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Microvascular Decompression Surgery for Elderly Patients: A Study Based on Proposals from the Joint Committee of the Japan Gerontological Society and the Japan Geriatrics Society

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Abstract

The present study evaluated the indications for microvascular decompression (MVD) in elderly patients based on the new classification of the elderly population proposed by the joint committee of the Japan Gerontological Society and the Japan Geriatrics Society in 2017.
Retrospective analysis of 171 patients with hemifacial spasm (HFS), trigeminal neuralgia (TN), and glossopharyngeal neuralgia (GPN) who underwent MVD in 2018. Patients were divided into three groups based on the proposal: old group, 75–89 years; pre-old group, 65–74 years; and not-old group, 64 years or younger. Preoperative comorbidities were divided into five types and the American Society of Anesthesiologists Physical Status (ASA-PS) was recorded. Outcome of the surgery and neurological complications were evaluated in June 2019.
No decrease in activity of daily living occurred in any patient and surgical results showed no difference among the three groups. Rate of preoperative cardiovascular diseases was higher in both the pre-old and old groups compared with the not-old group ($p < 0.001$ and Cramer V = 0.429). In terms of ASA-PS classification, only ASA-PS I and II were found, and rate of ASA-PS II was higher in the pre-old and old groups compared with the not-old group ($p < 0.001$ and Cramer V = 0.407). Some patients suffered from elevated blood pressure after surgery, but were successfully managed.
In conclusion, MVD for elderly patients can be achieved safely with careful patient selection and perioperative management. Data should be continuously accumulated for the future development of decision-making algorithm for MVD in the elderly.

Keywords: microvascular decompression, elderly patients, hemifacial spasm, trigeminal neuralgia, glossopharyngeal neuralgia

Introduction

A new classification for the elderly population was proposed by a joint committee of the Japan Gerontological Society and the Japan Geriatrics Society in 2017.[1)] Previously, the definition of "old" was age of 65 years or older. The new classification includes the categories of "pre-old" for age 65–74 years, "old" for 75–89 years, and "oldest old or super-old" for 90 years and older. The main reason for this revision is the increased levels of health as well as activities of daily life in the elderly population. The improvements in good general condition among the elderly population imply that treatments in any medical field can be indicated for patients with higher ages. Consequently, more elderly patients wish to undergo neurosurgery including microvascular decompression (MVD). Previously, we documented our treatment experience of trigeminal neuralgia (TN) for elderly patients with 70 years old as the dividing age.[2)] This study expanded the prior study, including all patients who underwent MVD surgery for all pathologies, such as hemifacial spasm (HFS), TN, and glossopharyngeal neuralgia (GPN), dividing the cohort based on the new classification.

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Materials and Methods

Patients

The clinical records of 172 consecutive patients with HFS, TN, and GPN who underwent MVD at our hospital between January and December 2018 were retrospectively reviewed. Patients were divided into three groups: the old group consisting of patients aged 75–89 years, the pre-old group consisting of patients aged 65–74 years, and the not-old group consisting of patients aged 64 years or younger. No patient was aged 90 years or older. Our policy required that MVD should be offered if the patient complained of relevant symptoms and understood the concept of the surgery, and was fit for general anesthesia and postoperative care regardless of age. The study was approved by the hospital ethics committee, with the informed consent of all patients.

Preoperative management

After confirmation of the clinical symptoms, all patients underwent magnetic resonance imaging as well as detailed check-ups of their general condition. Besides the preoperative routine standard studies, a history of comorbidity was obtained and patients were referred to the appropriate physicians for preoperative consultation if necessary. Patients were admitted to the hospital a day before surgery and preoperative physical status was evaluated according to the American Society of Anesthesiologists Physical Status (ASA-PS) classification by the anesthesiologist. Cognitive function was not checked objectively in any elderly patient. Instead, we checked the effects on daily life of the patients' symptom of pain or spasm.

MVD

MVD was performed with the transposition method through the standard retrosigmoid approach. The patient was placed in the lateral park bench position and retrosigmoid craniotomy was completed prior to the microscopic procedure. Decompression was performed through the infrafloccular approach for HFS and GPN, and the supracerebellar approach for TN. Brainstem auditory evoked potentials were monitored routinely during MVD for HFS.[3] All microsurgical procedures in this series were performed by the same surgeon (K.A.)

Postoperative care

All patients were returned to the regular nursing wards and not admitted to the intensive care unit. Ambulation was allowed by the next morning if the clinical condition was stable. Patients were scheduled for discharge from the hospital on postoperative day 8 after removing the surgical staplers. Therefore, the scheduled hospital stay was 10 days, but earlier discharge was allowed for any patient in good condition on request.

Evaluation of surgical outcome and complications

Patients were evaluated in June 2019. If a patient had discontinued hospital visits for any reason, a brief telephone interview was performed. The outcome was divided into three categories: complete relief, partial relief, and no subjective relief. Any neurological deficit after the surgery and persisting at June 2019 was recorded. The method of hearing evaluation was changed during the study period. No formal hearing tests were conducted before July 2018. Instead, hearing function was meticulously checked by finger scratching close to the ears preoperatively and postoperatively, and apparent decreased hearing was followed up by audiography.[3] In contrast, all patients underwent preoperative ear check-up by the otolaryngologist and both preoperative and postoperative audiography from July 2018. Postoperative hearing disturbance of greater than 10 dB was recorded as nerve disorder. Patients with symptoms of lower cranial nerve (CN) palsy (CNs IX and X), such as dysphasia and/or hoarseness, were also referred to the otolaryngologist for evaluation of laryngeal and pharyngeal function. Other complications that were directly related to surgery, such as cerebrospinal fluid (CSF) leakage and cerebrovascular events, were also recorded.

Data collection

The medical records of all patients were reviewed, and data were gathered on the demographics and diagnosis. Preoperative comorbidity was divided into five types: cardiovascular, pulmonary, cerebrovascular, abdominal, and others. Cardiovascular comorbidity included hypertension, hyperlipidemia, history of angina or myocardial infarction, abnormal electrocardiography findings that required further studies ordered by the cardiologist, and other cardiovascular diseases. Pulmonary comorbidity included asthma, chronic obstructive pulmonary disease, current smoking, and others. Cerebrovascular comorbidity included history of transient ischemic attack, minor stroke, and others. Abdominal comorbidity included any chronic abdominal diseases that required regular medication. Others included diseases that required regular medication, such as endocrine diseases including diabetes. CN disorders complicated by surgery were recorded as transient or persistent, and other complications related to surgery including general condition were recorded. Patients who suffered from cerebrovascular events were evaluated with the modified Rankin Scale (mRS).[4] Duration of surgery and length of hospital stay were also determined.

Statistical analysis

All analyses compared the clinical parameters between the three groups. Chi-square tests were used to analyze sex, preoperative cardiovascular diseases, cerebrovascular diseases, abdominal diseases, postoperative disorders of CNs IX and X, and postoperative cerebrovascular events. Fisher's exact probability test was performed for affected side, diagnosis, preoperative pulmonary diseases and other diseases, ASA-PS, efficacy of surgery, postoperative disorders of CNs V, VI, VII, and VIII, and CSF leakage. One-way analysis of variance was used to analyze duration of surgery, and further Games-Howell test was applied to evaluate the significance for each group. The Kruskal–Wallis test was used to analyze length of hospital stay. IBM SPSS Statistics version 23.0 for Microsoft Windows (IBM, Armonk, NY, USA) was used for the analysis and p values of less than 0.05 were interpreted as significant. Data were analyzed for three groups, so if p values were less than 0.05 by chi-square test and Fisher's exact probability test, the Cramer V and adjusted residual were added for independent data differences. Interpretation of Cramer V was as follows: no correlation less than 0.2, mild correlation between 0.2 and 0.4, moderate correlation between 0.4 and 0.7, and strong correlation 0.7–1.0. Absolute value of adjusted residual greater than 1.96 was interpreted as significant.

Results

Data obtained from 171 patients were reviewed because 1 patient was lost to follow-up. The mean follow-up period was 11.3 months (range, 6–17 months). During this study period, in 2018, some surgical candidates were excluded from the waiting list for various reasons. A few overweight patients with inadequately controlled diabetes were declined or delayed regardless of age. A female patient aged over 75 years with HFS was also declined because she did not report problems due to HFS in daily life.

Table 1 summarizes the clinical characteristics of the 171 patients. Diagnosis of HFS and TN in the not-old and pre-old groups suggested significance based on the p value and the adjusted residuals. However, the Cramer V value was low (less than 0.2), which concluded implied no correlation.

Table 2 shows the rate of cardiovascular diseases was higher in both pre-old and old groups compared with the not-old group ($p < 0.001$ and Cramer V 0.429). For abdominal diseases, p value was below 0.05, but the Cramer V value did not show correlation (0.178). For the ASA-PS classification, rates of ASA-PS I and II were remarkably reversed between the not-old group and others ($p < 0.001$ and Cramer V 0.407).

Table 3 indicates the duration of surgery, surgical results, and length of hospital stay. Cerebrovascular events included any minor hemorrhage or ischemia. One pre-old hypertensive patient suffered a minor ischemic complication after surgery. This patient presented with high blood pressure untreated at the clinic visit, so medication had begun prior to admission and blood pressure was almost normal on admission. However, the patient suffered a minor cerebellar infarction postoperatively and blood pressure became uncontrollable shortly after. This patient complained of slight dizziness, but fully recovered to normal life (recorded as mRS 1). The other four patients with cerebrovascular events showed minor hemorrhagic events, but the clinical courses of all patients were uneventful and recorded as mRS 0 at the last follow up. There are four patients in the not-old group who required additional treatment for hypertension after surgery. Two patients in the not-old group had elevated blood pressure postoperatively and a hypertensive patient required increased medication dosage at discharge. A patient normotensive prior to surgery, but with continuously elevated blood pressure after surgery, required medication at discharge.

Discussion

The World Health Organization documents continuous extension of life expectancy in global countries and Japan is one of the top countries with the greatest longevity in the world.[5] The indications for surgical candidates for MVD may differ across countries, but the age of patients who wish to undergo surgical treatment seems to be higher in those with TN than HFS because the pain directly affecting daily living is more hazardous than spasm, and botulinum toxin injection is a major alternative treatment for HFS.[6] On the other hand, some other surgical procedures are available for medically refractory TN, such as radiofrequency rhizotomy, glycerol injection, balloon compression, and radiosurgery.[7–10] Outcomes for elderly patients with TN and HFS have been reported, but the limited population of elderly patients suitable for MVD makes investigation of a large series difficult even in a high volume center.[2,11–21] A report based on the National inpatient sample in the United States published in 2011 and two other systematic review studies included analysis of over 1000 samples to increase the statistical power, but did not achieve any definitive conclusion that MVD is safe for elderly patients.[22–24] Therefore, we believe that more clinical data are desirable.

Table 1 Summary of demographics, diagnosis, and preoperative treatments

	Not-old (≤64 yrs)	Pre-old (65–74 yrs)	Old (75–89 yrs)	p Value	Cramer V
Total number	134	28	9		
Age (yrs)					
Range	25–62	65–74	75–83		
Mean ± SD	49.0 ± 9.7	69.6 ± 2.7	79.4 ± 2.4		
Sex				0.087[a]	–
Female	92 (68.7%)	22 (78.6%)	9 (100%)		
Male	42 (31.3%)	6 (21.4%)	0 (0.0%)		
Side affected				0.301[b]	–
Left	65 (48.5%)	18 (64.3%)	4 (44.4%)		
Right	69 (51.5%)	10 (35.7%)	5 (55.6%)		
Diagnosis				0.038[b]	0.181
HFS	110 (82.1%)**	16 (57.1%)*	6 (66.7%)		
TN	21 (15.7%)*	10 (35.7%)**	3 (33.3%)		
GPN	2 (1.5%)	2 (7.1%)	0 (0.0%)		
TN and GPN	1 (0.7%)	0 (0.0%)	0 (0.0%)		

[a]Chi-square test, [b]Fisher's exact probability test. Asterisk indicates adjusted residual *less than –1.96 and **more than 1.96. GPN: glossopharyngeal neuralgia, HFS: hemifacial spasm, SD: standard deviation, TN: trigeminal neuralgia.

Table 2 Preoperative comorbidity and ASA-PS

	Not-old (≤64 yrs) n = 134	Pre-old (65–74 yrs) n = 28	Old (75–89 yrs) n = 9	p Value	Cramer V
Cardiovascular diseases	35 (26.1%)*	20 (71.4%)**	8 (88.9%)**	0.000[a]	0.429
Pulmonary diseases	3 (2.2%)	1 (3.6%)	1 (11.1%)	0.167[b]	–
Cerebrovascular diseases	1 (0.7%)	0 (0.0%)	0 (0.0%)	0.870[a]	–
Abdominal diseases	6 (4.5%)*	3 (10.7%)	2 (22.2%)**	0.049[a]	0.178
Other diseases	37 (27.6%)	10 (35.7%)	3 (33.3%)	0.722[b]	–
ASA-PS classification				0.000[b]	0.407
I	80 (59.7%)**	4 (14.3%)*	0 (0.0%)*		
II	54 (40.3%)*	24 (85.7%)**	9 (100.0%)**		

[a]Chi-square test, [b]Fisher's exact probability test. Asterisk indicates adjusted residual *less than –1.96 and **more than 1.96. ASA-PS: American Society of Anesthesiologists Physical Status.

This study included 171 cases with limited follow-up periods including managing preoperative and postoperative care. The surgical outcomes in the three groups showed no significant difference. The rates of preoperative cardiovascular comorbidities were significantly higher in the pre-old and old groups, but no adverse effect was found in all groups. Our finding of no inferiority in the pre-old and old groups indicates that MVD surgery is acceptable for elderly patients. Our stable surgical results depended on two factors. First, only patients with ASA-PS I and II were indicated for surgery. Hypertensive patients who had not been treated adequately at the first visit started strict medical control prior to admission. More preoperative comorbidities were recorded in the pre-old and old groups, but were controlled prior to admission. Second, the duration of surgery was significantly shorter in the old group compared with the other two groups. Surgical exposure of the cerebellopontine angle is commonly recognized as easier in the presence of atrophy, and surgery generally proceeds

Table 3 Duration of surgery, surgical outcome, complications, and length of hospital stay

	Not-old (≤64 yrs) n = 134	Pre-old (65–74 yrs) n = 28	Old (75–89 yrs) n = 9	p Value
Duration of surgery (min)				0.000[a]
Mean ± SD	208.0 ± 67.1	208.7 ± 65.2	156.0 ± 28.2*	
Surgical outcome				0.511[b]
Complete relief	111 (82.8%)	22 (78.6%)	6 (66.7%)	
Partial relief	12 (9.0%)	3 (10.7%)	2 (22.2%)	
No relief	11 (8.2%)	3 (10.7%)	1 (11.1%)	
Complication				
Cranial nerve disorder				
V (transient)	1	0	0	0.521[b]
(persistent)	1	0	0	
V (transient)	0	0	0	0.216[b]
(persistent)	0	1	0	
VII (transient)	2	1	0	0.709[b]
(persistent)	2	0	0	
VIII (transient)	2	1	0	0.230[b]
(persistent)	1	1	0	
IX and X (transient)	8	1	0	0.896[c]
(persistent)	1	0	0	
CSF leakage	3	1	0	0.391[b]
Cerebrovascular events	4 (mRS 0 in all cases)	1 (mRS 1)	0	0.855[c]
Length of hospital stay (days)				
Mean ± SD	10.0 ± 3.9	10.9 ± 2.9	9.7 ± 10.0	0.109[d]
Median	10.0	10.0	10.0	

[a]One-way analysis of variance, [b]Fisher's exact probability test, [c]chi-square test, [d] Kruskal–Wallis test. Asterisk indicates significantly shorter than the other two groups by the Games-Howell test. V: trigeminal nerve, VI: abducens nerve, VII: facial nerve, VIII: vestibulocochlear nerve, IX: glossopharyngeal nerve, X: vagus nerve, CSF: cerebrospinal fluid, mRS: modified Rankin Scale, SD: standard deviation.

quickly and uneventfully in elderly patients with a skilled surgeon. This factor was reflected in the shorter duration of surgery and absence of postoperative CN deficits in the old group.

Evaluation of preoperative physical status and cognitive function can pose a challenge in the decision-making process, especially for elderly patients. Elderly patients visiting our clinic to consider MVD surgery may present with slight cognitive function, so MVD may be declined. The necessity for surgery must be estimated in such patients because no clear-cut standard indications have been established. To avoid over-indication for elderly patients who are considering MVD, we always meticulously interview and ask detailed questions about how the symptom affects daily life. Consistency of explanations between the patient and the family can also be helpful for evaluation. Such procedures are particularly important for patients with HFS because the effect of facial spasm may be more difficult to evaluate than degree of pain in an elderly patient.

Age cutoff point in the elderly population is uncertain. The age cutoff for defining the elderly has been reported as 60, 65, 70, and 75 years.[2,11–21] Therefore, systematic reviews based on those studies may lack consistency in defining the elderly population.[22–24] The present study investigated the efficacy and safety of MVD surgery for elderly patients using division of the cohort into three groups instead of the conventional two groups. In fact, only nine patients aged over 75 years (old group) were included in this study, whereas 37 patients were included in the elderly cohort defined as aged 65 years or older (pre-old and old groups). However, we adopted the three groups to assess the meaningfulness of the new proposal from the joint committee in Japan despite of the small population of the old group. The present study suggests similar directions to our previous report,[2] so we believe that the analysis based on the new classification will be important in the future because worldwide longevity is ongoing.

This study has some limitations. First, the follow-up period was short, of only 6–17 months (mean, 11.3 months). The surgical outcome might be modified with a longer follow-up period. However, the major messages from this study include the safety of MVD in elderly patients, which can be evaluated as the rate of complications over a rather shorter postoperative period because major adverse events are often observed immediately after the surgery. One of the major disadvantages of long-term follow-up is that some patients are lost for various reasons, and limited life span is likely, especially for elderly patients. Second, the patient population was still small, even though all pathologies indicated for MVD surgery were included. Therefore, data were carefully analyzed with the aid of a specialist. Third, this study is reported from a high volume center, which is advantageous to maintain stable surgical results. Therefore, our surgical findings may not always apply to low volume centers.

Conclusion

MVD for elderly patients is acceptable if carefully selected. Based on our results, preoperative physical status is a major factor that affects the surgical indication. Shorter duration of surgery in the elderly cohort may have contributed maintaining good surgical results. Increases in worldwide longevity require that data should be continuously accumulated for the future.

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Conflicts of Interest Disclosure

All authors have no conflicts of interest. All authors who are members of The Japan Neurosurgery Society (JNS) have registered online Self-reported COI Disclosure Statement Forms through the website for JNS members.

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