Brain and Spine 2 (2022) 100848

Contents lists available at ScienceDirect

Brain and Spine

journal homepage: www.journals.elsevier.com/brain-and-spine

# Macrovascular decompression of a dolichoectatic vertebral artery via Kawase approach in a patient suffering from trigeminal neuralgia – A case report

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ARTICLE INFO

*Keywords:*
Trigeminal neuralgia
Kawase approach
Vertebrobasilar dolichoectasia
Vertebral artery

ABSTRACT

*Introduction:* Secondary trigeminal neuralgia due to vertebrobasilar dolichoectasia is a rare entity. Surgical therapy via pterional craniotomy approach and anterior petrosectomy has already been described in literature. We present an 81-year female patient suffering from left sided trigeminal neuralgia due to vertebrobasilar dolichoectasia.
*Research question:* We show in this case report a macrovascular decompression of a dolichoectatic vertebral artery via Kawase approach.
*Material and methods:* Successful decompression under continuous intraoperative neuromonitoring via pure Kawase approach and ventro-lateral transposition of a dolichoectatic vertebral artery through a polyester-titanium sling was achieved.
*Results:* Postoperative the patient described an immediate improvement of the trigeminal neuralgia symptoms. At the two-month postoperative follow-up the patient remained trigeminal neuralgia painless free and suffered from a regredient facial nerve palsy.
*Discussion and conclusion:* We report for the first time a successful macrovascular decompression of a dolichoectatic vertebral artery via Kawase approach under continuous intraoperative neuromonitoring. In-contrast to traditional suboccipital retrosigmoidal approach our strategy obtains sufficient working space and angles. Thus, adequate transposition of the dolichoectatic vessel could be achieved.

## 1. Introduction

Patients with vertebrobasilar dolichoectasia (VBD) suffer from dilated and elongated vertebral and basilar arteries (Arrese and Sarabia, 2016; Ince et al., 1998). Trigeminal neuralgia (TN) due to compression by these altered arteries is rare ranging from 2 to 7.7% of described cases (Apra et al., 2017; Noma et al., 2009; Park et al., 2012). As targeting the pathology via classic retrosigmoidal approach is not providing optimal working conditions, decompression via pterional craniotomy and anterior petrosectomy has been described in literature (Yoon et al., 2019). Our report shows for the first time a macrovascular decompression via pure Kawase (Kawase et al., 1985, 1991) approach.

## 2. Clinical presentation

We present the case of an 81-year-old female patient suffering from left-sided typical trigeminal neuralgia symptoms in the third branch of the trigeminal nerve. In detail, the patient described pain attacks, triggered by chewing, brushing teeth, speaking and cold stimuli. Initial pain improvement was achieved with carbamazepine therapy. For several months symptoms aggravated significantly. Thus, the patient decided for a surgical therapy after a detailed information about the procedure and alternatives. Due to the elongated basilar artery leading to brainstem compression, the patient has been wheelchair-bound for two years with incomplete motoric paraplegic symptoms.

Preoperative radiological imaging of the brain is demonstrated in Fig. 1 and is showing a VBD with a nerve-vessel conflict on the left side. As surgical approach a pure anterior petrosectomy, according to Kawase, was chosen. In contrast to the typical retrosigmoidal approach, we therefore expected a far better working angle for the transposition of the dolichoectatic arteries. Operation was performed under permanent intraoperative neuromonitoring of somatosensory evoked (SEPs) and

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https://doi.org/10.1016/j.bas.2021.100848
Received 18 September 2021; Received in revised form 21 November 2021; Accepted 1 December 2021
Available online 6 December 2021

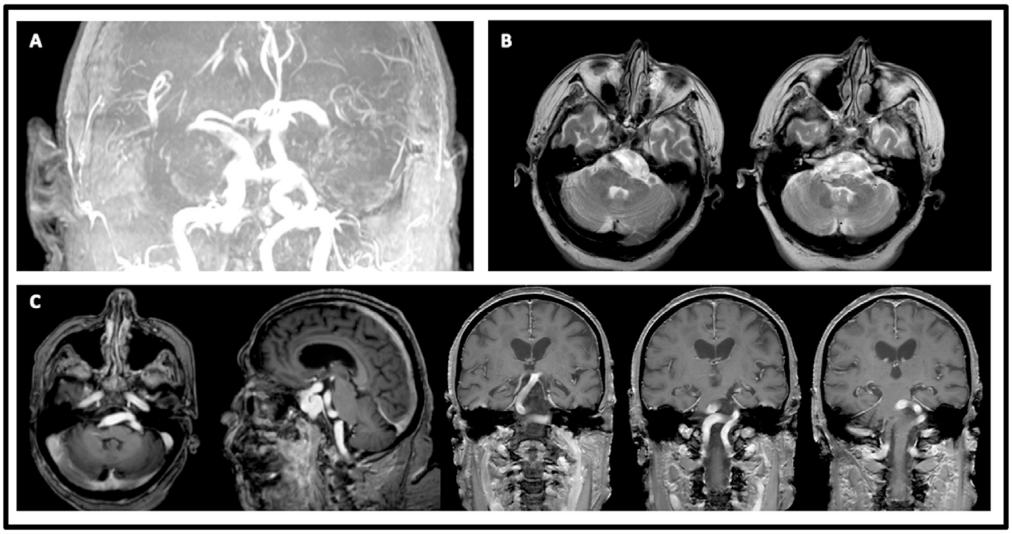


**Fig. 1.** Preoperative imaging showing the vertebrobasilar dolichoectasia with a nerve-vessel conflict on the left side. A: Time-of-flight MRI scan; B: T2 weighted MRI scans; C: T1 contrast enhanced MRI scans.

motor evoked potentials (MEPs). Furthermore, the left trigeminal and left facial nerve were monitored continuously.

The surgical procedure is demonstrated sequentially in video 1 through an intraoperative microscopic view.

In detail, after non-linear skin incision and craniotomy, foramen spinosum was in view and arteria meningea media was coagulated. Temporal lobe was medialized and greater superficial petrosal nerve, arcuate eminence and petrous ridge were designated. Petrous apex was identified and an anterior petrosectomy was performed using a 3 mm diamond burr till clivus and dura of the posterior fossa were in view. Dura was opened arc shaped. Following situs was subtemporal-intradural prepared until cisterna ambiens could be opened, leading to a CSF drainage in the manner of a ventriculocisternotomy. Afterwards neurolysis of the left trochlear nerve and incision of the tentorium behind the trochlear nerve was performed. Subsequently the dura was also incised. Incisions met in the superior petrosal sinus that was coagulated and transected. Following the left trigeminal nerve was in view. Moreover, a prominent vessel was visible that compressed and displaced the trigeminal and the trochlear nerve laterally. The exposure was extended dorsally to identify the nerve exit zone of the trigeminal nerve from the brainstem. The prominent vessel was further exposed and could be determined as ipsilateral vertebral artery (VA), that was pushed far cranially. Following VA was further mobilized and displaced ventrolateral. For transposition a polyester-titanium sling (Medtronic, Translace™) was used, that was placed around the artery. *In situ* location of the sling was tethered through an aneurysm clip in the area of the clival dura. Transposition of the VA is summarized in Fig. 2.

Finally, a Teflon sponge was inserted between the root entry zone of the trigeminal nerve and the ventro-lateral displaced VA to relieve any further vessel-nerval conflict. This is shown in Fig. 3.

Intraoperative monitoring did not show any pathological conditions concerning MEPs, SEPs and affected cranial nerves. CT scans of the first postoperative day are demonstrated in Fig. 4 and show a satisfactory postoperative result.

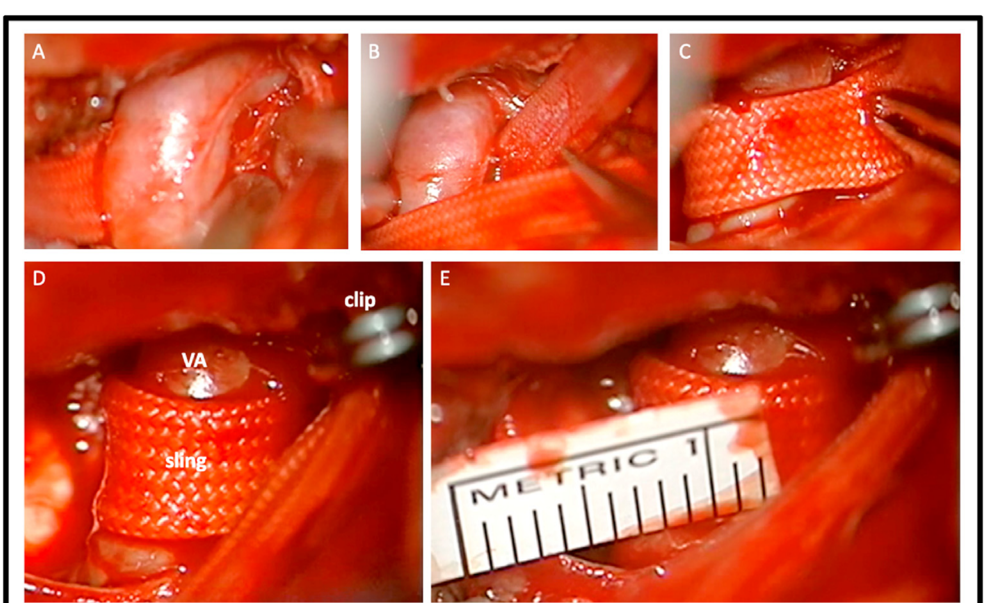


**Fig. 2.** Intraoperative transposition of the VA. A–C: Chronological sequential view on the process of sling placement around the VA; D: In-situ situation clip assisted tethering in the area of the clival dura; E: Intraoperative metric measurement of the VA.

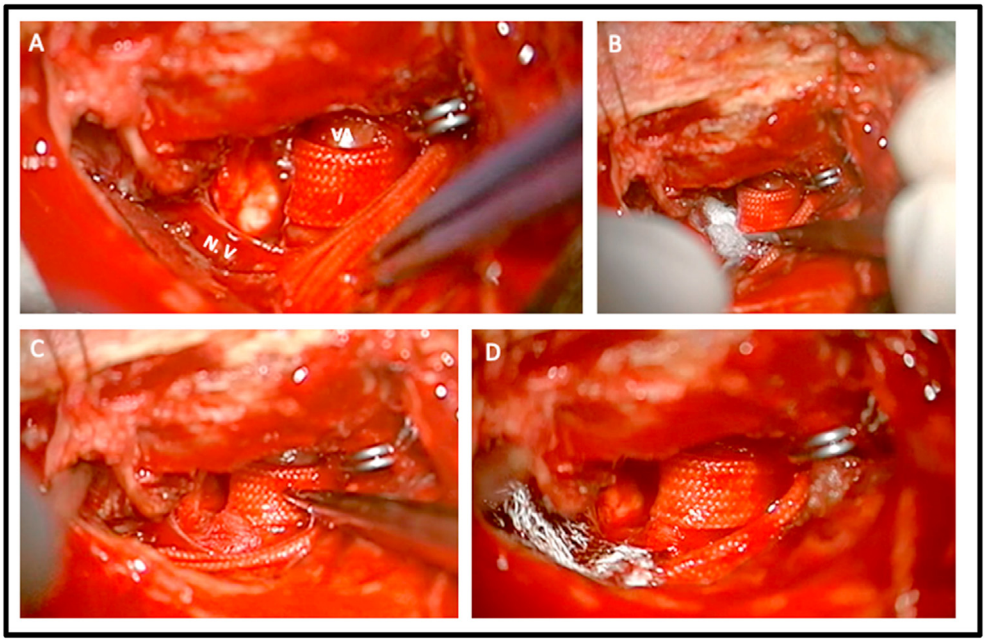


**Fig. 3.** Insertion of Teflon between VA and root entry zone of trigeminal nerve. A: In-situ situation after intraoperative transposition of the VA. Trigeminal nerve (N. V) is visible; B + C: Insertion of Teflon; D: Final intraoperative view.

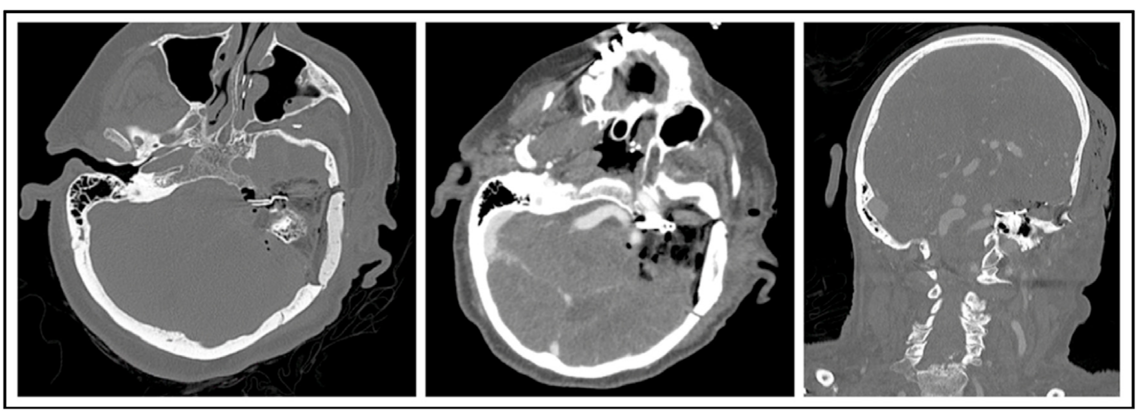

**Fig. 4.** Postoperative CT and CT-angiographic imaging.

Postoperative the patient described an immediate improvement of the TN symptoms. The patient developed left facial nerve palsy and a hyperdensity in the cerebellum according to the region of left PICA was described. At the two-month postoperative follow-up the patient remained TN painless free with a regredient facial nerve palsy ° IV according to House-Brackman.

## Informed consent

We obtained informed consent for the use of photos and video material from the patient.

## Discussion

TN is characterized by brief paroxysmal, electric shock like pain in one or more divisions of the trigeminal nerve (Maarbjerg et al., 2017). For TN caused by nerval-vascular conflicts incidence rates up to 5 for 100.000 people per year are described (Apra et al., 2017; Sindou et al., 2009). Most-common trigeminal compression is described by superior cerebellar arteries (75%) (Apra et al., 2017; Barker et al., 1996). Cases of TN secondary to compression by VBA are rare with about 2–7.7% (Apra et al., 2017; Noma et al., 2009; Park et al., 2012; Ma et al., 2013).

First line therapy is pharmacological treatment with sodium channel blockers (Cruccu et al., 2008). In medically refractory patients surgical treatment or gamma-knife therapy can be considered (Vanaclocha et al., 2016). Microvascular decompressions performed via retrosigmoidal approach, that has been first described by Janetta in 1967 (Jannetta, 1967), are reliable neurosurgical procedures with few complications (Sekula et al., 2008) and immediately postoperative pain relieve up to 90% (Sindou et al., 2009; Lovely and Jannetta, 1997; Bendtsen et al., 2019). In contrast, macrovascular decompressions involving dolichoectatic vertebrobasilar arteries are technical more challenging due to the prominent size and lowered elasticity of the targeted vessels. Leading to higher described complication and morbidity rates up to 50% (Arrese and Sarabia, 2016; Ince et al., 1998; Apra et al., 2017; Chai et al., 2020; El-Ghandour, 2010; Miyazaki et al., 1987).

Neurosurgical treatment of secondary TN due to VBD is described via traditional retrosigmoidal targeting, a modified presigmoid-transtentorial-petrosal approach and a pterional craniotomy followed by anterior petrosectomy (Yoon et al., 2019; El-Ghandour, 2010; Linskey et al., 1994). To obtain sufficient working space and angles and to reach a sufficient view on the root of the trigeminal nerve in the presented case, we decided to use a pure Kawase approach (Kawase, 2011; Aziz et al., 1999) to treat the targeted dolichoectatic vertebral artery. Due to the prominent size of the vessel we decided to apply a polyester-titanium sling in combination with a clip for the transposition of the artery, followed by the insertion of a Teflon sponge as described in literature (Yoon et al., 2019; Choudhri et al., 2017).

Macrovascular compression was successful and continuous performed intraoperative monitoring did not show any pathological conditions concerning MEPs, SEPs and affected cranial nerves. The patient was postoperative immediately pain free and the facial nerve palsy was under slight regression at the two-month follow up. This underlines that our chosen strategy was suitable. Nevertheless, we want to point that Kawase approach has a not negligible complication profile (Volovici et al., 2020). We therefore recommend the described rare macrovascular decompression with performance of intraoperative monitoring in specialized medical centers after detailed information of the patient. As operative course was undisturbed with normal intraoperative monitoring conditions, we cannot specifically determine in which operation step the facial nerve palsy was induced. This complication warns us that transposition of a dolichoectatic vertebral or basilar artery might have distant effects that cannot necessarily visualized through the targeted Kawase approach.

## Conclusion

We report for the first time a successful macrovascular decompression of a dolichoectatic vertebral artery via pure Kawase approach under continuous intraoperative neuromonitoring. In-contrast to traditional suboccipital retrosigmoidal approach our strategy obtains sufficient working space and angles. Thus, adequate transposition of the dolichoectatic vessel could be achieved.

## Declaration of competing interest

The authors declare that there is no conflict of interest.

## Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.bas.2021.100848.

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