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Original Research

Clinical analysis and surgical treatment of trigeminal neuralgia caused by vertebrobasilar dolichoectasia: A retrospective study

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HIGHLIGHTS

- The TN mainly occurs in older male patients with hypertension and stoke history.
- All cases with TN caused by VBD were pain-free after MVD and no recurs.
- Simple MVD (or with SPPR) is effective and enough to deal with TN caused by VBD.

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ABSTRACT

Background: Trigeminal neuralgia (TN) caused by vertebrobasilar dolichoectasia (VBD) is rare and needs further exploration. The purpose of this study is to investigate the clinical features and surgical treatment of TN caused by VBD.

Methods: 15 patients with TN caused by VBD were included in our study. The patient data regarding clinical characteristics, neuroimaging presentations, intraoperative findings and treatment outcomes were analyzed retrospectively. Moreover, the previous relevant literature was reviewed simultaneously. Simple MVD was performed in 13 cases and MVD plus trigeminal nerve selective partial posterior rhizotomy (SPPR) was conducted in 2 patients.

Results: Of all patients, 7 cases were female and 8 were male. The average age at operation was 60.8 years old (range, 35yrs–75yrs). 13 patients suffered from hypertension and 7 had a history of stoke. The extended and ectatic vetebrobasilar artery (VBA) was preliminarily identified in preoperative imaging presentations and finally confirmed during surgical procedure. The facial neuralgia disappeared immediately after surgery in all patients. All patients were relieved of pain (BNI score I) with an average of 29.8 months follow-up.

Conclusions: Our results suggest that simple MVD is effective for TN caused by VBD. MVD plus SPPR can be cautiously performed if patient has advanced age and is susceptible to numbness.

1. Introduction

Trigeminal neuralgia (TN) is a symptom composed of paroxysms of facial pain usually confined to the innervation of trigeminal nerve. Vertebrobasilar dolichoectasia (VBD) is a rare disease characterized by evident ectatic, prolongated, and tortuous vertebrobasilar arteries, initially named by Smoker [1–3]. VBD is also known as vertebrobasilar ectasia (VBE) or ectatic vertebrobasilar artery complex in the literature [4,5]. The incidence of TN due to VBD is rare, accounting for about 2%–7.7% of TN [1,4,6–9].

Various complex surgical techniques have been reported in managing TN caused by VBD [4,5,10]. The surgical outcome for

Abbreviations list: AICA, anterior inferior cerebellar artery; BA, basilar artery; BNI, the Barrow Neurological Institute; CTA, computed tomography angiography; DSA, digital subtraction angiography; FHE, facial hyperalgesia; HFS, hemifacial spasm; ITN, idiopathic trigeminal neuralgia; MRA, magnetic resonance angiography; MVD, microvascular decompression; RFT, radiofrequency thermocoagulation; SCA, superior cerebellar artery; SPPR, selective partial posterior rhizotomy; TN, trigeminal neuralgia; VA, vertebral artery; VBA, vetebrobasilar artery; VBD, vertebrobasilar dolichoectasia; VBE, vertebrobasilar ectasia.

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patients with TN caused by VBD has been reported to be relatively poor [10–12]. This study analyzes the clinical features and surgical outcomes of TN caused by VBD, and estimates the effectiveness of MVD in managing this disease. Previous literature which reported a group of patients (≧10) with TN due to VBD was summarized and discussed. The pathogenesis of VBD and surgical strategies regarding decompression of the trigeminal nerve is detailed with analysis of these cases as well.

2. Materials and methods

The clinical data were collected from 402 patients with idiopathic trigeminal neuralgia (ITN) treated in our department from January, 2010 to December, 2016 and 15 patients were identified as VBD. The patient data regarding clinical characteristics, neuroimaging presentations, intraoperative findings and treatment outcomes of the fifteen cases were analyzed retrospectively. This work has been reported in line with the PROCESS criteria [30].

Of all patients, 7 cases were female and 8 cases were male. Age at operation ranged from 35 to 75 years old with an average age of 60.8 years old. The average duration from presenting symptoms to operation was about 2.9 years (range, 6 months to 8 years). Thirteen patients had a history of hypertension (range, 6 months to 40 years), 7 patients with brain infarction (6 patients with multiple lacunar infarction and 1 patient with lacuna infarction of right basal ganglion), 1 patient with brainstem hemorrhage. Three cases were accompanied with facial hyperalgesia (FHE). No cases were accompanied with facial hypoesthesia or ipsolateral hemifacial spasm (HFS). Therapy before admission included oral drugs (Carbamazepinein in 10 cases, Oxcarbazepin in 3 cases), acupuncture therapy in 1 cases and percutaneous radiofrequency thermocoagulation (RFT) once in 1 case. The clinical summary of these 15 patients was presented in Table 1.

All cases received three dimensional time-of-flight magnetic resonance angiography (3D -TOF-MRA) preoperatively. Computed tomography angiography (CTA) were performed in 9 patients.

All patients underwent microsurgical exploration via a suboccipital retromastoid craniectomy. The compression of Vth nerve by the ectatic and tortuous VBA in varying degree was demonstrated in the videos of surgical procedures. MVD of the compressed nerves was performed in 13 cases. Two patients with advanced age and obvious compressed nerve root had MVD plus trigeminal nerve selective partial posterior rhizotomy (SPPR). After the arachnoids around the nerves and vessels thoroughly opened, small thin pieces of Teflon were fashioned into the interstices between the nerve and vessel, namely, the neurovascular conflict areas.

According to Smoker et al., the vertebrobasilar system can be considered over-extension if the basilar artery (BA) lies lateral to the margin of the clivus or dorsum sellae or if it bifurcates above the plane of the suprasellar cistern and ectasia can be diagnosed if the BA has a diameter greater than 4.5 mm [2]. Reference to the MRA standards raised by Ubogu, the length of basilar artery greater than 29.5 mm or the vertical distance from the connection of the basilar artery starting point and a bifurcation point greater than 10 mm is defined as extension. For vertebral arteries, if the length is greater than 23.5 mm, or at any point the vertical distance from the connection of the skull entry point and the basilar artery starting point is greater than 10 mm, it is considered extension [13,14].

According to Szapiro's classification, relationship between corresponding vessels and trigeminal nerve roots is divided into three levels: grade I, abuts against the nerve roots without obvious signs of compression; grade II, nerve roots were obviously compressed with or without shift; grade III, deformation or impression induced by compressed nerve root [15]. Outcome was evaluated by the Barrow Neurological Institute (BNI) pain intensity score, namely, I, no pain; II, occasional pain, not requiring medication; III, some pain, controlled with medication; IV, some pain, not controlled with medication; V, severe pain or no pain relief.

3. Results

The 15 cases of TN caused by VBD accounted for about 3.7% of the whole ITN patients at the same period. The neuralgia was left sided in 6 patients and right sided in 9. Twenty-two trigeminal divisions were affected in 15 patients. The first branch of trigeminal nerve was offended in 4 patients, the second branch in 12 patients and the third in 6 patients. The patients who had a history of hypertension accounted for 86.7% and those who had a history of stroke accounted for 46.7%.

The extended and ectatic vetebrobasilar artery was found in the ipsilateral side of the neuralgia in all patients from 3D-ToF-MRA. The affected trigeminal nerve root became thin, dislocated and even deformed compared with the contralateral one (Figs. 1 and 2).

Table 1
Clinical summary of 12 cases of TN caused by VBD.

Case No.	Age	Sex	History of TN	Affected side and branch	Other symptoms	History of HT	Previous history	Prehospital therapy methods	Major Offending vessels	Therapy methods	Szapiro's Classification	Follow-up times(m)	Outcome (BNI)
1	35yrs	F	8 yrs	R(2nd,3rd)	N	14 yrs	N	CBZ	VA	MVD	grade II	25 m	I
2	61yrs	M	2yrs	R(2nd)	N	N	gall-stone	CBZ	VA	MVD	grade II	23 m	I
3	71yrs	F	1yrs	L(2nd)	N	N	N	CBZ	BA	MVD	grade III	16 m	I
4	59yrs	F	1yrs	R(2nd,3rd)	N	21yrs	brainstem hemorrhage	CBZ	VA	MVD	grade II	17 m	I
5	63yrs	F	1yrs	R(1st,2nd,3rd)	N	3yrs	N	OXC	BA	MVD	grade I	16 m	I
6	71yrs	M	3yrs	L(2nd)	N	40yrs	multiple lacunar infarction, abdominal aortic aneurysm	CBZ	BA	MVD	grade II	40 m	I
7	53yrs	M	1yrs	L(1st)	N	20yrs	multiple lacunar infarction	–	VA	MVD	grade III	42 m	I
8	44yrs	M	4yrs	L(2nd)	FHE	8yrs	multiple lacunar infarction	RFT	BA	MVD	gradeII	48 m	I
9	60yrs	F	2yrs	L(2nd)	N	5yrs	diabetes	OXC	BA	MVD	grade II	37 m	I
10	72yrs	M	6 m	R(3rd)	FHE	6 m	multiple lacunar infarction	CBZ	VA	MVD + SPPR	grade II	37 m	I
11	75yrs	M	1yrs	R(2nd)	FHE	30yrs	lacuna infarction of right basal ganglion; coronary heart disease	OXC	VA	MVD + SPPR	grade II	49 m	I
12	62yrs	F	2yrs	R(1st,3rd)	N	10yrs	multiple lacunar infarction	CBZ	BA	MVD	grade II	61 m	I
13	59yrs	M	3yrs	R(2nd)	N	5yrs	N	CBZ	VA	MVD	grade II	16 m	I
14	65yrs	F	5yrs	R(2nd,3rd)	N	10yrs	N	CBZ	VA	MVD	grade II	13 m	I
15	63yrs	M	3yrs	L(1st,2nd)	N	8yrs	multiple lacunar infarction	CBZ	BA	MVD	grade III	7 m	I

TN trigeminal neuralgia, HT hypertension, FHE Facial hyperesthesia, BA basilar artery, VA vertebral artery, RFT radiofrequency thermocoagulation, CBZ Carbamazepine, OXC Oxcarbazepin, MVD microvascular decompression, SPPR selective partial posterior rhizotomy.