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ORGANIZATION OF THE MOTOR NEURON SOMATA OF GENIOHYOID AND INFRAHYOID MUSCLES IN THE MEDULLA OBLONGATA AND SPINAL CORD OF RAT: A HORSERADISH PEROXIDASE STUDY

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ABSTRACT

Geniohyoid and infrahyoid muscles are important muscles of the neck because they are involved in the process of swallowing. The organization of their motoneurons has been studied by many investigators in rat and many other experimental animals but their results are not in agreement with each other even in the same species including rat. This prompted the present investigation. Thirty Sprague-Dawley rats were used in the study. The study was performed in medulla oblongata and upper cervical segments of spinal cord by retrograde transport of horseradish peroxidase (HRP) after its injection into geniohyoid and infrahyoid muscles using tetramethylbenzidine (TMB)-HRP method. The sections were examined to identify HRP-labelled neuron somata. Reconstruction of cell groups containing HRP-labelled neuron somata was made. HRP-labelled neuron somata were organized as follows on the experimental (right) side: (1) Geniohyoid motoneurons: In rostral two thirds of closed part of medulla oblongata (MO) they were located in the ventral part of the main hypoglossal nucleus; in the caudal third of closed part of MO, they were in ventrolateral subnucleus. At spinomedullary junction (SMJ) they were in dorsomedial part of ventral grey column; a few were also seen scattered on right side of central canal and among the corticospinal fibres after pyramidal decussation. (2) Thyrohyoid motoneurons were found in dorsomedial part of right ventral grey column at SMJ and in dorsomedial column of right ventral grey column at C-1 (first cervical segment). (3 & 4) Sternohyoid and sternothyroid motoneurons: At SMJ they were present in the region ventral or ventrolateral to the central canal and in the dorsomedial part of the right ventral grey column. At C-1 and rostral half of C-2, they were located in dorsomedial column of right ventral grey column. In caudal half of C-2 and whole length of C-3, they were located in dorsomedial and ventrolateral columns of right ventral grey column. (5) Omohyoid motoneurons: At SMJ, they were observed in dorsomedial part of the right ventral grey column. At C-1, they were observed in the dorsomedial column of right ventral grey column. In C-2 and C-3, they were observed in dorsomedial and ventrolateral columns of right ventral grey column. Our results indicate that the motor neuron somata of geniohyoid muscle were organized in a group located in the medulla oblongata and at the SMJ, whereas, the motor neuron somata of infrahyoid muscles were organized in groups located at the SMJ and the ventral grey column of the cervical spinal cord.

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CHAPTER ONE
INTRODUCTION

1.1 BACKGROUND OF STUDY

Geniohyoid and infrahyoid muscles are important muscles of the neck because they are involved in the process of swallowing. Geniohyoid muscle elevates the hyoid bone and infrahyoid muscles (thyrohyoid, sternohyoid, sternothyroid and omohyoid) depress the hyoid bone and larynx during swallowing (Standring, 2015).

In literature, there are three different views regarding the innervations of geniohyoid (GH) and thyrohyoid (TH) muscles. Firstly, the former is innervated by the hypoglossal nerve, and the latter is innervated by cervical nerves (Brodal, 1981). Secondly, both are innervated solely by the cervical nerves (Romanes, 1972) and thirdly, both GH and TH receive dual innervations from the hypoglossal and cervical nerves (Kikuchi, 1970).

All infrahyoid (IH) muscles of rat are supplied by ansa cervicalis, a loop of nerve connecting the hypoglossal nerve with ventral rami of upper cervical nerves. However, in many other mammals (including man), the TH is supplied by the first cervical nerve, through its communication with the hypoglossal nerve, and the remaining three infrahyoid (IH) muscles are supplied by the ansa cervicalis. Some studies reported that the IH motoneurons occupy the supraspinal nucleus, which appeared to be part of hypoglossal nucleus and the ventral horn with their axons passed through the first to third cervical nerves (Uemura-Sumi, 1980; Kitamura et al., 1986). Kosaka and Jagita (1903) and Stuurman (1916) have denied that IH motoneurons exist in the hypoglossal nucleus in monkey and mouse, respectively (Kitamura et al., 1986). Yoshida et al. (1983) described that IH motoneurons exist in hypoglossal nucleus, while Uemura-Sumi (1980) and Gottschall et al. (1980) denied it in cat and rat, respectively, due to uncertain distinction between hypoglossal and supraspinal nucleus (Kitamura et al., 1986).

The motoneurons (motor neuron somata, or motor neuron cell bodies) of GH muscle in rat have been reported by some investigators to occupy a ventral or ventrolateral position in the hypoglossal nucleus, though there are some difference of