional Review Board (IRB) permission obtained for the study.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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How to cite this article: Yoshizaki W, Fujikawa Y, Torikoshi S, Katayama T, Iwasaki K, Toda H. Effects of microvascular decompression on quality-of-life in trigeminal neuralgia patients aged 70 years and older. Surg Neurol Int 2023;14:41.