Nitric oxide modulates spontaneous cord dorsum potentials in the cat spinal cord

Elías Manjarrez\textsuperscript{a}, Teresa Rocha\textsuperscript{b}, Gerardo Rojas-Piloni\textsuperscript{a}, Ignacio Méndez\textsuperscript{a}, Amira Flores\textsuperscript{a,\*}

\textsuperscript{a}Instituto de Fisiología, Benemérita Universidad Autónoma de Puebla. Puebla, Mexico
\textsuperscript{b}Facultad de Medicina, Benemérita Universidad Autónoma de Puebla. Puebla, Mexico

Received 3 May 2001; received in revised form 7 June 2001; accepted 8 June 2001

Abstract

A previous study has shown that lumbar spontaneous cord dorsum potentials (CDPs) are produced by background activity of a neuronal ensemble located in the dorsal horn. Here, the effects produced by intravenous application of the nitric oxide synthase inhibitor L-N\textsuperscript{G}-nitro arginine (L-NOARG, 100 \(\mu\)g/kg) and of the nitric oxide donor 3-morpholinosydnonimine hydrochloride (SIN-1, 500 \(\mu\)g/kg) on spontaneous CDPs were examined. Experiments were performed on pentobarbitally anesthetized, paralyzed and spinalized cats. The amplitude of spontaneous CDPs increased after L-NOARG, however, decreased after SIN-1. These observations suggest that electrical activity of dorsal horn neurones generating spontaneous CDPs is dependent on nitric oxide production.

Keywords: Dorsal horn neurons; Background activity; Cord dorsum potentials; Free radical gas; Nitric oxide synthase; Spontaneous activity; Non-nociceptive; 3-morpholinosydnonimine hydrochloride

A previous study [8] has shown that the spontaneous cord dorsum potentials (CDPs) are generated by the activation of a population of dorsal horn neurones that share the same functional pathways as those neurones responding to stimulation of low threshold cutaneous afferents. It was not clear, however, the origin of the background activity of this neuronal population.

Some recent findings, obtained by in vivo electrochemical detection, show that nitric oxide (NO) is produced continuously at spinal dorsal horn level [12,13]. Therefore, one can suggest that NO released from dorsal horn neurones could be involved in the modulation of background activity of neurones producing spontaneous CDPs. The purpose of the present study was to provide evidence of the effects produced by a nitric oxide synthase (NOS) inhibitor and a NO donor on the spontaneous CDPs. Disclosure of this modulation could be important since the spontaneous activity of these dorsal horn neurones sets a background level of transmission regulation in the Ia-motoneuron pathway [8].

Guidelines contained in NIH publication 80–23 revised in 1978 on the principles of laboratory animal care were followed throughout. All efforts were made to minimize the number of animals used and their suffering. Experiments were carried out on adult cats (2.5–3.5 kg body weight) initially anesthetized intraperitoneally with pentobarbital sodium (Smith Kline, 35–40 mg/kg). The lumbo-sacral and low thoracic spinal segments were exposed and the left L5 to S1 ventral roots sectioned. The blood pressure (BP) was monitored through the carotid artery. The left radial vein was also cannulated to administer additional doses (10 mg/kg) of pentobarbital to maintain the animals in deep anesthesia. After the surgical procedures, the animals were paralyzed with a single dose of pancuronium bromide (Pavulon, Organon; 0.3 mg/kg, i.v.) and maintained under artificial respiration. In addition, the animals were spinalized at the T12 segment. Adequacy of anesthesia was assessed verifying that the pupils were constricted and that blood pressure was stable (between 90 and 110 mmHg) and not affected by noxious stimulation of the skin. When necessary, a solution of etilefrin (Effortil, Boehringer-Ingelheim) diluted with isotonic saline (1:10) was infused intravenously to maintain