

Case Report

Total hip replacement in a patient with contralateral hemipelvectomy: a case report

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Received: 15 June 2023

Revised: 21 July 2023

Accepted: 24 July 2023

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ABSTRACT

Total hip arthroplasty is one of the most frequently performed surgeries today with excellent clinical and functional results for patients with advanced stages of hip osteoarthritis. Performing this surgical procedure in patients with a history of lower limb amputation is rare, so some important considerations must be taken for surgical planning, positioning on the operating table, and rehabilitation. There are very few case reports described in the literature. We present the case of a patient with symptomatic stage III Tonnis hip osteoarthritis and a history of contralateral external hemipelvectomy, who underwent total hip replacement. Preoperative planning, surgical technique, and 6-year follow-up are described.

Keywords: External hemipelvectomy, Hip osteoarthritis, Total hip arthroplasty

INTRODUCTION

Total hip arthroplasty is the treatment of choice for hip osteoarthritis in advanced stages. Due to the significant improvement in pain and functionality, as well as its reproducible results and low rate of complications, it has been considered the surgical procedure of the 20th century.¹ Global burden of disease study conducted by university of Washington and the institute for health metrics considers hip osteoarthritis the eleventh condition, among 291, reported as a contributor to disability and the 38th position in burden of disease by life-years adjusted to disability.² It is estimated that more than one million procedures per year are performed worldwide and degenerative joint pathology is the most frequent cause of surgical indication.³

Performing hip arthroplasty in patients with history of lower limb amputation is rare, with few case reports

described in literature.^{4,5} One of the most radical amputations of lower limb is external hemipelvectomy, in which lower extremity is resected together with ipsilateral pelvis. It is reserved specifically for some malignant bone and soft tissue tumors of pelvis with compromise of neurovascular structures, non controlled infections, or severe trauma.⁶ Few cases of contralateral total hip arthroplasty in patient with external hemipelvectomy have been reported in literature, main indication for joint replacement in these patients being presence of symptomatic hip osteoarthritis without improvement with analgesic management and physical therapy.⁷⁻⁹

CASE REPORT

A 42-year-old gym instructor, with history of right external hemipelvectomy due to surgical site infection secondary to traumatic amputation at the level of proximal

third of the femur, in a traffic accident 16 years before. He managed his rehabilitation process with orthosis, which was withdrawn after year of use due to non-tolerance and since then he has used crutches to move around.

He presented 5 years of progressive pain in the left hip, without radicular symptoms, without improvement with the use of anti-inflammatories or physical therapy, and with deterioration of his quality of life. The physical examination revealed a weight of 80 kilos and a height of 1.76 meters for body mass index of 25.8. When evaluating the mobility arcs of the left hip, intense pain was found, achieving only 90° flexion, 30° abduction, and 5 degree external and internal rotation. No signs suggestive of radicular pathology were found and the surgical scars from the contralateral external hemipelvectomy were found to be in good condition and without signs of infection.

AP and supine lateral radiographs of the left hip showed severe hip degenerative changes with complete loss of joint space, subchondral sclerosis, and superolateral migration of the femoral head. It was classified as Tonnis III hip osteoarthritis.¹⁰ The image also shows good bone quality, with adequate preservation of the cortices, which is why it was classified as a Dorr A femur (Figure 1).¹¹

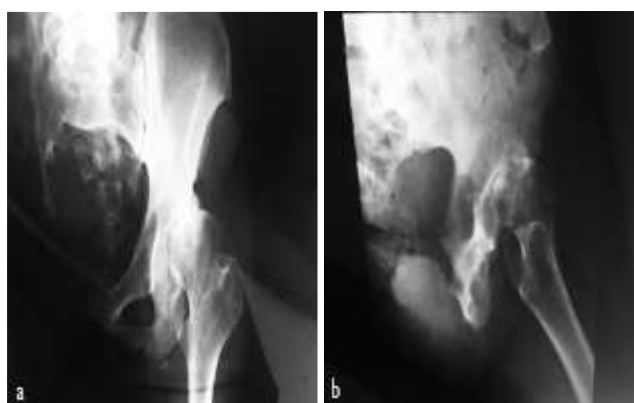


Figure 1 (A and B): Ap and lateral X-ray of left hip in supine position. Hip osteoarthritis Tonnis III with proximal subluxation of femoral head is evidenced.

The patient was presented at a joint replacement board and it was decided to perform a total left hip arthroplasty to relieve pain and improve his quality of life.

The procedure was performed in the right lateral decubitus; to avoid adduction of the left hemipelvis and lower limb, several pillows were placed under it for support. After prophylactic antibiotic administration, a posterolateral approach was performed. Dissection by planes, disinsertion of the external rotators, and posterior capsulotomy, with findings of severe acetabular femoral head degenerative changes, no other alterations were evident. A Consensus prosthesis was placed with an uncemented acetabular cup and femoral stem, with a cobalt chrome head and a highly crosslinked polyethylene insert, with adequate stability with the range of motion.

Reinsertion of external rotators and wound closure by planes. No complications occurred during surgery.

Rehabilitation began the next day with a walker-assisted gait. The patient was managed by an interdisciplinary team of physiotherapists, nurses, orthopedic surgeons and physiatrists to recover his functionality early. Once it was confirmed that the patient presented adequate pain control, good condition of the surgical dressing, proper positioning of the implant by means of an X-ray, anemia was ruled out and rehabilitation goals were achieved, the patient was discharged 48 hours after surgery (Figure 2).



Figure 2 (A and B): Ap and lateral postop X-ray of left hip, in supine position, taken same day of surgical procedure.

During the first postoperative control at 15 days, the patient presented significant improvement in pain, the surgical wound was found without alterations and complete mobility of the left hip (flexion 100 degrees, extension: 20 degrees, abduction: 40 degrees, adduction: 20 degrees, external rotation: 30 degrees, internal rotation: 20 degrees) The follow-up was carried out at 6 weeks, 3 months, 6 months, and then annually until the sixth year. During all the controls, adequate clinical evolution was found, without complications and with adequate functionality. The radiographs and clinical images of the control at 6 years are shown below (Figure 3 and 4).



Figure 3 (A-C): Six year postop AP and lateral X-ray of left hip in supine position. AP pelvis X-ray with support, note the valgus position of the acetabulum with respect to its supine position.

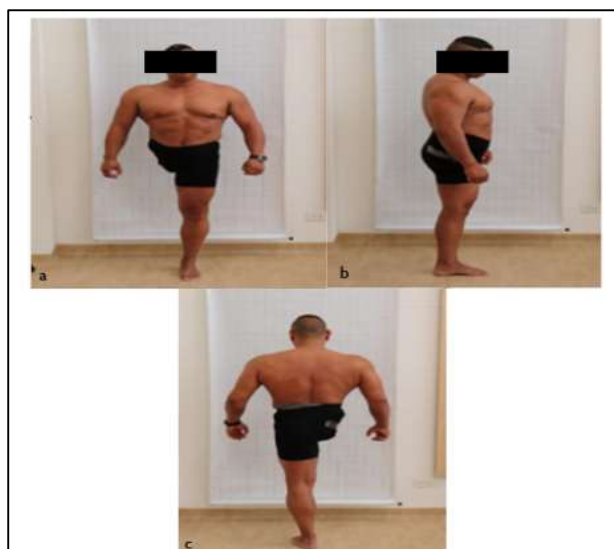


Figure 4 (A-C): Postoperative clinical control at 6 years of follow-up.

Electromyography and gait analysis were performed at 1 year follow up in order to evaluate the rehabilitation process. The gait report takes the Davis Heel protocol for normal adult gait as a reference. The patient's clinical condition (hemipelvectomy and total hip replacement) and the use of crutches to walk cause changes in relation to the normal gait pattern. In general, an increase was found in the stride time and in the support time, and a decrease in the time of the swing phase (Figure 5).



Figure 5 (A and B): Results of gait analysis, left lower limb and with the use of two crutches.

Slight but sustained abduction of the hip was evidenced throughout the gait cycle, flexion throughout the gait cycle, and hip in external rotation from the initial contact phase to the medium support phase, to subsequently perform an internal rotation in end support. The swing phase is closer to normal walking.

In the knee, a small tendency to valgus was found during the initial and medium support, which drastically changed to varus during the phase of terminal support and initial and medium swing. Although the varus was seen in the patient's film record, it seemed to be of a lower value than that reported by the software, so it is possible that the passage of the crutch through the referential markers could have affected this result. The knee rotation presented normal parameters in the stance phase and a change to internal rotation during the swing phase, which was evidenced in the video. However, the high value reported by the software could also be the product of the passage of the crutch that distorted the image of the referential marker. The knee presented an increase of about 10° in flexion during the stance phase and a decrease in the swing phase in relation to the normal pattern (Figure 6).

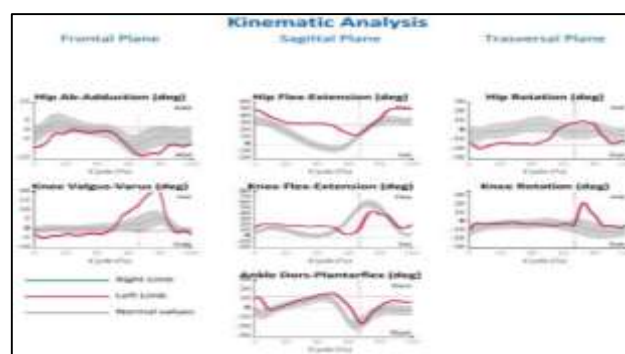


Figure 6: Kinematic analysis of the gait.

Regarding analysis of plantar pressures without crutches, a normal foot configuration was found, with symmetrical weight distribution. When using crutches, support became more posterior, concentrating greatest weight load on calcaneus, creating a high-pressure zone in this region (Figure 7).

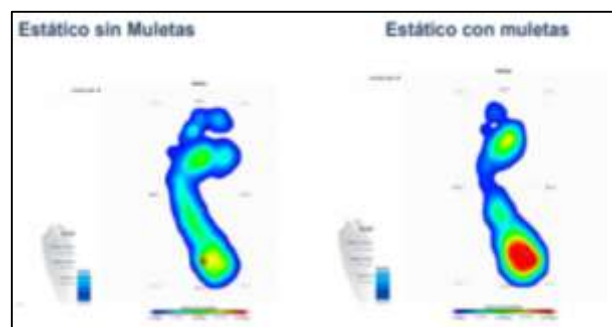


Figure 7: Analysis of plantar pressures with and without crutches. Image on right shows increased pressure on the support, more so in hindfoot area.

In the dynamic analysis, during walking with crutches, some high-pressure areas were observed throughout the foot during the step, due to the one-legged support and the use of the crutch in the stance phase of the gait only as a stabilizing element, without that is used for redistribution of the load, increasing the compressive forces in the prosthesis and joints of the supported limb (Figure 8).

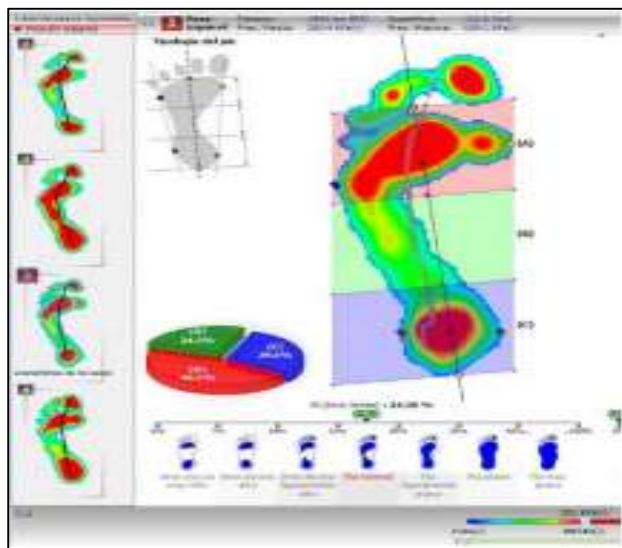


Figure 8: Dynamic analysis of plantar pressures. Generalized increase in pressure zones, throughout the stance phase, due to monopodal support and despite the use of both crutches.

DISCUSSION

The literature is scant for external hemipelvectomy patients who underwent contralateral hip arthroplasty, only a few case reports are found. In 2006, Bong et al and Sommerville et al each published a case of this type; both patients were 62 years old and the indication for external hemipelvectomy was oncological, with the development of symptomatic contralateral hip osteoarthritis after 39 years and 9 years respectively; for the surgical procedure, both cases were performed in lateral decubitus and lateral approach; In the first case, an uncemented prosthesis was used with screw fixation of the acetabular cup, and in the second case, a prosthesis with cementing of both components, both cases with a 1-year follow-up.^{7,9} In the case published by Sommerville, a non-displaced stress fracture of the acetabulum occurred during follow-up, with no prosthetic or functional repercussions, which consolidated, and no complications were reported.⁹

Goyal et al published a case report of a 52-year-old patient with a history of left external hemipelvectomy due to trauma in childhood, in addition to presenting in that event a right hip fracture dislocation managed in a conservative way. After 43 years the patient developed symptomatic right hip osteoarthritis. The patient was positioned in lateral decubitus and a posterolateral approach was performed; This case required a subtrochanteric osteotomy

to lower the proximal femur, in addition, a superior acetabular bone defect was evidenced, which was managed with autograft of the femoral head and fixation with screws, with the placement of a non-cemented prosthesis with screws in the acetabular cup and extended femoral stem and wire cerclages, with a 5-year follow-up; In the aforementioned cases, their clinical and functional evolution was good, the patients did not use an orthosis for hemipelvectomy and for their mobilization they used crutches.¹²

Regarding the case presented by Goyal et al the surgical options for contralateral hip osteoarthritis were arthrodesis and total prosthetic arthroplasty.¹² In our patient arthrodesis was not a viable option, since it would decrease his level of activity and would require a prolonged period of immobilization to allow bone healing and joint fusion. The joint arthroplasty option allowed this patient to preserve his joint mobility and allow him to continue with his daily activities.

The considerations in the surgical planning of this patient that were published in the previous case reports were taken into account. In the lateral decubitus position, the placement of various pillows to prevent the operated limb from having an adducted position and also to stabilize the pelvis; the lateral supports, one in the sacral zone and the other at the level of the pubis, the rest of the surgical procedure was conventional, without presenting any intra-surgical or postoperative complications.¹²

Several considerations must be taken into account after carrying out this case, beginning with preoperative planning. First, regarding the radiological evaluation of these patients, AP and lateral radiographs of the pelvis should be taken, both supine and standing, because the position of the pelvis is dynamic. In a standing position, in the coronal plane, the remaining hemipelvis, due to the action of the center of gravity, tends to incline towards the contralateral side, causing the position of the acetabulum to be more valgus; In the sagittal plane, the position of the acetabulum depends more on the spinopelvic balance, so it should be investigated if the patient has a history of lumbosacral pathology or surgical intervention at this level, classify that patient if he is balanced or not and if he is rigid or flexible.¹³

The positioning of the acetabular cup should be based on 2 planes. The coronal plane, it is suggested to position the cup around 40 degrees of inclination, which improves the stability of the prosthesis. It is important to mention that the cup must have bone coverage greater than 70%. In the sagittal plane, the cup must be positioned with anteversion, traditionally $15 \pm 10^\circ$ were sought, however recently the types of spinopelvic balance have been more taken into account (flexible and/or rigid balanced and flexible and/or rigid unbalanced).¹⁴

Another consideration is the performance of a preoperative gait analysis, in order to evaluate which are characteristics

of gait in these patients, whether or not they use an orthosis, in order to plan better postoperative rehabilitation and have some better functional results and the use of electromyography has the objective of evaluating what the muscular function is, emphasizing the periarticular muscles of the hip, which, together with the gait analysis, allows planning and individualizing the rehabilitation process.¹⁵ In our patient these studies were carried out postoperatively after one year in which an increase in the times of the stance and swing phases of the gait, increased support in the retro foot with the static tests, and increased support of both the forefoot and hindfoot in the dynamic tests, even with the use of crutches, which has an impact on the increase in the joint reaction force that the prosthetic elements have to support and that could affect the survival of this prosthesis.

Regarding the surgical act, the patient's position was, in all reported cases, in lateral decubitus and lateral approach in two of the three cases; The reason for the lateral approach, according to the authors, was to avoid the risk of prosthetic dislocation. We use a posterolateral approach as the evidence is currently clear that surgical repair of the external rotators and posterior capsule has been shown to decrease dislocation rates from 5% to less than 1%, which is equal to that reported for the direct approach.¹⁶ In fact, studies show the integrity of 83.8% in the reattachment of the external rotators 8 weeks after surgery.¹⁷ It is very important to have an adequate positioning of the patient in lateral decubitus, since changes in the position of the pelvis on the surgical table can alter the perception of the version and acetabular inclination and lead to an improper implantation of the components.¹⁸ The disadvantage of lateral decubitus is the adducted position that the limb and pelvis would take to intervene, but that can be corrected by placing some support to compensate for this, either by using pillows or inflatable devices underneath.

The decision to cement or not rests basically on the bone quality of these patients.¹⁹ Our patient had good bone quality, with adequate preservation of the femoral cortical, so uncemented components could be implanted.

Due to its complexity, rehabilitation in these patients is an essential step. The literature shows that they must be managed by an interdisciplinary group, which improves their functionality and quality of life compared to the pre-surgical stage.^{20,21}

CONCLUSION

Total hip arthroplasty in a patient with external hemipelvectomy is a rare and complex surgical event. A radiographic preoperative planning of the pelvis, spinopelvic balance must be carried out and complemented with a gait analysis. Intraoperatively, emphasis should be placed on the proper positioning of the patient to avoid changes in the pelvis that alter acetabular visualization. Rehabilitation must have a multidisciplinary

approach and postoperative follow-up must be strict to ensure functional improvement and quality of life.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: Not required

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Cite this article as: Caicedo Mazabel PA, Gaitan Lee H, Guzmán Nalus F, Sardi Barona LA. Total hip replacement in a patient with contralateral hemipelvectomy: a case report. *Int J Res Orthop* 2023;9:1053-8.