

# Total Hip Arthroplasty in Patients Younger Than 30 Years of Age

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**Key words:** total hip arthroplasty, young patients, complications

## Abstract

**Background:** Previously reported results of total hip arthroplasty in patients under the age of 30 indicate a high complication rate and questionable durability.

**Objectives:** To estimate the results of THA in extremely young patients.

**Methods:** We report the results of 69 THA procedures in 56 patients who were under the age of 30 at the time of surgery (mean age  $23.23 \pm 4.31$  years) and were followed postoperatively for 2–23 years (mean  $7.4 \pm 3.79$  years).

**Results:** Loosening of the cup (11/69) and early traumatic dislocation (5/69) accounted for the majority of complications.

**Conclusion:** The final average Harris hip scores of  $90.59 \pm 9.36$  in these patients indicated that THA is a successful and durable treatment modality for young patients with disabling diseases affecting the hip joint. However, due to the likelihood of complications it should be used with caution in this patient group. Efforts should be made to diminish the complication rate.

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For many years, arthrodesis of the hip or resection arthroplasty were considered the salvage procedures for end-stage painful co-arthrosis in young patients. The introduction of total hip arthroplasty in the early 1960s presumably offered a better option. However, several investigators who followed patients for at least 10 years questioned the durability of this procedure in young patients. They indicated a high complication rate (e.g., relatively early loosening) and short durability, mainly because of intensive linear wear of the polyethylene cup resulting from a very active lifestyle [1–3]. Furthermore, most of these studies comprised patients younger than 50 years old, the majority of whom suffered from juvenile rheumatoid arthritis or post-congenital hip dysplasia [1–6]. We report the medium-term results of 56 THA treatments in patients under the age of 30 at the time of surgery who suffered from a variety of disabling conditions affecting the hip joint.

## Patients and Methods

Between 1972 and 1995, 56 patients (30 females and 26 males) under the age of 30 (mean  $23.23 \pm 4.31$ , range 14–29 years) underwent an aggregate of 69 THAs due to various disabling conditions that affected the hip joint [Table 1]. Neither arthrodesis nor resection arthroplasty, although considered the salvage procedures for such conditions, were performed on these young

**Table 1.** Diagnosis at surgery

| Diagnosis                                     | No. of patients/<br>operation |
|---|-------------------------------|
| Arthritides                                   |                               |
| Juvenile rheumatoid arthritis                 | 5/6                           |
| Familial Mediterranean fever                  | 5/5                           |
| Ankylosing spondylitis                        | 3/4                           |
| Systemic lupus erythematosus                  | 4/5                           |
| Traumatic arthritis                           | 10/10                         |
| Post-DDH arthrosis                            | 8/11                          |
| Post-septic arthritis in infancy              | 7/7                           |
| AVN post-myeloproliferative disease treatment | 3/6                           |
| Others  |                               |
| Primary idiopathic osteoarthritis             | 1/1                           |
| Post-Perthe's disease                         | 1/1                           |
| Post-proximal focal femoral deficiency        | 1/1                           |
| Gaucher's disease                             | 1/1                           |
| Ewing sarcoma                                 | 1/1                           |
| Slipped capital epiphysis                     | 2/3                           |
| Ehler's Danlos syndrome                       | 1/1                           |
| Avascular necrosis, idiopathic                | 3/6                           |
| Total   | 56/69                         |

DDH = developmental dysplasia of hip

patients before the THA. While aware of the high risk of THA at this young age, all the patients preferred THA over the other solutions that were offered.

These 56 patients had undergone an average of 1.23 operations per patient prior to THA [Table 2]. Cementless prostheses (Landos hydroxyapatite, or Bousquet screwed hydroxyapatite-coated stem) were used in almost all cases (46 and 17 respectively, 91.29%), and 6 were cemented (Charnley) arthroplasties. Preoperative treatment included prophylactic antibiotics (Cefonicid, 1 g until the drain was removed), and from the day of surgery low molecular weight heparin was given once daily for 6 weeks. No routine prophylaxis for heterotopic ossification was administered. Demographic, operative and postoperative details were recorded from the patients' preoperative files.

The mean follow-up period was  $7.4 \pm 3.79$  years (range 2–23 years). All patients (with the exception of one who died from Ewing sarcoma 2 years postoperatively) were examined annually, answered a questionnaire, and attended a formulated follow-up. Recent X-ray radiographs of the pelvis and affected hips were used

THA = total hip arthroplasty

**Table 2.** Previous operations/patient groups

| Group                                     | No. of patients/<br>operation |
|---|-------------------------------|
| Arthritides                               | 17/6                          |
| Traumatic arthrosis                       | 10/8                          |
| Post-DDH                                  | 8/39                          |
| Post-septic arthritis                     | 7/24                          |
| Others/Miscellaneous                      | 11/8                          |
| Post-myeloproliferative disease treatment | 3/0                           |
| Total                                     | 56/85                         |

to estimate the loosening (fixed, probable, possible, and definite), linear wear, femoral and acetabular osteolysis, cortical hypertrophy and stress shielding, especially of the Bousquet prosthesis. The latest Harris hip scores were recorded for each patient. Linear regression was used for statistical analysis with HHS as the dependent variable. Non-dependent variables included length of follow-up, preoperative HHS, gender, age at surgery, weight, duration of disease, occupation, affected side, hospitalization time, diagnosis, operative blood loss, surgical approach, unilateral or bilateral surgery, and type of prosthesis. The same statistical method was used to evaluate the risk of complications as a dependent variable.

## Results

All patients (except for the one who died from Ewing sarcoma) participated in the follow-up study. The mean preoperative HHS was  $54.04 \pm 7.31$  (range 31–67) compared to  $90.59 \pm 9.36$  (range 79–100) postoperatively. No statistically significant differences were found in pre- or postoperative HHS in any of the patient groups [Table 2]. No thigh pain occurred in the cementless-stem group, including those with the Bousquet prosthesis. In the Bousquet group, cortical hypertrophy and stress shielding were evident, but were totally reversed after the first year and there were no complaints.

Postoperative complications manifested in 34.78% of hip surgery cases ( $n=24$ ) [Table 3]. These included:

- Loosening of the cup in 11 hips (at mean 6.09 years postoperatively). Revision of the cup was performed in eight hips; the other three were non-symptomatic.
- Loosening of both components in four cases, and revision performed in three.
- Traumatic dislocation in five hips (two after a fall, two after a road accident and one during intensive dancing), all of which were treated by closed reduction. None of the dislocations recurred, except in the dancer who continued to dance against all medical advice.
- Deep infection in three cases (two cases of methicillin-resistant *Staphylococcus aureus*, and one case of *Salmonella shigella*) that necessitated staged revision in two instances, and “Girdlestone” resection arthroplasty in the third, who refused any other suggested treatment.
- Pulmonary emboli in one patient during the 1 week hospitaliza-

**Table 3.** Complications of surgery

| Complication/hip          | Complications |         |
|---------------------------|---------------|---------|
|                           | No.           | (%)     |
| Loosening of cup          | 11            | (15.94) |
| Loosening of stem and cup | 4             | (5.79)  |
| Dislocation               | 5             | (7.25)  |
| Deep infection            | 3             | (4.34)  |
| Pulmonary emboli          | 1             | (1.45)  |
| Total                     | 24            | 34.78   |

tion, which resolved completely after treatment with anti-coagulants.

At the latest follow-up, all patients were questioned on their satisfaction with the operation, taking into consideration the alternative options of arthrodesis or resection arthroplasty that had been described to them. All but one (a patient with deep infection who was treated by resection arthroplasty) indicated satisfaction with their current status although they were aware of the potential risks of future additional surgery.

No statistically significant differences were found between the Bousquet and the Landos groups with regard to the HHS and the complication rate.

The multivariate statistical analysis with HHS as the dependent variable revealed high statistically significant differences: namely, the negative effect of the length of hospitalization ( $P < 0.0001$ ) and cemented prostheses ( $P < 0.008$ ) on the HHS. Reevaluation of these results using the multiple linear regression analysis revealed that only length of hospitalization remained highly statistically significant.

The multivariate statistical method used to evaluate the risk of complications revealed significant differences in age, diagnosis and prosthesis type: i.e., the younger the patient's age at surgery the higher the risk of complications ( $P = 0.01$ ); the rarer the hip disease (e.g., a patient included in the “others” category in Table 1) the higher the complication rate ( $P = 0.04$ ); and higher complication rate with cemented prostheses ( $P = 0.02$ ). Evaluation performed by multiple linear regression analysis showed that only the young age of patients at the time of surgery remained statistically significant for the risk of one of the postoperative complications.

## Discussion

The use of total hip arthroplasty as a salvage procedure in young patients with disabling hip diseases has generated theoretical, philosophical and practical debates. Only a few reports in the orthopedic literature have discussed THA in the very young population – under the age of 30 at the time of surgery – whose lifestyle is physically and mentally more demanding [7,8]. The results of these reports, mostly related to the cemented prosthetic era, are confusing. Some have shown a higher rate of loosening, e.g., 14.3% cup loosening, and dislocation when compared to elderly osteoarthritic patients [9–11]. Conversely, some reports have demonstrated promising results, such as 86% femoral component or 84% acetabular component survival after 20 years [12,13].

HHS = Harris hip scores

The theoretical, physiologic and psychological debate is particularly delicate with regard to young patients when considering the alternatives to THA: arthrodesis or resection arthroplasty. Both options, although providing considerable pain relief, may also intensify the degree of physical disability even in daily life, such as inability to sit on a regular chair or couch, severe limping, difficulties in playing sport, and copulation. Furthermore, in medium to long-term follow-up after hip arthrodesis, there are multifarious reports on the high percentage of low back pain and/or ipsilateral knee pain (up to 65%), excluding numerous other complaints. Although 80% of the patients were satisfied with the results of the operation and had good functional outcome, many of them needed supportive aids [14–16]. The results of resection hip arthroplasty are much worse, especially regarding HHS (range 54–60), poor functional outcome, and satisfaction rate (52%) [17–19]. Although good control of previous infection was achieved in the majority of patients, and mobility was acceptable, the measured average oxygen consumption was 264% higher than normal, and the energy consumption was even higher than that recorded in patients after above-knee amputation [20].

Moreover, neither arthrodesis nor resection arthroplasty is an acceptable or practical option for patients with bilateral hip disease (e.g., bilateral avascular necrosis post-myeloproliferative disease treatment). These options prove even more problematic in patients with multiple joint disease (rheumatoid arthritis, systemic lupus erythematosus, familial Mediterranean fever, etc.).

More than one-third of the patients suffered from multiple joint disease and we could not offer any alternative option that would allow normal function and lifestyle. On the other hand, it should be strongly emphasized to patients that THA might be associated with a high complication rate (mostly of cup loosening), and that THA in young patients is still a temporary solution. Nevertheless, the medium-term results ( $7.4 \pm 3.79$  years) in the patients in our study are promising: the mean postoperative HHS was  $90.59 \pm 9.36$  and stable for the long-term patients. The relatively high rate of complications could be attributed to the following factors:

- Previous surgical procedures: average of 1.52 procedures per patient, ranging from 4.88 per patient and 3.43 per patient in the post-DDH group (developmental dysplasia of hip) and post-septic arthritis in infancy, respectively, to 0 per patient and 0.35 per patient in the post-myeloproliferative-treated patients and arthritic groups, respectively [21,22]. These multiple previous operations jeopardize the soft tissue integrity that is important for good hip function. Furthermore, these multiple previous operations increase the risk for infections because they were performed in older operating rooms without laminar flow.
- The vigorous physical normal lifestyle of these young patients contributed to the high rate of cup loosening [23,24]. Loosening of the prosthesis that occurred at a mean 6.09 years for the cup only, and 7.5 years for both the cup and the stem, was caused, in our opinion, by the dynamic functional level of these young patients. Similarly, the five dislocations also occurred during vigorous physical activity, even though the patients were instructed to refrain from such activities.

## Conclusions

This study emphasizes the good medium-term results and satisfaction with THA in patients younger than 30 years of age at the time of surgery, especially when compared to arthrodesis or resection arthroplasty [14,18]. It should be emphasized that THA in young patients, although *superior to* arthrodesis or resection arthroplasty, is not the ideal final treatment, as evidenced by the high complication rate, especially loosening and high prosthetic material wear. The patient should be informed that although there are good chances for pain relief and return to a normal lifestyle, there is a high risk of at least one future revision. The younger and more active the patient, the higher the risks for revision. Early detection and successful treatment of predisposing conditions to the development of co-arthrosis, such as developmental dysplasia of hip, septic arthritis and slipped epiphysis, may reduce the need for these salvage procedures in young patients. Futuristic development in prosthetic designs and materials as well as biologic solutions, such as cementless prostheses (hydroxyapatite-coated in our series), may contribute to improved outcome in young adults in the future.

## References

1. Ballard WT, Callaghan JJ, Sullivan PM, et al. The results of improved cementing techniques for total hip arthroplasty in patients less than 50 years old. A ten-year follow-up study. *J Bone Joint Surg [Br]* 1994;74:385–9.
2. Cage DJN, Granberry WM, Tullos HS. Long-term results of total arthroplasty in adolescents with debilitating polyarthropathy. *Clin Orthop* 1992;283:156–62.
3. Callaghan JJ, Forest EE, Olejniczak JP, et al. Charnley total hip arthroplasty in patients less than 50 years old. A twenty to twenty-five-year follow-up note. *J Bone Joint Surg [Am]* 1998;80:704–14.
4. Bsila RS, Inglis AE, Ranawat CS. Joint replacement surgery in patients under thirty. *J Bone Joint Surg [Am]* 1976;58:1098–104.
5. Chandler HP, Reineck FT, Wixson RL, McCarthy JC. Total hip replacement in patients younger than 30 years old. A 5-year follow-up study. *J Bone Joint Surg [Am]* 1981;63:1426–34.
6. Collis DK. Long-term (12 to 18-year) follow-up of cemented total hip replacement in patients who were less than 50 years old. A follow-up note. *J Bone Joint Surg [Am]* 1991;73:593–7.
7. D'Antonio JA, Capello WN, Manley MT, Feinberg J. Hydroxyapatite coated implants. Total hip arthroplasty in the young patient and patients with avascular necrosis. *Clin Orthop* 1997;344:124–38.
8. Dorr LD, Luckett M, Conaty JP. Total hip arthroplasties in patients younger than 45 years: A nine-to-ten year follow-up study. *Clin Orthop* 1990;260:215–19.
9. Halley DK, Wroblewski BM. Long-term results of low-friction arthroplasty in patients 30 years of age or younger. *Clin Orthop* 1986;211:43–50.
10. Feller JA, Kay PR, Hodgkinson JP, Wroblewski BM. Activity and socket wear in the Charnley low-friction arthroplasty. *J Arthroplasty* 1994;9:341–5.
11. Haber D, Goodman SB. Total hip arthroplasty in juvenile chronic arthritis: a consecutive series. *J Arthroplasty* 1998;13:259–65.
12. Joshi AB, Porter ML, Trail IA, et al. Long-term results of Charnley low-friction arthroplasty in young patients. *J Bone Joint Surg [Br]* 1993;75:616–23.
13. Kronick JL, Barba ML, Paprosky WG. Extensively coated femoral components in young patients. *Clin Orthop* 1997;344:263–74.
14. Barnhardt T, Steihl JB. Hip fusion in young adults. *Orthopedics* 1996;19:303–6.
15. Callaghan JJ, Brand RA, Pedersen DR. Hip arthrodesis. A long term follow-up. *J Bone Joint Surg [Am]* 1985;67:1328–35.

## Original Articles

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16. Sponseller PD, McBeath AA, Perpich M. Hip arthrodesis in young patients. A long-term follow-up study. *J Bone Joint Surg [Am]* 1984;66:853-9.
  17. Scalvi A, Campacci A, Marcer M, et al. Girdlestone arthroplasty for loosening of the total hip prosthesis: evaluation and results. *Chir Organ Mov* 1995;80:279-85.
  18. Bourne RB, Hunter GA, Rorabeck CH, Macnab JJ. A six-year follow-up of infected total hip replacements managed by Girdlestone's arthroplasty. *J Bone Joint Surg [Br]* 1984;66:340-3.
  19. Bittar ES, Petty W. Girdlestone arthroplasty for infected total hip arthroplasty. *Clin Orthop* 1982;170:83-7.
  20. Kantor GS, Osterkamp JA, Dorr LD, et al. Resection arthroplasty following infected total hip replacement arthroplasty. *J Arthroplasty* 1986;1:83-9.
  21. Sarmiento A, Ebramzadeh E, Gogan WJ, McKellop HA. Total hip arthroplasty with cement. A long-term radiographic analysis in patients who are older than 50 and younger than 50. *J Bone Joint Surg [Am]* 1990;72:1470-6.
  22. Shinar AA, Harris WH. Cemented total hip arthroplasty following previous femoral osteotomy: an average 16-year follow-up study. *J Arthroplasty* 1998;13:243-53.
  23. Sochart DH, Porter ML. The long-term results of Charnley low-friction arthroplasty in young patients who have congenital dislocation, degenerative osteoarthritis, or rheumatoid arthritis. *J Bone Joint Surg [Am]* 1997;79:1599-617.
  24. Sochart DH, Porter ML. Long-term results of cemented Charnley low-friction arthroplasty in patients aged less than 30 years. *J Arthroplasty* 1998;13:123-31.
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