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Shortening surgery for dysmetria after total hip arthroplasty.

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Summary: Introduction; Doctor, why do I have the longest leg? During a THA it is frequent that a lengthening of the limb occurs to compensate the tendency that exists towards posterior instability, through the use of longer and more offset neck components. It is important to plan a good balance, since in general a discrepancy of more than 7-10 mm is poorly tolerated and is the most frequent cause of post-PTC litigation in the US. Material and methods; We conducted a review of three patients who presented a discrepancy greater than 1 cm after THA and underwent corrective surgery at our hospital. Symptoms were assessed using the HHS scale and dysmetria was measured using the Woolson method on the pelvic radiograph. Results; The first patient underwent a shorter head replacement and fascia lata meshing; in the second, a change was made to a double mobility cup; in the third, it was decided to replace the stem associated with an osteotomy and descent of the greater trochanter. In all cases the results were satisfactory. Conclusion; In a patient who presents an unacceptable dysmetria, we must assess the risk/benefit when planning a surgical correction, since the shortening of a limb will lead to an increase in the instability of the prosthesis. There are various therapeutic options but little bibliography on the results, and likewise quite contradictory. Today the best treatment is prevention, through the use of pre and perioperative markers, navigation and/or intraoperative scopy.

Keywords: "dysmetria", "PTC", "total arthroplasty", "hip", "shortening", "anterior approach".

1. Introduction

Hip replacement surgery or total hip arthroplasty (TCA) is an increasingly common procedure, especially in view of the higher prevalence of degenerative hip disease throughout the world. In addition to being one of the most performed interventions, it is one of the most successful.

What can we currently do to reduce the percentage of dislocations after placing a hip prosthesis, improve the functional recovery of the patient so that it is as fast as possible and improve their pain? In this sense, the anterior approach to the hip is becoming very important .

1.1. Anterior approach to the hip

The anterior approach to the hip is performed in an internervous and intermuscular plane, with respect to the muscles and tendons, and is therefore inherently stable. his three

The main advantages are less postoperative pain, early mobilization, and rapid recovery.

In a recent meta-analysis on **early complications** (10), the anterior approach is compared with the posterior approach, and it is seen that there are statistically significant lower rates of infection, dislocation, and reoperation with the DAA. No statistically significant differences were observed in heterotopic ossification, wound complications, fractures, or thromboembolic events. However, a higher percentage of nerve injury was seen, but this is purely sensitive due to injury to the terminal branches of the femorocutaneous nerve, with no clinical repercussions or global patient satisfaction.

Various studies show that it is superior in terms of **early satisfaction** on the part of the patient. In the meta-analysis carried out by *Miller* in 2018 (10), it is seen that the DAA presents a better immediate postoperative period compared to the posterolateral approach: in the first 90 days the patient presents less pain, less need for narcotic drugs and better functionality of the hip. On the other hand, the *Dutch Peters Registry in 2018* (11) shows that patient **satisfaction in the medium term** (from 3-12 months) is higher for the anterior and posterolateral approaches (equalizing each other) than for the lateral and anterolateral.

1.1.1. Experience with the DAA in our hospital

In our hospital the Berend and Lomardi technique is followed. The patient is placed in the supine position, which gives us access to both legs and therefore the possibility of carrying out a good perioperative evaluation of the discrepancies at all times.

In addition, a femur lifting hook is used to protect the abductor musculature throughout the surgical procedure, especially the tensor fascia lata. A rigorous femoral release is then performed to avoid perioperative complications, especially fractures and malposition of the implants.

Thanks to this position of the patient in supine decubitus, the use of **intraoperative scopy** is easy , which allows good planning to be carried out at all times, especially in complex cases.

In total, in our hospital we have around 1100 cases of PTC placed by anterior approach, with the following results: - We have not found any case of discrepancies greater than 1cm.

- Neither was there any case of misalignment of the stem or subsidence of the same.
- Minor complications: 1 case of incomplete intraoperative fracture (which was solved with a cerclage).
- Major complications: 1 case of PTC dislocation after hip fracture (of 53 cases, that is, 1.28%) and 2 PTC dislocations placed due to coxarthrosis (of 879 cases, that is, 0.22%) .
- Our patients have excellent mobility, without any restrictions. They are allowed to load the first postoperative day, sometimes without orthotic aids.

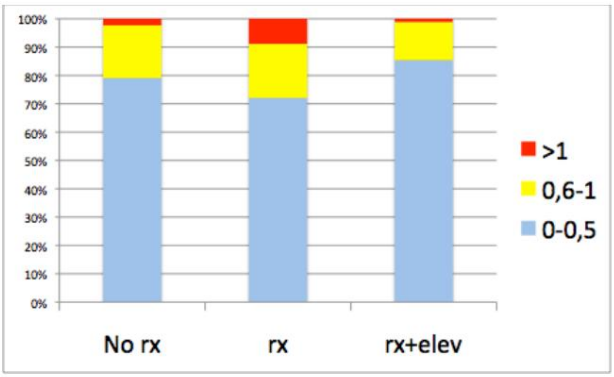


Image 1. Summary graph of the percentage of discrepancies

1.2. lower limb dysmetria

Among the most common objectives when we perform a total hip arthroplasty we have the restoration of normal biomechanics and the preservation of the equality of the length of the limb without compromising the stability of the prosthesis (2) .

Unequal length is a common reason for patient dissatisfaction and litigation (2);(3); (4). In fact, it is the most frequent cause of post-PTC litigation in the USA. According to a study by Röder et al. (BMC Musculoskeletal Disorders 2012, 13:95), where they review 10,415 cases of patients without previous dysmetria from 4 different hospitals, the incidence in Europe is around 7%: 4.7% of patients suffered lengthening of the > 1 cm and 2.7% suffered a shortening > 1 cm. (3)

In general, all the results show that in the majority of interventions, lengthening of the intervened limb occurs, in which the most common is that they are not greater than 1 centimeter in length. These discrepancies caused by the intervention in most cases are not relevant enough to cause problems in the biomechanics of gait or in the development of a normal daily life for the operated patient (1) .

. *Edeen et al and Ranawat et al.* wrote that the difference in leg length must be 10 mm or less for a patient to have a good quality of life (4), lengthening the same being worse tolerated. One of the most accepted ways of measuring a patient's satisfaction after a PTC is the HHS (Harris Hip Score).

There are **three causes** of discrepancies after a PTC:

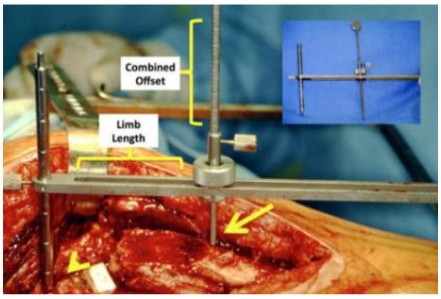
- **Suprapelvic:** due to factors related to the lumbar spine, such as degenerative pathologies with scoliosis that cause an obliquity of the pelvis. It usually goes unnoticed preoperatively.
- **Functional or apparent:** contractures of the abductor muscles most frequently occur, which can be treated by physiotherapy exercises with TFL or GM stretching. If this is not resolved, meshing of the iliotibial band could also be performed.

  These contractures can be:
  - o Primary o
  - Secondary to an increase in offset o
  - Secondary to an elongation
- **Structural** or real (osteoarticular). It is the one that is caused by the increase in the head-neck distance of the prosthesis or its poor positioning.

1.2.1. structural dysmetria

There are a number of factors that influence the likelihood of a dysmetria after implantation of a PTC:

- Position of the patient in lateral decubitus.
- Type of anesthesia (more frequent with the spinal dea).
- Little use of intraoperative gauges.
- Discomfort from fluoroscopy or navigation tion.
- Previous surgeries.



On some occasions, the discrepancy is an indirect result of the positioning of the components, such as the lengthening of the neck of the prosthesis to compensate for its instability. The most fearsome complication after a PTC is its possible dislocation. To improve this, it has been seen that, in addition to a horizontal and anteverted cup, one of the ways to achieve this is to use longer neck components with more offset. With this, however, we are going to cause a dysmetria, so it is important to plan a balance of both consequences well. In this sense, the introduction of the use of intraoperative scopy that allows us to use a direct anterior approach has been essential.

Different **techniques** are used to assess length discrepancy in the lower extremities such as clinical measurements, pelvic radiography, telemetry, computed tomography, or intraoperative measurement.

There are several methods for radiographically measuring limb length. The first method, described by Williamson and Reckling, consists of drawing a horizontal line through the two inferior points of the ischial tuberosities. We can also draw a horizontal line between the lower surfaces of the tears of the acetabulum, which may be more reliable points than ischial landmarks (Woolson et al method) (9). In any case, the distance between these points and the center of the lesser trochanter is measured.

Alternatively (after Meermans et al) (12) a vertical line, perpendicular to the estimated center of the head, can be drawn on each femur, and the difference in length between the two vertical lines represents the difference in limb length.

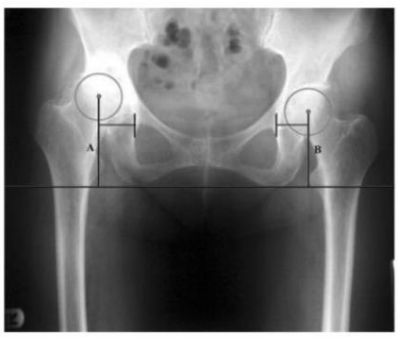


Image 2. Radiographic assessment of the difference in limb length according to the Meermans method (12)

Image 3. Radiographic assessment of the difference in limb length according to the Woolson method (9)

One of the most important questions that the doctor must ask the patient is how he assesses the length of the member (if any). It has been seen that the perception of the patient and the presence of real limb discrepancy are not well correlated: there is a discrepancy between the HHS and the discrepancy measured radiologically in most patients.

The severity of the symptoms increases with the increase in the length of the limb: among them are a disability as a result of pain, lameness, fatigue, nerve palsy and functional impairment of the hip. Nerve injury is the most serious complication associated with dysmetria: in a review of 23 THAs complicated by peroneal and sciatic nerve palsy, Edwards et al (13) found a range of lengthening of 2.7 cm for the peroneal nerve and of 4.4 cm for the sciatic.

Although the problem of LLD (leg length discrepancy) cannot be eliminated, it can be minimized by taking into account factors such as good preoperative planning, identification of risk factors, intraoperative measurements, and various correction methods. These include good preoperative planning to define the correct cut of the neck, the correct length of the neck of the femoral component and its insertion depth, as well as the use of a standard reference point in the pelvis and femur and the measurement of the distance between them intraoperatively.
This is currently possible thanks to the use of the scopy that allows us a direct anterior approach. In addition, thanks to the supine position, we are able to compare the distance between both internal malleolus (leg-to-leg comparison), although this method is more inaccurate.

1.3. Treatment of discrepancies: correction surgery

For structural discrepancies, applying a lift is usually sufficient, although sometimes the patient may continue to have symptoms and need intensive physiotherapy treatment. In the worst case, shortening surgery can be performed.

In the retrospective study by McWilliams et al (1), 21 patients who underwent dysmetria correction surgery after primary hip arthroplasty were reviewed. The discrepancy was measured in the pelvic radiograph according to the Woolson method (9), which, as we have said, takes as reference the rotational center of the femoral head, the teardrop of the acetabulum and the center of the lesser trochanter. In the postoperative follow-up, following the modified method of D'Aubigne and Postel, the pain, functionality, and postoperative satisfaction of the patients were investigated.

The result was that, of all of them, none reached the maximum score on the satisfaction scale (0-6), and that only three of them were free of symptoms and complications. However, they conclude that, despite the fact that revision surgery is not without risk and may not completely alleviate the patient's pain, due to the improvement it produces, it is considered a useful and successful treatment for those patients who do not respond to conservative treatment. .

In summary, the treatment options that exist up to now are the following: • Raise to compensate for the dysmetria (greater comfort for the patient). • Waist stretches in knee and hip extension. • Lengthening of the healthy side. • Shortening of the operated limb: carries a great risk of dislocations if it is performed by conventional means. • Dual mobility or restrictive cups • Replacement of the head with a shorter neck • Osteotomy of the greater trochanter and its descent.

2. Materials and methods

In the following article we will review and discuss three cases of patients from our hospital who presented refractory symptoms to limb discrepancy after placement of a total hip replacement, and therefore required surgical correction in our hospital, using a different technique in each of them.

In our case, we used the HHS score instead of the D'Aubigne and Postel score and the Woolson method (9) to measure discrepancies in the AP radiograph of the pelvis.

The *objectives* set are the following: - Assess
the discrepancies caused by the intervention and the causative symptoms.
- Analyze surgical treatments to compensate for discrepancies according to the degree of deformity and patient characteristics.

The *keywords* that were used were “hip prosthesis”, “lower extremity discrepancies”, “discmetry treatments”, “hip arthroplasty”, “asymmetry lower limb ex tremity”, “leg”, “hip arthroplasty AND asymmetry lower limbs”, “limb – length discrete pancy after hip arthroplasty”, “x-ray measurement lower limb”, “lower limb inequality”.

3. Results

The first patient underwent a shorter head replacement and meshing of the fascia lata. In the second case, a double mobility cup was replaced, and in the third case it was decided to replace the stem associated with an osteotomy and descent of the greater trochanter.

In all three cases, the patients presented mixed-type dysmetria, that is, both structural as functional. The results were satisfactory in all cases.

3.1. clinical case 1

A 64-year-old female patient underwent surgery for right PTC due to femoral neck fracture, in another hospital, in August 2014. A standard size 50 cup with a 32 mm head and a 12/14 locking stem was placed through a posterolateral approach.

In July 2016, she went to the outpatient clinic of our hospital with pain when starting to walk and claudication. He walks without sticks but he mentions that when he has been walking for a while he needs to walk in abduction. The pain is referred mainly to the posterior aspect of the hip and the anterior aspect of the thigh. Always use a 2 cm rise on the contralateral leg. The HHS was 80.

The radiograph shows a vertical cup and positive discrepancy of the right hip. cha:

Image 4. AP pelvis X-ray. A 70º vertical cup is observed, a right discrepancy of +5mm and an offset of +9mm.

Surgery was performed for shortening in November 2016, performing a **modular head replacement** by direct anterior approach, without excessive release to avoid possible posterior instability. A head with a shorter neck, ceramic, 32 mm +1 (ie -4 mm, so 4 x 0.7 = 2.8 mm less height and offset) is placed. In addition, a **lengthening of the iliotibial band** (mesh of the fascia lata proximal and distal to the greater trochanter) is performed . A cup replacement was also offered to improve the position, but the patient refused because she wanted to receive as little surgical aggression as possible.

Image 5. AP X-ray of the pelvis of the same postoperative patient. We observed a difference of +2mm and an Offset of +6.

Two months after the intervention, the patient no longer takes analgesics for pain. Use a 1 cm lift and walk around the house without canes or claudication. After a year, he refers to carrying out a normal activity. He walks without sticks, with some occasional discomfort that does not require painkillers. Clinically, HHS of 98 and radiographic control without changes. Stability and good functionality on examination: FE 120/10, RIRE 20/20, ABAD 30/30.

3.2. clinical case 2

A 66-year-old female patient, who underwent a total uncemented right hip prosthesis 2 years ago through a posterolateral approach due to protusive coxarthrosis. In the postoperative period, he presented paralysis of the External Popliteal Sciatic Nerve and neuropathic pain.

Since then he has used a contralateral 25mm rear sight without which he can hardly walk. He has an HHS of 76. He walks with a cane for the streets.

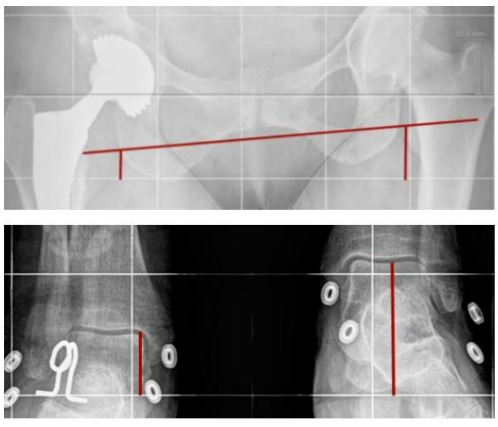


Image 6. MMII telemetry and AP pelvis X-ray: we found a 14mm structural elongation with an 8mm offset increase and a 70º vertical cup.

The treatment of choice in this case was the **double mobility cup** (6). It is about of a device that consists of a mobile prosthetic head inside a retentive polyethylene, which, in turn, moves freely inside the metallic acetabular cup. The two joints are intended to decrease wear and loosening forces, and increase joint range without compromising intraprosthetic stability.

Its advantages are a greater range of movement without limitations due to its great stability, with good transmission of forces and low wear rate of polyethylene.

Image 7. Postoperative AP pelvic X-ray of the same patient, standing. A residual discrepancy of +10mm and a symmetrical offset are observed.

One year post-surgery, the patient wears a 7-8mm lift (previously 25mm) and walks perfectly without aids. He has an HHS of 88 and his neuropathic pain has improved. On examination, peroneal and dorsiflexor strength at 4/5 (lack of eversion and active dorsiflexion above 0º).

3.3. clinical case 3

This is a 55-year-old female patient who underwent surgery on multiple occasions for hip dysplasia with placement of a total bilateral prosthesis. Left PTC was placed in 1994 (50 cup with two screws and ceramic head with short neck and 10 stem).

She went to outpatient clinics at our department in March 2016 because for a month she had been noticing a sensation of anterior bulge in the right hip on various occasions, as well as a palpable anterior inguinal lump that subsequently disappeared. He also presented insecurity for walking, with a feeling of positive discrepancy in said hip. He walks with a cane in his right hand and a 35 mm riser in his left shoe.

On examination, there was greater discomfort in external rotation. When external rotation is forced with flexion of less than 20º, that is, in extension, a jump is noted and what appears to be the femoral head is palpated, which is reduced in internal rotation.

In RX and CT no mobilization of prosthetic components is appreciated.

Image 8. Preoperative AP pelvic X-ray.

Given the possibility of dealing with self-reduced subluxations of the anterior prosthetic femoral head, a series of rehabilitation guidelines are given (avoid external rotation and use a pelvimuslera prosthesis) and it is decided to re-operate surgically.

In June 2016, the extraction of the femoral component was performed by means of **a transfemoral osteotomy,** implantation of a long revision stem, and reinsertion of the trochanteric fragment descended by about 2 cm, to improve the dysmetria without affecting stability too much. The osteotomy is closed with a 4-hole flattened claw to keep the fragment descended, and two cerclages are placed. It was decided not to replace the cup given the complete absence of the anterior wall.

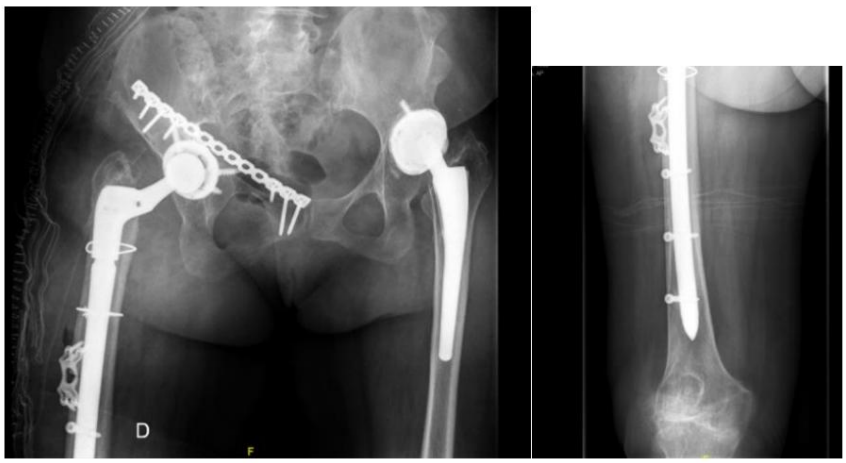


Image 8. Postoperative AP pelvis and AP right femur X-ray.

At the two-month checkup, he presented with symptoms of pain in the upper thigh and loss of strength in the quadriceps suggestive of paresis of the femoral nerve, which improved

at 4 months. Last revision in April 2018 with unchanged radiological control. The patient walks without canes at home and with one on the right side in the street, due to her multi-joint involvement (contralateral PTC and bilateral gonarthrosis). Upon examination, FE 60/0 RIRE 10/20 ABAD 20/20 GM 3-4.

4. Discussion

Doctor, why do I have the longest leg? After a total hip arthroplasty, it is common for perioperative limb lengthening to occur as a way of compensating for the tendency towards posterior instability of the prosthesis. Its magnitude is variable, but in general a discrepancy of more than 7-10 mm is normally poorly tolerated.

If a patient presents an unacceptable discrepancy, we must assess the risk/benefit when planning a surgical correction, since the shortening of a limb will lead to increased instability. We must also take into account

the increase in offset, which can produce a lumbopelvic contracture that leads to a false lengthening of the limb.

It is also important to emphasize the scant literature that exists on shortening surgery after PTC. The treatment options are extensive but their results are not clear. Therefore, today the best treatment for dysmetria is its prevention, through the use of pre and postoperative markers, navigation techniques, and the use of intraoperative scopy, currently possible with the direct anterior approach.

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Bibliography

1. McWilliams, Anthony B., et al. Revision Surgery for Leg Length Inequality after Primary Hip Replacement. H.I.P. International, vol. 28, no. 5, Sept. 2018, p. 554–558.
2. Parvizi, Javad & Sharkey, Peter & A Bissett, Gina & H Rothman, Richard & Hozack, Bill. Surgical Treatment of Limb-Length Discrepancy Following Total Hip Arthroplasty. The Journal of bone and joint surgery. American volume. 2004;85-A. 2310-7.
3. Flecher X, Ollivier M, Argenson JN. Lower limb length and offset in total hip arthroplasty. Orthop Traumatol Surg Res [Inter net]. 2016;102(1):S9–20.
4. Röder C, Vogel R, Burri L, Dietrich D, Staub LP. Total hip arthroplasty: leg length inequality impairs functional outcomes and patient satisfaction. BMC Musculoskeletal Disorder [Internet]. 2012;13(1):95.
5. Ogawa K, Kabata T, Maeda T, Kajino Y, Tsuchiya H. Accurate leg length measurement in total hip arthroplasty: A comparison of computer navigation and a simple manual measurement device. Clin Orthop Surg. 2014;6(2):153–8.
6. Valdez, Sebastian, and Bertrand Bouxin. Cups with double mobility: principles, advantages and results. Magazine of the Argentine Association of Orthopedics and Traumatology 74.1 (2009): 102-110.
7. Brun, Ole-Christian L., et al. The Direct Anterior Minimal Invasive Approach in Total Hip Replacement: A Prospective Department Mental Study on the Learning Curve. H.I.P. International, vol. 28, no. 2, March 2018, p. 156–160.
8. Garcia-Juarez, JD, et al. Incidence and effect of leg length discrepancy after total hip arthroplasty. Mexican Orthopedic Act 27.1 (2013): 43-46.
9. Woolson, Steven T., James M. Hartford, and Aenor Sawyer. Results of a method of leg-length equalization for patients under going primary total hip replacement. The Journal of arthroplasty 14.2 (1999): 159-164.
10. Larry E Miller, Joseph S Gondusky, Atul F Kamath, Friedrich Boettner, John Wright & Samir Bhattacharyya. Influence of surgi cal approach on complication risk in primary total hip arthroplasty, Acta Orthopaedica. 2018; 89:3, 289-294, DOI: 10.1080/17453674.2018.1438694
11. Rinne M. Peters, et al. Similar Superior Patient-Reported Outcome Measures for Anterior and Posterolateral Approaches After Total Hip Arthroplasty: Postoperative Patient-Reported Outcome Measure Improvement After 3 months in 12,774 Primary Total Hip Arthroplasties Using the Anterior, Anterolateral, Straight Lateral, or Posterolateral Approach. J Arthroplasty, vol. 33, no 6, June 2018, p1786-1793.
12. Meermans G., et al. Preoperative Radiographic Assessment of Limb-length Discrepancy in Total Hip Arthroplasty. Clin Orthop Report Res. 2011 Jun; 469(6): 1677–1682.
13. Edwards BN, Tulles HS, Noble PC. Contributory factors and etiology of sciatic nerve palsy in total hip arthroplasty. Clin Orthopedics. 1987;218:136–141.