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## Topical Application of Glutamate and Substance P Onto Trigeminal Nucleus Caudalis Produce Dorsal Horn Neuronal Inhibitions in the Rat

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24. Topical application of glutamate and substance P onto trigeminal nucleus caudalis produce dorsal horn neuronal inhibitions in the rat

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Powerful inhibitions of dorsal horn convergent neurons can be produced by widespread noxious stimuli (diffuse noxious inhibitory controls, d.n.i.c.) including those applied to trigeminal regions (Le Bars *et al.* 1979). The present study considers whether glutamate and two primary afferent peptides, substance P and somatostatin (Salt & Hill 1983), applied topically onto the surface of trigeminal nucleus caudalis, can mimic these inhibitory effects.

Convergent cells were activated by either natural (brush, touch, pinch, heat) or electrical A and C fibre stimulation in the Halothane-O<sub>2</sub>-N<sub>2</sub>O anaesthetized rat after exposure of the lumbar spinal cord. The animal was ventroflexed and nucleus caudalis exposed. Paraffin wax was used to seal the ventricular and arachnoid spaces. Substance P, somatostatin or glutamate, in artificial c.s.f., were applied to the surface of the nucleus in a volume of 25 µl and dorsal horn neuronal activity monitored. Glutamate (10 mM) produced a rapid and powerful inhibitory effect on the C fibre evoked responses of five neurons with a peak  $54.4 \pm 13\%$  inhibition ( $n = 5$ ) at 10 min and recovery by 20 min. A parallel but weaker inhibition of the A fibre responses was observed.

Substance P (10–50 µg) produced a less marked but more prolonged inhibition of 15 cells, excited one cell and did not affect another. A  $35.6 \pm 6\%$  ( $n = 15$ ) inhibition of C fibres was seen at 10 min and lasted until 25–30 min. The A fibre responses of these cells were reduced by  $10.5 \pm 5\%$ . Responses of five innocuous only cells and four proprioceptive were not altered by substance P ( $n = 6$ ) or glutamate ( $n = 3$ ). Higher doses of substance P did not produce greater inhibitions.

Somatostatin (10 µg) inhibited four convergent cells and excited seven neurons. The maximum inhibition of C fibre responses was  $53 \pm 9\%$  of control at 15 min whereas the cells excited had responses of  $148 \pm 19\%$  at this time. Overall, the effect of somatostatin was a weak excitation ( $113 \pm 19\%$ ). The time course of the events were similar to those following substance P.

The results indicate that both glutamate, a general neuronal excitant, and substance P can mimic a noxious stimulus and induce d.n.i.c., whereas somatostatin has mixed effects. The effects of somatostatin and the relatively weak inhibitions produced by substance P indicate that neither may have major roles in primary afferent excitatory transmission but this approach may be useful in studying other putative nociceptive transmitters.

*References*

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