

Artery Cell Contraction via ROS and NO Balance Examined by In Vivo Multi-photon Imaging Technique and Laser Injuries Technique

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Blood pressure is regulated dynamically by arterial wall tensions *in vivo*, but the previous methods did not clarify their detailed mechanisms in living animals due to the lack of visualization technique. Thus we aimed to visualize cell kinetics during artery contractions processes by combining *in vivo* multi-photon imaging and photochemical reaction technique by laser injuries.

We recently developed the *in vivo* fluorescent imaging technique based on two photon microscopy, which enabled us to directly visualize the femoral artery in living animals. In addition, by combining with the visualization technique with laser induced injury models, we could visualize transient artery contraction in response to ROS (reactive oxygen species) (Figure a). Using this novel animal model, we elucidated the functional contribution of smooth muscle cell of artery to hypertensive diseases. We also directly measured the ROS and NO (nitric oxide) production in smooth muscle cells, which was analyzed and quantified by novel tracking software.

We observed that ROS and NO production was counter-balanced in transient artery contractions (Figure b and c). As for the molecular mechanisms, we confirmed that this contraction is via PKC and NADPH signaling. The contraction was inhibited by Ca blocker, isosorbide, sildenafil, and angiotension II blockers administrations.

In addition, by treating the artery with CaCl solution, the aneurysm formation was also visualized. In the early phase, the hyper-responsiveness of artery wall, and transient thrombus formation was observed. In the later, the wall was stiffened, collagen contents were increased, and aneurysm was observed in last.

These results indicated the ROS and NO counter balances dynamically regulate artery contractions. eNOS also contributed to these contractions, and imaging can visualize various dynamic signaling. In sum, our imaging system can be a powerful tool to analyze the molecular mechanisms of hypertension and artery aneurysm.

References:

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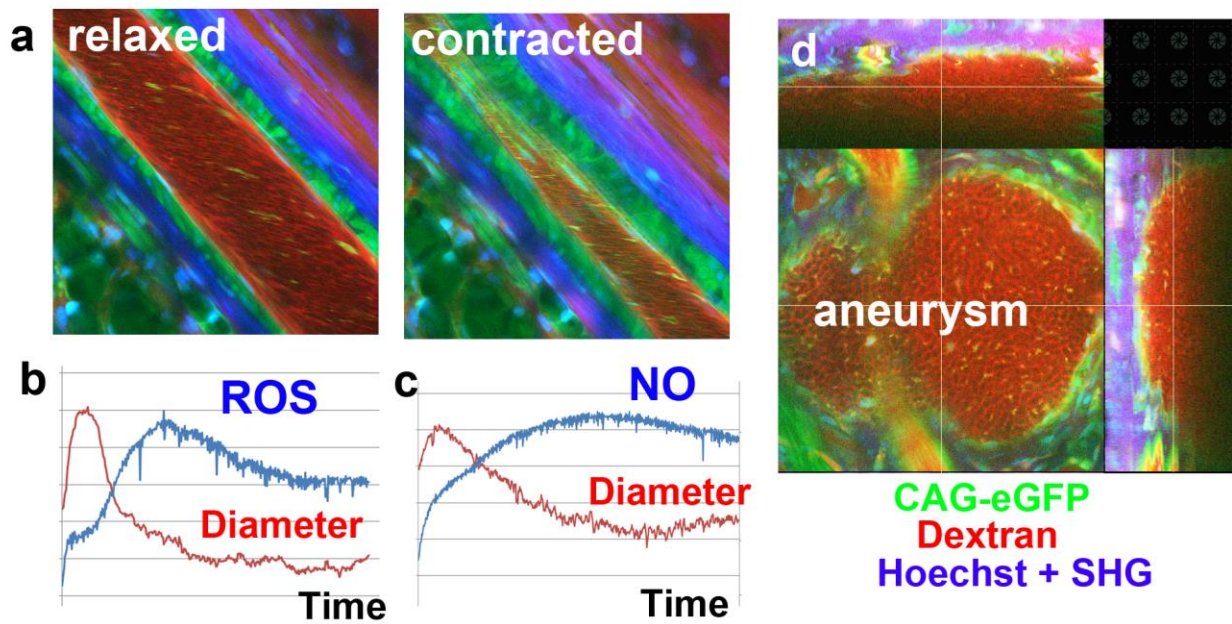


Figure : In vivo imaging of femoral arteries and contractions by ROS stimulation (Green: CAG-eGFP, Red: dextran, Blue: Hoechst)