

Evaluation of the hemodynamics of the femoral head compared with the ilium, femoral neck and femoral intertrochanteric region in healthy adults: measurement with positron emission tomography (PET)

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Objective: Non-traumatic osteonecrosis of the femoral head (ONF) is considered to be a disease that occurs primarily due to ischemia of the femoral head, while its etiology and pathology are not fully understood. It is therefore necessary to identify the characteristics of the hemodynamics of the femoral head. In this study, the hemodynamics in the ilium and proximal regions of the femur, including the femoral head, was investigated using positron emission tomography (PET). **Methods:** The subjects of this study consisted of 8 hip joints of four healthy male adults and 3 hip joints on the contralateral side of a femoral neck fracture, avulsion fracture of the greater trochanter and coxarthrosis (1 case each, all females) for a total of 11 hip joints of 7 subjects. The ages of the subjects ranged from 25 to 87 years (average age: 54 years). Blood flow was measured by means of the $H_2^{15}O$ dynamic study method and blood volume was measured by means of the ^{15}O -labeled carbon monoxide bolus inhalation method. **Results:** Blood flow was determined to be 9.1 ± 4.8 ml/min/100 g in the ilium and among proximal regions of the femur (femoral head, neck and intertrochanteric region), 1.8 ± 0.7 ml/min/100 g in the femoral head, 2.1 ± 0.6 ml/min/100 g in the femoral neck, and 2.6 ± 0.7 ml/min/100 g in the intertrochanteric region. In addition, blood volume was 4.7 ± 1.3 ml/100 g in the ilium, and among proximal regions of the femur, 1.1 ± 0.5 ml/100 g in the femoral head, 2.1 ± 0.7 ml/100 g in the femoral neck, and 2.6 ± 0.9 ml/100 g in the intertrochanteric region. The results showed that both blood flow and volume were lowest in the femoral head. Blood flow and volume were significantly lower in the proximal regions of the femur (femoral head, neck and intertrochanteric region) than in the ilium ($p < 0.01$). **Conclusion:** The present study demonstrated that the femoral head is in a hypoemic state as compared with other osseous tissue, indicating that even the slightest exacerbation of hemodynamics in the femoral head can trigger an ischemic condition culminating in ONF.

Key words: positron emission tomography, blood flow, blood volume, femoral head