

Acetabular Component Orientation in Total Hip Arthroplasty Using Transverse Acetabular Ligament (TAL)

Sher Afgan, Irfan Ahmad, Naeem Ahmad, Shahzad Javed, Amer Aziz

ABSTRACT

Objective: To assess the effectiveness of transverse acetabular ligament (TAL) as a guide for acetabular cup ante version during total hip arthroplasty and its effect on postoperative hip dislocation.

Methods: This descriptive case series was on 117 patients suffering from Hip pathologies underwent elective primary total hip arthroplasties (THA). Patients were examined radiologically postoperatively to calculate abduction (Inclination) angle and ante version angle. All patients were followed up for a period of 6 months for clinical and radiological assessment. Effectiveness was assessed as rate of postoperative hip dislocation. One sample Chi-square goodness of fit test was used to assess statistical significance for proportion of patients in safe zone with $p < .05$ as statistical significant.

Results: Out of 117 THAs, 42(35%) patients were operated for avascular necrosis of femoral head, 27(23%) for hip osteoarthritis, 22(18%) for rheumatoid arthritis of the hip and 24(20%) for fracture neck of femur. There were 75 males and 52 females with range of age from 17 to 72 years. The mean abduction angle was calculated on postoperative AP radiograph to be 42.94° range (39° - 46°) degrees. The hip anteversion angle was measured on a cross table lateral radiograph of the operated hip. The mean ante version angle of acetabular cup on a cross table lateral view of the hip was 16.88° degrees range (13° - 22°). The rate of postoperative hip dislocation was 0.85% at six months follow up.

Conclusion: Transverse acetabular ligament and an excellent patient specific tool to guide us towards the correct ante version of the acetabular component and can assist to position the acetabular component in THR.

Keywords: Transverse acetabular ligament, Hip arthroplasty, Hip dislocation.

INTRODUCTION

Total hip Arthroplasty (THA) provides effective symptomatic and functional treatment in a different conditions including osteoarthritis, inflammatory arthritis, avascular necrosis of femoral head, infections etc. Osteoarthritis (OA) is the most common indication for THA [1].

Outcome of the total hip arthroplasty procedure depends upon the meticulous position of acetabular and femoral components. Acetabular cup orientation is the single most significant step upon which depend

upon the major outcome factors including stability and longevity of the implant. Incorrect positioning of the acetabular component results in high rates of dislocation, component impingement, loosening, osteolysis and accelerated bearing surface wear [2]. Different devices and methods are available for correct positioning of acetabular cup among which the use of transverse acetabular ligament (TAL) as patient specific reference point is gaining popularity [3].

The position on the operating table, dislocation of the native hip and the use of retractors alter the pelvis and, thus, acetabular version [2].

The objective of this prospective study is to assess the effectiveness of TAL as a guide for acetabular cup anteversion during total hip arthroplasty and to the incidence of post operative hip dislocation in a six months follow up.

*Department of Orthopaedics Surgery Unit I,
Jinnah Hospital, Lahore
Correspondence: Dr. Sherafghan
Email: drafghan@hotmail.com*

METHODS

It is a prospective study conducted between 1st august 2015 to 1stfeb 2016. It included 117 patients suffering from hip arthritis due to various reasons. All of these patients underwent primary Total Hip Arthroplasty. Post op AP radiograph of the pelvis with both hips was done in each case to assess abduction angle of the acetabular cup. We used the method devised by Lewinnek GE 1978 [7] to measure inclination on plain AP radiographs. Abduction angle is the angle between the lines drawn through the face of the cup and the inter teardrop line [4]. The anteversion angle was calculated by Woo's method by getting cross table lateral view of the operated hip. On cross-table-lateral radiographs, cup anteversion is measured as the angle formed by the long axis of the ellipsoid projection of the cup base and a vertical line [5]. . One sample Chi-square goodness of fit test was used to assess statistical significance for proportion of patients in safe zone with $p < .05$ as statistical significant.

SURGICAL TECHNIQUE

All patients were operated using Hardinge lateral approach⁶ to expose the affected hip joint with patient in supine position. The TAL was identified, according to recommendations of Archbold, acetabulum was fully exposed, retractors were applied in such a way that TAL remained superficial to inferior retractor, then TAL served as a guide to acetabular reaming. The final acetabular reamer was embraced by TAL, the acetabular component likewise was also embraced by TAL. The whole of the practice is aimed to keep face of the reamer and acetabular component parallel to TAL. This method resulted in a version of cup, which was close to the normal anteversion of the patient.

RESULTS

Out of 117 patients 42 patients were operated for avascular necrosis, 27 for hip osteoarthritis, 22 for rheumatoid arthritis, and 24 for complications of fracture neck of femur. There were 75 males and 52 females with ages from 17 to 72 years. The transverse acetabular ligament was identified and exposed in all cases. It included 117 THAs, 42(35%) patients were operated for avascular necrosis of femoral head, 27(23%) for hip osteoarthritis, 22(18%) for rheumatoid arthritis of the hip and 24(20%) for complications of fracture neck of femur. There were 75 males and 52 females with range of age from 17 to 72 years. The

mean abduction angle was calculated on postoperative AP radiograph to be 42.94° (39° - 46°). The hip anteversion angle was measured on a cross table lateral radiograph of the operated hip .The mean anteversion angle of acetabular cup on a cross table lateral view of the hip was 16.88° degrees range (13° - 22°). All patients were followed for a period of six months post operatively. All of the patients were assessed clinically for stability and on AP and lateral radiographs for acetabular cup position. Only one patient (0.85%) had a posterior dislocation of hip at two months after primary THA, which was after a fall. The patient was managed by close reduction and remained eventless afterwards.

DISCUSSION

The transverse acetabular ligament connects the inferior acetabular notch, forming the infero medial boundary of acetabulum. The TAL is a continuation of acetabular labrum in the inferior acetabular notch. We have used TAL as a landmark to control the anteversion of the acetabular cup [3].

Unlike the acetabular cup inclination, which is universally accepted to be around 45 degrees, version of the acetabular cup is still to some extent a controversial issue. Lewinnek GE 1978 [7] simplified the issue by suggesting $15^{\circ} \pm 10$ degrees of cup ante version as safe zone. Viste A. et al [8] contradicted by denying any universal cup ante version, they were of the opinion that this variable is patient specific. Murray 1993 [9] described three different interpretations of cup ante version namely anatomical, operative and radiographic. He devised conversion normograms for these definitions. To get the proper cup ante version is the question, apparently navigation technology is the answer but it is not cost effective in third world countries.

Archbold HA et al [3] suggested the use of TAL as patients specific intra operative method to proper cup anteversion. They showed excellent results by operating 1000 hips for THA. Exposing TAL in 99.7% of the cases using it as a guide for proper cup anteversion. They had only six posterior hip dislocations (0.6%) after eight months follow up. El Idrissi M. 2016 [10] performed the study on limited number of patients showing excellent results. Epstein NJ. [11] in 2011 presented the only to date comparative study comparing the use of TAL for acetabular component positioning with conventional free hand method concluding that anteversion angle was more accurate

in experimental group i.e mean 23.6 degrees vs. mean 29.5 degrees for control group (P= 0.0586) [12]. Kalteis T. et al [12] in 2011 employed computer navigation software to conclude that there was moderate reliability of intra and inter observer assessment to detect the plane between TAL and posterior labrum, they further concluded that there was no significant difference between two different orientations of acetabular component (i.e. position defined by TAL and posterior labrum versus software generated orientation) in terms of post operative range of motion and impingement.

Miyoshi H. 2012 [13] highlighted that in about 90% of the cases positioning of the acetabular component with reference to TAL falls in safe zone of Lewinnek [7, 13]. The term "safe-zone" has been introduced in 1978 by Lewinnek based on the clinical observation that less dislocation did occur when the acetabular cup was placed within 30 to 50o of abduction and 5 to 25o of anteversion. Miyoshi H. 2012 [13] in their study highlighted that in about 90% of the cases positioning of the acetabular component with reference to TAL falls in safe zone of Lewinnek. They found out that in 42 out of 47 hips (89.36%) anteversion angle fell in the safe zone as compared to our study in which we evaluated 117 patients , in 106 patients (90.59%) anteversion angle fell in the safe zone. (p=.000).

Jain S. 2013 [14] in a review article concluded that this technique is consistently accurate in gaining correct anteversion angle as suggested by Lewinnek [7], however consistent identification of TAL in every case is increasingly controversial. The dislocation rate after THA has been considered controversial as an outcome measure as it is a multi factorial entity [14].

In our study recognition of TAL has not been a problem. Postoperative mean ante version angle lies within safe zone of Lewinneck [7] i.e. $15^{\circ} \pm 10^{\circ}$. The dislocation rate in our study is 0.85%, which is minimal and comparable to the study of Archbold et al [3] who reported 0.6% rate of posterior dislocation in a follow up of minimum eight months.

CONCLUSION

It is concluded from above study that TAL is an excellent anatomical landmark to guide us towards the correct ante version of the acetabular component. The correct positioning of the acetabular cup in turn minimizes the rate of postoperative hip dislocation.

This method does not need costly instrumentation and is independent of patient positioning.

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