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 ± 4.31 years) and were followed postoperatively for 2–23 years (mean 7.4 ± 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 ± 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.

Table 1. Diagnosis at surgery

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>No. of patients/operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arthritis</td>
<td></td>
</tr>
<tr>
<td>Juvenile rheumatoid arthritis</td>
<td>5/8</td>
</tr>
<tr>
<td>Familial Mediterranean fever</td>
<td>5/5</td>
</tr>
<tr>
<td>Ankylosing spondylitis</td>
<td>3/4</td>
</tr>
<tr>
<td>Systemic lupus erythematosus</td>
<td>4/5</td>
</tr>
<tr>
<td>Traumatic arthritis</td>
<td>10/10</td>
</tr>
<tr>
<td>Post-DDH arthritis</td>
<td>8/11</td>
</tr>
<tr>
<td>Post-septic arthritis in infancy</td>
<td>7/7</td>
</tr>
<tr>
<td>AVN post-myeloproliferative disease treatment</td>
<td>3/6</td>
</tr>
<tr>
<td>Others</td>
<td></td>
</tr>
<tr>
<td>Primary idiopathic osteoarthritis</td>
<td>1/1</td>
</tr>
<tr>
<td>Post-Peirès disease</td>
<td>1/1</td>
</tr>
<tr>
<td>Post-proximal focal femoral deficiency</td>
<td>1/1</td>
</tr>
<tr>
<td>Gaucher's disease</td>
<td>1/1</td>
</tr>
<tr>
<td>Ewing sarcoma</td>
<td>1/1</td>
</tr>
<tr>
<td>Slipped capital epiphysis</td>
<td>2/3</td>
</tr>
<tr>
<td>Ehler's Danlos syndrome</td>
<td>1/1</td>
</tr>
<tr>
<td>Avascular necrosis, idiopathic</td>
<td>3/6</td>
</tr>
<tr>
<td>Total</td>
<td>56/89</td>
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</tbody>
</table>

DDH = developmental dysplasia of hip

For many years, arthrodesis of the hip or resection arthroplasty were considered the salvage procedures for end-stage painful coxarthrosis 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 ± 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 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 hydroxapatite, or Bousquet screwed hydroxapatite-coated stem) were used in almost all cases (46 and 17 respectively, 91.29%), and 6 were cemented (Charmin) 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 ± 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.
to estimate the loosening (fixed, probable, possible, and definite), linear wear, femoral and acetabular osteolysis, cortical hypertrophy and stress shielding, especially of the Bouquet 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 ± 7.31 (range 31–67) compared to 90.59 ± 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 Bouquet prosthesis. In the Bouquet 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>
<thead>
<tr>
<th>Group</th>
<th>No. of patients/operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arthritis</td>
<td>17/6</td>
</tr>
<tr>
<td>Traumatic arthrosis</td>
<td>10/8</td>
</tr>
<tr>
<td>Post-DDH</td>
<td>8/39</td>
</tr>
<tr>
<td>Post-septic arthritis</td>
<td>7/24</td>
</tr>
<tr>
<td>Others/Miscellaneous</td>
<td>1/18</td>
</tr>
<tr>
<td>Post-myeloproliferative disease treatment</td>
<td>3/0</td>
</tr>
<tr>
<td>Total</td>
<td>56/85</td>
</tr>
</tbody>
</table>
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 ± 3.79 years) in the patients in our study are promising; the mean postoperative HHS was 90.59 ± 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
Capsule

A dieter's dream

Eat what you want and never gain weight. But shedding pounds is an unwanted health issue for those who have cachexia-uncontrollable weight loss unaffected by eating. Cachexia adds significantly to the morbidity of cancer and chronic infectious diseases such as AIDS. The condition also compromises the health of the elderly who lose muscle mass by the same process.

Two papers recently reviewed by the Faculty of 1000 have added to our understanding of cachexia by approaching the subject from entirely different angles. Many cachexia researchers focus on the preferential loss of muscle mass, which is cachexia's hallmark. But the authors of the first paper concentrated on changes in energy metabolism that accompany the condition. In fact, energy imbalance lies at the very heart of the process, says senior author Bruce Spiegelman, professor of cell biology at Dana-Farber Cancer Center in Boston. In Spiegelman's view, cachexia is widely misunderstood. The key finding that propelled Spiegelman's work was his group's discovery of a master regulator of oxidative metabolism, the transcriptional activator PPARα, and the co-activator PGC1. PGC-1 has pleiotropic effects on respiration in response to various physiologic signals that mediate energetic processes such as thermogenesis or gluconeogenesis. Spiegelman has linked this regulatory pathway to the cytokine TNFα, which was shown more than 20 years ago to induce cachexia in experimental models. This observation had tied certain diseases to cachexia, but it has provided no insight into the mechanism. With the discovery of PGC-1, Spiegelman reasoned that such a regulator might provide the kind of inroad into energy metabolism that a cytokine, bent on wreaking havoc with an organism's energy balance, could use.

The second paper, from Se-In Lee's group at Johns Hopkins University, adds another element to the process—the circulating hormone myostatin, a member of the TGFβ superfamily. Myostatin's effects on skeletal muscle growth are well known; myostatin knockout mice have dramatically greater muscle mass, and the so-called double-muscled cattle (known to cattle breeders for more than 200 years) have myostatin mutations. Lee and co-workers show that chronic exposure of mice to myostatin induces rapid cachexia and reduces the diameter of muscle fibers. This effect had not been observed before, partly because several serum factors bind myostatin, inhibiting its activity in vivo. Lee circumvented this by injecting myostatin-producing CHO (Chinese hamster ovary) cells into murine skeletal muscle. Within a few weeks, these mice had lost 33% of their total body weight on average, which the researchers showed was due mainly to reduced fiber diameter. Myostatin overexpression also induced the expression of genes involved in cell-cycle inhibition and apoptosis, suggesting that myostatin affects muscle cell survival and regulates fiber size as well. Lee says no data exist on humans yet because the assays for myostatin cannot be detected in human serum with the currently available tools.

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You can fool all the people all the time if the advertising is right and the budget is big enough

Joseph E. Levine (1906-87), American film producer and executive


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