An In Vivo Demonstration of Macroscopic Periacetabular Vascularization: Computed Angiography Study

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Introduction

The vascular supply to the acetabulum is ensured by the periacetabular vascular ring, which consists of several arteries, including the superior gluteal artery, inferior gluteal artery, obturator artery, and medial circumflex femoral artery. Knowledge of the periacetabular vascular ring is crucial for various surgical procedures, including conservative surgical procedures (eg, arthroscopic or open procedures) and complex reconstruction procedures (eg, complex revision of the acetabular component in patients with a severe bone defect). Although vascularization of the femoral neck/head has received considerable attention, the periacetabular region, including the acetabulum and its surrounding structures, remains relatively unexplored. Only a limited number of studies have investigated periacetabular vascularization, with most of these studies focusing on non-living cases. To the knowledge of the authors of this video, no studies have described macroscopic periacetabular vascularization in vivo.

Goal

The primary objective of this video is to address this research gap by providing a comprehensive description of macroscopic periacetabular vascularization in a living individual. By using advanced imaging techniques (CT angiography), the goal is to provide the first in vivo description of periacetabular vascularization.

Methods

After obtaining institutional review board approval, we acquired the clinical and radiographic data of a 31-year-old patient who was admitted to our emergency department after a motor vehicle collision. The patient underwent CT angiography to determine the extent of the injuries. The CT scans showed no evidence of traumatic vascular or bone lesions. CT was performed with the use of a 128-slice CT scanner, with an acquisition thickness of 0.6 mm. The CT protocol was optimized for the angiographic phase after the administration of contrast media and included an axial acquisition that covered the level of the aortic bifurcation, extending to the distal third of the femoral diaphysis.

Results

The superior gluteal artery arises from the posterior trunk of the internal iliac artery. It divides into a superficial and deep branch at the suprapiriformis canal. The superficial branch runs between the gluteus medius and the gluteus maximus before terminating. The deep branch further divides into a superior branch and an inferior branch. The superior ramus extends toward the superior margin of the gluteus minimus and reaches the anterior superior iliac spine. The inferior ramus courses toward the lateral aspect of the gluteus minimus, connecting to the tensor fascia lata. In addition, we identified a small branch referred to as the supra-acetabular ramus by Beck and Ganz in 2003, or the artery of the roof of the acetabulum according to Yiming. This branch originates directly from the deep branch and travels toward the inferior aspect of the gluteus minimus, supplying the acetabular roof.

The inferior gluteal artery arises from the anterior trunk of the internal iliac artery and exits the pelvis through the greater sciatic foramen. Running below the gluteus maximus and descending medially to the sciatic nerve, the inferior gluteal artery gives off muscular branches to the piriformis and a branch to the sciatic nerve. We also identified the presence of small rami directed to the posterior wall of the acetabulum.

The obturator artery originates from the anterior trunk of the internal iliac artery and follows an anteroinferior course along the lateral side of the pelvic wall, parallel to the obturator nerve, reaching the upper aspect of the obturator foramen. It then exits the pelvis through the obturator canal and divides into three branches: the anterior branch, posterior branch, and acetabular branch. During its course, the obturator artery gives off small branches that supply the quadrilateral plate. The anterior branch of the obturator artery supplies the external obturator muscle and the superior pubic ramus, whereas the posterior branch follows the superior border of the obturator foramen, providing small vessels to the inferior acetabulum. The acetabular branch supplies the roof of the acetabulum and the round ligament as it enters the acetabulum below the transverse ligament.

The medial circumflex femoral artery originates from the posterior trunk of the profunda femoris artery. It courses posteriorly and laterally, passing through the groove between the iliopsoas and pectineus muscles. As it continues its path, the medial circumflex femoral artery reaches the posterior aspect of the femoral neck, at which it divides into two main branches: the ascending branch and the descending branch. We identified that a ramus of the ascending branch is directed to the inferior-lateral area of the hip capsule.

Conclusion

Imaging techniques allowed for visualization of the macroscopic arteries that provide vascularization of the periacetabular region. A better understanding of periacetabular vascularization may aid in the planning of conservative, traumatic, and

reconstructive hip surgery. The correlation between periacetabular vascularization and the vitality of bone in patients with an acetabular defect may have substantial clinical implications. Knowledge of this correlation may provide valuable guidance with regard to the possibility of implant integration in hip revision surgery.