

**Relationship between the structure and
the velocity profile
in the accompanying vein of the limb**

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Deep Vein Thrombosis

Characteristics:

- In the deep vein (accompanying vein) of the lower limb.
- Not observed in the cutaneous vein.
- Stagnant is an important factor for the disease.

Variety of Veins

Anterior

Left

Right

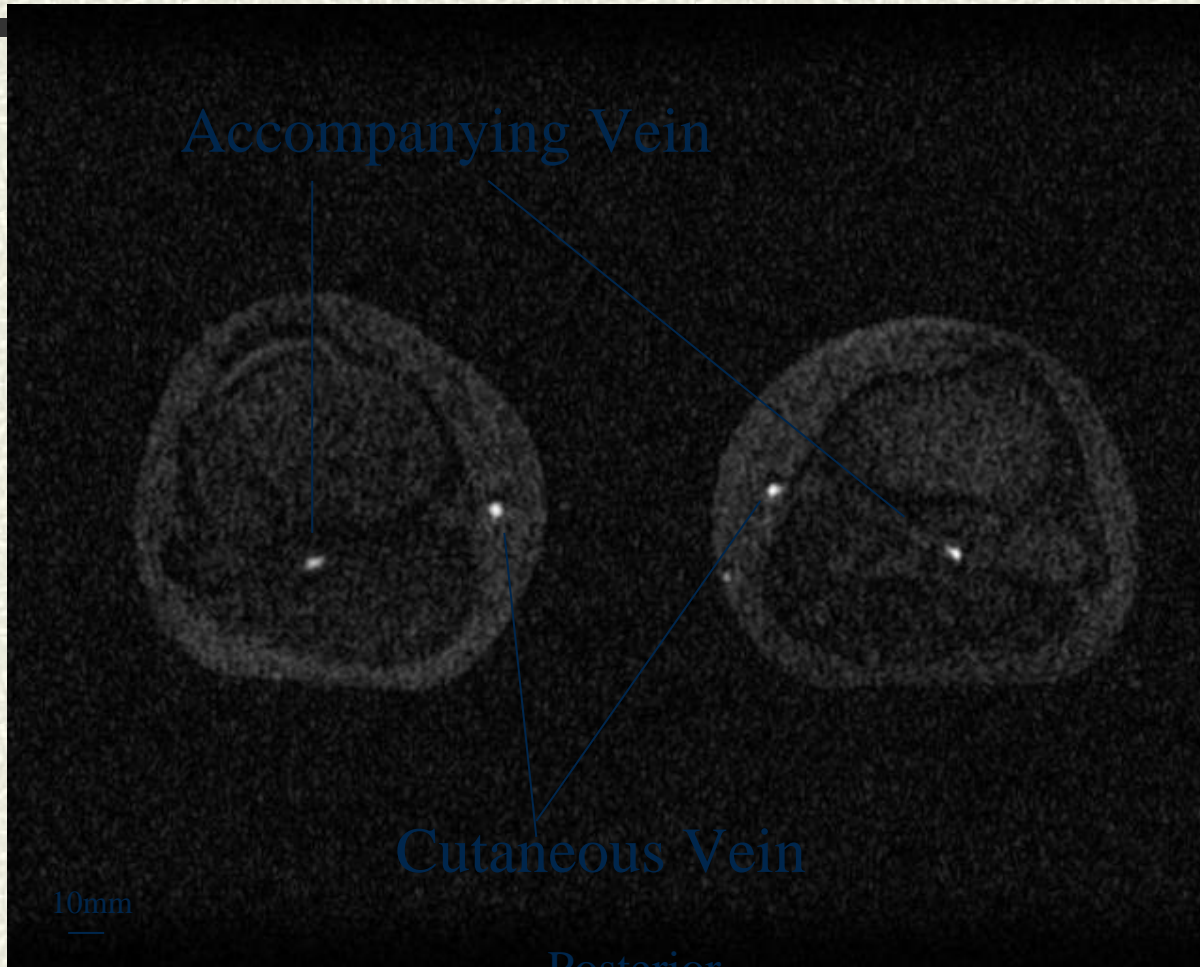
Accompanying Vein

Cutaneous Vein

10mm

Posterior

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Differences in veins (Limb)

Accompanying (Deep) Cutaneous(Superficial)

Smooth muscle

<

Diameter Control

Muscle

Nerve

Valve Interval

<

Past Studies

- Kamm RD (1982) ••••• Simulating the velocity profile in the accompanying vein.

--->The results showed the importance of the calf pump.

- Faghri PD et al. (1997) & Stannard JP et al (2001)
•••• Practical application (calf pump)

-->There was not enough results, which showed that the calf pump could prevent the thrombosis sufficiently.

Purpose

Investigate the velocity in the veins in human lower limbs.

- Measure the velocity in the accompanying vein and the cutaneous vein in human under limbs.
- Observe the velocity change by the exercise. (calf pump effect)

Method

Volunteer •••• 5

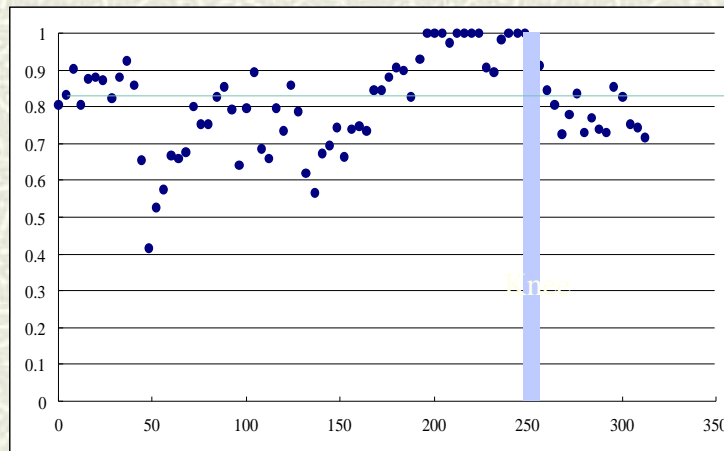
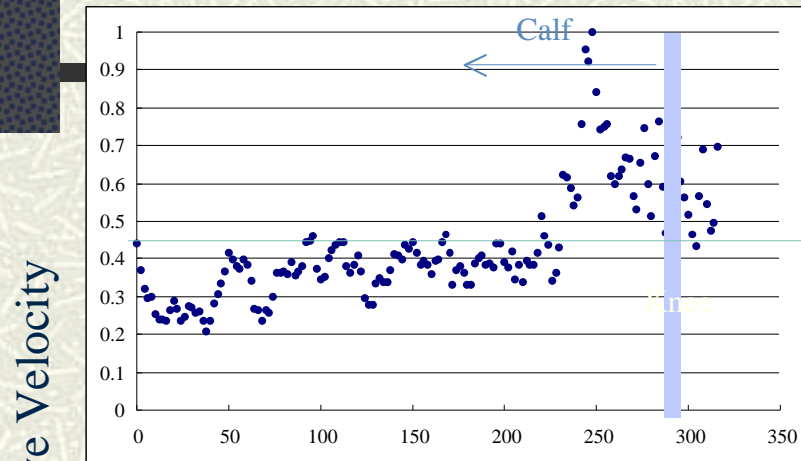
FOV •••• around knee. (one of them, thigh)

Sequence •••• 2D TOF (TR=30, TE=9, ST=3-4)

Resolution •••• 0.5 -1 mm

All the measurements were done by 1.5 T EXCELART MR System (TOSHIBA Corporation, JAPAN).

Result -Exercise Effect-



Position along the body axis [mm]

Relative Velocity = 1



Velocity > 13 cm/sec

Discussion

- Exercise Effect-

- The maximum velocity appeared in the accompanying vein
- The average velocity was increased



• Exercise (Calf Pump) -> Change the diameter -> Flow increase

Result

-Position in Maximum Velocity-

Sample A ●●● Deep Vein (near the ankle, cutaneous vein)

Sample B ●●● Deep Vein

Sample C ●●● Cutaneous Vein

Sample D ●●● Cutaneous Vein

Sample E ●●● Cutaneous Vein

Discussion

Tone:

Cutaneous Vein •••• changed by the mental stress
Accompanying Vein •••• changed by the muscle



The velocity in the vein may reflect the mental stress.

The mentality would be important for the blood flow.

Conclusion

Calf pump & Nerve System



Blood flow in the accompanying vein

Future Study

- Evaluate the contractility of the smooth muscle in the cutaneous veins.
- Evaluate the transformation of the accompanying vein by the muscle contraction.