Estimation of the Arterial Stenosis by Means of Blood Pressure Waveform

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The blood pressure wave propagates to peripheral artery from heart through systemic circulatory system. In an uniform blood vessel, the pressure wave propagates along the vessel without any distortion. In systemic circulatory system, the pressure wave changes their shape along the blood vessels due to the reflection of the pressure wave at the boundary of blood vessels. The reflection is usually not so big in normal circulatory system, however, if there is the stenosis in an artery, big reflection occurs at the stenosis, because the energy of forward propagation wave is partially returned backward, and the energy of wave propagated to peripheral vessels greatly decreased. Therefore, the amplitude of pressure wave in the peripheral vessels remarkably decreases even by a very small stenosis.

Arterial stenosis has been mainly measured by the change of average or maximum blood pressure for long time. The average or maximum blood pressure does not seriously decrease by the small stenosis because the pressure drop at the stenosis mainly depends on viscous resistance of flow. When the stenosis is small, the ratio of central and peripheral average blood pressures is much smaller than the ratio of central and peripheral pressure waves.

The degree of stenosis, therefore, can easily be measured by the amplitude ratio of central and peripheral pressure waves. This method was both theoretically and experimentally discussed in this paper. For theoretical discussion, an electrical simulation model of systemic circulation system was used.