IN VIVO METHOD OF LONG-TERM PERFUSION OF THE CENTRAL CANAL OF THE ADULT CAT SPINAL CORD FOR NEUROPHYSIOLOGICAL RESEARCH

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KEY WORDS: spinal cord; perfusion of central canal.

Morton et al. [2] suggested a method of perfusing the central canal of the adult cat (or rabbit) spinal cord *in vivo* and simultaneous recording of potentials from the central spinal roots, which is an important development for research in neurophysiology and neuropharmacology. To inject the perfusion fluid into the central canal the workers cited used a steel injection needle which was inserted through the dorsal surface of the upper lumbar segments into the depth of the spinal cord blindly until the tip of the needle was inside the central canal. To allow drainage of the perfusate the spinal cord was transected completely at the level S1-S2. The outflowing perfusate was collected by means of a special cannula, introduced into the central canal of the sacral segments against the flow of perfusate. The use of this method in experiments on cats in the present writers' laboratory showed that it is not absolutely suitable for long-term experiments on the spinal cord. During perfusion the position of the tip of the needle relative to the central canal was found to move, so that the flow of perfusion fluid was interrupted. Airtightness of the perfusion system is disturbed and perfusate begins to escape from the track surrounding the needle. The method of collecting the perfusate recommended by Morton et al. likewise proved not quite suitable for our purposes, because of damage to the upper sacral segments, in which some centers controlling muscles of the lower limbs are situated.

For the reasons given above the writers have therefore developed their own version of a technique for perfusing the central canal of the adult cat spinal cord *in vivo*, and a description of it is given below.

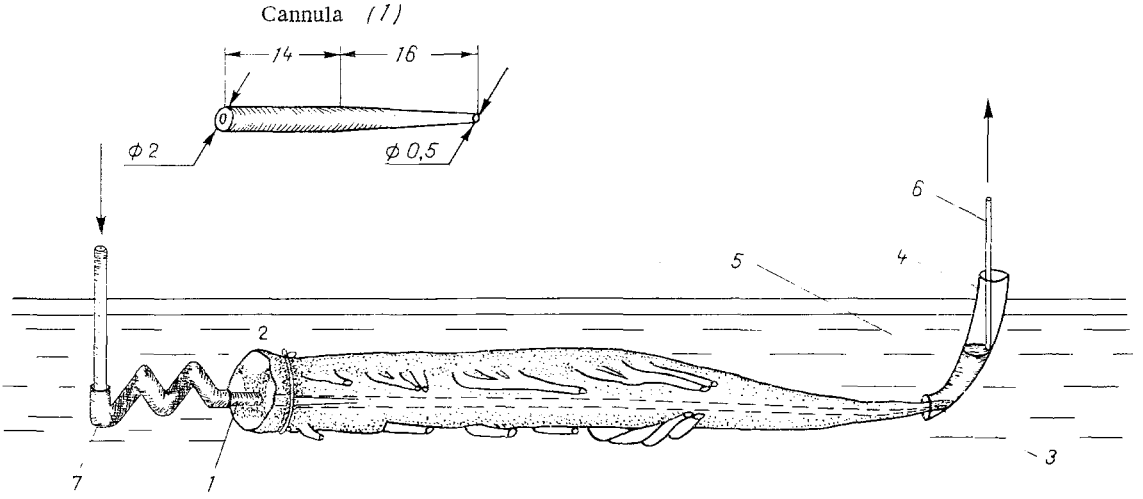

Fig. 1. Scheme of apparatus for perfusion of central canal of lumbosacral expansion of spinal cord. Explanation in text. Dimensions of cannula given in millimeters.

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To inject perfusate into the central canal of the spinal cord a Teflon cannula was used (Fig. 1). The cannula was introduced into the central canal of the upper lumbar segments after total transection of the spinal cord at the level L2-L3 under visual control, as shown in Fig. 1, and was fixed inside the canal by means of the ligature 2. Free drainage of the perfusate from the central canal was ensured by dividing the terminal part of the spinal cord (filum terminale) without damaging the sacral segments or their roots. To collect perfusate the stump of the filum terminale 3 was drawn inside a special polyethylene funnel 4. Airtightness of the space between the inner surface of the funnel and the filum terminale was ensured by covering the spinal cord with a layer of mineral oil 5. Perfusate collecting in the funnel was withdrawn by means of a water-jet pump 6. The inlet cannula was connected to the vessel containing perfusate, which consisted of artificial cerebrospinal fluid with the composition given by Merlis [1], by means of a thin vinyl chloride tube 7. About 15 cm of this tube was immersed in the warm (36-38°C) mineral oil surrounding the spinal cord, which warmed the perfusate entering the spinal cord. Our 3 years of experience of the use of this method of perfusing the central canal of the lumbosacral segments of the spinal cord has shown that it ensures stable fixation of the tip of the inlet cannula in the central canal, with reliable airtightness of the perfusion system, so that a continuous flow of perfusion fluid along the central canal for many hours is possible; the sacral segments and their roots likewise are absolutely undamaged, so that the standard electrophysiological technique can be used to study the functions of the spinal centers controlling the muscles of the lower limb, so that selective stimulation of cutaneous or muscular afferent nerves of the hind limb is possible and potentials can be recorded from the ventral and dorsal roots of the lumbar and sacral segments.

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USE OF A MICROPRISM GRATING TO MEASURE ERYTHROCYTE VELOCITY IN MICROVESSELS

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The blood flow rate in the microvessels (BFRM) is one of the most important parameters which determine the metabolic level in the tissues [2]. In pathological states it undergoes considerable changes, which correlate with the degree of damage, indicate the severity of the pathological process, and can be used as an early diagnostic sign of disease [3, 7, 8]. Determination of BFRM in living objects is connected with considerable technical difficulties. Methods based on the use of cross correlation, the Doppler effect, and frame analysis of motion pictures and videograms [1, 4-6, 9], while providing important information on the microcirculation nevertheless have disadvantages in the form of limitations of measurable velocity or range of diameters of the microvessels, complexity and cumbersomeness of the apparatus, its high cost, the impossibility of obtaining the results of measurements during recording (in the case of motion picture and video filming), etc. This has necessitated the designing of improved instruments for BFRM measurement. One such instrument is the PRIM (Ernst Leitz, West Germany), which is intended for measuring the velocity of erythrocytes and is based on spatial image filtration by means of a microprism grating [11]. An experi-

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