

# 運動負荷中及び終了後の中心血圧測定による 心血管リスク評価の有効性の検討

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## Central Blood Pressure Measurement During and After Dynamic Exercise for Evaluating Risks of Cardiovascular Diseases

by

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### ABSTRACT

The aim of this study was to assess the central blood pressure response to exercise with risks of cardiovascular diseases associated with hypertension. Thirty-four male volunteers (aged  $51 \pm 7$  years; mean  $\pm$  s.d.) who were free from cerebrovascular and cardiovascular diseases, diabetes mellitus and renal diseases were examined. The subjects underwent a graded symptom-limited submaximal exercise test on bicycle ergometer. At baseline, during and after the cycle exercise, peripheral pulse waveforms were recorded by a radial applanation tonometry. Central (ascending aortic) pressure waveforms were then estimated using a generalized transfer function. Pulse pressure amplification, defined as the

ratio of peripheral to central pulse pressure, was used as a marker of wave reflection. Compared to the baseline, pulse pressure amplification significantly increased during exercise, and after the exercise it gradually decreased to the baseline level. We divided the subjects into subgroups according to the presence or absence of hypertension, dyslipidemia and glucose intolerance. Throughout the exercise test, pulse pressure amplifications in the subjects with hypertension and those with multiple risk factors, including hypertension together with at least one of dyslipidemia and glucose intolerance, were significantly lower than those with normal blood pressure. Furthermore, the subjects with multiple risk factors had significantly reduced pulse pressure amplification after exercise compared to those with hypertension alone. In multiple regression analysis, the post-exercise pulse pressure amplification was independently associated with age and the presence of multiple risk factors including hypertension. There was a significant correlation between post-exercise pulse pressure amplification and left ventricular mass index.

These results suggest that pulse pressure amplification is associated with the hypertension, dyslipidemia and glucose intolerance, and with increased left ventricular mass. Thus, the measurement of central blood pressure during and after exercise may be useful in investigating the hypertension-related risks of cardiovascular diseases.

## 要 旨

本研究は、運動負荷中及び終了後の中心血圧測定から得られるパラメータが心血管リスクの評価に有用であるかを検討することを目的とした。成人男性34名（平均年齢51.2±7.2歳）を対象に、自転車エルゴメーターによる運動負荷試験を多段階漸増負荷法で実施した。負荷試験中は右上腕部より血圧を連続的に測定するとともに、トノメトリ法により橈骨動脈血圧波形の記録を行った。さらに、この波形を伝達関数により大動脈起始部血圧波形に変換して中心血圧を求めた。また、橈骨動脈と大動脈の脈圧比（amplification）を脈波における反射指数として用いた。amplificationは、負荷前に比べ負荷中及び終了直後では有意に上昇し、負荷後は徐々に低下して負荷前のレベルに戻る傾向にあった。高血圧、脂質代謝異常、耐糖能異常の有無により、対象者を正常血圧群、高血圧

群、多重リスク群（高血圧+脂質代謝異常かつ/または耐糖能異常）に分けて比較すると、高血圧群と多重リスク群のamplificationは負荷試験中のいずれの測定点においても正常血圧群に比べて有意に低値を示した。高血圧群と多重リスク群の比較では、負荷前と負荷中のamplificationに差はなかったが、負荷後においては多重リスク群が有意に低値であった。また、負荷後のamplificationを従属変数としたステップワイズ法による重回帰分析では、年齢、高血圧を含む多重リスクの有無が独立の決定因子であった。さらに、負荷後のamplificationと左室心筋重量係数との間には有意な相関関係が認められた。

以上のことから、運動負荷試験中に橈骨トノメトリ法で測定した中心血圧のパラメータは、高血圧を含む脂質代謝異常や耐糖能異常の集積の有無、あるいは左室肥大の程度と関連し、心血管リスクの評価において有用である可能性が示された。