VASOACTIVE EFFECTS OF ATRIOPEPTIN ON VENTRAL AORTIC RINGS FROM THE HAGFISH, MYXINE GLUTINOSA

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Our recent studies (Evans et al., Am. J. Physiol. 257, R939-R945, 1989; Evans & Weingarten, Bull. MDIBL 28, 4-5, 1989) have demonstrated that isolated, aortic, vascular smooth muscle (VSM) rings from a teleost and elasmobranch vasodilate in response to synthetic rat atriopeptin (AP101-126). Contrary to mammalian VSM (e.g., Genest & Cantin, Rev. Physiol. Biochem. Pharmacol. 110, 2-147, 1988), aortic rings from these two species do not have to be preconstricted with agonists such as carbachol or norepinephrine to demonstrate the effect. To date, the receptors to AP have not been visualized autoradiographically in the ventral aortae of teleosts or elasmobranchs, but they have been identified in the ventral aorta of the hagfish (Kloas et al., Comp. Biochem. Physiol. 91A, 685-688, 1988). We decided, therefore, to investigate the physiological sensitivity of the VSM from the hagfish to AP.

The proximal ventral aorta (between the heart and the first branchial branch) was dissected free from anesthetized hagfish (1% MS222) and placed in ice-cold hagfish Ringer's solution (Evans & Robbins, Bull. MDIBL 24, 52-53, 1984). The vascular endothelium was removed by abrasion with a roughened, wooden rod and one or two rings (1-2 mm diameter) were mounted in 5 ml of hagfish Ringer's for tension measurements as described previously (Evans et al., Bull. MDIBL 27, 84-85, 1987-88). Rings were hung at 50 mg tension and maintained at that tension for at least 30 min until stable tensions were reached.

Our initial experiments demonstrated that rings that had not been preconstricted were relatively insensitive to AP so our concentration-response curves (10^{-11} to 2×10^{-7} M) were generated after the addition of 10^{-4} M carbachol, producing an initial tension of 114 ± 7.3 mg (SE; N = 8). Five out of the eight rings responded to 10^{-11} M AP with a slight vasoconstriction (2-6 mg), but 10^{-9} M produced significant vasodilation (-16 ± 4.6 mg), which was increased with higher AP concentrations to a maximum of -53 ± 10 mg, a nearly 50% reduction in tension. The calculated EC_{50} of the response to rat AP was 4×10^{-9} M, identical to that found for the teleost and shark ventral aortae (Evans et al., op. cit., 1989; Evans & Weingarten, op. cit., 1989), demonstrating that even the earliest vertebrates possess physiologically-relevant VSM receptors to AP. The high sensitivity to the synthetic mammalian AP also suggests that a putative hagfish AP must share significant structural homology with mammalian AP. The physiological role played by a volume/solute balance hormone like AP in an organism that is isotonic, and nearly isoionic, to sea water remains to be seen. Supported by NIH EHS-P30-ESO3828 to the Center for Membrane Toxicity Studies and NSF DCB-8801572 to DHE.