Original Article

Long-term survivorship analysis of cemented total hip replacement (THR) after avascular necrosis of the femoral head in renal transplant recipients

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Abstract

Background. We studied the long-term survival and the rate of revision of 93 consecutive total hip replacements (THRs) performed for avascular necrosis of the femoral head after renal transplantation from 1971 to 1988. Seventy-four were primary procedures while 19 hips had undergone previous surgery procedures on the same hip in the form of other conservative options.

Methods. The patients of mean age of 38 years were analysed by the Kaplan–Meier method with revision for any reason as the end-point. The follow-up period averaged 216 months (range 1–332).

Results. Thirteen hips were revised while 26 patients (36 hips) died during the follow-up period. The cumulative survival of the implant was 98.8% at 10 years and 63.8% at 20 years.

Conclusions. Cemented THR performed after renal transplantation is satisfactory and, at least for the first 10 post-operative years, the results are equivalent to those obtained in the general population with primary osteoarthritis.

Keywords: cyclosporin; femoral head osteonecrosis; prednisolone; renal transplantation; total hip replacement

Introduction

Aseptic necrosis of the femoral head is a disabling complication of renal transplantation. Although its incidence has markedly decreased during the last two decades as a result of the lowered steroid dosage secondary to the introduction of cyclosporin in immunosuppressive regimens, it still occurs in 4.5% of renal transplant recipients [1–5]. Several other factors are also associated with a decreasing incidence of aseptic necrosis of the femoral head, i.e. better control of pre-transplant hyperparathyroidism, and better clinical and nutritional condition of the renal graft candidates [5]. Still, total hip replacement (THR) represents a major cause of hospitalization after renal transplantation. In the United States Renal Data System, renal transplant recipients had a cumulative incidence of total hip arthroplasty of 5.1 episodes/1000 person-years, which is 5-8 times higher than that reported in the general population, avascular osteonecrosis being the most frequent diagnosis (72% of the cases) [6].

Hip arthroplasty for patients on chronic haemodialysis yielded poor results and infection rates of up to 19% [7,8]. In contrast, total hip arthroplasty after renal transplantation proved to be a reliable procedure, probably the procedure of choice for those patients [6,9–11]. However, very few long-term results of large series of THR in renal transplant recipients have been reported so far. Such information is not mentioned in recent reviews regarding calcium metabolism and skeletal problems associated with renal transplantation [4,5]. Finally, some authors even raised serious concerns about the survival rate of cemented THR in this population, arguing that steroid-induced metabolic bone disease and pre-existing renal osteodystrophy could pose a significant threat to the long-term survival of the implant [12].

We here report a long-term (>10 years) survivorship analysis of THR performed for all consecutive steroid-induced osteonecrosis occurring in renal transplant recipients from our institution.

Patients and methods

We now extend the long-term outcome of our renal transplant recipients with osteonecrosis in whom THR had been performed from May 1971 to October 1988 [17] with a review
of all patient’s data starting from May 1971 until June 2003. A total of 63 renal transplant recipients [45 males, 18 females; mean age at transplantation: 35.2 years (range 16–55), first transplantation (n = 57; 84 THRs), second transplantation (n = 6; nine THRs)] underwent 93 consecutive cemented THRs (92 Charnley Kerboull femoral prostheses, one Vives femoral prostheses, all cemented polyethylene cups) in Cliniques Universitaires St Luc, Brussels. The original nephropathies were chronic glomerulonephritis (28), malformative uropathy (17), chronic interstitial nephritis (four), Alport’s syndrome (three), autosomic dominant polycystic kidney disease (two), post-abortum cortical necrosis (two), systemic lupus erythematous (one), renal vasculitis (one), renal tuberculosis (one) and unknown (four). Six of the patients had not been dialysed prior to renal transplantation; the remaining 57 patients had been on haemodialysis for an average of 24 months (range 1–118). The immunosuppressive regimen at the time of THR consisted of an association of azathioprine–prednisolone (n = 43), cyclosporin–azathioprine–prednisolone (n = 17), cyclosporin–azathioprine (n = 2) or cyclosporin–prednisolone (n = 1). During post-transplant follow-up, 52 (82.5%) of the patients had been given boluses of 500 mg intravenous (i.v.) methylprednisolone injections/day during three consecutive days in addition to anti-lymphocyte serum or anti-thymocyte globulins, as part of an acute rejection therapy: 15, 18 and 19 patients experienced one, two and more than two rejection episodes, respectively.

The delay between transplantation and the first THR was 45 (range 12–172) months, so that the mean age of the patients at THR was 38 years (range 18–69). Of these TRHs, 74 were primary, 16 secondary and three tertiary procedures. Of those 16 hips that had one previous hip surgery; six had core decompression, seven had cup arthroplasty, one had a cemented double cup, one had a cecal prosthesis and one had a resection of the femoral head and neck. Of those three hips that had two previous procedures, two had core decompression followed by cup arthroplasties and one had core decompression followed by cecal prostheses. Two early deaths related to the surgical procedure occurred early in our experience: one patient presented with local sepsis complicated by severe thrombocytaemia and gastrointestinal haemorrhage; the other suffered a massive pulmonary infection with Klebsiella complicated by septicaemia, shock, and local sepsis with hip dislocation. Other post-operative complications were pulmonary infection (one), transient sciatic nerve irritation (three), wound haematoma (six), transient functional deterioration of renal function (three) and successfully treated rejection episode (two).

All patients were followed on a regular basis. Systematic clinical examination and plain hip X-rays were performed yearly during the first four post-transplant years and once every 2 years thereafter.

In this population, we first studied the time elapsed from THR to revision, the implant and patient survival, and then we compared those survival analyses with the data reported from large published series in patients with osteoarthritis and other conditions, matched for age, length of follow-up and type of implant.

Statistical analysis

The end-point for survival was defined as revision when a part of, or the whole implant was removed or exchanged.

The treating physicians reported the patients who had been restarted on dialysis, re-transplanted or had died so that the implant survival times of these patients were censored on the day of death or on the day of the last reported medical visit with the implant in place. Follow-up time ranged from 1 to 332 months with a mean of 216 months. The survival of the implants and of the patients was determined with actuarial life table constructs as described by Kaplan and Meier.

Statistical analyses were performed using the SPSS software (SPSS Inc., Chicago, IL).

Results

The rate of revision-free survival for all implants was 98.8 ± 2.2% [mean and 2 SEM, 95% confidence interval (CI)] at 10 years; it then dropped to 63.8 ± 20.6% at 20 years, as illustrated in Figure 1. Thirteen hips had to be revised, one for recurrent dislocation less than a year after initial THR, two for late sepsis (>10 years after initial THR) and 10 for aseptic loosening of one or both components, i.e. femoral and/or acetabular. Twenty-six patients (36 THRs) died and eight patients (nine THRs) had to resume haemodialysis (all of them were subsequently retransplanted without any untoward effect) during the follow-up period.

The rate of survival with aseptic loosening of the femoral component as the end-point was 100% at 10 years and 78.8 ± 15% at 20 years (Figure 2).

The rate of survival with aseptic loosening of the acetabular component as the end-point was 100% at 10 years and 66.6 ± 21.3% at 20 years (Figure 3).

The rate of survival with death as the end-point was 81.7 ± 8.2% (mean and 2 SEM, 95% CI) at 10 years and 35.8 ± 18.8% at 20 years (Figure 4). The number of patients at risk for any event was 53, 47, 32 and 27 at 5, 10, 15, and 20 years post-transplantation, respectively.

One patient (one THR) with functional failure of the replaced hip did not undergo a hip replacement because of a below-knee amputation; four deceased patients (four THRs) were also known to have progressively loosening implants.

Discussion

Our study shows that, in renal graft recipients with THR, the 15- and 20-year survival rates of the prosthesis implants are 82 and 63.8%, respectively. This observation suggests that renal transplant recipients with a THR do not increase their risk of developing late complications secondary to the hip intervention.

A few studies have evaluated the long-term outcome of THR in renal graft recipients. Romero et al. reported a hip re-operation rate of 9.9 and 54.6% at 10 and 15 years, while mortality rates were 32.2 and 42.2%, respectively. Based on this analysis, they concluded that the risk of THR failure was higher than the risk.
of death associated with renal transplantation [13]. Deo et al. also reported a high early failure rate of the THR in their small series of renal transplant patients [14]. Finally, the Minneapolis group also reported a few years ago their experience in 50 renal graft recipients in whom 66 THRs had been performed: their overall rate of implant survival, and acetabular and femoral survival at 10 years were 78±11, 86±9 and 87±9%, respectively [10]. The results of those studies do not coincide with our findings as we observed an overall rate of implant survival, and acetabular and femoral survival at 10 years of 99±2, 100 and 100%, respectively. These discrepancies in outcomes have to be interpreted with caution. Some clinical factors, such as the type of dialysis prior to transplantation (haemodialysis vs peritoneal dialysis), the persistence of post-transplant hyperparathyroidism, the incidence of acute rejection episodes in the first post-transplant months (indicative of administration of higher steroid doses), etc. might affect the THR outcome, though the latter is still poorly documented. More interestingly, our results in transplanted patients also compare favourably with large series in specific young populations operated on with cemented total hip arthroplasty.
In a group of patients with juvenile arthritis [15] or with ankylosing spondylitis [16], survival rates with revision of the THR as the end-point were 83% at 15 years and 73% at 20 years, respectively, similar to ours. Keener et al. [17] also published comparable results in a less homogenous group of patients who were ≤40 years old, or ≤50 years old at the time of surgery, respectively. Our results are also similar to those reported by large arthroplasty registers in which good results in all disease groups aged ≤60 years can be obtained with the use of cemented implants [18].

Some authors have contested the use of cemented TRH in renal graft recipients and questioned whether uncemented bipolar hemi-arthroplasty and porous-ingrowth total hip replacement could not be an alternative. To the best of our knowledge, no evaluations of renal graft patients receiving cementless THRs with a long follow-up have been published, so that no comparison is possible.

There is one main limitation of our study: lack of revision does not necessarily imply hip integrity. The surgeon’s willingness to revise the prostheses depends on the age and co-morbidity of the patient. This is particularly true in a renal transplant patient population with high co-morbidity factors. One of our patients presented a loosened implant, associated with a below-knee amputation for vascular disease, and was not considered for revision. On the other
hand, a clinical outcome study might reach the wrong conclusions in this particular study group: one patient suffering from hemiplegia was unable to walk for the last years of his life. The application of a functional outcome scale would indicate THR failure while the patient’s hip replacement is doing well.

Also, our observation is valid for patients given immunosuppression combining azathioprine and prednisolone or, azathioprine, prednisolone and cyclosporin. The bone effects of the new immunosuppressive agents currently used in renal transplantation are even more controversial: beneficial for tacrolimus [19], more deleterious for sirolimus [20]. Still, their effect on bone remodelling after a THR needs to be evaluated further.

Altogether, the collected data from this study point to the conclusion that cemented THR is a safe and symptomatically effective treatment for osteonecrosis of the femoral head in renal transplant patients, bearing in mind that there are differences between the revision rate and the clinical outcome, the definition of failure chosen here being reliable. Cemented THR should thus be offered in this population when symptoms become significant. The results in terms of THR survivorship at least for the first 10 years are comparable with those of patients of a similar age who did not have a renal transplantation.

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Conflict of interest statement. None declared.

References

1. Landmann J, Renner N, Gachter A, Thiel G, Harder F. Cyclosporine A and osteonecrosis of the femoral head. *J Bone Joint Surg (Am)* 1987; 69: 1226–1228

2. Le Parc JM, Andre T, Helenon O, Benoit J, Paolaggi JB, Kreis H. Osteonecrosis of the hip in renal transplant recipients. Changes in functional status and magnetic resonance imaging findings over three years in three hundred and five patients. *Rev Rhum Engl Ed* 1996; 63: 413–420

3. Marston SC, Gillingham K, Bailey RF, Cheng EY. Osteonecrosis of the femoral head after solid organ transplantation. A prospective study. *J Bone Joint Surg* 2003; 85: 2145–2151

4. Torres A, Lorenzo V, Salido E. Calcium metabolism and skeletal problems after transplantation. *J Am Soc Nephrol* 2002; 13: 551–558

5. Sperschneider H, Stein G. Bone disease after renal transplantation. *Nephrol Dial Transplant* 2003; 18: 874–877

6. Bucci JR, Oglesby RJ, Agooda LY, Abbott KC. Hospitalizations for total hip arthroplasty after renal transplantation in the United States. *Am J Transplant* 2002; 2: 999–1004

7. Lieberman JR, Fuchs MD, Haas SB et al. Hip arthroplasty in patients with chronic renal failure. *J Arthroplasty* 1995; 10: 191–195

8. Sunday JM, Guille JT, Torg JS. Complications of joint arthroplasty in patients with end-stage renal disease on hemodialysis. *Clin Orthop* 2002; 397: 350–355

9. Radford PJ, Doran A, Greatorex RA, Rushton N. Total hip replacement in the renal transplant recipient. *J Bone Joint Surg (Br)* 1989; 71: 456–459

10. Cheng EY, Klibanoff JE, Robinson HJ, Bradford DS. Total hip arthroplasty with cement after renal transplantation. Long-term results. *J Bone Joint Surg (Am)* 1995; 77A: 1535–1542

11. Romboutts JJ, Kallel S, Pirson Y et al. Surgical treatment of aseptic necrosis of the femoral head in renal transplant recipients. *Orthop Int Ed* 1992; 1: 12–20

12. Murzic WJ, Mc Collum DE. Hip arthroplasty for osteonecrosis after renal transplantation. *Clin Orthop* 1994; 299: 212–219

13. Romero J, Schreiber A, Birnswanger U. Late complications after total hip replacement in renal allotransplant recipients. *Int Orthop* 1994; 18: 368–371

14. Deo S, Gibbons CL, Emerton M, Simpson AH. Total hip replacement in renal transplant patients. *J Bone Joint Surg (Br)* 1995; 77A: 299–302

15. Lehtimäki MY, Letho MUK, Kautiainen H, Savolainen HA, Hämäläinen MMJ. Survivorship of the Charnley total hip arthroplasty in juvenile chronic arthritis: a follow-up of 186 cases for 22 years. *J Bone Joint Surg (Br)* 1997; 79B: 792–795

16. Sochart DH, Porter ML. Long-term results of total hip replacement in young patients who had ankylosing spondylitis: eighteen to thirty-year results with survivorship analysis. *J Bone Joint Surg (Am)* 1997; 79A: 1181–1189

17. Keener JD, Callaghan JJ, Goetz DD, Pederson DR, Sullivan PM, Johnston RC. Twenty-five-year results after Charnley total hip arthroplasty in patients less than fifty years old. A concise follow-up of a previous report. *J Bone Joint Surg Am* 2003; 85: 1066–1072

18. Furnes O, Lie SA, Espehaug B, Volset SE, Egsaeter LB, Havelin LI. Hip disease and the prognosis of total hip replacements. *J Bone Joint Surg (Br)* 2001; 83: 579–586

19. Sakai T, Sugano N, Kokado Y, Takahara S, Ohzono K, Yoshikawa H. Tacrolimus may be associated with lower osteonecrosis rates after renal transplantation. *Clin Orthop* 2003; 415: 163–170

20. Bhandari S, Eris J. Premature osteonecrosis and sirolimus treatment in renal transplantation. *Br Med J* 2001; 323: 665

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