19) Quantitative Observations of Fine Structure of Myocardial Plasma Membrane in Rat Ventricle.

Hiroshi Ozasa, Koji Watanabe, Toshikazu Nishio, Chuzo Mori,
Ryoichi Horie*, Yukio Yamori*.
Departments of Pediatrics and Pathology*, Shimane Medical University,
Izumo, 693, Japan.

INTRODUCTION

The heart of newborn is different from that of adult on mechanical and electrical characteristics. The fine structure of myocardium in a newborn animal is also expected to alter with growing. In this study, we investigated the developmental ultrastructural changes of myocardial plasma membrane of Wistar rats of Kyoto strain (WKY) with freeze-fracture method.

MATERIALS AND METHODS

WKY at the following ages were used: 7 day-old (male or female), 4 week-old, 8 week-old and 16 week-old (male for each). Three animals for each age were prepared. The animal was anesthetized and thoracotomy was performed. The heart was fixed with perfusion with 2% glutaraldehyde in 0.1M phosphate buffer (pH 7.4) through a needle cannulated at the apex. The myocardial tissue from free wall of the left ventricle was cut into 1 mm-width pieces and fixed for the following 2 hours. After infiltrated in graded glycerols, the tissue was frozen in liquid nitrogen and freeze-fractured at -130°C , 5×10^{-2} torr and replicas were made in a JFD-7000 freeze etch equipment. Three replicas from each animal were examined with an electron microscope and three photographs of randomly selected fields from each replica were taken. Eighteen areas of $0.16 \mu\text{m}^2$ were randomly selected from the photographs per group and intramembranous particles (IMP) larger than 5 nm in their diameter were counted. The mean diameter of the particle was determined by measuring those of fifty particles clearly outlined.

RESULTS

We show the density of IMP of rat ventricular myocardium.
Numbers of particles per μm^2 (mean $\pm$ SD)

Age	P-face		E-face	
7 day	1232 $\pm$ 60	(18)	197 $\pm$ 26	(18)
4 week	1465 $\pm$ 96	(18)	220 $\pm$ 26	(18)
8 week	2131 $\pm$ 199	(18)	548 $\pm$ 69	(18)
16 week	2272 $\pm$ 96	(18)	541 $\pm$ 47	(18)
	() : no. of areas counted			

Mean diameter of IMP was not significantly different with age.

DISCUSSION

The IMP have been regarded as integral membrane protein complexes, including ion-selective channel, carriers and receptors, which are responsible for function of the plasma membrane (Kordylewski: AM J Physiol 245: H992, 1983). In this study, the density of IMP on P-face increased largely after the age of 4 week-old. Previous reports have suggested that 4 week-old is just the time that the contractile function of myocardium reaches the value in adult rats (Hopkins, Circ Res 32: 685, 1973) and that the inotropic response to catecholamines becomes similar to that in adult rats (Driscoll: Pediatr Res 12: 42, 1978). These data suggest that the increase of density of IMP of rat myocardium might relate to its functional development.