Comparison of the Contractile Response and Intracellular Ca^{2+} Level in Esophageal Striated Muscle of Wistar Kyoto Rats and Stroke-Prone Spontaneously Hypertensive Rats. Fumiko Sekiguchi¹⁾, Kazuo Yamamoto²⁾, Keiichi Shimamura²⁾ and Satoru Sunano¹⁾. ¹⁾Faculty of Pharmaceutical Sciences, Kinki University, Higashi-osaka 577, ²⁾Research Institute of Hypertension, Kinki University, Osaka-sayama 589.

It has been known that various responses in vascular smooth muscle from spontaneously hypertensive rats (SHR) are different from those in the preparation from normotensive Wistar Kyoto rats (WKY). Some reports indicate that intracellular Ca^{2+} regulatory system is altered in the vascular smooth muscle in SHR, and the alteration contributes to the abnormal responses. Functional changes have also been presented in skeletal muscles of SHR which does not contribute to the modulation of blood pressure. In the present study, contractile response to electrical field stimulation (EFS), K^+ depolarization, caffeine, and cyclopiazonic acid (CPA), a selective inhibitor of sarcoplasmic reticulum (SR) Ca^{2+} -ATPase, were studied in the esophageal striated muscle from stroke-prone SHR (SHRSP) and compared with those in the preparation from WKY. In addition, changes in intracellular Ca^{2+} level ($[\text{Ca}^{2+}]_i$) induced by some agents were also investigated.

Sixteen-week-old, male SHRSP and WKY were used in the present experiments. Systolic blood pressure of WKY and SHRSP was 137.3 ± 2.0 mmHg and 240.5 ± 7.3 mmHg, respectively. Strip preparations of the esophageal striated muscle (length: 10 mm, width: 2 mm) were made from outer layer muscle of which inner muscularis mucosae was removed. Mechanical responses of the preparations were observed isometrically with a force-displacement transducer in a modified Tyrode's solution. Twitch contraction of the preparation was initiated by the stimulation of electrical pulse of 100 volt, 10 msec duration and 1 min interval. Contraction by K^+ depolarization was initiated by increasing K^+ concentration of the incubation medium to 142.4 mM. Changes in $[\text{Ca}^{2+}]_i$ were measured simultaneously with tension changes by the Fura-3 method.

EFS-induced twitch contraction in the preparations from both WKY and SHRSP decreased gradually and disappeared finally by the removal of Ca^{2+} from modified Tyrode's solution. The time course of the decrease of twitch contraction was faster in the preparation of SHRSP. High K^+ -induced contraction also decreased gradually and disappeared finally by the removal of Ca^{2+} in both preparations. The depression was more marked in the preparation of SHRSP. Caffeine induced concentration-dependent contraction which was abolished by long-term exposure of Ca^{2+} -free solution. The contraction was apparently smaller in the preparation of SHRSP. In the preparation of WKY, CPA (10 μM) induced a tonic contraction accompanied by increase in $[\text{Ca}^{2+}]_i$. Although the preparation of SHRSP showed an increase in $[\text{Ca}^{2+}]_i$, it failed to induce tension development. The elevation of $[\text{Ca}^{2+}]_i$ induced by CPA was significantly smaller than that in the preparation from WKY. Both CPA-induced tension development and increase in $[\text{Ca}^{2+}]_i$ were dependent on extracellular Ca^{2+} , and were abolished in the absence of extracellular Ca^{2+} . However, they were not affected by an application of verapamil (10 μM). CPA augmented the EFS-induced twitch contraction in both preparations from SHRSP and WKY prolonging the relaxing phase. The effect was greater in the preparation of WKY.

In summary, the SR-dependent contractile responses in the esophageal striated muscle from SHRSP were obviously different from those in the preparation from WKY. In addition, the contractile responses in the esophageal striated muscle were affected strongly by the removal of extracellular Ca^{2+} , and the effect of the removal was more marked in the preparation from SHRSP. It was suggested that the function of Ca^{2+} uptake, Ca^{2+} release and the sensitivity to drugs of SR were altered in the preparation from SHRSP when compared with those in the preparation from WKY.