

Pharmacological investigation of the autonomic transmission to the rat colon.

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Abstract:

The automatic neurotransmission to the distal rat colon has been studied using electrical field stimulation and actions of drugs on the isolated in vitro preparations. The minimal parameters for eliciting contractile responses were 0.5Hz, 0.5msec, although the stimulation programme employed were 10Hz, 1msec. for 5 seconds at 120 seconds interval under a supramaximal voltage of 25V. This usually resulted in monophasic responses which were abolished by tetrodotoxin(TTX).

Hexamethonium (5×10^{-7} - 5×10^{-5} M) produced an inhibition of ca 18.5 - 69% (n=6) on the amplitude of the electrically mediated twitches (EMTs). Adrenaline (Adr.) (5×10^{-8} - 5×10^{-6} M), noradrenaline (NA) (8.5×10^{-7} - 8.5×10^{-5} M) and isoprenaline (Isop) (1.3×10^{-6} M) depressed the EMTs in the rat colon. Propranolol (10^{-8} - 10^{-6} M) and phentolamine (1.34×10^{-7} - 1.34×10^{-5} M) depressed the EMTs by ca 17- 38% and 7.5-15% respectively (n=7) and also potentiated the twitch-inhibiting action of these catecholamines. Idazoxan (2.5×10^{-7} - 2.5×10^{-5} M) inhibited the EMTs by ca 5- 50% (n=3). Tyramine (4×10^{-8} M) profoundly inhibited the EMTs by ca 85%. Guanethidine (8×10^{-9} - 8×10^{-7} M), however, produced a concentration dependent twitch-augmentation of the EMTs. Low doses of NA (5×10^{-8} - 4×10^{-7} M) induced contractile responses which were partially reduced by phentolamine (5×10^{-7} - 2×10^{-6} M). High doses of adrenaline (10^{-6} - 8×10^{-6} M), noradrenaline (10^{-6} - 8×10^{-6} M) and isoprenaline (6.6×10^{-8} - 5.3×10^{-7} M) relaxed the colon. These were partially reversed by propranolol (2×10^{-7} M) and phentolamine (5.3×10^{-7} M).

Atropine (1.45×10^{-8} - 1.45×10^{-6} M) partially reduced the EMTs by ca 10 - 50%, while physostigmine neither augmented the EMTs nor enhanced responses that were resistant to inhibition by atropine. Atropine abolished all contractile responses elicited by acetylcholine, carbachol and nicotine. ATP (3.6×10^{-6} - 3×10^{-4} M) induced inhibition of the EMTs by ca 5 - 90%. Low doses of ATP (1.2×10^{-7} - 9.6×10^{-7} M) however contracted the colon.

Thus, the functional autonomic transmission appears to be: a) entirely neurogenic; b) partially cholinergic and motor; c) in possession of weak inhibitory and excitatory α ($\alpha_1 + \alpha_2$) but inhibitory β adrenoceptors. Evidence for non-adrenergic and non-cholinergic (NANC) contribution is also presented and may involve, e.g. purinergic receptors, and the multiple tachykinin receptors.

Keywords: Neurotransmission/ electrical field stimulation/ colon/ contractile/ inhibition/ adrenaline/ phentolamine/ tetrodotoxin/ electrically mediated twitches/ propranolol/ nicotine/ cholinergic/ tachykinin receptors/ rats

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