Short Report

Responses of Monkey Thalamus to Nociceptive Stimuli

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NAKAHAMA, H., NISHIOKA, S. and AIKAWA, S. Responses of Monkey Thalamus to Nociceptive Stimuli. Tohoku J. exp. Med., 1970, 102 (4), 413-414 —— The activities of the 9 Cl (Nucl. centralis lateralis), 9 LP (Nucl. lateralis posterior) and 43 Pul (pulvinar) neurons were studied in a monkey (Macaca mulatta) using various natural stimuli. The numbers of single neurons responsive to nociceptive stimuli were 4 in Cl; 2 in LP; and 4 in Pul. The receptive fields of some neurons were limited or were represented by the whole body. ——— Macaca mulatta; nociceptive stimuli; Cl LP Pul

It was shown in previous papers that there exist the nociceptive neurons in the thalamic pulvinar nucleus (Pul) of cats1,2 and monkeys.3 However, the literature which deals with the receptive fields of the Pul neurons of monkeys is scanty. The present study was initiated to secure this information. In the present report, observations not only on Pul but on Nucl. centralis lateralis (Cl) and Nucl. lateralis posterior (LP) are described.

The methods and techniques used in this study were essentially the same as those described in the previous paper.2 A monkey (Macaca mulatta), weighing 2.5 kg, was operated on under ether anesthesia. Wound margins and pressure points were infiltrated with Xylocaine jelly (AB ASTRA, Sweden). The animal was finally immobilized with gallamine triethiodide and maintained under artificial respiration. Electroencephalographic recordings suggested that the animal was usually in a state of light sleep, if he was kept quiet. Each neuron was tested for its response to a variety of natural stimuli. Somatic stimuli were offered in such ways as stroking, tapping or pricking the skin; pinching the skin with toothed forceps; squeezing the skin and the deep tissues; and joint rotation. Non-somatic stimuli consisted of light flashes, sudden presentation of light over the animal’s eye; claps or tones were also given.

The present results are based on the evidence obtained from the 61 Cl, LP and Pul single neurons (Fig. 1). Out of these neurons, 10 were responsive to pricking the skin and to pinching it with toothed forceps, but not with non-toothed forceps. This indicates that neurons responsive to nociceptive stimuli exist in Cl, LP and Pul. Out of the 9 Cl neurons, 3 were responsive only to nociceptive stimuli; 1, to both nociceptive stimuli and hair movement; 1, only to hair movement. Out of the 9 LP neurons, 1 responded only to nociceptive stimuli; and 1, to both nociceptive and sound stimuli. Out of the 43 Pul neurons, 4 were responsive only to nociceptive stimuli; and 1, only to hair movement. Some examples of the receptive fields of

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Fig. 1. Data obtained in the dorso-ventral penetration of a microelectrode passed through Cl, LP and Pul on the left side of the thalamus. Straight lines represent tracks through the section shown. The approximate positions along the penetration where the single neurons responded to nociceptive stimuli were given by •; to hair movement, by to both nociceptive stimuli and hair movement, by ○; to both nociceptive and sound stimuli, by ×. For abbreviations, see Olszewski.  

Fig. 2. A representative sample of the receptive fields of the Pul (A), Cl (B), and LP (C) neurons. Black and oblique lines indicate an area from which the neurons responded to nociceptive stimuli. Black shows higher sensitivities.

The Pul, Cl, and LP neurons responsive to nociceptive stimuli are shown in Fig. 2A, B, and C, respectively. The receptive fields of some neurons were discontinuous, were represented by the contralateral limb, or existed in the whole body. When the skin was pinched with toothed forceps for 5 sec, the nociceptive neurons rapidly responded for about 1–2 sec.

The results that the nociceptive neurons existed in Cl, LP and the dorsal part of Pul (Fig. 1) may have an interesting bearing on the problem that the stereotaxic thalamotomy relieved the patients from intractable pain.

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References