



Clinical Study

The trigeminocardiac reflex in Onyx embolisation of intracranial dural arteriovenous fistula

C.K. Ong, M.T. Ong, K. Le, M.A. Power, L.L. Wang, D.V. Lam, R.J. Parkinson, J.D. Wenderoth*

Division of Interventional Neuroradiology, Department of Medical Imaging, Prince of Wales Hospital, Barker Street, Randwick, New South Wales 2031, Australia

ARTICLE INFO

Article history:

Received 30 October 2009

Accepted 5 January 2010

Keywords:

Dural arteriovenous fistula

Onyx

Trigeminocardiac reflex

ABSTRACT

We investigated the incidence of the trigeminocardiac reflex (TCR) during ethylene vinyl alcohol copolymer (Onyx Liquid Embolic System, ev3 Neurovascular, Irvine, CA, USA) embolisation of intracranial dural arteriovenous fistulas (DAVFs) and evaluated the post-procedural recovery of these patients. Between June 2006 and July 2009, 21 patients (11 females, 10 males) with a mean age of 61 years (range: 25–85 years) underwent 28 Onyx embolisations of intracranial DAVFs at our institution. The case histories of these patients were reviewed retrospectively. A TCR occurred in three (10.7%) of the embolisations, with bradycardia lower than 60 beats/minute and a drop in mean arterial blood pressure of 20% or more. The reflex was blunted promptly with intravenous atropine, and follow-up of these patients showed no complications that might have been directly related to it. The TCR may occur during Onyx embolisation of intracranial DAVFs. Recognition of this phenomenon allows for early detection and appropriate intraoperative management.

Crown Copyright © 2010 Published by Elsevier Ltd. All rights reserved.

1. Introduction

The trigeminocardiac reflex (TCR), first described by Kumada et al., is a well-known reflexive phenomenon of bradycardia, hypotension, apnoea and gastric hypermotility upon mechanical stimulation in the distribution of the trigeminal nerve.¹ It has been reported to occur during ophthalmic, craniomaxillofacial and skull base surgery, as well as operations involving manipulations of the trigeminal ganglion and falx cerebri.^{2–9}

With an increasing number of intracranial dural arteriovenous fistulas (DAVFs) being treated endovascularly, TCR has also been reported in several instances of tentorial DAVFs that were embolised with ethylene vinyl alcohol copolymer (Onyx Liquid Embolic System, ev3 Neurovascular, Irvine, CA, USA).^{10,11}

Over the last few years, almost all of the patients who presented to our institution with intracranial DAVFs have been treated with Onyx embolisation as the definitive therapy. We present the occurrence of TCR in our patients and analyse its possible underlying mechanisms.

2. Materials and methods

We define the occurrence of TCR as abrupt bradycardia of less than 60 beats/minute and hypotension with a drop in mean arte-

rial blood pressure of 20% or more, during transarterial or transvenous injection of Onyx or its solvent, dimethyl-sulfoxide (DMSO).

2.1. Patient population

Between June 2006 and July 2009, 21 patients who had intracranial DAVFs underwent a total of 28 embolisations with Onyx at our institution. There were 11 females and 10 males, with a mean age of 61 years (range: 25–85 years). Ten of the patients had cavernous sinus DAVFs, nine had tentorial DAVFs along the transverse-sigmoid sinuses and two had lesions over their superior sagittal sinus. To obliterate the lesions, five patients underwent two, and one patient three, sessions of embolisation.

All of the case histories, particularly the embolisation reports, intraoperative anaesthetic charts and intensive care unit records, were reviewed retrospectively. One patient was lost to follow-up. The mean duration of follow-up for the remaining patients was 9 months (range: 3–29 months).

2.2. Anaesthetic set up

The embolisations were performed under standard general anaesthetic protocol. After pre-medication of oral midazolam, anaesthesia was induced using fentanyl (3 µg/kg), propofol (2 mg/kg) and vecuronium (0.1 mg/kg). Following endotracheal intubation, the lungs were mechanically ventilated with a mixture of air and oxygen (inspiratory fraction of oxygen [FiO₂] = 0.35).

* Corresponding author. Tel.: +61 2 9382 0315; fax: +61 2 9382 0317.

E-mail address: jason.wenderoth@sesiahs.health.nsw.gov.au (J.D. Wenderoth).

Anaesthesia was maintained with fentanyl and propofol. Additional boluses of vecuronium were given if required. Routine intraoperative monitoring included pulse oximetry and electrocardiography. Each patient had an indwelling radial artery catheter inserted to allow continuous invasive blood pressure measurement.

2.3. Embolisation technique

The ten patients who had cavernous sinus DAVFs underwent a total of 12 transvenous embolisations. The cavernous sinuses in these patients were accessed via the ipsilateral inferior petrosal sinus (IPS) ($n = 5$), the contralateral IPS and intercavernous sinus ($n = 1$), the ipsilateral superior ophthalmic vein under ultrasound guidance ($n = 1$) or by direct percutaneous transorbital puncture through the superior orbital fissure ($n = 5$).¹² The other 12 patients who had DAVFs along the transverse-sigmoid sinus or superior sagittal sinus were treated with a total of 16 transarterial embolisations via the middle meningeal artery ($n = 9$) or occipital artery ($n = 7$).

Once the microcatheter (Marathon or Echelon 10, ev3 Neurovascular) was navigated into the desired position, its dead space was slowly filled with DMSO over approximately 90 seconds. Onyx-18 or Onyx-34 was then injected gradually through the microcatheter. Whenever unintended reflux was noted, the injection was held for 30 to 90 seconds to allow the Onyx polymerisation to proceed before it was then restarted (the reflux-hold-reinjection technique). As noted previously, six of the patients required more than one embolisation session to obliterate their lesions completely. For the first 24–48 hours post-embolisation, all of the patients were monitored in the intensive care or high dependency units.

3. Results

Intraoperative TCR was encountered during three (10.7%) of the 28 embolisations. All three of these patients were female; the mean age was 76 years (range: 70–85 years; Table 1). One of the patients (patient 3) had hypertension, for which she took regular perindopril, an angiotensin-converting enzyme inhibitor. The other two patients had no significant medical history. None of these patients were taking a beta-blocker or calcium channel antagonist pre-operatively.

Patient 1 had a Cognard type IV left tentorial DAVF, supplied predominantly by branches of the left middle meningeal and occipital arteries. Her lesion was approached transarterially via the petrous branch of the left middle meningeal artery. The microcatheter was advanced as distally as possible, and Onyx-18 was injected gently. Despite the reflux-hold-reinjection technique, there was significant retrograde flow of Onyx along the microcatheter (Fig. 1). When the refluxed Onyx cast reached the foramen spinosum, the patient went into sinus arrest with marked hypotension. The injection was stopped immediately and 1 mg of intravenous (i.v.) atropine administered. The patient's vital signs returned to

baseline within 30 to 40 seconds; the Onyx injection was resumed until the DAVF was completely occluded. During the remainder of the procedure, the TCR did not recur.

The TCR in patients 2 and 3 occurred under similar circumstances. Each patient had a unilateral cavernous sinus DAVF, with an occluded ipsilateral inferior petrosal sinus. Given this, the cavernous sinus was accessed via direct percutaneous transorbital puncture through the superior orbital fissure (Fig. 2).¹² Once the microcatheter tip was advanced to the posterior aspect of the cavernous sinus, the dead space of the catheter was filled slowly with DMSO over approximately 90 seconds. Towards the end of microcatheter priming with DMSO, each patient developed significant bradycardia with an abrupt drop of arterial blood pressure. The DMSO injection was ceased immediately and 1 mg of atropine given intravenously. The haemodynamic parameters returned to normal within 30–40 seconds. The embolisation was then resumed and the DAVF obliterated in each instance, with no further recurrence of the TCR.

The post-operative recovery was uneventful for all three patients. At the 3- and 6-month follow-up, the patients were well and showed no evidence of any complication that might have been related to the intraoperative TCR.

4. Discussion

Any irritation of the trigeminal nerve, or of the structures innervated by this nerve, may trigger the TCR. Neuronal signals are transmitted through the trigeminal nerve back to its sensory nucleus, constituting the afferent pathway of the reflex arc.¹³ The sensory nucleus of the trigeminal nerve is connected, via short internuncial fibres in the reticular formation, to the motor nucleus of the vagus nerve, from which cardioinhibitory fibres arise as the efferent pathway terminating in the myocardium.⁴ As a result, bradycardia and various arrhythmias may occur. Other fibres from the vagal motor nucleus may also induce hypotension, apnoea and gastric hypermotility.⁴ The reflex stops as soon as the triggering factor is removed.⁸

Schaller proposed that the TCR may be a physiological, rather than pathophysiological, entity that mediates a reflexive neuroprotection induced by oxygen-sensitive sympatho-excitatory reticulospinal neurons in the rostral part of the ventrolateral medulla.¹⁴ However, while the TCR normally serves a purposeful and protective function, it may, under certain circumstances, become exaggerated and put patients at risk.¹⁴

Onyx is a cohesive, non-adhesive embolic agent that consists of ethylene vinyl alcohol copolymer dissolved in DMSO (an organic solvent) with suspended micronised tantalum powder that provides radiopacity for fluoroscopic visualisation.¹⁵ Once the mixture comes into contact with liquid, including blood, the DMSO diffuses away rapidly, and allows precipitation and solidification of the copolymer.¹⁶

The TCR observed in our patient 1 occurred when the Onyx refluxed along the middle meningeal artery to the region of the foramen spinosum, resembling the instances reported by Lv et al.^{10,17} A

Table 1
Summary of the three patients who experienced intraoperative trigeminocardiac reflex during embolisation of DAVF

Patient no.	Age (yrs)	Sex	Pathology	Presentation	Embolisation approach
1	70	F	Left tentorial DAVF, Cognard type IV	Left occipital headache and tinnitus	Transarterial via the left middle meningeal artery
2	72	F	Right cavernous sinus DAVF, Cognard type IIb	Right chemosis and sixth nerve palsy	Direct transorbital puncture via the superior orbital fissure
3	85	F	Left cavernous sinus DAVF, Cognard type IIb	Left proptosis, chemosis and visual deterioration	Direct transorbital puncture via the superior orbital fissure

DAVF = dural arteriovenous fistula, yrs = years.

Download English Version:

<https://daneshyari.com/en/article/3062577>

Download Persian Version:

<https://daneshyari.com/article/3062577>

[Daneshyari.com](https://daneshyari.com)