Functional analyses of the cardiac natriuretic peptides in medaka using a knockdown technology

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The natriuretic peptide (NP) family comprises atrial, B-type, and ventricular NP (ANP, BNP and VNP) secreted from the heart, and four C-type NPs (CNP1-4) mainly produced in the brain. Cardiac NPs have potent osmoregulatory actions to promote seawater adaptation in eels. In order to delineate further the role of cardiac NPs in teleost osmoregulation, we applied a gene knockdown technique using medaka (*Oryzias latipes*) that has only one cardiac NP, BNP in teleost species. We first examined the dynamics of BNP genes expression together with CNP3 (ancestor of cardiac NP) in developing embryos using real-time qPCR and *in situ* hybridization. BNP gene strongly expressed in cardiac ventricles and its mRNA levels peaked at 48 hpf when ventricular formation was started. CNP3 gene expressed in the heart and vein, and its mRNA levels transiently increased at 35 hpf when heart formation was started. BNP knockdown caused serious defects in the ventricular formation, resulting in much smaller ventricle than controls. CNP3 knockdown induced a remarkable atrial enlargement. In addition to the developmental effects, BNP and CNP3 knockdown produced an increase in osmolality of seawater embryos. Thus, cardiac NPs are responsible not only for cardiac development but osmoregulation in medaka.