INHIBITORY EFFECTS OF RETICULOSPINAL FIBERS OF THE LATERAL FUNICULUS ON NEURONS OF THORACIC SPINAL REFLEX PATHWAYS

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Experiments on anesthetized cats with partial transection of the spinal cord showed that reticulo-spinal fibers in the ventral part of the lateral funiculus participate in the inhibition of polysynaptic reflexes evoked by stimulation of the ipsi- and contralateral reticular formation. The reticulo-fugal wave in the ventrolateral funiculus evoked comparatively short (up to 70 msec) IPSPs in some motoneurons of the internal intercostal nerve investigated and at the same time evoked prolonged (up to 500 msec) inhibition of IPSPs caused by activation of high-threshold segmental afferents. This wave also led to the appearance of IPSPs in 14 of 91 (15.5%) thoracic spinal interneurons studied. The duration of these IPSPs did not exceed 100 msec; meanwhile, segmental excitatory responses of 21 of 43 interneurons remained partly suppressed for 120-500 msec. It is concluded that the inhibitory action of the lateral reticulo-spinal system on segmental reflexes is due to several synaptic mechanisms, some of them unconnected with hyperpolarization of spinal neurons. The possible types of mechanisms of this inhibition are discussed.

INTRODUCTION

It has been known for a long time that stimulation of the bulbar reticular formation (RF) causes marked inhibition of segmental reflex transmission from, in particular, high-threshold afferents (flexor reflex afferents – FRA) [5, 7, 19]. As the results of experiments in Lundberg’s laboratory showed [12, 13, 15, 16], this effect is brought about by two descending reticulospinal (RS) systems: the dorsal RS system (located in the dorsolateral funiculus of the spinal cord – DLF) and the "ventral quadrant" system. Meanwhile it is known that this latter system, in turn, consists of two separate subsystems of tracts: medial, running in the ventral funiculus, and lateral, located chiefly in the ventral part of the lateral funiculus [18]. These subsystems originate from reticular structures in different locations and, as neurophysiological investigations have shown, they differ in the character of their synaptic action on spinal neurons [4, 5, 7]. However, the role of the lateral tract in RS inhibition and the possible mechanisms of this inhibition have not been specially investigated. This paper describes an attempt to undertake such a study.
Fig. 1. Inhibition of polysynaptic reflex disk charges evoked by stimulation of RF after various partial transections of the spinal cord; a) reflex discharges in internal intercostal nerve (ICi) of segment T10 evoked by stimulation of homonymous nerve of adjacent segment T11 by stimuli of increasing strength. b) Action of conditioning stimulation of ipsilateral RF (IRF; indicated by arrow) on amplitude of test discharges evoked by stimulation of ICi during successive increase in interval between stimuli. Last discharge is initial test response. Top beam shows discharge, bottom beam dorsal cord potential in T10. Numbers show strengths of stimulation of ICi, in thresholds. c) Curves of reticulospinal inhibition of discharges evoked by stimulation of ICi. Curve 1 obtained with reticulospinal tracts intact, curves 2, 3, and 4 after corresponding transections of spinal cord in T8, degree of which is shown above abscissa (transected part shaded). Abscissa, interval between beginning of RF stimulation and testing stimulation of ICi, msec; ordinate, amplitude of test discharges, in % of initial value. Site of stimulation of RF by 5 stimuli at a frequency of 300 Hz shown on right by asterisk on scheme of section through medulla in plane P 10. d) The same as in c, but in a different experiment.

EXPERIMENTAL METHOD

Experiments were carried out on 30 adult cats anesthetized with chloralose (50 mg/kg) and pentobarbital (10 mg/kg).