Neurophysiologie Clinique/Clinical Neurophysiology (2016) 46, 165—169

Disponible en ligne sur
ScienceDirect
www.sciencedirect.com

Elsevier Masson France
EM|consulte
www.em-consulte.com/en

TECHNICAL NOTE/NOTE TECHNIQUE

Peripheral component of laryngeal and pharyngeal motor evoked potentials

Composante périphérique des potentiels évoqués moteurs laryngés et pharyngés

Munevver Celik Gokyigit[a,*], Ibrahim Ercan[b], Selma Seker[b], Lale Gundogdu Celebi[a], Cumhur Ertekin[c]

[a] *Şişli Etfal Education and Research Hospital, Department of Neurology, Istanbul, Turkey*
[b] *Şişli Etfal Education and Research Hospital, Department of Otolaryngology, Head and Neck Surgery, Istanbul, Turkey*
[c] *Ege University Medical School Hospital, Department of Neurology, İzmir, Turkey*

Received 31 March 2016; accepted 14 May 2016
Available online 16 June 2016

KEYWORDS
Cricopharyngeus;
Peripheral MEPs;
Swallowing;
Thyroarytenoideus;
Vagus nerve

Summary In this study, the responses of thyroarytenoid (TA) and cricopharyngeus (CP) muscles were simultaneously recorded to peripheral magnetic stimulation of the vagus nerve. Recordings were performed in 13 subjects by means of concentric needle EMG electrodes inserted in the TA and CP. Magnetic shocks were delivered to the vagus nerve with a round coil placed occipitally, while EMG was silent in the TA. In all subjects, clear-cut responses were obtained simultaneously in both muscles. In TA compared to CP, the maximum amplitude of the responses were higher, whereas the onset latency was shorter. Our results revealed that simultaneous recordings of TA and CP motor responses to occipital magnetic stimulation enabled a reliable evaluation of their peripheral innervation by the vagus nerve.

MOTS CLÉS
Crico-pharyngien ;
Déglutition ;
Nerf vague ;
PEM périphériques ;
Thyro-aryténoïdien

Résumé Dans cette étude, les réponses des muscles thyro-aryténoïdien (TA) et crico-pharyngien (CP) ont été enregistrées simultanément à la stimulation magnétique périphérique du nerf vague. Les enregistrements ont été réalisés chez 13 sujets au moyen d'électrodes aiguilles concentriques d'EMG insérées dans les muscles TA et CP. Des chocs magnétiques ont été délivrés sur le nerf vague avec une bobine circulaire placée au niveau occipital, alors que l'EMG était silencieux dans le TA. Chez tous les sujets, des réponses claires ont été obtenues simultanément dans les deux muscles. Dans le TA, comparativement au CP, l'amplitude maximale

* Corresponding author at: Husrev Gerede cad., Erbil apt., No:102 D:4 Tesvikiye, 34365 Istanbul, Turkey.
E-mail address: munevvergokyigit@gmail.com (M. Celik Gokyigit).

http://dx.doi.org/10.1016/j.neucli.2016.05.068
0987-7053/

des réponses était plus grande, alors que la latence était plus courte. Nos résultats montrent que les enregistrements simultanés des réponses motrices du TA et du CP aux stimulations magnétiques occipitales permettent une évaluation fiable de leur innervation périphérique par le nerf vague.

Introduction

The thyroarytenoid muscle (TA) is the main laryngeal adductor muscle and forms the body of the vocal folds, situated deeply in the submucosa of the larynx [5]. Its fibers are sometimes separately termed ''vocalis'', ''thyreoepiglotticus'' and ''ventricularis''. It is innervated by the recurrent laryngeal branch of the vagus nerve, which innervates all the intrinsic laryngeal muscles except the cricothyroid muscle (CT), this being supplied by the superior laryngeal branch of the vagus nerve [5]. It attaches to cricoid and thyroid cartilages, superficially close to the extrinsic laryngeal muscles [5].

The innervation of the upper esophageal sphincter (UES) striated muscles, especially the cricopharyngeus muscle (CP), is less clear. The branches of the pharyngeal plexus and recurrent laryngeal nerve, both originating from the vagus nerve, were assumed to innervate CP in morphological studies [6].

Cisternal magnetic stimulation can excite the peripheral part of cranial nerves, including the vagus nerve at the brainstem entry zone [11]. As shown by electrophysiological recordings, TA activation is in close temporal relationship with the onset of CP pause during oropharyngeal swallowing [3,6,7]. Thus, cisternal magnetic stimulation should evoke potentials in a time-locked fashion on TA and CP, since both are innervated by vagus nerve branches.

The aim of this study was to investigate the simultaneous behaviour and extent of activation of CP and TA by recording of the peripheral component of motor evoked potentials (MEPs) on these both muscles to peripheral magnetic stimulation.

Materials and methods

Thirteen healthy subjects, 8 females and 5 males, aged between 27 and 56 years (37.6 ± 8.6) were included in the study. Participants did not have any systemic or localized disorders concerning laryngeal or oropharyngeal muscles or nerves. Informed consent of each patient was obtained. The study was approved by the ethical committee of Sisli Etfal Education and Research Hospital.

Electrophysiological examinations were performed while the subject was in a semi-sitting position with the head tilted posteriorly. The EMG activity of TA and CP was recorded by means of concentric needle electrodes, as described previously [3,6,9,15]. To record TA activity, the concentric needle electrode (Medelec disposable DMC-37; diameter 0.46 mm; recording area 0.07 mm^2; Victor Medical Medelec Ltd. Surrey, UK) was percutaneously inserted 0.2—0.3 cm lateral to the cervical midline. After passing the cricothyroid ligament, the needle electrode was advanced posteriorly, superiorly and laterally. The correct insertion of the TA muscle was verified by observing its activity during swallowing and during phonation of ''ee'' sounds. To record CP activity, the concentric needle electrode was inserted through the skin at the level of cricoid cartilage about 1.5 cm lateral to its palpable lateral border and advanced in a posterior and medial direction. As the electrode penetrated into the muscle, a high frequency tonic EMG activity appeared on the oscilloscopic screen of the EMG apparatus (Medelec Sapphire 4ME-EMG-EP). During swallowing, this tonic activity of the CP disappeared for a brief period (about 400—600 msec) while the EMG activity of the TA occurred. These activities served as criteria for correct electrode placement into both CP and TA for simultaneous recordings (Fig. 1) [3,6,9]. The simultaneous activities of both muscles were obtained on the left side in all subjects except 1, because the situation in our laboratory enabled easier left-sided needle electrode insertion and cisternal stimulation.

After placing the concentric needle electrodes into the muscles, the head of the subject was raised slightly using a pillow and she/he was instructed to hold her/his head sustained in this position.

For the magnetic stimulation of the vagus nerve, a round magnetic coil (9 cm diameter) was used, connected to a magnetic stimulator (Novametrix Magstim 200, 2 Tesla version; Whitland, Dyfed, Wales, UK). The magnetic shocks were delivered during resting tonic activity of the CP, while there was silence in TA activity. To do so, we waited for spontaneous swallows of saliva between magnetic shocks while observing the activity of TA and CP on the EMG apparatus screen. This period also served to check position of needle electrodes to discontinue and discard recordings if they lost their appropriate position.

The stimulation site was lateral to the occiput, ipsilateral to the recording side, approximately midway between the tip of the mastoid and the inion (most prominent projection of the occipital bone). Some small lateral and/or vertical adjustment of the circular coil was necessary to find the optimum stimulation side according to the amplitude of TA response. The magnetic stimulus intensity used to identify the optimum stimulation side was approximately 50% of the maximum stimulator output (Fig. 1). To determine the motor threshold intensities (minimum magnetic stimulation intensity to induce MEPs) stimulus was decreased by 5% or 10% steps until the TA and CP MEPs disappeared successively. To record the maximum amplitude of TA and CP MEPs and to determine the stimulus intensity needed to elicit them, the stimulus output was increased stepwise by 10% (Fig. 1). In one subject, only the maximum amplitudes were briefly recorded because she asked to discontinue the examination.

IBM SPSS Statistics 20 software was used to calculate the mean and standard deviation of threshold and maximum