

Sex difference of arterial response to cold exposure

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Introduction

Hypersensitive aesthesia for coldness (so-called Hie-sho in Japanese) is known to occur more frequent in women [1,2,3]. We hypothesized that it is derived from sex difference of deep-seated vascular response to coldness. To clarify this mechanism, we focused on the arterial response to coldness by cold spray in rat hindlimb using synchrotron radiation micro-angiography (SRMA).

Manuscript preparation

Male and female adult rats (both groups, n=6) were employed. Rats were subjected to be exposed by cold spray in 5 seconds. Tissue temperature of hindlimb was continuously recorded in 15 minutes after cold exposure. SRMA was performed at pre and one minute after cold exposure.

Results

The temperature of the hindlimb decreased rapidly with cold exposure in all cases, and minimum tissue temperature was observed one minute after cold exposure in both groups. The reduction in tissue temperature was larger in female than in male (female: 23.0±/6.1 degree C vs. male: 12.0±/6.1 degree C) (p<0.05). This difference was significantly existed until 14 minutes after cold exposure.

There was no significant difference in arterial diameter between both groups at pre cold exposure. In both groups, the diameters of arteries were significantly dilated at one minute after cold exposure compared with pre cold exposure (p<0.05). However, the rate of expansion was less significant in female than in male (female: 69±40% vs. male: 119±73%, p<0.05) (Fig.1 and 2).

Discussion

There have been several reports on sex differences in vascular response to cold exposure in cutaneous vessels using indirect methods with measured by laser Doppler flowmetry and plethysmography. In this study, the results have shown that deep-seated arteries dilate without constriction by cold exposure and female arteries expand less than male with cold exposure. This could be visualized for the first time by SRMA with high resolution. We emphasize that less expansion of may contribute to “Hie-sho” in female in addition to cutaneous cold vasoconstriction.

Conclusion

From this experiment, it is clarified that female vessels are less expansive against cold exposure.

References

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- [2] S. Ishino. Sanhujinka Chiryō 1999; 78:535-537
- [3] H. Matsuo. Sanhujinka Chiryō 2000; 82:329-331.

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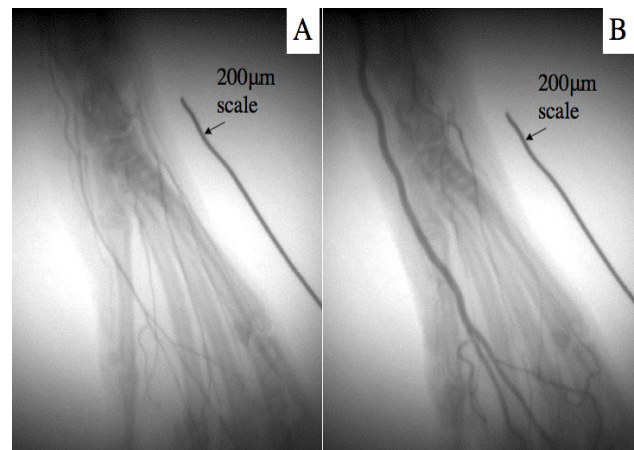


Fig.1 An example of SRMA of rat hind limb pre(A) and one minutes after(B) cold exposure (male)

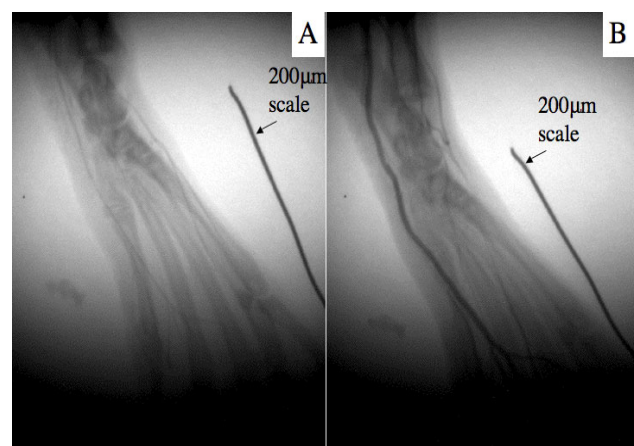


Fig.2 An example of SRMA of rat hind limb pre(A) and one minutes after(B) cold exposure (female)