

## Characteristics of myocardial blood flow distribution in heart disorders associated with angiogenesis: Two dimensional mapping of heavy element-loaded microsphere in heart muscle by using monochromatic synchrotron radiation-excited x-ray fluorescence

Hidezo MORI<sup>1,2</sup>, Naoichiro HATTAN<sup>1</sup>, Yoshiro SHINOZAKI<sup>1</sup>, Etsuro TANAKA<sup>\*1</sup>, Hideki IWAGURO<sup>1</sup>, Kazunobu BAN<sup>1</sup>, Koichiro YOSHIOKA<sup>1</sup>, Hisanori FUJIKURA<sup>1</sup>, Yoshinori SUGIO<sup>1</sup>, Takafumi SEKKA<sup>1</sup>, Eriko KUWABARA<sup>1</sup>, Atsuo IIDA<sup>3</sup>

<sup>1</sup>Tokai University School of Medicine, Bohseidai, Isehara-shi, Kanagawa 259-1193, Japan

<sup>2</sup>National Cardiovascular Center Research Institute, Fujishirodai, Suita-shi, Osaka 565-8565, Japan

<sup>3</sup>Institute of Material Structure Sciences, National Laboratory for High Energy Physics, Oho, Tsukuba-shi, Ibaraki 305-0801, Japan

We examined the hypothesis that transmyocardial laser revascularization (TMR: new surgical angiogenic therapy) relieves myocardial ischemia by increasing the blood supply to ischemic regions via the transmural channels, by means of acute canine experiments.

Ten TMR channels were created by using a CO<sub>2</sub> laser (20 - 30 joule) in the mid-portion of the left ventricle (LV) supplied by the left anterior descending coronary artery (LAD). Regional blood flow during transient ischemia (2 min) induced by LAD ligation was compared before and 30min after the TMR. At the third transient ischemia the mid LV was cut along with the short axis for the analysis of NADH fluorescence in the regions around the TMR channels.

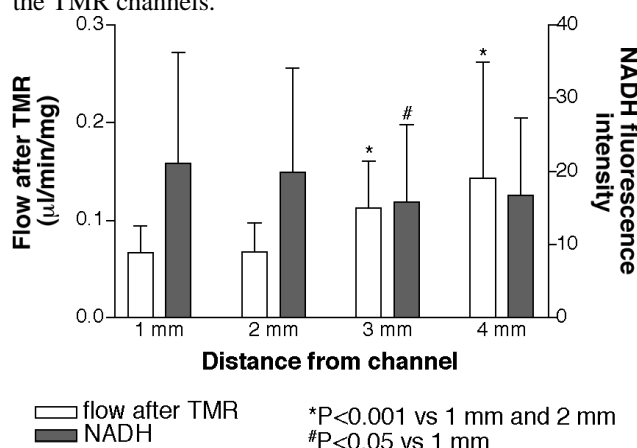


Fig. High-resolution analysis of flow and NADH fluorescence around the TMR channels

In the low-resolution analysis, blood flow reduction in the ischemic region (2 - 4 gram tissue) was not significantly altered after the TMR, and NADH fluorescence (2 - 3 cm<sup>2</sup> area) was observed throughout the ischemic region without significant regional variation. High-resolution analysis (1mm x 1mm in area, 2.8 mg tissue, Figure) revealed that the regional flow after TMR in the regions 2 mm or less from the channel was lower than the flow before TMR (paired t test), and lower than the flow after TMR in the regions 3 mm or more away (ANOVA). NADH fluorescence was higher in the regions close to the channels (1 - 2 mm) than in the regions 3 - 4 mm away from them.

Creating TMR channels did not improve the blood supply to ischemic region and rather aggravated the local ischemia in the immediate phase.

### References

- [1] Y. Nakajima et al. Am. J. Physiol. 277, 46, H2353-H2362 (1999)
- [2] K. Umetani et al. J. Synchrotron Rad. 5, 1130-1132 (1998)
- [3] H. Mori et al. Radiology 201, 173 (1996)
- [4] H. Mori et al. Circulation 89, 863 (1994)

\* tanaka@is.icc.u-tokai.ac.jp