Clinical Neurology and Neurosurgery 122 (2014) 23–28

Contents lists available at ScienceDirect

Clinical Neurology and Neurosurgery

journal homepage: www.elsevier.com/locate/clineuro

Operative management of patients with radiosurgery-related trigeminal neuralgia: Analysis of the surgical morbidity and pain outcome

Gerganov Venelin M.[1], Giordano Mario*, Erck Elolf[2], Almarzooq Osamah[3], Samii Amir[4], Samii Madjid[5]

International Neuroscience Institute, Rudolf Pichlmayr Str. 4, Hannover 30625, Germany

ARTICLE INFO

Article history:
Received 9 November 2013
Received in revised form 2 March 2014
Accepted 13 April 2014
Available online 22 April 2014

Keywords:
Trigeminal neuralgia
Radiosurgery
Gamma knife
Cerebellopontine angle
Vestibular schwannoma

ABSTRACT

Object: Trigeminal neuralgia (TGN) occurring after radiosurgical treatment of cerebellopontine or petroclival tumors may be very difficult to control. Our aim was to determine the efficacy of neurosurgical treatment in regards to pain control and to evaluate the procedure-related complication and morbidity rates.

Methods: Retrospective study of a series of operated patients with radiosurgery-induced TGN. The primary goal of the surgery was to inspect and decompress the trigeminal nerve; the second goal was to remove the tumor remnant completely, if safely feasible. The main outcome measures were pain control, time to onset of pain relief and its duration, occurrence of new neurological deficits or worsening of the existing one and completeness of tumor removal.

Results: The four patients met the inclusion criteria: 2 with vestibular schwannomas, 1 with petroclival meningioma and 1 with an epidermoid. TGN occurred 12–60 months after radiosurgery (mean 39 months). At presentation the pain attacks occurred multiple timesdaily and lasted from a few seconds to 2–3 min. The Complete tumor removal via the retrosigmoid approach was achieved in all cases. There were no major operative complications or persistent morbidity, besides one patient with trochlear nerve palsy. All patients experienced immediate pain relief after surgery. At follow-up (median duration – 42.5 months) the three patients reported complete pain resolution. One patient had occasional slight pain but did not need any medications.

Conclusion: Surgery is safe and effective treatment option of patients with intractable radiosurgery-induced TGN. It leads to excellent pain control and is curative in regards to the neoplastic disease.

1. Introduction

Radiosurgery is widely used as an alternative to microsurgery in case of small cerebellopontine angle (CP angle) or petroclival tumors or as an adjunctive treatment following incomplete tumor removal. The reduction of prescription doses to 12–15 Gy led to decline in the posttreatment morbidity rates [1–5]. Trigeminal neuropathy – facial paresthesias or numbness – is by far the most common non-audiofacial radiosurgery-related neuropathy and develops in 2–8% of the patients [1,3,4,6–8]. Trigeminal neuralgia (TGN) as a complication of radiosurgical treatment has been occasionally reported. Putative pathogenetic mechanisms are direct radiation-induced injury of the trigeminal fibers in the brainstem or of the compressed by the tumor trigeminal nerve root. Although the trigeminal pain is usually transient [9], in some patients, it may persist and is extremely difficult to control. The systematic analyses of the management options and outcome of treatment of intractable radiosurgery-induced trigeminal neuralgia have never been published in the literature. Some patients have been treated with medications, some underwent second radiosurgery, while in others the tumor remnant was removed via the translabyrinthine approach [1,18,24]. The success rate of these procedures in terms of pain control, however, has not been reported.

* Corresponding author. Tel.: +49 511 27092865; fax: +49 511 27092706.
E-mail addresses: gerganov@ini-hannover.de (V.M. Gerganov), mario.giordano@alice.it (M. Giordano), Elolfelolf@ini-hannover.de (E. Elolf), Osamahalmarzooq@ini-hannover.de (A. Osamah), Amirasamii@ini-hannover.de (S. Amir), Madjidsamii@ini-hannover.de (S. Madjid).
[1] Tel.: +49 511 270 92 835.
[2] Tel.: +49 511 270 92 306.
[3] Tel.: +49 511 270 92 809.
[4] Tel.: +49 511 270 92 400.
[5] Tel.: +49 511 270 92 840.

http://dx.doi.org/10.1016/j.clineuro.2014.04.016
0303-8467/

We evaluated retrospectively, our experience with the surgical management of the patients with CP angle or petroclival tumors with intractable radiosurgery-induced TGN. Our goal was to determine the efficacy of neurosurgical treatment in regards to pain control and to evaluate the procedure-related complication rates.

2. Patients and methods

2.1. Patient population

All the patients operated at our institution for a CP angle or petroclival tumor following previous radiosurgical treatment were reviewed retrospectively. Their documentation, pre- and postoperative neuroradiological data, operative reports, operative videos and follow-up data were collected in a database. In particular the following information was recorded: patients age, sex, initial diagnosis and treatment; type of radiosurgery; neurological status before and after radiosurgery and at presentation; tumor type, size and location; characteristics of the trigeminal pain, previous pain management; outcome of surgery and neurological status at discharge and follow-up.

2.2. Inclusion criteria

Included in the current study were patients with intractable TGN, which occurred after the radiosurgical treatment. TGN was defined as paroxysmal lancinating unilateral pain in the distribution of the trigeminal nerve lasting from several seconds to minutes. Possible trigger points or trigger actions were recorded. The pain intensity was evaluated using the Barrow Neurological Institute pain intensity score [10].

2.3. Indications for surgery and surgical procedure

Indications for the current surgery were inadequate pain relief with the medical therapy (at least 2 different medications, including high dose of carbamazepine therapy for at least 12 months) and/or failure of previous invasive procedures. The primary goal of surgery was to inspect and decompress the trigeminal nerve from any possible tumor- or scar-induced compression. Second goal was to remove the tumor remnant completely, if safely feasible. All patients were operated in the semi-sitting position via the retrosigmoid approach. Details of the operative technique have been presented earlier [11,12].

2.4. Outcome and follow-up

The main outcome measures were pain control, time to onset of the pain relief and its duration, occurrence of new neurological deficits or worsening of the existing one, and completeness of tumor removal. The modified Barrow Neurological Institute pain intensity score was utilized to evaluate the pain relief [13]. The facial nerve function was categorized using the House–Brackmann (HB) scale [14].

Long-term follow-up was established either by direct examination of the patients or by telephone interview. The following two issues were inquired: (1) type, intensity and location of pain after surgery; (2) need and type of additional medical therapy.

3. Results

Four patients met the inclusion criteria of the study (Tables 1 and 2). Their mean age was 46.5 years, ranging from 38 to 55 years. Two of them had vestibular schwannomas, one had petroclival meningioma and one – an extensive CP angle epidermoid. Three patients (N: 1, 2 and 4) have been operated initially at another hospital: partial tumor removal was performed, followed by gamma knife treatment because of further growth of the tumor remnant. The trigeminal pain occurred 12–60 months after radiosurgery (mean 39 months): paroxysmal lancinating pain in the distribution of the ipsilateral trigeminal nerve. At presentation the pain attacks occurred multiple times each day and lasted from a few seconds to 2–3 min. Trigger points, however, were not identified. In 3 patients the pain intensity score was V/V (severe pain or no pain relief) and in 1 was IV/V (some pain, not adequately controlled with medications). All patients have been treated unsuccessfully with various pain medications. In 2 of them radiofrequency thermocoagulation of the trigeminal ganglion has been also performed: it had no effect on the pain but caused trigeminal sensory changes (V2 in Patient N:1 and V2, 3 in Patient N:4).

3.1. Neurological outcome

The outcome of surgery is presented in Table 2. The Complete tumor removal could be achieved in all cases. After surgery one patient (Patient N:3) had a trochlear nerve dysfunction. The anatomical integrity of the facial nerve was preserved in all patients with intact facial nerve function prior to surgery. Patient N:4 presented with HB Grade 4/6 facial nerve palsy. His facial nerve at surgery was found to be atrophic and responded poorly to electrostimulation. It was therefore excised and reconstructed primarily in the CP angle with an interpositional sural nerve graft. The follow-up of this patient is six months. All other patients at follow-up had excellent facial nerve function: HB Grade I in 2 and Grade II in 1 of them (the patient had a HB Grade II facial function prior to surgery). CSF leak occurred in the two patients and were managed successfully with lumbar drainage for 7 days.

3.2. Intraoperative findings

In all the patients the tumor remnant caused compression of the trigeminal nerve and was strongly attached to its surface. The thickening of the arachnoidea around the trigeminal nerve was a further universal finding. The vascular compression of the nerve, however, has never been found. In Patient N:4 the whole nerve was

Table 1
General patient's characteristics.

Patient characteristics	Number
Total number of patients	4
Age (months)	• Mean: 46.5 • Range: 38–55
Male	4
Female	0
Duration of symptoms (months)	• Mean: 39 • Range: 12–60
Pain distribution	V1–2:1 V2–3:1 V1–3:1 V3:1
Previous pain treatment	Medications:4 Thermocoagulation:2
Pain intensity score (BNI scale)	IV/V (some pain, not adequately controlled with medications:1 V/V (severe pain or no pain relief):3
Pain relief (modified BNI scale)	I/V (no pain, off medications):2 II/V (occasional pain, off medications):2