Total hip arthroplasty after Legg–Calvé–Perthes disease

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Background
Patients who have hip osteoarthritis secondary to Legg–Calvé–Perthes disease (LCPD) have deformities of the acetabulum and femoral head; few studies have presented the outcome and risks associated with total hip arthroplasty (THA) for patients with a history of LCPD.
Aim
The aim of this study was to evaluate the results and complications associated with THA for LCPD.
Patients and methods
Thirty-four patients with secondary hip osteoarthritis as a sequelae of LCPD underwent cementless THA. Their average age was 38.7 years old (range: 26–65 years old), while the average follow-up period was 6.5 years (range: 5–10 years). The patients were evaluated clinically (using the Harris hip score) and radiologically.
Results
The Harris hip score improved from 48.2 points preoperatively to 92.8 points at the time of the last follow-up. The shortening of the affected limb has improved from –1.6 to 0.2 cm. The complications included three cases of intraoperative femur fractures and three cases of sciatic nerve palsy that developed after extensive lengthening of the lower limb. Patients with a history of previous childhood hip surgery were significantly younger at the time of arthroplasty when compared with patients who were treated nonoperatively (P=0.0006).
Conclusion
Hip arthroplasty showed good outcomes in patients with LCPD at an average of 6 years follow-up. Intraoperative fractures and nerve injuries are common. Caution should be taken while restoring leg length as stretching the sciatic nerve may result in a permanent deficit.

Keywords:
Legg–Calvé–Perthes disease, osteoarthritis, total hip arthroplasty

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Introduction

Treatments for Legg–Calvé–Perthes disease (LCPD) are diverse, and the long-term outcomes of the disease are poorly understood [1]. One of the major problems in the long term for the patients with LCPD is development of hip osteoarthritis (OA) that might result in the need for a total hip arthroplasty (THA). The reported overall prevalence of OA after LCPD was between 5 and 100% [2,3] and the prevalence of THA ranged from 0 to 24% [4–6]. However, there are limited data available in the literature regarding the outcome of THA in patients with sequelae of LCPD [7–9].

Patients having LCPD are unique regarding the technical difficulties while THA being performed due to multiplanar deformities of the femoral head, short neck, a high greater trochanter, shallow and retroverted acetabulum, abductor dysfunction, and retained metalwork if a previous surgery was performed (e.g. varus osteotomy) [7,10].

To our knowledge, few studies reported the outcomes of THA in patients with secondary hip OA secondary to the sequelae of LCPD.

The aim of this study was to evaluate the results and complications associated with THA for LCPD.

Patients and methods

The study was done in a prospective way between May 2005 and September 2010, 34 patients (22 males and 12 females) underwent 40 cementless THAs due to secondary hip OA as a sequel of LCPD. The study was approved by the institutional ethics committee in the orthopeadic department Mansoura university, Mansoursa. Egypt. Six patients had a bilateral THA. All patients reported a history of undergoing operative or nonoperative treatment for LCPD.

Twenty-three hips (57.5%) had undergone previous childhood surgery (group A), including pelvic osteotomy [11], femoral osteotomy [6], femoral osteotomy plus soft-tissue procedure (four), and femoral and pelvic osteotomy (one). Seventeen hips had a nonoperative treatment for LCPD (group B).

In the conservative group (group B), there is spherical congruency in 10 hips, six of them were healed with Stulberg class I and class IV. Aspherical congruency was found in three hips, that is, two Stulberg class III hips and one Stulberg IV hip, and there are no data about the classification in the remaining four hips in group B. In the operated group (group A), 11 hips healed with spherical congruency: four are Stulberg class II and seven class I. Five hips healed with spherical congruency and all of them were Stulberg class III hips. No case were recorded as Stulberg IV or V. The remaining seven hips had no data about their class. As regards the age of onset of the diseases in the conservative group, all but three patients had an age-at-onset less than 6 years (two patients 9.5 years, of which one was bilaterally affected, and one 7.3 years) and in the operated group, all but two patients had an age-at-onset less than 6 years (both 7.8 years).

The overall mean age at the time of surgery was 38.7 years. The mean BMI was 26.3 kg/m^2. The mean body weight was 67.1 kg. The mean follow-up period was 6.5 years (range: 5–15 years). Hospital stay ranged between 2 and 5 days, with an average of 3 days.

The acetabulum is shallow-elongated and retroverted in most of the cases and in all cases, the acetabular deformity was classified as Crowe type I and II. There was antrolateral bowing of the femur in six cases.

Surgery

All patients were given a prophylactic antibiotics before surgery and all operations were performed through a posterolateral approach. The femoral component was inserted with a press-fit technique and the largest broach that would fill the metaphysis and leave little cancellous bone remaining was used. Regarding the acetabular component, it was fixed only by press-fitting. In all cases, cementless implants were used.

Postoperative care

The redivac was removed after 24 h, an antibiotic was given for 4 days, while oral anticoagulants were given for 1 month. Patients were mobilized on the second postoperative day.

Clinical evaluation

All patients were followed up periodically at our outpatient clinic every 3 months during the first year and every 6 months after that. The clinical outcome was evaluated regarding comparing preoperative and postoperative Harris hip score (HHS) [12], pain, infection, and neurovascular complications.

Loosening of the acetabular cup was defined if there was movement in the position of the cup of more than 2 mm medially, vertically, or laterally, if the radiolucent lines were widened more than 2 mm in the posterior, anterior, and lateral radiographs of the acetabular cup, or if the inclination angle changed by more than 5°. Loosening of the femoral component was defined as subsidence of greater than 5 mm according to the method of Callaghan *et al.* [11].

The postoperative leg length was measured and compared with the preoperative leg length. The leg-length discrepancy is measured from the line intersecting the ischial tuberosities to the midpoint of the lesser trochanter on both sides.

Both groups were compared for operative time, blood loss, HHS, and the presence of complications: neurologic injury, vascular injury, presence of postoperative infection, presence of arthroplasty dislocation, need for revision of any components, deep-vein thrombosis, and/or pulmonary thromboembolism and periprosthetic fractures.

The nonparamettric test and χ^2 test were used to compare both groups. Matched-pair analysis was used to compare pre- and postoperative HHSs. Significance was set at a P value less than or equal to 0.05.

Results

Total hip arthroplasties were performed in 34 patients (40 hip joints) with secondary OA due to LCPD. Twenty-three (57.5%) hips had a history of previous childhood hip surgery. The mean age of patients with a history of previous childhood hip surgery was 35.03 years old, while, it was 43.98 years old in patients without past history of hip surgery for treatment of LCPD. The difference between both groups was statistically significant ($P<0.05$).

The hip OA that needed THA had bilateral presentation in 15% of the sample group (six patients). Out of the total sample, 30% were female patients. Among group A patients, 10 patients (43.5%)

were females, while in group B, eight patients (47.1%) belonged to this sex. There was no statistically significant difference between the two groups.

The mean BMI was 29.6 kg/m^2 in group A, while it was 31.7 in group B with no statistical difference.

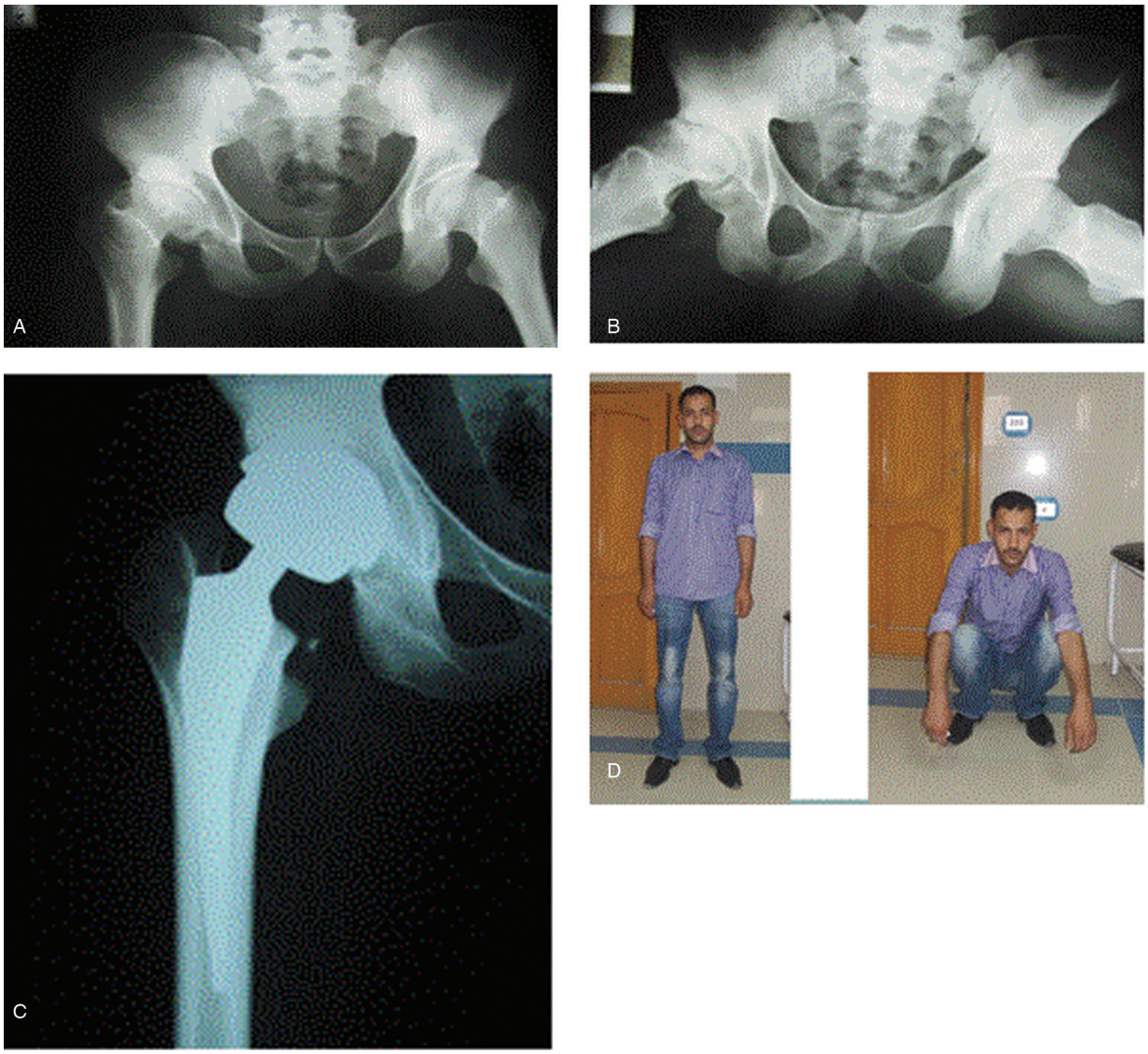
The mean follow-up time of patients in group A was 6.2 years, while, it was 6.7 years. These data showed no statistical difference.

The patients' overall average preoperative HHS was improved from 48.2 points (range: 40–68) to 92.8 points (range: 78–95) postoperatively (Figs. 1 and 2). In group A, average HHS was improved from 49.3 points to 90.2 points, while, in group B, it was improved from 46 points to 92.3 points. The difference between both groups was statistically insignificant (P =0.48).

The mean operation time was 100 min (range: 90–110 min) in group A, while it was 85 min (range: 70–100 min) in group B with no statistical difference (P=0.68). The average total amount of blood loss was 443.3 ml (range: 265–720 ml) in group A and 430 ml (range: 25–670 ml) in group B with no statistical difference (P=0.34).

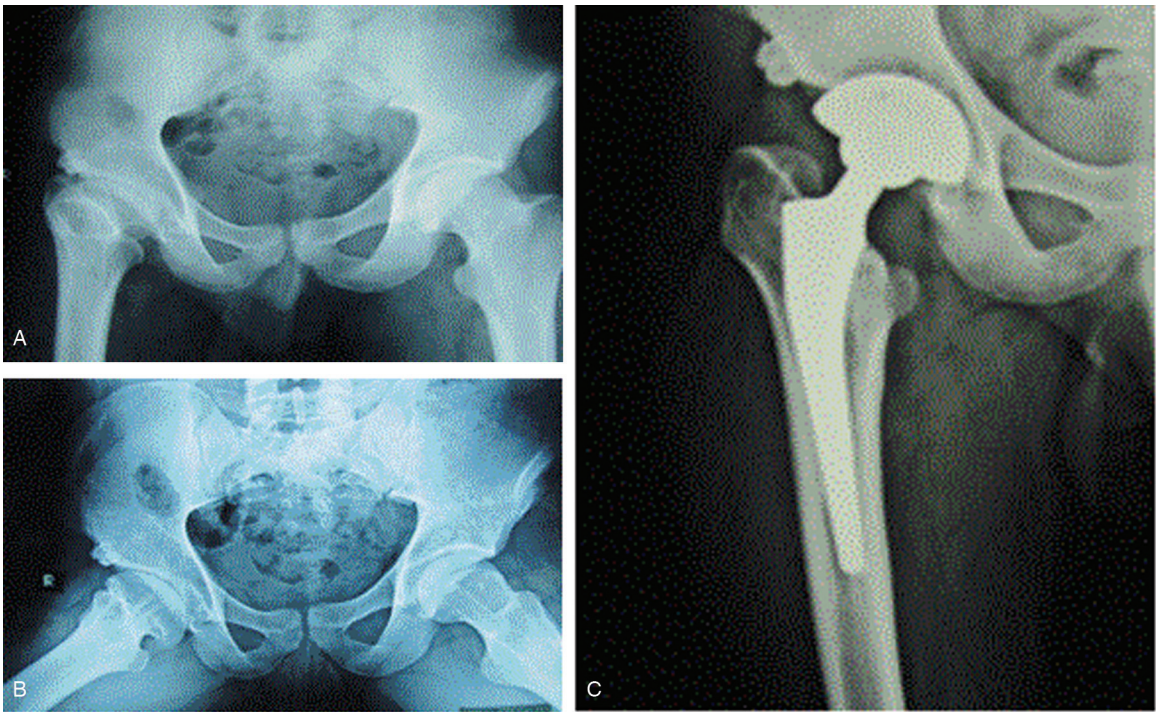
We found that the survival rate of the implants in group A was 96.3% and in group B was 98.8%. There was no statistical difference (P=64). The overall survival rate of the implants was 97.8%.

Figure 1



(a, b) Preoperative anterioposterior and lateral pelvis film of a 25-year-old man who had right Legg–Calvé–Perthes disease treated conservatively with a brace. At presentation, the leg-length discrepancy is measured at 2.3 cm with the affected leg shorter than the unaffected side. (c) Follow-up radiography after 3 years with good position of the prosthesis. (d) Photograph with good function.

Figure 2



(a, b) Preoperative anterioposterior and lateral pelvis film of a 29-year-old man who had right Legg–Calvé–Perthes disease treated with a shelf acetabuloplasty. At presentation, the leg-length discrepancy is measured at 2.9 cm with the affected leg shorter than the unaffected side. (c) Radiography after 5 years of follow-up.

Regarding the reported complications, three patients in group A (7.5%) showed intraoperative femoral fracture type A2 according to Vancouver classification that was fixed with wires and cables and weight bearing was not permitted until bony union. Two of the three patients had a previous femoral osteotomy and the third one had a previous pelvic osteotomy. No patients complained of thigh pain. At the final follow-up, all hips showed stable fixation. No hip had osteolysis and subsidence around the implant loosening. There was no dislocation or heterotopic ossification. Two cases had infection and were treated with two-stage revision.

Neurologic complications at the time of THA were frequent. Three patients (7.5%) developed sciatic nerve palsy: one was permanent and two resolved. Two patients related to group A and the third one in group B. The three patients were lengthened by 2.3, 1.4, and 3.2 cm (mean: 2.3 cm) at the time of THA compared with the mean of 1.4 cm in the patients who did not sustain a neurologic injury (P=0.32). These three cases were done early in the study series (case numbers 3, 7, and 12 in this study group). The average limb-length discrepancy was improved from −1.6 cm (range: −2.5 to −0.8 cm) preoperatively to 0.3 cm (range: −0.1 to 3.2 cm) postoperatively.

No significant difference in outcomes was detected between patients with LCPD who underwent previous childhood surgery compared with patients with LCPD who were treated conservatively. However, a higher number of complication rates was noted in patients with LCPD who underwent previous childhood surgery, although this did not reach statistical significance.

No statistical difference could be found between the two study groups regarding the Stulberg classification (Mann–Whitney U-test, P=0.83).

Discussion

OA is one of the major problems in the long term for the patients with LCPD that might result in the need for a THA. The reported overall prevalence of OA after LCPD was between 5 and 100% [2,3], and the prevalence of THA for those patients ranged from 0 to 24% [4–6]. This study presents a group of patients with LCPD who went on to THA. We found that complications were frequent in this population although survivorship of THA was generally good.

In our series, cementless implants had acceptable survivorship of 97.8% at 6.5-year follow-up. Traina *et al.* [9] reported a 96% survivorship at 15 years for

primarily ingrowth components in patients with a history of LCPD. Takenaga *et al.* [13] used uncemented implants and reported survivorship of 86% at 10–15-year follow-up in patients younger than age 50 years.

Patients who have LCPD are unique regarding the technical difficulties of THA. This is due to the multiplanar deformities of the femoral head, the high greater trochanter, the shallow and retroverted acetabulum, and the short neck of the femoral head. Also, previous surgical procedures undertaken during childhood (particularly femoral osteotomies) make THA more difficult [7,10]. In this study, we found that the press-fit femoral component was difficult in the patients who had previous femoral osteotomy due to the altered normal anatomy of the proximal femur and the marked femoral neck anteversion. In the present study, the risk of intraoperative femoral fracture was 7.5% compared with 3% of patients undergoing arthroplasty for any cause [14]. In agreement with Baghdadi *et al.* [15], fracture during stem insertion might be due to the deformity of femur in these patients. Femoral fracture was higher in cases with previous surgery (group A). It is better to do a careful preoperative evaluation using computed tomography to measure the anteversion of both femur and acetabulum to avoid such intraoperative risks.

Sciatic nerve palsy as a complication for LCPD has not typically been known. Takenaga *et al.* [13], in a small case series, reported a high rate of neurologic deficit in patients with LCPD undergoing arthroplasty (6%). In our study, the three patients who had neurologic deficit were lengthened by a mean of 2.3 cm at the time of THA compared with the mean of 1.4 cm in the patients who did not sustain a neurologic injury. The patients complained of neurogenic pain without motor weakness on the affected leg. We think that this complication may be due to the long-standing nature of the shortened limb that may put the patient at increased risk of neurologic injury compared with the typical patient with OA. This complication occurred early in this study (case numbers 3, 7, and 12 in this study group), so, to avoid it later on in our last cases, we avoided to overlengthen the limb for patients with LCPD.

We observed that patients with LCPD who had surgical treatment had a risk of having secondary OA hip early and they were typically younger at the time of arthroplasty in comparison with those patients who had nonoperative treatment. This observation should be considered to change the trends in the treatment of LCPD. Further studies are needed to improve our knowledge on the treatment outcome of LCPD in greater detail. We need guidelines for surgery in patients with LCPD based on the findings of such studies.

This study has some limitations. It is a retrospective one performed in a small number of patients with short-term follow-up. A long-term follow-up must be necessary. The study does not have the control group of primary THA due to primary OA.

Conclusion

Hip arthroplasty showed good outcomes in patients with LCPD at an average of 6 years of follow-up. Intraoperative fractures and nerve injuries are common. Care should be taken to avoid excessive limb lengthening.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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