Journal of Cranio-Maxillo-Facial Surgery 42 (2014) e182–e185

Contents lists available at ScienceDirect

Journal of Cranio-Maxillo-Facial Surgery

journal homepage: www.jcmfs.com

Use of electrophysiological monitoring in selective rhizotomy treating glossopharyngeal neuralgia

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ARTICLE INFO

Article history:
Paper received 25 March 2013
Accepted 28 August 2013

Keywords:
Glossopharyngeal neuralgia
Electrophysiological monitoring
Selective rhizotomy of glossopharyngeal nerve
Vagus nerve

ABSTRACT

The aim of this study was to evaluate the effects of electrophysiological monitoring on selective rhizotomy of the glossopharyngeal nerve (SRGN) in treatment of glossopharyngeal neuralgia (GPN). From December, 2009 to May, 2012, SRGN was carried out on 8 patients with GPN, through a suboccipital sigmoid sinus posterior approach. The electrodes were placed on the cricothyroid muscle (vagus nerve). Two groups of amplitudes (A1 and A2) were recorded. A1 was recorded when the mixed nerve root was stimulated, and A2 when the part of the vagus nerve was stimulated. The glossopharyngeal nerve was sectioned and the vagus nerve was preserved. If A1/A2 $<$ 50%, the mixed nerve root should be sectioned, otherwise the mixed nerve root should be retained. As the representation of vagus nerve, the averages of A1 and A2 were 22 and 36 μV respectively. The 8 patients were followed up for 9–39 months. Seven patients (87.5%) obtained complete pain relief (excellent) without complications such as hoarseness, dysphagia, and cough. One case (12.5%) obtained moderate relief (good), and was under control with carbamazepine at a dosage of 600 mg/d. Cough was occurred in this patient, but relieved in two months. Electrophysiological monitoring in SRGN can improve the efficiency of pain relief and reduce the incidence of complications.

1. Introduction

GPN refers to transient, paroxysmal severe pain occurring in the glossopharyngeal nerve distribution area. Although its incidence rate is low (about 0.7/100,000 people), it often brings great suffering to the patients, such as inability to swallow when it attacks (Varrasi et al., 2011). Glossopharyngeal neurectomy, performed by accessing cerebellopontine angle (CPA) through the posterior sigmoid sinus is a routine surgical treatment for GPN. However, the pain relief rate (87.5–100%), recurrence rate, and incidence rate of complications (5–24%) vary significantly (Rushton et al., 1981; Patel et al., 2002; Sampson et al., 2004; Kondo, 1998; Ferroli et al., 2009; Kandan et al., 2010; Taha and Tew, 1995). Major complications, including hoarseness, dysphagia, and cough, are caused by vagus nerve injury. This may be because there are 1–2 communicating branches between the glossopharyngeal nerve and vagus nerve at the CPA. While the key point for a high success rate is to cut the communicating branches at the same time as glossopharyngeal neurectomy, the key point for low incidence of complications is to maximally preserve the vagus nerve. Depending on the surgeon's experience, it can be difficult to distinguish the communicating branches, maximally preserve the vagus nerve, and section the glossopharyngeal nerve.

Intraoperative neurophysiological monitoring is a commonly used technique in tumour surgery for the lower cranial nerves in order to maximally preserve function and reduce complications, but its use during GPN surgery has not been reported in the literature, and whether it can help to distinguish the communicating branches has not been discussed. In this study, 8 patients with primary GPN admitted to our hospital from December, 2009 to May, 2012 were reviewed. Intraoperative monitoring of evoked potential was used on the glossopharyngeal and vagus nerves, to guide the surgeons to carry out the SRGN. In this study the technique is described, and the effect is discussed.

2. Material and methods

2.1. Clinical data

In this study, patients clinically diagnosed with primary GPN who were treated at the Orofacial Nerve Division of the Department

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1010-5182/$ – see front matter
http://dx.doi.org/10.1016/j.jcms.2013.08.004

of Oral and Maxillofacial Surgery, the Shanghai Ninth People's Hospital affiliated to Shanghai Jiaotong University, between December, 2009 and May, 2012 were collected, for whom both medication and closed treatment were ineffective, and in whom the preoperative MRI examination excluded intracranial and extracranial space-occupying lesions. SRGN was carried out in 8 cases, including 2 males and 6 females, a male/female ratio of 1:3. The mean age was 48.3 years (range, 34–58 years), and the average disease course was 4.3 years (range, 1–10 years). 6 cases had pain on the right side and 2 cases on the left side (Table 1).

2.2. Preoperative preparation

An electromyography (EMG) and evoked potential device (Nicolet Viking Quest [USA]), with needle stimulation stimulator, and needle electrode as recording and reference electrode was used. After the patients were anesthetized and intubated, the muscle relaxants were reversed. The ground electrode was placed at one shoulder. A vagus nerve recording electrode was placed at the cricothyroid muscle outside the mouth (Fig. 1). The stimulator was used to stimulate the vagus nerve and the mixed nerve root between at CPA. The band-pass filtering frequency was 2–10,000 Hz, and stimulating intensity was 10 mA. The recording time was 0.2 ms.

2.3. Surgical procedure

Posterior sigmoid sinus access was employed to open a bone window about 3 × 3 cm. The dura mater was opened in an inverted T manner, and part of the cerebrospinal fluid was drained. The cerebellum was naturally retracted to reveal the CPA. An endoscope (Stryker Company, USA), 4 mm in diameter, was introduced for exploration and taking photographs. The glossopharyngeal nerve and vagus nerves were identified by two physicians (Fig. 2A). The part of vagus nerve furthest away from the glossopharyngeal nerve was first stimulated. The waveforms were obtained from cricothyroid muscle, and the amplitudes of A2 were recorded. Secondly, the mixed nerve root close to glossopharyngeal nerve was stimulated (Fig. 2B), and the amplitudes of A1 were recorded. The glossopharyngeal nerve was sectioned, while the vagus nerve was preserved. If A1/A2 < 50%, the mixed nerve root was sectioned

Table 1
Patient's information.

Case	Gender	Age (years)	Course (years)	Side
No.1	Female	42	3	Right
No.2	Female	34	10	Left
No.3	Male	39	4	Right
No.4	Male	52	3	Right
No.5	Female	41	1	Right
No.6	Female	58	6	Right
No.7	Female	58	3	Left
No.8	Female	62	4	Right

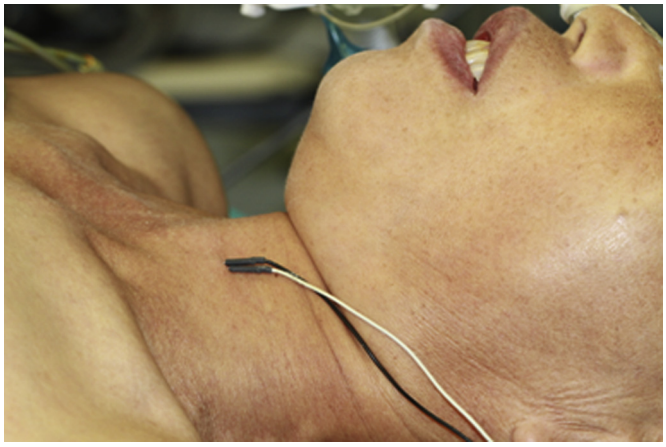

Fig. 1. Position of needle recording electrode. The vagus nerve recording electrode at the cricothyroid muscle outside the mouth.

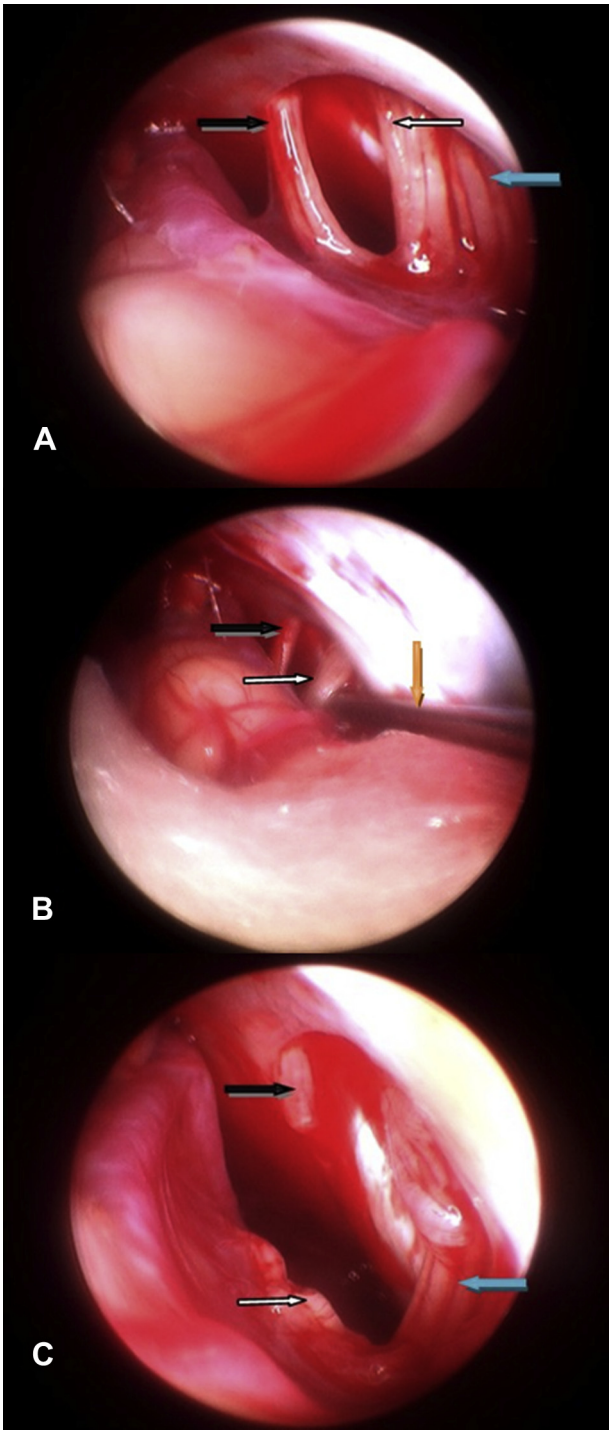

Fig. 2. Endoscopic electrophysiological monitoring and rhizotomy. A, identification of the glossopharyngeal nerve, the communicating branches, and the vagus nerve. B, stimulation of the communicating branches. C, rhizotomy of glossopharyngeal nerve and partial communicating branches. (Black arrow – glossopharyngeal nerve; white arrow – communicating branches; yellow arrows – stimulator; and blue arrow – vagus nerve).