The incidence of typical trigeminal neuralgia (TN) increases with age and neurologists and neurosurgeons frequently observe patients with this disorder at the age of 65 or more. Microvascular decompression (MVD) of the trigeminal root entry zone in posterior cranial fossa is the only etiological therapy for typical TN with the highest efficacy and durability of all treatments. This procedure is associated with possible risks (cerebellar hematoma, cranial nerve injury, stroke, and death) not seen with the alternative ablative procedures. Thus, the safety of MVD in the elderly remains non definitively demonstrated.

**Aims:** This study was conducted to determine whether MVD is a safe and effective treatment in elderly patients with TN in comparison to younger patients.

**Methods:** In this retrospective study, 25 patients older than 65 (mean age 70.1 ± 3.7 years) and 32 aging <65 (mean age 51.1 ± 6.2 years) underwent MVD by key-hole retrosigmoid approach for Type 1 TN (typical) or Type 2a TN (typical chronicized) from November 2011 to November 2016. A 75 y-o patient had Type 2b TN (atypical) versus 3 nonelderly patients were excluded. Elderly and younger groups were compared in relation to outcome and complication data.

**Results:** At a mean follow-up 23.0 ± 5.5 months, 22 old patients (88%) reported an excellent outcome without the necessity of any medication for pain, versus 28 (87.5%) of the younger group. Twenty elderly patients with Type 1 TN were compared with 24 younger patients with Type 1 TN, and no significant difference in outcomes was found (p > 0.05). Five elderly patients with Type 2a TN were compared with 8 younger patients with Type 2a TN, and no significant difference in outcomes was noted (p > 0.05). There was one case of CSF leak and one case of cerebellar hematoma both in the younger cohort. Mortality was zero in both groups.

**Conclusions:** On the basis of our experience and of the international literature, age itself seems not to represent a major contraindication against MVD for TN.

**Keywords:** elderly, microvascular decompression, retrosigmoid approach, trigeminal neuralgia, Tic douloureux


INTRODUCTION

Typical trigeminal neuralgia (TN) is characterized by acute, paroxysmal, recurrent, lancinating, or electric shock-like pain attacks by triggering factors, localized to the innervated area of one or more branches of trigeminal nerve.\(^1\)\(^2\)\(^3\)\(^4\)\(^5\) TN can be subdivided in Type 1, Type 2a and Type 2b.\(^2\)\(^3\)\(^4\) In Type 1, typical TN patients experience a memorable onset of symptoms often described as a “lightning-bolt of pain that came out of nowhere” with acute violent attacks by triggering factors. Type 2a are included those patients who have type 1 symptoms early in the disease course experiencing transition, over time, to a more constant pain (typical chronicized). Type 2b is the atypical TN and has a more insidious onset of dull, boring, constant, aching, or throbbing pain and, probably, a different etiology.\(^2\)\(^3\)\(^4\)

With the increase in the average age of the population, the proportion of elderly patients with TN is gradually increased and this makes us pay more attention to aged patients. Typical Type 1 and 2a TN is due to vascular compression of the trigeminal nerve at the root entry zone (REZ) in the brainstem by the superior cerebellar artery (SCA) or other vessels.\(^1\)\(^5\) For this reason, microvascular decompression (MVD) of the trigeminal REZ in posterior cranial fossa is the only etiological therapy for typical TN, with the highest efficacy and durability of all other available treatments, and represents the first choice for medically refractory TN.\(^1\)\(^9\)

Owing to the risks of posterior fossa surgery, some percutaneous procedures and radiosurgery have been proposed for a majority of elderly patients.\(^10\)\(^13\) The aim of this study was to confirm the efficacy and safety of MVD for typical TN in patients aging >65 and to compare the outcome with a control group of younger patients (<64 y).
**METHODS**

Patients with TN operated on consecutively between November 2011 and November 2016 at the Department of Neurosurgery at San Filippo Neri Hospital, ASL Roma1, Roma, Italy, were studied. A total of 57 patients with typical TN were divided into 2 groups: 25 patients older than 65 years and 32 patients younger than 64 years. According to the International Headache Society, the diagnosis for typical TN was based on the following criteria:

1. Paroxysmal attacks lasting from few second to maximum 2 minutes;
2. Distribution of severe intensity pain along one or more trigeminal divisions;
3. Quality of pain: sudden, burning or stabbing, intense, sharp, superficial;
4. Precipitation from trigger points or by definite daily activities;
5. No symptoms between the attacks
6. Absence of neurological deficits
7. Exclusion of other possible causes of facial pain
8. Response to carbamazepine

Magnetic resonance imaging was performed for all the patients to exclude patients with secondary TN and multiple sclerosis and for searching possible neurovascular conflict with the REZ of trigeminal nerve (Figure 1). Patients who had previous MVD or who were classified as American Society of Anesthesiologists (ASA) grade III or higher were excluded. The operative outcomes are subjectively considered to be excellent (complete relief) if patients became pain-free. The operative outcomes are considered to be good (partial relief) if patients tolerated the pain well with medications or if mild pain not requiring medications still exists. The outcomes are poor in case of minimal or no relief from TN or because of the persistence of neurological deficit (even if not severe).

**Operative Technique**

Under general anesthesia, the patients were operated on in a lateral position. The retrosigmoid craniectomy was approximately 2.5 × 2.5 cm, exposing sigmoid sinus and transverse sinus. Dura mater was opened and cerebrospinal fluid (CSF) was slowly released from arachnoid cisterns to obtain cerebellar hemisphere decompression. By using microneurosurgical technique and instruments, the arachnoid surrounding the fifth nerve was opened sharply. The whole intracisternal length of the trigeminal nerve was exposed from the root entry zone in the brainstem. Conflicting vessels were gently dissected and moved away from the nerve, and pieces of Teflon were inserted to prevent compression again. Small pieces of fibrillary surgical and gel foam were placed around and fibrin glue was applied for fixing the vessel in the new position. The superior petrosal vein and its main branches were protected. The dura was closed accurately and the bone was re-applied with mini plates and miniscrews.

**Statistical Analysis**

Each patient of Group >65 was matched to every patient of the younger Group. After matching, a paired sample t-test was performed. For categorical analysis, a Chi-square test was used to calculate differences in FN outcome and HP rates. Statistical significance was defined as p≤0.05. Data are expressed as means and standard deviations.

**RESULTS**

Table 1 summarizes the results. In detail, the elderly group, the mean age was 70.1 ± 3.7 years (range, 65–84 y). There were 6 men and 19 women. In the younger group, the mean age was 51.1 ± 6.2 years (40–63 y), with 7 men and 25 women. Twenty elderly patients with Type 1 TN were compared with 24 younger patients with Type 1 TN and 5 elderly patients with Type 2a TN were compared with 8 younger patients with Type 2a TN.

The second and third branches of the trigeminal nerve were affected most frequently in both groups. All patients were in ASA grade I or II. The SCA (alone or in association with other vessels) was the dominant conflicting vessel: 19 out of 25 (76%) and 30 out of 32 (93.7%) in the younger group (p<0.05). Other vessels involved

![Figure 1](image-url) Axial 3D FIESTA MRI of a 73-year-old lady with second and third branches left trigeminal neuralgia. The left vertebral artery crosses the REZ of ipsilateral trigeminal nerve
Table 1  Results of MVD for typical TN in patients older and younger than 65 years

<table>
<thead>
<tr>
<th></th>
<th>Older (25 cases)</th>
<th>Younger (32 cases)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age</td>
<td>70.1</td>
<td>51.1</td>
<td></td>
</tr>
<tr>
<td>Male/Female</td>
<td>6/19</td>
<td>7/25</td>
<td></td>
</tr>
<tr>
<td>Type1/Type2a</td>
<td>20/5</td>
<td>24/8</td>
<td></td>
</tr>
<tr>
<td>Trigeminal branches</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V1</td>
<td>12</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>V2</td>
<td>25</td>
<td>27</td>
<td></td>
</tr>
<tr>
<td>V3</td>
<td>23</td>
<td>28</td>
<td></td>
</tr>
<tr>
<td>Offending vessel</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SCA</td>
<td>19</td>
<td>30</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>AICA</td>
<td>5</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>VA</td>
<td>2</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Petrosal vein</td>
<td>0</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Major complications</td>
<td>none</td>
<td>1 CSF leak</td>
<td></td>
</tr>
<tr>
<td>Mortality</td>
<td>None</td>
<td>none</td>
<td></td>
</tr>
<tr>
<td>Follow-up pain control: medications required</td>
<td>3/25</td>
<td>4/32</td>
<td></td>
</tr>
<tr>
<td>Subjective poor result</td>
<td>3/25</td>
<td>5/32</td>
<td></td>
</tr>
</tbody>
</table>

were anterior-inferior cerebellar artery (AICA) in 5 older and 2 younger patients, the vertebral artery in 2 older and 1 younger, and the petrosal vein in 1 young patient.

**Outcome: Complications**

Headaches, nausea, and vomiting were minor and transient complications after surgery equally distributed in both groups, treated with symptomatic medical therapy and disappearing in a few days after surgery. There was one case of CSF leak repaired with medications and one case of small cerebellar hematoma gradually reabsorbed both in the younger cohort. Mortality was zero in both groups.

**Outcome: Pain Control**

At a mean follow-up 23.0 ± 5.5 months, 22 old patients (88%) reported a very good outcome without the necessity of any medication for pain, versus 28 (87.5%) of the younger group. An 84 y.o. lady was lost to follow-up, dying 6 months after surgery for basal ganglia cerebral hemorrhage. A total of 7 patients (12.3%), 3 over 65 and 4 younger, experienced recurrence during the follow-up period. Twenty elderly patients with Type 1 TN were compared with 24 younger patients with Type 1 TN, and no significant difference in outcomes was found (p > 0.05). Five elderly patients with Type 2a TN were compared with 8 younger patients with Type 2a TN, and no significant difference in outcomes was noted (p > 0.05).

**DISCUSSION**

Typical TN is one of the most severe facial pain disturbances. Patients with typical TN experience a severe neuropathic pain condition affecting the face. Pain is severe, debilitating, and interfere with general activity, mood, work, and social relationships and reduce the quality of life. During prolonged attacks, pain can be severe enough to induce inadequate nutrition and hydration or hypertension. More than one-third of employed patients stated that TN adversely affected their working status in terms of reduced hours, disability, or early retirement.

Currently, many kinds of percutaneous surgical modalities are available: thermocoagulation, balloon compression, and glycerol gangliolysis, as well as radiosurgical techniques are recommended to patients with TN resistant to carbamazepine or other similar drugs. All these treatments are performed routinely, being considered less invasive and safer than MVD. However, there is considerable evidence that a neurovascular conflict plays is at the basis of the pathogenesis of typical Type 1 and Type 2a TN. Therefore, MVD represents the only surgical technique that directly treats and solves the etiology of typical TN. It provides the longest-lasting pain relief, with very low rates of facial dysesthesia and corneal reflex dysfunction. In addition, high-resolution MRI precisely delineates the nature and location of neurovascular conflict, allowing to plan the procedure and improving patients’ selection.

Immediately after MVD, patients always experience improvement or relief of pain, up to 95-97%. In addition, this procedure ensures the best long-term outcome. In a series of 1204 patients with a mean follow-up of 6 years, Barker et al reported that 70% had an excellent result, remaining pain-free without medication. In a series of 330 patients with a mean follow-up of 8 years, Sindou et al reported that the long-term percentage of pain-free patients was 80%.

Although the excellent result of MVD for typical TN has been reported in large studies in the literature, still today several neurosurgeons prefer to treat elderly patients with percutaneous procedures or radiosurgery for the presumed generic risks of craniotomy and MVD. However, studies comparing the efficacy of MVD with percutaneous procedures or radiosurgery showed that MVD is superior, especially as regard the long-term outcome. In particular, on comparing MVD and percutaneous radiofrequency gangliolysis, Burchiel et al reported a pain-free rate of 90% and 65% after 1 year, respectively. Tronnier et al compared the long-term outcome of MVD in 225 patients with
that of percutaneous radiofrequency rhizotomy in 206 cases: 2-year pain-free rate was 50% with radiofrequency and 76.4%, with MVD; in the last group, after 20 years the pain was still controlled in 63% of patients.

Radiosurgery represents another noninvasive option for patients with TN, but it achieves the poorest short- and long-term pain relief. After a median follow-up period of about 18 months, Jawahar et al reported that only 42.3% of patients treated with radiosurgery were pain-free. In a series of 44 patients older than 70 years, Javadpour et al reported that MVD could be performed in elderly patients without higher morbidity and mortality in comparison to younger patients. Several studies confirmed that there is no significant difference regarding with short- and long-term pain relief between the elderly and younger patients and that the microsurgical findings do not differ among the two groups. SCA alone, or in combination with AICA or a vein, is the most frequent operative finding independently to the age of the patient. The prevalence of SCA in the younger patients of our series (93.7% versus 76% of older patients: \( p<0.05 \)) seems not to have a clear explanation.

These findings are in line with our observations. In our study, 88% of typical TN patients older than 65 and 87.5% of younger, respectively, referred an immediate pain relief after MVD. After a mean follow-up period of 22 months, the percentage of pain control remained the same in both groups. Moreover, there is no evidence demonstrating that age itself is a predictor of adverse outcome and severe complications. Co-morbidities, including hypertension, diabetes, and cardiovascular disease were found in several patients, especially in those older than 65. These associated diseases require attention and have to be treated appropriately.

There were no deaths or life-threatening morbidities in our series. Transient headaches, nausea, and vomiting were the most frequent side effects, equally distributed in the two groups of age. Other complications could include hearing loss, trigeminal hyperesthesia, wound infection, cerebellar infarct/hematoma, CSF leak, and deep venous thrombosis, independent to age. On the contrary, the atrophy of the cerebellum and the broadening of cisterns in aged patients give more space, and both exposure and exploration of trigeminal nerve REZ may be easier in these patients. These factors reduce the possible injuries by retraction of the cerebellar hemisphere and cranial nerves. However, in old patients, cerebral arteries and veins are more fragile, and the microsurgical manipulation should be extremely gentle to avoid any damage to the small perforators feeding the brain stem. The slow suction of CSF slowly and cutting of arachnoidal membranes facilitate the retraction of cerebellar hemisphere and avoid the rupture of the superior petrosal veins and the bridging veins. The injury could cause severe morbidities and deaths in the procedure of MVD to the main branches of the superior petrosal veins: preserving the venous system has been underlined as fundamental key point by many authors.

It is necessary to balance the efficacy and side effects of MVD in elderly patients. In our series, we observed neither mortality nor life-threatening morbidities. In a series of 1590 patients treated with MVD, Kalkanis et al reported a mortality rate of 0.3%, very close to 0.2% rate summarized by Sweet in a series of 8000 patients who underwent percutaneous ablative procedures. Moreover, mortality and morbidity rates of MVD seem to be independent of the age of patient itself, but are lower in high-volume centers. In fact, MVD requires sufficient experience and training for ensuring the expected results.

**CONCLUSIONS**

MVD is an effective surgical option for elderly patients with typical TN refractory to medical therapy and can be performed with low rate of complications. It directly treats the presumed etiology and can achieve the best immediate and long-term pain relief. Patients older than 65 with typical TN should have the chance to select MVD as long as they are considered eligible for general anesthesia. The major criterion influencing the selection of treatment must be general conditions and not age itself.

**DISCLOSURE**

The authors of this manuscript have no financial interest in the subject or technical devices under discussion.

**REFERENCES**


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