Materials Science

NE5A/2008G566

Evaluation of revascularization by arteriole/capillary ratio using synchrotron radiation coronary angiography

Tomohiro IMAZURU[*1], Shonosuke MATSUSHITA[1], Kazuyuki HYODO[2], Shizu AIKAWA[1], Chiho TOKUNAGA[1], Yoshiharu ENOMOTO[1], Shinya KANEMOTO[1], Fujio SATO[1], Yuji HIRAMATSU[1], Yuzuru SAKAKIBARA[1]

[1] Dept of Cardiovascular Surg, Univ. of Tsukuba, Tsukuba, Ibaraki, 305-8575, Japan
[2] KEK-PF, Tsukuba, Ibaraki 305-0801, Japan

Introduction

Revascularization consists of both angiogenesis and arteriogenesis. Angiogenesis is capillary growth around 10 μm in ischemic tissue. In contrast, arteriogenesis is growth and remodeling of preexisting vessels into arterioles, which is defined as 50 to 400 μm in diameter. In angiogenic cytokines, some are dominantly work for angiogenesis, and the others are for arteriogenesis. However, there has been no effective tool to identify it in vivo. Synchrotron Radiation Coronary Angiography (SRCA) may resolve this problem since it can identify small arteries down to 50 μm in diameter and densitometry on SRCA may help as evaluation of capillary growth.

Manuscript preparation

Erythropoietin (Epo) is used as a cytokine to enhance revascularization since Epo is expected to bring about both angiogenesis and arteriogenesis. Other angiogenic factor like G-CSF is also evaluated.

After creating myocardial infarction in rat, Epo and G-CSF was injected. Hearts were hanged in Langendorff apparatus 4 weeks later. SRCA was performed. Arteriogenesis is evaluated by number of crossing arterioles on lattice of SRCA image (Fig 1). Arteriogenesis is evaluated by area of twilight zone (area between normal and infarction) in 256 B/W gray scales (Fig 2).

Results

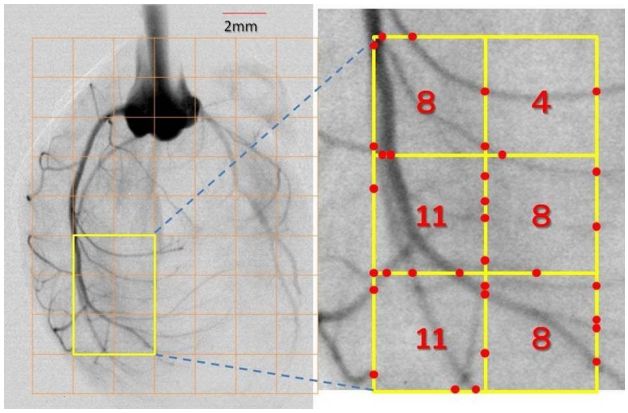
Both arteriogenesis and angiogenesis were able to quantify with SRCA. Epo enhanced arteriogenesis significantly than G-CSF and vehicle (Fig 3).

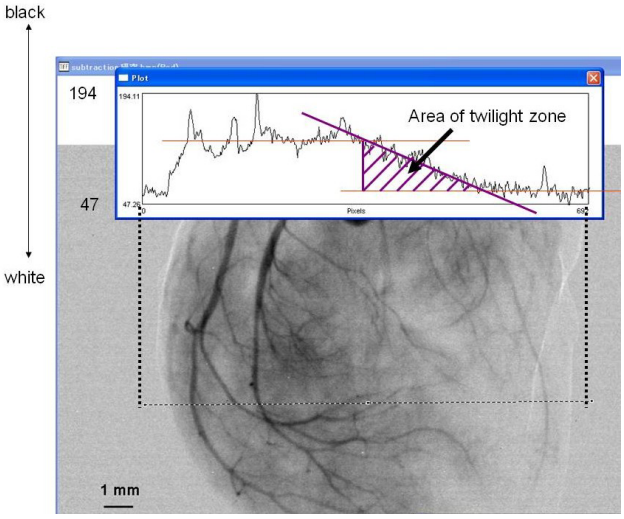
Conclusion

It is proved that SRCA is capable to quantify both arteriogenesis and angiogenesis. The ratio arteriole/capillary by SRCA can provide recognition of angiogenic nature of therapeutic cytokines. It is expected to apply for future angiogenic therapy.

Reference

Imazuru T, Matsushita S, Hyodo K, Tokunaga C, Kanemoto S, Enomoto Y, Watanabe Y, Hiramatsu Y, and Sakakibara Y: Erythropoietin enhances arterioles more significantly than it does capillaries in an infarct rat heart model. Int Heart J 50(6): 801-810, 2009





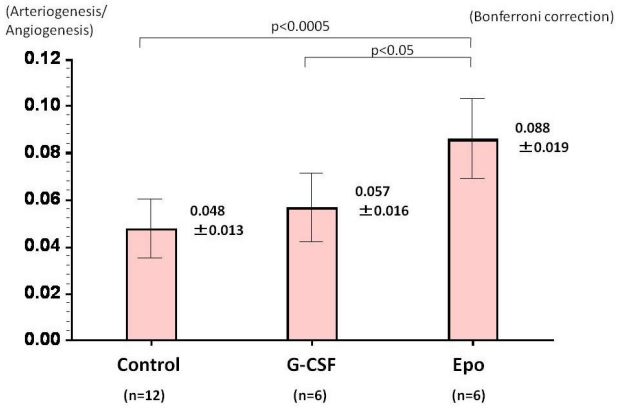


Fig.1 to 3 (upper, middle, lower figures)

*imazuru@tmch.or.jp