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Original article

A multimodal approach prevents instability after total hip arthroplasty: A 1 year follow-up prospective study

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ABSTRACT

Introduction: Joint dislocation is one of the most frequent complications after hip arthroplasty. Multiple strategies have demonstrated ability to prevent instability when used in isolation, but the effect when more than one intervention is implemented has not been measured. The purpose of this study is to assess the rate of dislocation after implementation of a protocol of combined strategies for prevention of instability.

Materials and methods: Consecutive patients undergoing primary total hip replacement for hip osteoarthritis between February 2012 and June 2014 were included. A multimodal protocol including patient education, use of large femoral heads, posterior soft-tissue repair, and intraoperative adjustment of limb length and hip offset was applied. Dislocation episodes were documented trough medical records review and a telephonic follow-up at 3 and 12 months after surgery.

Results: During the period of study 331 patients were included, mean age was 66 years and 68.8% were females. Only 0.91% of patients were lost to follow-up. Eighty-nine percent of patients received all interventions. Cumulative dislocation rate at 3 months was 0.60% and 0.90% at 12 months.

Conclusions: The implementation of a multimodal protocol for prevention of prosthesis instability produces a low rate of dislocation, which compares favorably with benchmarks. We recommend the use of a combination of multiple interventions to prevent this complication.

1. Introduction

Prosthesis dislocation is one of the most frequent complications after hip arthroplasty.[1] The prevalence of this complication ranges between 0.2 and 7%[1–3] and it is the third cause of revision surgery after aseptic loosening and periprosthetic infection.[4–7] Despite that two thirds of the cases of instability can be resolved with non-surgical treatment,[8] the Australian National Registry of Joint Replacements reports that 13–42% of re-operations are due to this complication.[9] Although dislocation might occur at any moment after implantation of the hip prosthesis, it has been described that there is a high risk for dislocation during first 3 months after surgery.[1,10,11] Meek et al. reviewed the Scottish National arthroplasty non-voluntary registry and found that 23% of dislocations occurred during the first 3 months and 43% between 3 and 12 months.[12]

Instability after primary total hip replacement is associated with multiple risk factors that depend on the characteristics of the patient, surgical technique and implant selection.[1,8,9,13,14] Factors related to patients are: gender, age, obesity, ASA (American Society of Anesthesiologists) classification, epilepsy, neuromuscular disorders, ligamentous laxity, rheumatoid arthritis, avascular necrosis of the femoral head, intracapsular fractures.[9,15,16]

On the other hand, factors associated with the procedure such as surgical technique, implant selection, restoration of limb length and offset, adequate implant positioning, use of large femoral heads,[17,18] and posterior soft-tissue repair (posterior capsule, piriformis tendon, and conjoined tendon),[13,19] have demonstrated

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to prevent instability when used in isolation,[20,21] but the effect, when more than one intervention is implemented, has not been measured. Therefore, a multimodal protocol for prevention of instability has been developed and implemented in our institution in order to diminish the risk of dislocation after total primary hip arthroplasty.

The contribution of this study to current orthopedic knowledge is to report the rate of dislocation when a multimodal protocol for prevention of instability is implemented. It further seeks to describe the rate of dislocation after total primary hip arthroplasty when multiple proven strategies are combined for prevention of instability, which is yet to be reported in current orthopedic studies.

2. Materials and methods

A prospective cohort study was conducted, including consecutive patients who were scheduled for primary total hip arthroplasty and in whom the multimodal protocol for prevention of instability was implemented, between February 2012 and June 2014. Identification of cases of dislocation was carried out by telephonic follow-up at 3 and 12 months after the date of surgery. Every patient included for analysis had a 12 month follow-up assessment. Patients requiring hip arthroplasty for hip fractures or oncologic pathology and cases in which a constrained or dual mobility acetabular component was used were excluded. This decision was made considering that one or more of the interventions could not be implemented in these groups of patients as well as the fact that dual mobility components produce a lesser risk of dislocation than conventional implants.[22–24]

2.1. Surgical technique

Patients were positioned in lateral decubitus ensuring that the pelvis was parallel to the horizontal plane. In all patients, a posterolateral mini-incision approach was used.

2.2. Multimodal protocol for prevention of instability

1. Patient education: patients were educated on safe behaviors following hip replacement surgery. Additionally, a booklet was provided and patients were invited to a group talk where the goals of the procedure, the surgical technique, rehabilitation plan and measures to prevent dislocations were explained and discussed. These topics were also reviewed individually during hospitalization.
2. Intraoperative adjustment of limb length, femoral offset and articular-trochanteric distance: reference measures of these parameters are obtained from the native hip. After final components were placed, a last measurement was performed to determine whether the goals of restoration of limb length, femoral offset and articular-trochanteric distance were achieved. These measurements were performed with the aid of a leg length and lateral offset measurement device (Llinas Leg Length and Lateral Offset Gauge – Innomed, Inc. Savannah, Georgia). This gauge allows surgeons to calculate the distance from a fixed point in the ilium to the lateral cortex of the greater trochanter, thus providing accurate data on leg length and lateral offset.
3. Accurate orientation of prosthetic components: adequate acetabular cup positioning was attempted with the use anatomic landmarks and an inclinometer. The goal was to obtain 15–25° of anteversion and 40–50° of inclination.
4. Use of large femoral heads: according to intraoperative findings, femoral heads $\geq$32 mm whenever it was possible.
5. Intraoperative assessment of prosthetic hip stability: with trial components in place, stability was assessed at the following positions: (a) 120° of flexion, (b) combination of 45° of flexion, 15° of adduction, neutral rotation and 45° of internal rotation, and (c) full extension and maximum external rotation. Whenever the test was not satisfactory, adjustments of trial components were made in order to achieve stability once definitive components were implanted.
6. Posterior soft-tissue repair: with the hip joint in neutral position, posterior capsule and short external rotators were repaired independently with one sutures and re-attached to the greater trochanter through two drill holes.

2.3. Statistical analysis

Descriptive analysis on demographic data, frequency of implementation of each intervention and the rate of dislocation during 3 months after the surgery was performed.

3. Theory

As previously stated prosthesis instability remains one of the most common causes of revision surgery after total hip replacement. There exists several strategies for the prevention of this complication however, to the best of our knowledge, there are no descriptions in the literature regarding the effect of combining these strategies. Therefore this study seeks to describe the implementation of a protocol for prevention of hip prosthesis dislocation that includes 6 different approaches, and to its impact on the rate of dislocation. In theory this protocol may be more effective for the prevention of instability and lay the path for further studies on this multimodal strategy.

4. Results

During the period of study 331 patients were included, 228 females and 103 males. Mean age was 66.2 years. Three patients (0.91%) were lost to follow-up: 2 patients died within the first month after surgery and 1 patient was not available for contact (Table 1). With the exception of these losses to follow-up, patients were contacted at 3 months and 1 year after surgery.

Eighty-nine percent of patients (295/331) received all interventions. All patients received education according to parameters established (Table 2). Posterolateral approach was performed in all patients and posterior soft-tissue repair was completed in 98.5% of them. The caliper was used to restore limb length and femoral offset in 90.63% of cases and the inclinometer was used for cup orientation in 300 patients. Similarly, 97.58% of patients received physical therapy at home (Table 2).

Table 1
Summary of demographic characteristics of patients included in the study.

Variable	*N*	Percentage
Total of procedures	331	100%
Mean age	66.14	
Gender		
Females	228	68.88%
Males	103	31.12%
Diagnosis		
Primary osteoarthritis	247	74.6%
Secondary osteoarthritis		
Developmental hip dysplasia	26	7.9%
Rheumatoid arthritis	16	4.8%
Post-traumatic	16	4.8%
Avascular necrosis	12	3.6%
Other	14	4.2%
Lost to follow-up	3	0.91%
Death	2	0.60%
Unable to contact	1	0.30%

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