PHYSIOLOGY

Sciatic Nerve Activity evoked by Sensory-motor Cortex Stimulation during Paradoxical Sleep

THE cortico-spinal system undergoes consistent modifications during the desynchronized phase of sleep. The integrated pyramidal activity rises to a level even higher than that reached in wakefulness[1]; the pyramidal tract neurones change their temporal pattern of discharge[2]; the integrated pyramidal activity increases synchronously with rapid eye movements and myoclonic twitches[3]; and the sciatic nerve responses to liminar pyramidal stimulation are abolished[4].

The aim of the present investigation was to study the behaviour of sciatic nerve responses to sensory-motor cortex stimulation during sleep and wakefulness, in order to obtain further information on the function of the cortico-spinal system during these physiological phases.

The experiments were performed on unrestrained, unanaesthetized cats with chronic implanted electrodes. Bipolar stimulating electrodes were applied subdurally on the surface of the sensory-motor cortex of one side. Bipolar electrodes left in place around the sciatic nerve of the opposite side could record the spontaneous and evoked activity of a large population of lumbo-sacral motoneurones. The sensory-motor cortex was stimulated with bursts of from two to five stimuli at 300/sec, 0·05–0·5 msec, 1–3 V delivered every 1–2 sec. The spontaneous and evoked activity in the sciatic nerve was recorded on an 'Ampex' tape-recorder during wakefulness, synchronized sleep and desynchronized sleep, averaged on a *CAT* 400 'Mnemotron' and then photographed on an oscilloscope. The electroencephalogram (from frontal areas), the electromyogram (from nuchal muscles) and the oculogram indicated the stages of wakefulness and sleep which occurred during the experiments.

During wakefulness without apparent movements of the animal, a spontaneous activity was present in the sciatic nerve. A train of from two to five stimuli delivered to the sensory-motor cortex evoked a complex response on the neurogram with a latency of 12–18 msec from the first stimulus. Synchronous with the electrical potentials, which fluctuated in amplitude, a slight flexion of the hindleg of the same side was generally observed. Fig. 1*A* shows an average of fifty responses during wakefulness in which three main deflexions are seen. During synchronous sleep the evoked activity in the sciatic nerve was usually slightly reduced in amplitude, although did not change in its latency and pattern (Fig. 1*B*). It can be seen that the first and second deflexions are reduced in amplitude as compared with wakefulness. When the animal went into an episode of paradoxical sleep (with desynchronized EEG, flattening of nuchal muscles and rapid eye movements, REM) the evoked activity was usually tonically reduced in amplitude with phasic marked increase generally synchronous with the bursts of REM. The averaged values were often higher than those observed during wakefulness (Fig. 1*C*), the increase being proportional to the amount of REM present during the paradoxical sleep episode. It can be seen that the latency of the discharges does not change, while the increase in amplitude affects particularly the second and third deflexions of the neurogram. Both the second and the third deflexions also appear to be slightly shorter in duration than those seen in Fig. 1 *A* and *B*. The results indicate that the excitability of the corticospinal system is tonically depressed during synchronized and desynchronized sleep, whereas it increases during wakefulness and REM periods of desynchronized sleep. Since the sciatic nerve activity evoked by liminar pyramidal stimulation is abolished during paradoxical sleep[4] the phasic enhancement of activity evoked by sensory-motor cortex stimulation during this phase may be due to an increase of cortical excitability.

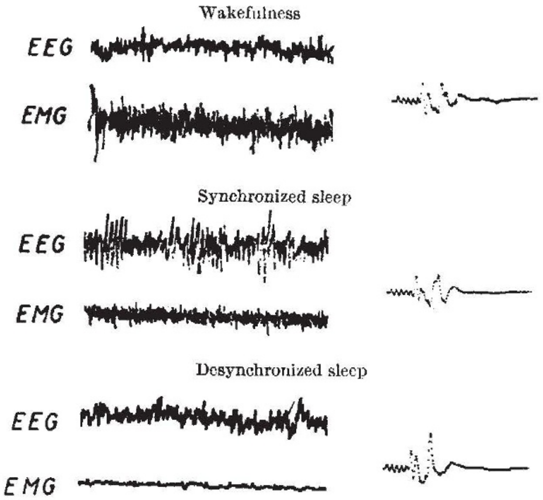

Fig. 1. Sciatic nerve activity evoked by sensory-motor cortex stimulation during wakefulness, synchronized and desynchronized sleep. Chronic unrestrained, unanaesthetized animal with frontal EEG and nuchal EMG. *A*, *B* and *C*: fifty averaged sciatic nerve responses evoked by stimulation of the contralateral sensory-motor cortex with bursts of 5 impulses at 300/sec, 0·07 msec, 3 V during wakefulness (*A*), synchronized sleep (*B*) and desynchronized sleep (*C*). Sweep duration 125 msec

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Electrocardiograms of Lambs in Selenium Deficiency

STUDIES have been made of lambs taken from their dams at 4 weeks of age and weaned, by stages, on to a selenium-deficient diet of the type used by Schwarz[1] for the development of dietary hepatic necrosis in rats. Lambs on this diet develop muscular dystrophy, the lesions appearing in both the cardiac and skeletal musculature; the livers do not become necrotic as they do in the rat. Control lambs fed the same diet, supplemented with an oral drench of 10 mg of sodium selenite per week, do not develop muscular dystrophy.

Electrocardiography on these lambs reveals the development of a characteristic abnormality. As the disease progresses the *T*-wave increases in amplitude until it finally dominates the record; at this stage the elevated *S–T* segment is typical of the pattern of myocardial infarction in man (Figs. 1 and 2). As the abnormal electrocardiograph develops progressively over a period of

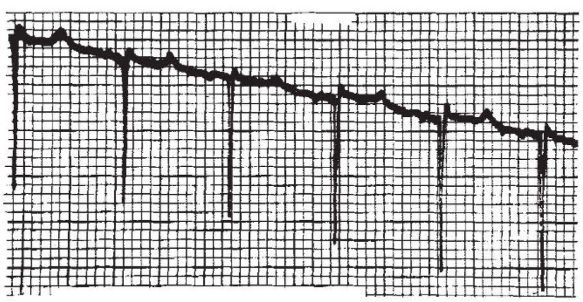

Fig. 1. Electrocardiogram of a lamb maintained for a few weeks on a selenium-deficient diet. At this stage no abnormality has developed in the electrocardiogram pattern