

高血圧者における水中浸漬時の水圧が 筋組織血液動態に及ぼす影響について

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Effects of Intramuscular Oxygen Hemodynamics in Hypertensive Patients in Water Immersion

by

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ABSTRACT

The purpose of the present study is to compare the intramuscular oxygen hemodynamics in and out of water in order to investigate the potential value of underwater exercises for elderly patients with hypertension. After the sensor of a laser tissue blood-oxygen monitor was installed over the right vastus medialis muscle of 5 healthy aged subjects and aged hypertension patients who are receiving medical therapy, tissue oxygen saturation (StO₂) level, tissue hemoglobin (HbT) level, tissue deoxygenated hemoglobin (HbD) level, and tissue oxygenated hemoglobin (HbO₂) level were measured. Measurements were made

under each of 6 conditions: standing, sitting, lying supine on the ground, standing in water up to the navel or to the xiphoid positions and lying supine on the water. In both healthy subjects and those with hypertension, the heart rate was the highest while standing on the ground, followed by sitting on the ground and lying supine on the ground. It was slightly higher while standing in water up to the navel position than when supine on the ground, and was the lowest while standing in water up to the xiphoid position. In healthy subjects and the hypertension patients, StO_2 level was the lowest while standing on the ground, followed by sitting on the ground and lying supine. It was slightly lower while standing in water up to the navel position than while lying supine on the ground, but was the highest when standing immersed to the xiphoid position. The StO_2 level can be calculated from the ratio of tissue oxygenated hemoglobin level / tissue hemoglobin level. The StO_2 level appeared to increase due to the decrease the tissue hemoglobin level in femoral blood hemodynamics because the changes in posture or water pressure increased the venous return. Decreased heart rate increases the cardiac stroke volume due to increased the venous return, suggesting that both control group and hypertensive patients also show the same reactions.

要 旨

本研究は、高血圧症を有する高齢者に対する水中運動の適応を検討する為に、陸上及び水中時の筋組織血液動態の比較を行った。高齢健常者5例、内科的治療を行なっている高血圧者7例に対し、経皮的レーザー組織血液酸素モニターを用いて、右側大腿内側広筋にセンサーを取り付け、組織内酸素飽和度 (StO_2) と組織ヘモグロビン量 (HbT)、組織脱酸素化ヘモグロビン量 (HbD)、組織酸素化ヘモグロビン量 (HbO_2) を測定した。測定は、陸上立位、陸上椅座位（以下、陸上座位）、陸上背臥位（以下、陸上臥位）、水中立位で水位が臍部（以下、水中臍位）、水中立位で水位が剣状突起部（以下、水中胸位）、水中背臥位（以下、水中臥位）の各環境において測定した（平均水温; 31.2℃, 平均室内温度; 22.0℃, 水中臍位の平均水位; 95.8cm, 水中胸位の平均水位; 111.0cm）。各姿勢・環境での測定値を計測するにあたり、その条件への適応能力に個人差が認められたため、と

くに本研究においては30秒間の心拍数の安定 (± 1) を目安に各姿勢・環境の測定点及び測定期間を定めた。心拍数の変動は、健常群及び高血圧群において、水中胸位では最低値を示した。高血圧群の血圧値の変動は、陸上座位時の $159.6 \pm 18.9 / 79.4 \pm 13.0$ (mmHg) と比較して水中胸位時が $138.6 \pm 22.5 / 69.0 \pm 10.7$ (mmHg) と統計上有意に低下していた ($p < 0.01$)。筋組織血液動態の変動は、高血圧群及び健常群において有意な差はなかった。しかし、浸水時の心拍の安定時間において、高血圧群が有意に遅い反応を示した。