

## The Safety and Feasibility of Minimally Invasive Plate Osteosynthesis (MIPO) on the Medial Side of the Femur: A Cadaveric Injection Study

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**Background/Purpose:** Minimally invasive plate osteosynthesis (MIPO) of the femoral shaft, the distal femur, and periprosthetic fractures have achieved satisfactory clinical outcomes. The standard lateral approach is simple and carries the least risk for neurovascular injury. The percutaneous plate insertion on the medial side of the femur appears to be a dangerous procedure due to possible femoral artery injury. This study aims to determine the feasibility of applying MIPO of the femur via the medial approach, to observe the risk of injury to the femoral artery and to determine the anatomical relationship between the artery and the implant using computed tomography (CT) angiography.

**Methods:** A descriptive study of ten fresh cadavers (20 femurs) was done. Two separate incisions were made, creating a submuscular tunnel close to the medial side of the femur. An 11- or 13-hole LCP lateral proximal tibial plate (5.0) was inserted through the distal incision into the submuscular tunnel and was fixed to the proximal and distal femur with two screws on each side. A CT angiogram with 3-dimensional (3D) reconstruction was made to determine the distance from and location of the plate relative to the femoral artery. Finally, both incisions were connected and surgical dissection was done to identify the structures at risk with this approach.

**Results:** No disruptions of superficial or deep femoral arteries were found. The closest distances from the superficial femoral artery and deep femoral artery to the plate were 8.3 to 27.2 mm. (average 16.3 mm; 99% confidence interval [CI]: 12.7-19.9) at the level 3 and 4.5 to 20.0 mm (average 8.6 mm; 99% CI: 6.4-10.9) at the level 2 in the proximal part of femur, respectively. The location where the superficial femoral artery crossed the anterior cortex of the femur in the sagittal plane was 9.7% to 36.0% of the femoral length (average 20.1%; 99% CI: 15.0%-25.3%) and the posterior cortex of the femur was 24.7% to 55.3% of the femoral length (average 40.8%; 99% CI: 35.0%-46.7%). The location where the deep femoral artery crossed the anterior cortex of the femur in the sagittal plane was 7.9% to 25.3% of the femoral length (average 13.4%; 99% CI: 10.6%-16.3%) and where it crossed the posterior cortex of the femur was 21.7% to 39.4% of the femoral length (average 31.2%; 99% CI: 27.1%-33.3%). The only structure potentially at risk was the descending branch of lateral femoral circumflex artery, which may be encountered in the proximal dissection.

**Conclusion:** MIPO of the femur via medial approach is a feasible option for treatment of femoral fractures when the lateral approach is otherwise contraindicated. The distal two-thirds of the femoral length measured from tip of the greater trochanter to the lateral joint line of the knee is safe for this approach.