The Safe Surgical Dislocation of the Hips

An Essay

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ABSTRACT

Traditionally, surgical dislocation of the native hip has been discouraged because of the possible risk to the femoral head blood supply. Reinhold Ganz has clarified the proximal femoral vascular anatomy and has used this knowledge to develop a safe surgical dislocation technique for the hip. This new surgical technique has made possible safe and effective treatment of many intra-articular and periarticular conditions of the hip, many of which cause pain and arthrosis. In the hip, osteoarthritis very commonly is associated with well-recognized developmental deformities, classically from dysplasia, slipped epiphysis, or Perthes disease. Recent work has demonstrated that other much less well-recognized anatomic hip abnormalities, such as acetabular retroversion, acetabular overcoverage, and decreased femoral head-neck offset, are equally important generators of pathologic mechanics that frequently lead to arthrosis. Currently, the surgical dislocation technique plays a central role in treating hips with femoroacetabular impingement. Additionally, the surgical dislocation technique facilitates other femoral procedures such as flexion intertrochanteric osteotomy and femoral neck osteotomies. The surgical technique will be described in detail and the most recent surgical results will be discussed.

KEYWORDS

Hip, surgical dislocation, femoral head vascularity, Avascular necrosis, osteoarthritis, dysplasia,Perthes disease, femoro-acetabular impingement Acetabular fracture, Posterior wall Dome, Slipped capital femoral epiphysis, treatment, Ganz approach, flip osteotomy, Laser Doppler Flowmetry, hip arthroscopy.

INTRODUCTION

Surgical dislocation of the hip is not widely performed.The potential danger to the vascularity of the femoral head has been emphasized.The information of how to avoid this danger is little. Ganz et al had described a surgical technique that used for safely dislocating the hip joint this technique depends on the detailed anatomical studies of the blood supply to the femoral head.(1)

The deep branch of the medial femoral circumflex artery (MFCA) is the primary source for the blood supply of the head of the femur. The short external rotators are frequently divided in the posterior approaches to the hip and pelvis. A damage to the deep branch may results from these approaches and the blood supply to the head may be disrupted, but as long as the obturator externus is kept intact the the deep branch of the MFCA will be protected from being disrupted or stretched during dislocation of the hip in any direction. Precise knowledge of the extra capsular anatomy of the MFCA and its surrounding structures will help to avoid iatrogenic avascular necrosis of the head of the femur in reconstructive surgery of the hip. (2-3)

The deep branch of the medial femoral circumflex artery runs along the greater trochanter anterior to the short rotators. According to Ganz et al it is kept intact as long as the trochanteric flip osteotomy is done anterior to the short

rotators.The lateral retincular branches enter into the lateral aspect of the femoral head,which can be protected by a precise Z shaped capsulactomy ***(Ganz et al., 2009).*** (4)

Surgical hip dislocation allows the surgeon full visualization of the proximal femur and acetubulum. During hip motion the technique makes it possible to directly detect the pathologic relationship between the proximal femur and the acetabuluar rim ***(Sink et al., 2010)*** (5). It also provides a wide excellent exposure of the femoral head and neck,which facilitate a complete and precise evaluation of the femoral head and neck contour***(Ganz et al., 2009).*** (4)

Recently; the Ganz Approach for safe surgical dislocation of the hip is used for femoroacetabulur impingement, slipped capital femoral epiphysis, hereditary multiple exostoses, Perthes disease, osteoid osteoma, Rheumatoid synovitis, pigmented villonodular synovitis,joint debridement and neonatal septic hip sequelae. (4)

Aim of the Work

The aim of the work is to focus on indications, surgical technique, results and possible complications of safe surgical dislocation of the Hips.

Chapter 1

VASCULAR ANATOMY OF THE HIP JOINT

The vascular anatomy of the femoral head is highly specific because the vascular patterns established during the growth phases do not change at maturity and persist throughout life. There are three groups of vessels which supply the upper end of the femur, they are called foveolar artery or artery of the ligamentum teres, the nutrient artery of the shaft,and the retincular or capsular arteries. [8]

1. The Foveolar Artery:

This artery may arises from the medial femoral circumflex artery, or from the obturator artery or may from both.it goes into the acetabulum below the transverse ligament and, it runs along the ligament to the femoral head after giving off a pulvinar branch to the Haversian fat pad. In children up to the age of thirteen years the artery may penetrate the fovea and supply the deep cartilage of the head or the ossific centre. The foveolar vessels show alteration in the size and the arrangement in elder population. The number of penetrating foveolar vessels in adults is nearly double that which is found in children, and the diameter of the vessels is increased by 80 percent. [8]

2. The Nutrient Artery:

This artery enters through the mid shaft of the femur and it may be single or double. In the medullary cavity the superior branch runs upwards and makes an anastomoses with the cervical branches of the retinacular arteries. Nutrient vessels cross the epiphysial plate from the metaphysis to the epiphysis. [8]

3. Retinacular Arteries:

They arise from the medial and lateral femoral circumflex arteries. These two arteries form an extracapsular arterial ring which gives rise to ascending cervical arteries which form a subsynovial Intra-articular Arterial anastomotic ring. [8]

- ***The Medial Femoral Circumflex Artery(MFCA):***

This artery arises from the medial aspect or posterior aspect of the profunda femoris artery (fig.1). The artery pass in a posterior direction in the interval between the iliopsoas and pectineus muscles and then between the medial capsule and the obturator externus muscle. [9]

Figure (1): Photograph that shows Anterior aspect of the right hip after capsulotomy, showing medial femoral circumflex artery. [10]
1 "femoral artery", 2 "medial femoral circumflex artery", 3"retinacular branch ", and 4" anterior aspect of the femoral neck".

There are two main central and five peripheral anastomoses of the "MFCA" (table 1), (fig.2). It is found to be extracapsular, and the largest and most consistent is abranch of the inferior gluteal artery which runs along the inferior border of piriformis. This branch is often as large as the deep branch itself. [2]

Table (1): Anastomoses of the MFCA [2]

Anastomosis with (artery, branch)	*Anastomosis from (branch of MFCA)*
Central ***Obturator artery:*** Anterior(superficial) branch	Ascending branch
Posterior (deep) branch	Acetabular branch
Lateral femoral circumflex artery: Descending branch	Deep branch at the base of the neck of the femur
Periphery First perforating artery	Trochanteric branch Posterior to the quadratus muscle
Lateral femoral Circumflex artery Transverse branch	Trochanteric branch
Superior gluteal artery Deep branch	Deep branch at insertion of gluteus medius
Inferior gluteal artery	Deep branch along inferior border of piriformis,posterior to conjoined tendon
Internal pudendal artery	Deep branch on the retroacetabular surface

Recently, Adequate blood to the femoral head could be supplied by The inferior gluteal part of this anastomosis when the medial femoral circumflex artery is damaged this was reported by ***Gautier et al.*** [2]

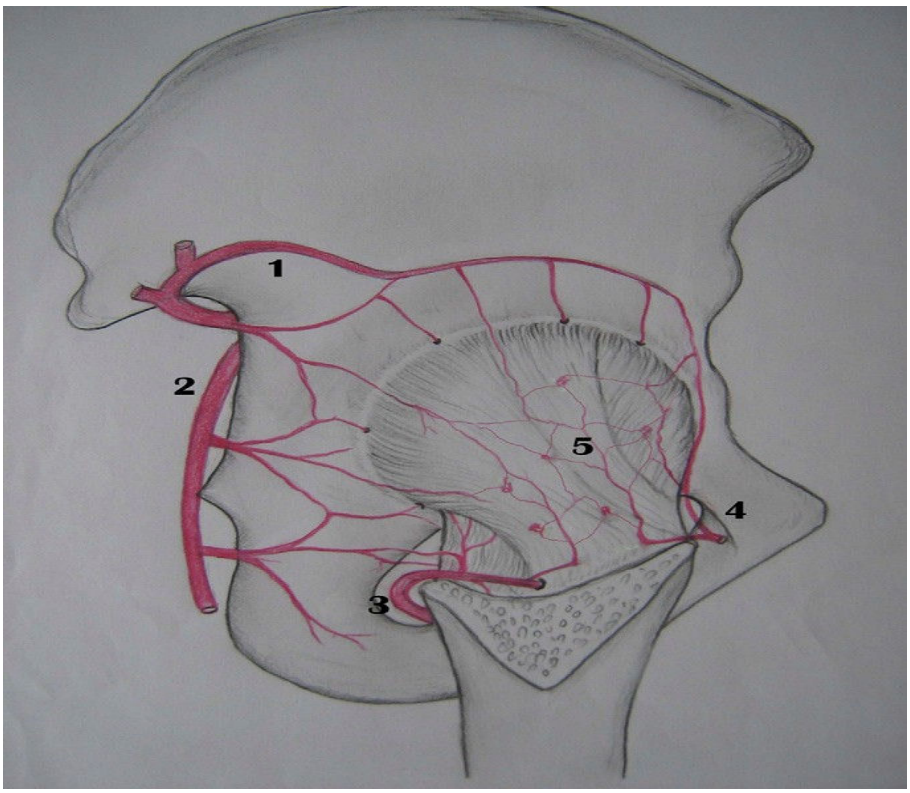

Figure (2): The Hip joint "a posterior view" which describe the periacetabular vascular ring, and the anastomoses between the distal and the proximal vessels. 1 "superior gluteal artery", 2 "inferior gluteal artery", 3 "the medial femoral circumflex artery", 4 "the lateral femoral circumflex artery", and 5 "the perforating vessels (cut surface)".

The MFCA (table 2) gives five constant branches which are superficial, deep, ascending, descending and acetabular branch. [2]

Table (2): The five consistant branches of the MFCA [2]

Branch	Pathway
superficial	Its pathway between pectineus and adductor longus.
Deep	To the head of the femur.
Ascending	To adductor brevis, adductor magnus and obturator externus.
Descending	Its pathway between quadratus femoris and adductor magnus, supplying the ischiocrural muscles.
Acetabular	It gives off the foveolar artery "the medial epiphyseal artery ".

The main blood supply to the femoral head come from the deep branch of the MFCA.This artery has a constant pathway in the extracapsular segment. A trochanteric branch is presented at the proximal border of "quadratus femoris" muscle which pass to the lateral aspect of the greater trochanter. The level of the tendon of obturator externus muscle which located anterior to the deep branch of the MFCA is land marked by this branch and therefore it is an important branch. Leaving the obturator externus intact protects the deep branch of the MFCA from being stretched or disrupted during dislocation of the hip in any direction after the release of all other soft tissue attachments of the proximal femur including; the complete circumferential capsulotomy. While passing superiorly; the deep branch crosses anterior to the conjoint tendon of gemellus inferior, gemellus superior and obturator internus muscle (fig. 3). Then it makes an oblique perforation in the joint capsule just cranial to the insertion of the tendon of the superior

gemellus; and distal to the tendon of the piriformis. In its intracapsular segment it runs along the posterosuperior aspect of the neck of the femur dividing into two to four subsynovial retincular vessels which perforate at a distance between 2mm to 4 mm lateral to the bone cartilage junction of the femoral head (fig.4). [2]

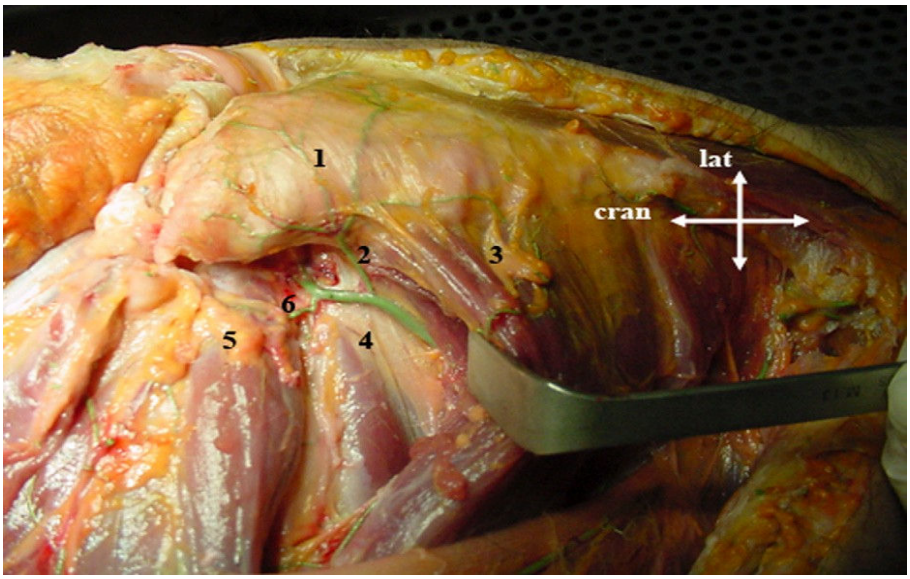

Figure (3): Photograph that shows Posterior aspect of the right hip,demonstrating the anatomic position of the deep branch of the MFCA.[10] 1 "greater trochanter", 2 "trochanteric branch of the MFCA", 3 "quadratus femoris muscle", 4 "obturator externus muscle" 5 "obturator internus and gemellus muscles", 6 "anastomotic branch to the inferior gluteal artery".

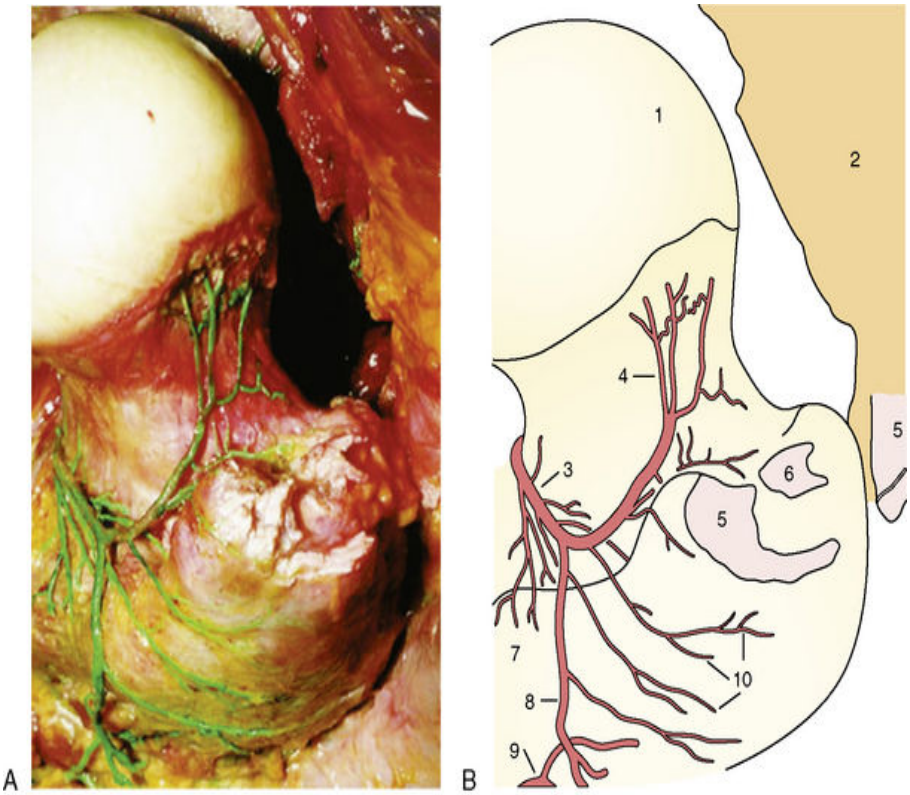

Figure (4): A, a picture that demonstrate the postero-superior proximal portion of the femur, and showing the terminal branches of medial femoral circumflex artery which perforating the femur. **B,** Illustration of posterosuperior proximal femur describing:1 "the femoral head"; 2 "gluteus medius muscle"; 3 "deep branch of the MFCA"; 4 "terminal branches of the MFCA"; 5 " tendon of the gluteus medius its insertion"; 6 "the tendon of the piriformis its insertion"; 7 "the nutrient vessels of the lesser trochanter"; 8 "trochanteric branch of the MFCA"; 9 "branch of the first perforating artery"; 10 " the trochanteric branches".

- ***The lateral femoral circumflex artery:***

It takes origin from the upper end of the profunda and from the femoral artery. The artery goes anterior to the" iliopsoas muscle" and it then divides into many terminal branches. The ascending branch runs laterally and superiorly

and is the source of the anterior ascending cervical branches to the femoral head and neck (fig.5). [9]

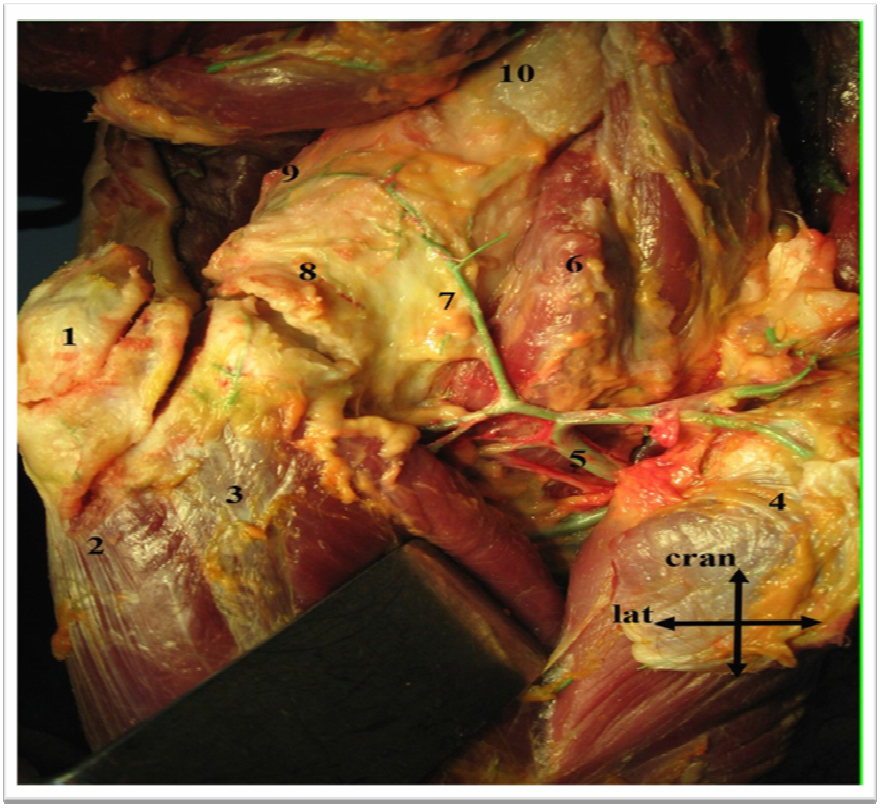

Figure (5): Photograph that shows the anterolateral aspect of the right hip after detachment of the abductor, rectus femoris, and tensor muscles, demonstrating a capsular branch and an anastomosis between the ascending branch of the lateral femoral circumflex artery and the supra-acetabular branch of the superior gluteal artery. 1"greater trochanter", 2 "vastus lateralis muscle", 3 "vastus intermedius muscle", 4 "the tensor fasciae latae muscle (it turned medially and distally)", 5 " lateral femoral circumflex artery", 6 "iliopsoas muscle", 7 "ascending branch of the lateral femoral circumflex artery", 8 "hip joint capsule (femoral attachment)", 9 "anterior end of the supra-acetabular branch of the superior gluteal artery anastomosing with the lateral femoral circumflex artery", and 10 "inferior iliac spine (rectus femoris tendon detached)".