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Original article

Total hip replacement in young non-ambulatory cerebral palsy patients

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ABSTRACT

Introduction: The everyday life of a non-ambulatory adolescent or young adult with cerebral palsy can be severely impaired by a painful or stiff hip. The usual surgical solutions such as proximal femoral resection (PFR) are not entirely satisfactory for pain relief, and are mutilating.
Hypothesis: A retrospective study assessed the impact of total hip replacement (THR) on such impairment, on the hypothesis that it is more effective than PFR in relieving pain, without aggravating disability.
Patients and methods: The surgical technique consisted in implanting a dual-mobility prosthesis with uncemented acetabular component and cemented femur, after upper femoral shaft shortening and short hip-spica cast immobilization. Forty THRs were performed in 33 patients, including 31 with multiple disability. Follow-up assessment focused on change in functional status, pain, and range of motion.
Results: Mean follow-up was 5 years. Pain was more or less entirely resolved. Improvement in range of motion was less striking, and there was no significant change in functional status. There were 2 general, 2 septic and 10 mechanical complications, 6 of which required surgical revision.
Discussion: In non-ambulatory cerebral palsy, THR provided much better alleviation of pain than found with PFR treatment. It should be reserved for patients able to withstand fairly long surgery and with femur size compatible with implantation of a femoral component, however small.
Level of evidence: IV, retrospective study.

1. Introduction

For parents and care-givers, it is important for an adolescent or young adult with cerebral palsy (CP), and who often has multiple disabilities, to be able to be seated comfortably. This requires a well-balanced spine and fairly flexible and pain-free hip joints [1]. The more or less asymmetric retractions of spasticity often induce out-of-round hip position during growth. Non-operative treatment during childhood does not always succeed in maintaining good hip positioning and, even when it does, osteoarthritis frequently develops in young adult patients and quickly becomes disabling [2,3]. Surgical solutions such as proximal femoral resection (PFR) fail to improve pain and functional status consistently [4]. Total hip replacement (THR) has rarely been used in paralyzed hips, and even more rarely in young adult non-ambulatory CP patients, for fear of early or late complications given the neurologic problems and general fragility of these patients [5,6]. The present retrospective study sought to describe results of THR at sufficient follow-up in young adult non-ambulatory CP patients, mostly with multiple disability, on the hypothesis that THR is more effective than (PFR) in terms of pain relief, without aggravating disability.

2. Patients and methods

2.1. Patients

The medical files of all non-ambulatory CP patients operated on by the senior authors for THR between January 2001 and January 2014 were analyzed retrospectively.

During the study period, 40 THRs were implanted in 33 patients: 17 male, 16 female; mean age at surgery, 19 years 2 months (range, 13 years 6 months to 31 years 8 months).

Thirty-one of the patients had concomitant non-motor problems: mental deficiency, epilepsy or sensory impairment. Their general health status allowed a long and potentially hemorrhagic procedure. Weight, however, was low, with a mean body-mass index of 17 at surgery [5,7].

The right hip was involved in 22 cases and the left in 18; in the 7 bilateral cases, the mean interval between surgeries was 14 months (range, 1 month to 3 years 7 months).

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Twenty-one of the 40 hips had history of surgery: 9 soft-tissue release procedures (adductor tenotomy), 9 femoral and pelvic osteotomies, 1 PFR, and 2 osteoma resections.

Paralytic scoliosis was frequently associated, requiring fusion up to the pelvis in 23 cases. In 16 of these cases, THR was performed after vertebral fusion, at a mean 42 months (range, 12–60 months), and in 7 vice versa at a mean 28 months (12–60 months).

Initial assessment and follow-up data were retrieved from medical files and collected by questionnaires sent to families and their community physicians.

Functional status was assessed in terms of walking capacity on the 5-level Gross Motor Function Classification System (GMFCS) [8] and of possible verticalization and self-help in transfer. All patients were GMFCS 5, 21 were able to help with transfer, and 10 were verticalized and 10 still had a possibility of verticalization.

All patients were operated on for pain confirmed by the family or care staff, in many cases assessed on the San Salvadour child pain scale (Douleur Enfant San Salvadour: DESS) adapted for multiple disability [9]. Pain was continuous in 16 cases, in seated position in 20, during transfer in 28 and during mobilization (e.g., for nursing care) in 26.

In 1 case pain in the seated position was located not in the hips, which were ankylosed in extension, but in the lumbar spine.

Range-of-motion study focused on flexion with an 80° threshold, determining comfortable sitting: 19 patients showed <80° flexion. Frontal and transverse motion and restriction could not be reliably quantified.

Radiography found femoral head dislocation in 18 cases, subluxation in 15, and good positioning in 6, but with severe deformity or inclusion by osteoma. In 1 case, the femoral head had been resected.

Statistical analysis used pairwise comparison of pre- and post-operative variables on McNemar's test for paired data (a non-parametric test for qualitative data), confirmed by multiple correspondence analysis.

The significance threshold was set at 0.05.

2.2. Surgical technique

The surgical approach was lateral, with trochanteric osteotomy and neck section, sometimes with immediate shortening of the femoral shaft to facilitate acetabular exposure.

The acetabular component was positioned within the native acetabulum. In 15 cases, a bone block taken from the femoral head was added and fixed by K-wire. After native acetabulum reaming, the acetabular component was impacted, taking account of frontal and sagittal spine orientation.

Upper femoral shaft shortening removed a mean 3.5 cm (range, 1–6 cm), conserving the whole metaphysis to receive the proximal part of the implant.

Osteotomy fixation used the extremity of the implant; persistent mobility, however, required fitting a 4-hole plate with unicortical screws in 5 cases.

Femoral antetorsion within the osteotomy was adjusted on introducing the femoral component, with the implant head well positioned inside the acetabulum so that the patella pointed upward. This often involved reducing initially excessive antetorsion.

Small-diameter femurs were reamed, completing metaphyseal preparation.

A small "dysplastic" or "made-to-measure" implant was used, and cemented in all but 3 cases. Trochanteric synthesis was prepared before fixing the femoral component with 2 metal or single-filament sutures and freshening of the lateral side of the shaft to receive the trochanteric medallion.

The definitive femoral stem was then introduced in the acetabulum, with a trial head to determine neck length. The definitive

Fig. 1. Dual-mobility implant parts: femoral stem, 26-mm head impacted in polyethylene insert.

26-mm steel head was introduced, outside the surgical field, in the mobile acetabular insert. The assembly was then impacted into the Morse cone of the femoral component, and then gently reduced within the acetabulum (Fig. 1).

The greater trochanter was reinserted in a rig prepared ahead of femoral fixation. A deep Redon aspiration drain was fitted before closure. Possible indications for adductor tenotomy were checked, and were systematically absent after femoral shortening.

A hip spica cast was used in 23 hips for the first 2 weeks. Gentle mobilization under traction was then initiated, and seated posture was resumed once hip flexion reached 80°.

Mean operative time, including cast fitting, was 200 min (range, 110–300 min).

Blood was collected for only 13 patients; mean blood-loss was 463 ml (range, 45–1520 ml), requiring transfusion of 1–4 units of autologous blood in 18 (out of 33) patients.

3. Results

3.1. Functional assessment

Three of the 33 died, at 38, 65 and 102 months postoperatively. Mean follow-up was 63.2 months (range, 9–147 months) (Fig. 2). Results are shown in Table 1.

Table 1
Results for functional status in the 33 patients. Results for pain and range of motion in the 40 THRs.

	Before	After	
Function (33 patients)			
GMFCS V	33	33	NS
Assisted sitting	28	27	NS
Independent sitting	5	6	NS
Transfer possible	21	21	NS
Verticalization possible	10	5	NS
Pain (40 hips)			
Permanent pain	16	0	$P < 0.05$
Pain sitting	20	1	$P < 0.05$
Pain on transfer	28	0	$P < 0.05$
Pain on perineal care	26	2	$P < 0.05$
Motion (40 hips)			
Flexion >80°	19	34	$P < 0.05$