Applications and outcomes of the surgical hip dislocation approach in hip preservation surgery for adolescents and young adults

Thesis Submitted for partial fulfillment of MD degree in
Orthopedic Surgery
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2018

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List of abbreviations

FH	Femoral head
GT	Greater trochanter
AVN	Avascular necrosis
LLD	Limb length discrepancy
LT	Ligamentum teres
FAI	Femoroacetabular impingement
OA	Osteoarthritis
ON	Osteonecrosis
PFO	Proximal femoral osteotomy
OCP	Osteochondroplasty
RNL	Relative femoral neck lengthening
PAO	Periacetabular osteotomy
ROA	Rotational acetabular osteotomy
SDH	Surgical dislocation of the hip
MCFA	Medial circumflex femoral artery
LCFA	Lateral circumflex femoral artery
IGA	Inferior gluteal artery
DDH	Developmental dysplasia of the hip
SCFE	Slipped capital femoral epiphysis
LCPD	Legg-Calvé-Perthes disease
ITO	Intertrochanteric osteotomy
AP	Anteroposterior
ANCHOR	Academic network for conservational hip outcomes research group
ATD	Articulo-trochanteric distance
CTD	Center-trochanteric distance
LCEA	Lateral center-edge angle
ROM	Range Of Motion
MRI	Magnetic resonance imaging
CT	Computed tomography
THA	Total hip arthroplasty
SD	Standard deviation
ORIF	Open Reduction and Internal Fixation

INTRODUCTION & THESIS PROTOCOL

In his description of the detailed anatomy of the blood supply to the skeleton and spinal cord, Crock [1] stated that "Theoretically a method is required by which the human hip joint can be dislocated atraumatically in the early phases of disease so that the blood supply of the upper end of the femur can be preserved. This would open the way for the use of new methods of surface replacement of articular cartilage based on developments in tissue culture and molecular biology. Rather than relying on prosthetic replacement of the hip to treat significant intra-articular pathology, a treatment philosophy based on biologic and physiologic principles could be more routinely used."

In 2001, Ganz et al [2], described a technique for operative dislocation of the hip, based on detailed anatomical studies of the blood supply to the proximal femur. It combines aspects of classic hip approaches which have been reported previously and consists of an anterior dislocation through a posterior approach with a 'trochanteric flip' osteotomy. The

external rotator muscles are not divided and hence, the medial femoral circumflex artery is protected by the intact Obturator Externus muscle. This approach allows for un-obscured 360 degrees view of the acetabulum and femoral head without risking the femoral head blood supply. Since then, this approach has been utilized by many surgeons for correction of the morphological abnormalities of the proximal femur with a reported low rate of complications [2-8].

During the past decade, the indications of this approach have been evolved rapidly to include many intra-articular hip pathologies and trauma, such as slipped capital femoral epiphysis (SCFE), Legg-Calvé-Perthes disease (LCPD) with severe residual deformity, femoroacetabular impingement, labrum tears, treatment of neonatal septic hip sequelae, excision of intra articular tumors as osteoid osteoma and exostosis, treatment of intra-articular synovial pathologies as synovial chondromatosis and pigmented villonodular synovitis, open reduction and internal fixation of acetabular and femoral head fractures, treatment of articular cartilage defects, resurfacing hip arthroplasty and removal of intra articular foreign bodies [2-9].

Despite the reported proven efficacy of this technique in the surgical management of all the previous indications, however, only a small number of reports in literature can be referred to when discussing the objective radiographic outcomes on patients' hips, rather than the subjective outcomes, especially regarding the incidence of femoral head AVN. Also, during the past few years, many studies, other than the earliest reports from the orthopedic centers that have originally described the technique, have reported many significant complications and limitations of this approach.

Therefore, our aim in this study is to evaluate the clinical and radiological outcomes of this approach in different entities of hip preservation, based on both subjective and objective methods. We aim also to develop a systematic conclusion regarding indications, contraindications, potential complications and short term outcomes of this procedure in each particular indicative group within our patients, and compare our results to the other available published reports about this technique.

PATIENTS AND METHODS

A minimum of twenty (20) patients, who are having various intra articular hip pathologies will receive our protocol of surgical hip dislocation approach. The clinical and radiographic outcomes will be followed prospectively.

-Preoperative assessment:

Inclusion criteria:

-Age of 12-45 years old

- Presence of any intra articular hip pathology or fracture, in which the surgical hip dislocation could be utilized to perform the surgical exposure, or the total surgical procedure used in the treatment plan.

Exclusion criteria

-Advanced hip osteoarthritis (Tonnis grade above 2)

-The presence of hip joint instability (Excluding the fracture cases).

- The presence of adult femoral head osteonecrosis based on radiological investigations and MRI.

-Early stages of Perthes disease before femoral head healing and final remodeling.

Preoperatively, all the patients will be assessed generally, locally and neurologically. Pre operative Oxford Hip Score will be utilized to document the pre operatice clinical status and the functional condition of the hip. Patients assessed radiologically mainly by plain radiographs of the hip (antero posterior and frog lateral views) to diagnose the pathologic condition, detect the congruity of the hip joint and plan for the surgical managment. CT scan, MRI may be utilized pre operatively for assessment of specific pathologic conditions in some patients.

Pre operative assessment of femoral head vascularity will be done by either MRI or Tc^{99} bone scan prior to surgery (Excluding the trauma cases).

Operative indications :

Management of intra articular hip pathology as in

-Slipped capital femoral epiphysis (SCFE),

- Healed Legg-Calvé-Perthes disease (LCPD) with severe residual deformity

-Femoroacetabular impingement, including labrum pathology.

-Heriditary multiple exostosis involving the hip joint.

-Treatment of septic hip and its sequelae.

-Acetabular fractures (posterior wall, posterior column, T and transverse types).

-Femoral head fractures.

-Hip dysplasia: In conjugation with a peri acetabular osteotomy.

Surgical procedure

Using a Kocher -Langenbeck or direct lateral incision and a trochanteric flip approach, the hip capsule is incised in a Z shaped manner and the hip can be exposed anteriorly, subluxated and dislocated in the same direction, while respecting the integrity of the external rotator muscles. This allows for a gap of up to 11cm between the head and the acetabulum, giving a view of the femoral head of about 360° and a full 360° view of the acetabulum.

Operative interventions

One or more operations from the following would be done:

-Femoral head and neck osteochondroplasty

-Synocevtomy and debridement of the hip joint.

-Sub Capital femoral head re orientation.

-ORIF of intra articular hip fractures

-Removal of intra articular hip pathology.

-Periacetabular osteotomy

-Relative femoral neck lengthening

-Trochanteric advancement.

-Labrum repair or reconstruction.

-Articular cartilage defect drilling or debridement.

-Proximal femoral osteotomy

Post operative assessment

Patients will be assessed generally regarding the vital data and blood picture.

Patients will be assessed clinically and neurologically.

Patients will be assessed radiologically by plain hip Xrays to assess post reduction correction, post operative CT scan may be done too for selected cases.

Follow up

-Follow up of the patients will be done at four to six weeks, 3 months, 6 months, 1 year then scheduled annually, unless any complications may happen.

-Clinical examination will be done at each visit to assess the post surgery functional and clinical improvement and patient satisfaction. The one year post operative Oxford hip score is utilized to document the clinical improvement or deterioation.

-Radiologic assessment will be done using plain X rays of the hip. CT scan may be performed for some patients to

assess the radiological outcomes of the operative interventions and potential complications.

- MRI for hip joint or Tc99 bone scan will be done, mostly at within 6 months post operatively to assess the blood supply of the femoral head and to detect the occurance of AVN of femur head secondary to the procedure. In SCFE and Perthes cases, Tc99 scan may be done during the first post operative week to detect very early cessation of femoral head blood supply after surgery.

AIM OF THE WORK

This study is conducted to evaluate and analyze the efficacy, clinical and radiological outcomes and potential complications of the surgical hip dislocation technique in each indicative category of hip preservation surgery for adolescents and young adults, based on both the subjective and objective results. Data interpretation will be established primarily on our own results, and compared to the published data in literature.

Review of Literature

Applied Anatomy

Developmental Anatomy of the Hip:

The proximal femur has a single epiphysis that is differentiated into the proximal femoral epiphysis (femoral head) and trochanteric apophysis (greater trochanter) at week 7 in utero. Ossification of the proximal femoral epiphyis starts at the age of 4 to 8 months, and the trochanteric apophysis at 4 years. The proximal femoral epiphysis fuses by age of 18 years and the trochanteric apophysis by age of 16 to 18 years **(Fig. 1-1)** [10].

The proximal femoral epiphysis contributes significantly to the metaphyseal growth of the femoral neck and less to primary appositional growth of the femoral head. Thus, disruptions in this region may lead to architectural changes that could affect the overall anatomic development of the proximal femur [10, 11].