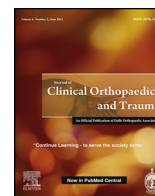




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Original article

Surgical hip dislocation through a direct lateral approach: A cadaveric study of vascular danger zones

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ABSTRACT

Objective: There is limited information on the potential danger to the vascularity of the femoral head during surgical dislocation of the hip using the direct lateral approach. The objective of this study was to investigate the topographical anatomy of the medial femoral circumflex artery (MFCA), the primary source of blood supply to the femoral head, in relationship to the direct lateral approach.

Methods: Seven unembalmed cadaver hips had dye injection into either the profunda femoris artery or the MFCA. Surgical hip dislocation was then performed through a direct lateral approach, noting the danger zones to the MFCA branches during each step of the exposure.

Results: None of the MFCA branches were found to cross the anterior surgical field superficial to the capsule. The deep (main) branch of the MFCA pierced the inferior capsule at the level of the lesser trochanter after emerging posterior to iliopsoas tendon. Ascending branches up the medial femoral neck were identified at this level. The deep branch then coursed posteriorly terminating in a variable number of vessels ascending the posterior femoral neck. Dislocation of the femoral head did not stretch or alter the course of the deep branch of the MFCA.

Conclusion: Safe surgical hip dislocation preserving the MFCA can be performed through a direct lateral approach as long as the inferomedial portion of the anterior capsule is preserved (main branch of the MFCA pierces the capsule at this level). Extracapsular injury is possible from inadvertent dissection at the level of the lesser trochanter or aggressive retraction on the iliopsoas. The posterior capsule should be left intact and instrumentation around the posterior neck should be avoided.

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1. Introduction

Surgical hip dislocation provides wide exposure to the hip joint allowing 360° view of the femoral head and acetabulum. This advantage has made it the gold standard for management of femoroacetabular impingement, which commonly involves both sides of the hip joint.^{1,2} Other reported indications include femoral head fractures,³ acetabular fractures,^{4,5} benign hip tumors,⁶ cartilage/labral lesions not amenable to arthroscopy,⁷ and sequelae of childhood conditions.⁸ The ability to dislocate the hip without disrupting the femoral head blood supply is critical in adolescents and young adults to prevent osteonecrosis of the femoral head.

Safe surgical dislocation of the femoral head can be theoretically performed through any approach. However, the technique described by Ganz et al⁹ has been the most widely studied and used. This technique involves anterior dislocation of the femoral head following a trochanteric flip osteotomy through a posterior approach. The trochanteric osteotomy helps preserve the medial femoral circumflex artery (MFCA) by avoiding tenotomy of the external rotators, which is routinely performed during the standard posterior approach (Fig. 1). While several studies reported no cases of femoral head avascular necrosis using the Ganz technique,^{9,10} lateral hip pain from nonunion, malunion, or symptomatic hardware have occurred in varying rates, often requiring hardware removal or revision open reduction and internal fixation.⁹ Other limitations include the need for protected weight bearing while the osteotomy heals and the relatively long learning curve of the procedure.

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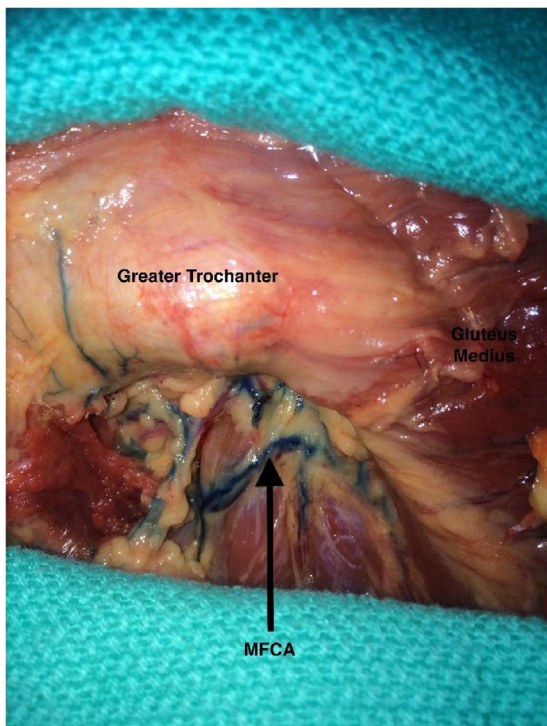


Fig. 1. Posterior view of a left hip. The medial femoral circumflex artery, which lies on the posterior surface of the short external rotators, can be easily injured during the standard posterior approach to the hip.



Fig. 2. Exposure through the femoral triangle showing 1. femoral artery; 2. medial femoral circumflex artery; 3. lateral femoral circumflex artery; 4. profunda femoris artery.

While it is believed that anterior-based surgical approaches to the hip pose a relatively low risk of injury to the femoral head blood supply, there is limited literature evidence to support this practice. The purpose of this anatomic study was to investigate the topographical anatomy of the MFCA in relationship to a direct lateral (Hardinge) approach. First described in 1982¹¹, the Hardinge approach is relatively easy to learn, avoids the need for trochanteric osteotomy, and is commonly used for in hip reconstruction. Knowledge of the vascular danger zones during this approach may help avoid iatrogenic vascular injury leading to osteonecrosis of the femoral head during hip preservation surgery.

2. Materials and methods

IRB approval was not required. Anatomical dissection was performed in 4 unembalmed cadavers (7 hips): three males and one female (age range 72–87 years). None of the cadavers had evidence of prior hip surgery or vascular disease. In each hip, the profunda femoral artery, MFCA, lateral femoral circumflex artery (LFCA), and femoral artery were identified through the femoral triangle (Fig. 2). The correctness of the ligated vessels was verified by two senior anatomists (co-authors). In 4 hips, the MFCA and LFCA were injected with 0.75% methylene blue solution. In 3 hips, only the MFCA was injected. In each injection, the cannulated vessel was clamped proximal and distal to its branching site to reduce the volume of injection. 30 ml of the dye solution was injected each time. The patency of the distal vessels was confirmed by visualization of dye intake into the retinacular vessels. The results were documented with a digital camera.

2.1. Approach

The cadaver was placed in lateral decubitus position. A longitudinal incision centered on the greater trochanter was made

and the underlying fascia lata was split in line with the skin incision. The anterior third of gluteus medius and minimus were then divided in the direction of the muscle fibers just proximal to their insertion on the greater trochanter. Distal dissection was carried through the anterior third of the vastus lateralis. Exposure of the anterior capsule was aided by progressive external rotation of the leg and releasing the reflected head of rectus femoris. The capsule was then split along the midplane of the femoral neck starting from the acetabular rim and terminating at the superior head/neck junction. The capsulotomy was completed by excising a triangular piece on each side of the split. Care was taken to ensure the inferomedial capsular piece was kept proximal and lateral to the lesser trochanter (to avoid violating the deep branch of the MCFA as described below). The hip was then dislocated anteriorly by flexion, adduction, and external rotation.

3. Results

The MFCA branched off the profunda femoral artery in 4 hips and from the femoral artery in 3 hips. Stepwise dissection down to the capsule was safe with no branches of the MFCA crossing the operative field superficial to the capsule (Fig. 3). However, in the specimens that received LFCA injection, the ascending branch of the LFCA was found to pierce the anterior capsule at its inferior aspect, terminating in 1–2 vessels along the anterior femoral neck (Fig. 4). Stepwise excision of the anterior capsule showed the main branch of the MFCA pierced the anteroinferior capsule at the level of the lesser trochanter (Fig. 5). This branch became more visible with anterior dislocation emerging posterior to iliopsoas tendon. After piercing the capsule at the anteroinferior neck, ascending branches were given at this level. The deep branch then coursed posteriorly terminating into a variable number of terminal branches. These terminal vessels then ascended the femoral neck covered by a clear fibrous sheath (retinaculum); hence their

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