A trigeminal pain syndrome was produced in experiments on albino rats by injecting tetanus toxin into the caudal nucleus of the spinal tract of the trigeminal nerve. Tetanus toxin was used as a substance disturbing inhibition. The syndrome described has the characteristic features of the clinically familiar trigeminal neuralgia. It is concluded that this syndrome of experimental trigeminal neuralgia is based on the formation of a generator of pathologically increased excitation (a pathological dispatch station) in the system of the caudal nucleus of the trigeminal nerve as a result of the disturbance of inhibition. Mechanisms similar in principle, a disturbance of inhibition and the formation of excitation generators in the corresponding parts of the CNS, are considered to lie at the basis of various pain syndromes.

KEY WORDS: caudal nucleus of the trigeminal nerve; trigeminal pain syndrome; tetanus toxin; generator of pathologically increased excitation; "dispatch" station phenomenon.

Previous investigations [6, 7, 9-11] have shown that a severe pain syndrome with all the characteristic features and with a profound disturbance of the catecholamine balance [5] can be produced by injecting tetanus toxin into the posterior horns of the gray matter of the lumbar spinal cord. Tetanus toxin has been used as a substance disturbing inhibitory processes [6, 14, 16, 17]. Analysis of the data obtained suggests that the induced pain syndrome is one form of pathological dispatch station phenomenon [6-8], a basis for the formation of a generator of pathologically increased excitation.

The object of the investigation described below is to ascertain whether a trigeminal pain syndrome can be obtained by this method.

EXPERIMENTAL METHOD

Albino rats weighing 220 ± 20 g were used. Purified tetanus toxin, in a dose of 0.1-1.0 MLD for rats was injected from a microinjector into the caudal nucleus of the spinal tract of the trigeminal nerve on the right side in a volume of $1 \times 10^{-4}$ ml. Control animals received inactivated tetanus toxin under the same conditions. Glycine (20% solution, pH 5.6) was injected after the toxin into the same area of the nucleus; in the control experiments an 8% solution of NaCl, iso-osmotic with the glycine solution and with the same pH was injected. Clinical observations were made on the animal's behavior and its movements and postures were photographed. In some experiments a sound recording and an actogram of the animal

*Corresponding Member, Academy of Medical Sciences of the USSR.
†At the insistence of Professor G. N. Kryzhanovskii, the Russian term "stantsiya otpravleniya" is rendered in this manner—Translator.
‡The toxin was purified by O. P. Sakhalova, working in the authors' laboratory.
were obtained by the use of a specially constructed chamber with microphones and strain gauges. The electrical activity in the masticatory, temporal, and frontal muscles were recorded from some animals. The total number of rats tested exceeded 100.

EXPERIMENTAL RESULTS AND DISCUSSION

Soon after injection of the toxin (the actual length of this period depended on the dose of the toxin injected) the animals began to scratch particular parts of the face or head. In some cases (as a rule, if the toxin was injected deeper into the nucleus) the scratching movements were preceded by washing movements with the forelimbs. Scratching of areas of the face of head was accompanied by a corresponding movement of the hind limb but only on the side of injection of the toxin (Fig. 1A); after each scratching the rats carefully "cleaned" the digits of that paw just as during an ordinary scratch reflex (Fig. 1B). In the intervals between scratching the rats were quiet. With the course of time the bouts of scratching became more frequent, they lasted longer, and their intensity increased. The bouts were paroxysmal in character; they were not provoked by external stimulation of any sort, but were "silent" in character.

Later the scratching movements became violent, the rats squeaked loudly and began to scratch desperately the same area as before. The animals became restless and aggressive, they dashed about the cage and flung themselves against its walls. The seizures increased in frequency; as before they were paroxysmal in character but now they were easily provoked by a stimulus applied to the zone of scratching. The seizures could be provoked by tactile stimuli of different strengths, even light, applied to this zone; their intensity and duration were virtually identical in every case and were independent of the strength of stimulation. The zone of scratching, which was not the zone of facilitated induction of the seizure, increased in size. The skin of this zone was injured by the scratching and the air was removed from it (Fig. 1C); in the late stages the zone increased in area and sometimes an extensive part of the face was injured (Fig. 1E, F); often the animals lacerated the tissues in the region of this zone. The animals' posture in the period between seizures was characteristic: they would sit or lie on their side, with the forelimbs or paws held tightly against the face (Fig. 1D). The palpebral fissure on the side of injection of the toxin was narrowed and sometimes lacrimation and increased discharge from the nose were observed. The intensity and the rate of increase of the symptoms depended on the dose of toxin injected: if relatively large doses (1 MLD) were given the syndrome developed rapidly and the symptoms were severe; if a dose of 0.1 MLD was given the syndrome developed slowly and it could be observed for 2-3 days. The main cause of death of the animals was evidently tetanus poisoning, although the role of catecholamine imbalance, leading to paralysis of the heart, as took place in the spinal pain syndrome [5, 9], cannot be ruled out.