

The Girdlestone pseudarthrosis in the treatment of infected hip replacements

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Summary. *The results of 78 resections of the head and neck of the femur (Girdlestone pseudarthrosis) in patients with infected hip replacements were studied. The mean follow-up was 5 years. At the time of the resection, gram-positive organisms were found in 53% of the cases, gram-negative in 33%, and in 12% there were mixed flora. The Girdlestone pseudarthrosis controlled the infection in 86% and achieved satisfactory relief of pain in 83%. The mean shortening of the limb was 4.1 cm and every patient needed some type of external walking aid. We found no correlation between the type of organisms and the persistence of infection, nor between shortening and the functional results. The Girdlestone pseudarthrosis is an acceptable method of controlling infection and relieving pain after infection of a total hip replacement.*

Résumé. *Le résultat de 78 arthroplasties de résection (technique de Girdlestone) réalisées sur 78 patients présentant un sepsis au niveau de leur prothèse de la hanche – moyenne de suivi 5 ans- a été analysé. Lors de l'arthroplastie de résection, les germes trouvés furent Gram positif dans 53% des cas, Gram négatif dans 33% et dans 12% des cas, ils présentaient une infection mixte. L'intervention de Girdlestone a permis de maîtriser l'infection dans 86% des cas et dans 83%, une maîtrise satisfaisante de la douleur. Mais au détriment du raccourcissement du membre (4.1 cm en moyenne) et obligeant le recours à un soutien externe pour marcher dans 100% des cas. Les auteurs ne trouvèrent aucune corrélation entre le type de germe et la permanence de l'infection ni entre le niveau de résection et le raccourcissement et ce dernier et le résultat fonctionnel. En conclusion, l'arthroplastie de Girdlestone est une méthode acceptable pour la maîtrise de l'infection et de la douleur.*

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Introduction

Infection of a hip replacement usually needs complete removal of all the components and the cement, which is associated with a mortality between 7% and 62% [5].

Resection of the hip was carried out, and first reported in 1817 and 1828, to treat septic or tuberculous arthritis to the hip; later the operation was used to treat severe arthrosis. Girdlestone described excision of the head and neck of the femur in the treatment of pyogenic and tuberculous arthritis of the hip [10] and later for osteoarthritis [11]. The procedure is now most frequently used as a salvage procedure after infected hip replacement operations.

Satisfactory results have been reported with relief of pain and restoration of function [22], but poor functional results have been described [1, 7, 17]. Control of infection has, however, been reported in from 76% to 92% of cases [2, 7, 12, 19].

The aim of this article is to review the results of infected total hip replacements treated by resection (Girdlestone pseudarthrosis) at the Septic Unit of our hospital.

Patients and methods

From 1972 to 1992, 102 Girdlestone procedures were carried out for 102 infected hip replacements. Five patients died during the postoperative period, and 19 were lost to follow-up.

The present study is of 78 patients who have a mean follow-up of 5 years (range 1 to 20 years). Thirty-three patients came to us from hospitals other than our own for treatment. The mean age was 61 years (range 29 to 89 years); 41 were men and 37 women.

Arthrosis had been the reason for replacement in 49 patients; other causes were avascular necrosis in 9, rheumatoid arthritis in 10, subcapital fracture in 7, tuberculous arthritis in 2 and unspecified arthritis in one.

Table 1. Treatment before resection

| Surgical procedures | Number of patients |
|---------------------------------------|--------------------|
| One-stage replacement | 4 |
| Two-stage replacement | 1 |
| Debridement preserving the prosthesis | 14 |

The operation was undertaken at an average of 9 months (range 1 week to 61 months) from the time when infection was suspected. The diagnosis was made after clinical, laboratory, histological and bacteriological examination.

Operative technique

Any sinus was excised followed by wide debridement of infected material and excision of all the necrotic, contaminated or friable tissue. The components were removed together with cerclage wires used for fixation of the trochanteric osteotomy, and any other material used for osteosynthesis. It was occasionally necessary to make a window or gutter in the femur to allow complete removal of cement. Gentamicin-polymethylmethacrylate (PMMA) beads were placed in 41 patients, and removed in only 9 of them. Primary closure of the wound was carried out except in 3 cases. Suction drainage was used.

After operation, skin traction (2.5 to 3 kg) was applied in all patients for a mean of 3 weeks, after which rehabilitation with progressive weightbearing was started; 73 patients required a shoe raise and a calliper was used by 3. Intravenous antibiotics, according to the sensitivity of the organisms, were given for a mean of 4 to 6 weeks.

Other surgical procedures carried out before resection on 17 patients are shown in Table 1.

The results were graded by the Merle d'Aubigné scoring system [18]. To compare proportions and numbers of the results the chi-square test was used.

Results

Forty-two further operations were carried out on 26 patients following the Girdlestone pseudarthrosis,

mainly to excise sinuses, for further debridement and to remove cement and gentamicin-PMMA beads.

No culture was available when the pseudarthrosis was performed in 5 patients. In the 57 of the remaining 73 the culture was positive with gram-positive organisms in 30 patients (53%), gram-negative in 19 (33%), a mixed infection in 7 (12%) and mycobacterium tuberculosis in one patient (2%) (Table 2). Culture was negative in 16 patients (22%).

Fragments of cement were retained in 18 patients, and gentamicin-PMMA beads were present in the femoral medullary canal and/or the floor of the acetabulum in 32.

Infection occurred early before the 12th postoperative week in 32 patients; it was subacute at between 12 weeks and a year in 17, and appeared late, after a year, in 29. Subacute and late infections usually presented with pain and a sinus; only 4 (8%) had a fever. The variable surface glycoprotein (VSG) was high in 79% of the patients, but leucocytosis was found only in 31% (Table 3). This difference was highly significant ($P < 0.000001$).

Shortening of 1 to 8 cm (mean 4.1 cm) was recorded in 72 patients; 6 had bilateral Girdlestone pseudarthroses. In the 72 unilateral cases, shortening at the level of resection was measured using the classification of Grauer et al. [12]: type I with more than 1.5 cm of the femoral neck remaining, type II with 1.5 cm or less femoral neck, type III in which the resection was through the intertrochanteric line, and type IV distal to this. Table 4 shows the shortening in types I and II compared with that in types III and IV. There was no statistically significant correlation between the level of resection and shortening ($P = 0.86$). The level of resection and range of motion (Table 4) were also analysed; the level of resection did not affect the functional result ($P = 0.73$).

The Merle d'Aubigné score for pain was satisfactory in 65 patients (83%). Forty-two patients (54%) had 40° to 80° of hip flexion, 18 (23%) had flexion of

Table 2. Organisms found in 57 patients at resection

| | Gram-negative | Gram-positive | Other |
|-------------------------------|---------------|---------------------------------|-------|
| <i>Pseudomonas aeruginosa</i> | 10 | <i>Staphylococcus aureus</i> | 23 |
| <i>Proteus morgani</i> | 2 | <i>Staphylococcus epidermis</i> | 8 |
| <i>Proteus mirabilis</i> | 6 | <i>Streptococcus</i> | 6 |
| <i>Escherichia coli</i> | 2 | <i>Corynebacterium sp.</i> | 1 |
| <i>Enterobacter cloacae</i> | 2 | | |
| <i>Klebsiella sp.</i> | 1 | | |
| <i>Serratia marcesens</i> | 2 | | |
| <i>Morganella morganii</i> | 1 | | |
| <i>Salmonella sp.</i> | 1 | | |

Table 3. VSG and amount of leucocyte count when the infection was diagnosed

| Infection and amount of patients | Increased VSG | Normal VSG | VSG not available | Leukocytosis | Normal leukocytes | Leukocytomy not available |
|----------------------------------|---------------|------------|-------------------|--------------|-------------------|---------------------------|
| Early | 32 | 18 | 5 | 9 | 9 | 16 |
| Subacute | 17 | 11 | 3 | 3 | 4 | 10 |
| Late | 29 | 16 | 4 | 9 | 6 | 16 |

Table 4. Level of resection, shortening and walking ability

| Level of resection | Number of patients | Shortening mean (cm) | No walking | 2 crutches | 1 crutch |
|--------------------|--------------------|----------------------|------------|--------------|--------------|
| Type I and II | 33 | 3.7 | 3p. (9.1%) | 16p. (48.5%) | 14p. (42.4%) |
| Type III and IV | 39 | 4.4 | 3p. (7.7%) | 21p. (53.8%) | 15p. (38.5%) |

Note: The 6 cases of bilateral Girdlestons were not included

Table 5. Shortening related to walking and pain (Merle D'Aubigne scale)

| Shortening | Walking | | Pain | |
|------------|------------|--------------|-----------------|--------------|
| | Level 0&1 | Level 2, 3&4 | Level 0, 1, 2&3 | Level 4, 5&6 |
| <0=3 cm | 12 (48%) | 13 (52%) | 6 (24%) | 19 (76%) |
| 3 to 5 cm | 16 (66.7%) | 8 (33.3%) | 4 (16.7%) | 20 (83.3%) |
| >5 cm | 16 (69.6%) | 7 (30.4%) | 2 (8.7%) | 21 (91.3%) |

Note: The 6 patients with bilateral Girdlestons were not included

Table 6. Patients with persistent infection

| Case | Sex/age | Side | Causative organism | PMMA presence | Retained cement | Type of prosthesis | Risk factors | Follow-up (months) |
|------|---------|------|---|---------------|-----------------|--------------------|----------------|--------------------|
| 1 | F-65 | L | <i>E. aureus</i> | No | No | Thompson | No | 88 |
| 2 | M-65 | R | <i>E. aureus</i> | Yes | No | TC | No | 30 |
| 3 | M-74 | L | <i>E. aureus</i> + <i>serratia marc.</i> | Yes | Yes | TC | AR. Corticoids | 92 |
| 4 | M-61 | R | <i>E. coli</i> | No | No | TC | No | 55 |
| 5 | M-65 | L | Negative | No | Yes | TC | No | 17 |
| 6 | M-54 | R | <i>E. aureus</i> | Yes | No | TC | SO | 90 |
| 7 | F-68 | R | No | Yes | No | TC | Obes. SO | 192 |
| 8 | F-56 | L | <i>Streptococo</i> | Yes | No | TC | No | 120 |
| 9 | M-65 | L | <i>E. au+pseudo</i> | No | No | TC | Obesity | 96 |
| 10 | M-61 | L | No | No | Yes | TC | SO | 36 |
| 11 | M-80 | L | <i>Pseudom aer</i> | Yes | Yes | TC | Age | 60 |

Note: TC=Totally cemented prosthesis; SO=Previous hip surgical operation; AR=Rheumatoid arthritis

to over 80°, 15 (19%) had less than 40° flexion and only 3 patients (4%) had an ankylosis in good position. No patient had an ankylosis on a bad position.

Every patient needed a walking aid: 2 crutches in 41 (52%), one crutch in 31 (40%) and 6 (8%) could not walk at all.

Table 5 shows shortening related to walking ability and pain. No statistically significant relation was found between shortening and walking ability, nor between shortening and pain ($P=0.24$ and $P=0.36$ respectively).

The six patients with bilateral pseudarthroses were analysed separately and showed no functional difference compared with the main group.

Infection was satisfactorily controlled in 67 patients (86%), but recurred in 11 (Table 6).

Discussion

Infected hip replacements are reported to show negative cultures in up to 20% [4, 16]. We believe that the high incidence (22%) in our series was due to our patients coming from other centres where they had been given antibiotics.

In our study, the Girdlestone pseudarthrosis controlled infection in 86% of patients as has been observed in other published results [2, 3, 7, 12, 19].

The absolute need to remove all the cement is controversial. Some authors believe that this is necessary [8, 15], but others are less definite [6]. Eighteen of our patients had remnants of retained cement and infection was controlled in 78%; infection was controlled in 88% of those who had all the cement removed. The difference between both groups was not statistically significant ($P=0.37$).

Infection relating to the presence of gentamicin-PMMA beads was analysed and showed that it was controlled in 81% of the 32 patients with beads in situ compared with 89% in the 41 patients who did not have beads in situ. The difference was not statistically significant ($P=0.40$).

In 8 of the 11 patients in whom the infection was not controlled, cement and/or gentamicin-PMMA beads were still present, whereas in the 67 patients whose infection was controlled, cement or beads were only present in 33 (49%). This difference was not statistically significant ($P=0.40$).

In our series, 47 patients (60%) had some risk factor predisposing to infection, such as rheumatoid ar-

thritis, diabetes mellitus, obesity, steroid administration, immunosuppressive and/or anticoagulant drugs [20]; 28 patients had had a previous hip operation. Such risk factors were not found to contribute to the persistence of infection and there was no relation between this and the type of organism found.

In 53% of patients, pain was satisfactorily controlled and there was adequate movement in 77%. The inconvenience of shortening of the limb (mean 4.1 cm) and a positive Trendelenberg sign resulted in every patient needing to use a walking aid. This is the most improved factor in the subjective result of a pseudarthrosis.

We did not find it necessary to use skeletal traction, nor to use a walking calliper and our results in relation to shortening and function were the same as in other series where skin traction was used for a determined period of time [3, 12, 14].

Grauer et al. reported a positive correlation between shortening and the level of resection. Patients with less shortening showed better walking and function, although the difference was not statistically significant [12]. We found that neither of these factors had any statistically significant correlation.

One- or two-stage replacement is nowadays the first choice of treatment for an infected hip replacement, but we believe that the Girdlestone pseudarthrosis is a good alternative salvage procedure. When organisms with multiple antibiotic resistance are involved and when the soft tissues are of poor quality, the highly complicated techniques necessary for the insertion of a new implant may result in its rejection by the patient [9].

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