The Effect of Renal Transplantation in End-Stage Renal Failure Patients Undergoing Total Hip Replacement

Abstract

Background: Patients with end-stage renal failure (ESRF) undergoing elective orthopedic surgery generally have higher postoperative morbidity and mortality compared to the general population. Studies on the outcome of ESRF patients undergoing total hip replacement (THR), especially those with a functioning renal transplant, are conflicting. We aim to evaluate the impact of renal transplantation on functional outcome and postoperative complications in patients with ESRF undergoing THR. **Materials and Methods:** A total of 29 primary THRs were performed in 25 patients with ESRF between 1999 and 2013. There were 12 patients with 14 THRs who had a functioning renal transplant at the time of surgery (transplant group), and 13 patients with 15 THRs who were dialysis dependent with either no or failed prior transplant (nontransplant group). Functional outcome was evaluated with the Oxford Hip Score (OHS) and Western Ontario and McMaster Universities Osteoarthritis Index. Clinical records and followup radiographs were used to evaluate postoperative complications. **Results:** There is lower mortality rate ($P = 0.02$) and lower overall complication rate in the transplant group compared to the nontransplant group (relative risk 0.60, 95% confidence interval 0.40–0.91, $P = 0.008$). The mean increase in OHS postoperatively was greater in the nontransplant group (nontransplant-24.7; transplant-18.7) and trended toward statistical significance ($P = 0.06$). **Conclusion:** ESRF patients who undergo THR experience improvements in functional outcome regardless of transplant status. There was no significant difference in postoperative functional outcomes between the two groups of patients, but patients with renal transplants are less likely to experience postoperative complications and have better survival.

Keywords: *Dialysis, end-stage renal failure, renal transplant, total hip replacement*

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Introduction

The prevalence of patients with end-stage renal failure (ESRF) on dialysis is on the rise.[1] Most patients will ultimately require renal transplantation to improve their quality of life. These patients have an increased relative risk (RR) of needing a total hip replacement (THR) of 6.6, compared with the general population.[2] While osteoarthritis is the most common indication for total joint replacement (TJR) in the general population,[3] the causative factors for this unique group of patients are multifactorial; Amyloidosis stemming from long term dialysis, osteonecrosis from chronic glucocorticoid therapy after renal transplantation and traumatic femoral neck fractures are not uncommon.[4]

The literature comparing outcomes of THR in renal transplant patients with nontransplant dialysis-dependent patients is scarce and conflicting.[5,6] Long term hemodialysis patients generally develop renal osteodystrophy and β2-microglobulin amyloid deposition in and around joints, predisposing to potential early osteolysis,[7,8] while chronic immunosuppressive therapy in renal transplant patients has raised postoperative concerns for infections. With improved medical care for ESRF patients and as well as increasing prevalence of functioning renal transplants,[1] the orthopedic community will be confronted with an increase in these patients requiring TJR. Thus, knowledge of how renal transplant may affect TJR outcome and mortality is vital.

We aim to determine in this retrospective review from a tertiary institution whether there is a difference in postoperative complications and functional outcome after THR in dialysis-dependent ESRF patients compared to those with a functioning renal transplant.

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Materials and Methods

Data retrieval

Appropriate ethics approval was obtained from our Institution's Review Board before the conduct of the study. Waiver for informed consent was approved as this was a retrospective review of existing clinical data. We searched our institution's computerized database for all THRs performed between 1999 and 2013.

Our inclusion criteria were as follows: (1) Patients with ESRF, defined as estimated glomerular filtration rate <15 ml/min/1.73 m² or initiation of renal replacement therapy, before primary THR; (2) Patients with a history of renal transplantation before primary THR. Patients were excluded if they developed ESRF or underwent renal replacement therapy after primary THR. These criteria allowed us to examine whether a functioning renal transplant or dialysis therapy at the time of THR resulted in a difference in the outcome.

Based on the criteria, we identified 25 patients with 29 THR, who were categorized according to transplant status. There were 12 patients with 14 THRs in the transplant group which consisted of patients who had a functioning renal transplant at the time of primary THR. There were 13 patients with 15 THRs in the nontransplant group, and this consisted of patients on chronic dialysis with either a non-functioning transplant or no prior renal transplant. In our study, the majority of THR were uncemented. There were only two hybrid THR (cemented femoral stem with uncemented acetabular cup).

The demographic profiles of both groups of patients are shown in Tables 1 and 2. The most common indication for THR in both groups was for avascular necrosis. The mean duration from initiation of dialysis to THR in the nontransplant group was 5 years (range 0.5–16 years). The mean duration from successful renal transplant to THR was 7 years (range 1–24).

One patient in the nontransplant group passed away 3 months postoperatively, and one patient in the transplant group defaulted at 6 months. All other patients were followed up clinically for a minimum of 2 years. The mean followup duration was 48 and 31 months in the transplant and nontransplant group, respectively.

Clinical records and radiographs of all included patients were evaluated in detail for postoperative complications. Oxford Hip Score (OHS) and Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) score was determined preoperatively and postoperatively at 6 months and 2 years. Serial radiographs were evaluated for loosening and wear by the two senior authors. All patients were managed preoperatively and postoperatively by a nephrologist team to optimize their medical condition before and after surgery.

Table 1: Indications for total hip replacement and etiology of end-stage renal failure

Variables	Transplant	Nontransplant
Number of patients (hips)	12 (14 hips)	13 (15 hips)
Indications for THR		
AVN	14	11
OA	0	2
NOF fracture	0	2
Cause of ESRF		
SLE	1	5
Chronic GN	3	7
IgA nephropathy	3	0
DM	1	2
Others	6	1

THR=Total hip replacement, ESRF=End stage renal failure, OA=Osteoarthritis, AVN=Avascular necrosis, DM=Diabetes mellitus, SLE=Systemic lupus erythematosus, NOF=Neck of Femur

Table 2: Preoperative demographics and co-morbidities

Variables	Transplant	Nontransplant	P
Gender			
Male	3	6	
Female	9	7	0.27
Age in years (mean; range)	49.1 (36-60)	45 (26-69)	0.33
BMI (kg) (mean; range)	22.4 (16.8-26.1)	23.1 (14.5-31.1)	0.73
Side			
Right	8	9	0.87
Left	6	6	
Co-Morbidities			
DM	5	4	0.59
HTN	12	11	0.41
Lipids	8	8	0.84
IHD	4	3	0.59
CVA	0	1	0.32
Autoimmune	1	5	0.08
Preoperative corticosteroid use (by number of THR)	14	11	0.04

THR=Total hip replacement, BMI=Body mass index, DM=Diabetes mellitus, IHD=Ischemic heart disease, CVA=Cerebrovascular Accident

Statistical analysis was performed via SPSS version 21 (IBM, Armonk, New York, USA). Univariate analysis of proportions between two categorical data was performed with Chi-square test. Data between two independent samples were analyzed with *t*-test. A value of $P \leq 0.05$ was considered statistically significant.

Results

Functional outcomes

Patients in the transplant group had significantly better preoperative OHS scores than the nontransplant group (33.6 vs. 41.4, $P = 0.01$). However, at 6 months and 2 years postoperatively, there was no significant difference in functional outcome between both groups

[Table 3 and Figure 1]. The mean improvement in pre and postoperative OHS was higher in the nontransplant group (24.7 vs 18.7, $P = 0.06$) but this was statistically non-significant. 85.7% and 73.3% of THR in the transplant and nontransplant group, respectively, managed to attain improvement of at least 11 points for the OHS, which is the minimally important change (MIC)[9] for the OHS. The mean length of stay was shorter in the transplant group (8.0 vs. 12.9, $P = 0.04$). There was no correlation between preoperative OHS and length of stay ($r = 0.11$).

Postoperative complications

Patients in the transplant group had a significantly lower risk of complications (RR 0.60; 95% confidence interval
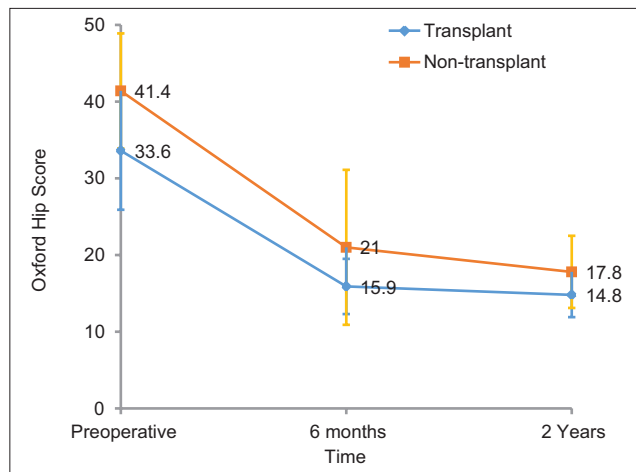

Figure 1: Comparison of Oxford Hip Score between transplant and nontransplant patient

0.40–0.91; $P = 0.008$) compared with the nontransplant group [Table 4]. There were two revisions in the nontransplant group-one for an infected prosthesis and another for femoral stem loosening. One patient in the transplant group and five patients in the nontransplant group were dead at latest followup. In the nontransplant group, the deaths occurred at a mean time of 25.5 months (range 4.5–37 months) from date of surgery. Survival analysis using Kaplan–Meier survival plot demonstrated better survival in the transplant group ($P = 0.02$ by log-rank test) [Figure 2].

Discussion

Patients with dialysis-dependent ESRF represent a challenging group of patients as they have higher postoperative morbidity and mortality after elective orthopaedic surgery,[10,11] even after renal transplantation.[12] Although renal transplantation is desirable for most ESRF patients on dialysis, it is not always possible due to lack of donors, resources, finances and suboptimal physiological status at the time when transplantation opportunity is available. Nonetheless, THR remains a viable option for these patients with symptomatic hip disease, conferring significant improvement in pain and function.[5,6,13]

The study showed that the preoperative OHS and WOMAC scores were significantly better in the transplant group compared to the nontransplant group (41.1 and 33.6, respectively, $P = 0.01$). This could be because patients with renal transplant enjoy a better quality of life and physical function[14] and have lower cardiovascular risk compared to patients on maintenance dialysis.[15] Thus, patients with a functioning renal transplant may be more willing to undergo

Table 3: Functional outcome

Variables	Transplant	Nontransplant	*P*
Preoperative OHS (mean; range)	33.6 (18-43)	41.4 (28-52)	0.01
Preoperative WOMAC (mean; range)			
Degree of pain	67.7 (32-100)	47.8 (20-100)	0.03
Degree of stiffness	71.8 (20-100)	61.5 (5-100)	0.42
Degree of difficulty	61.8 (22.4-91.2)	41.5 (7.1-93.5)	0.02
6 month OHS (mean; range)	15.9 (12-24)	21.0 (12-41)	0.12
6 month WOMAC (mean; range)			
Degree of pain	98.7 (88-100)	97.5 (92-100)	0.34
Degree of stiffness	99.2 (90-100)	91.7 (50-100)	0.12
Degree of difficulty	88.8 (65.9-98.2)	83.9 (48.2-100)	0.37
2 years OHS (mean; range)	14.8 (12-19)	17.8 (12-25)	0.09
2 years WOMAC (mean; range)			
Degree of pain	99.4 (92-100)	82.6 (86-100)	0.13
Degree of stiffness	100 (100-100)	95.9 (80-100)	0.09
Degree of difficulty	95.7 (82.4-100)	74.7 (71.8-100)	0.05
Increase in OHS score (mean; range)	18.7 (6-27)	24.7 (12-36)	0.06
Increase in WOMAC (mean; range)			
Degree of pain	30.0 (4-68)	41.5 (28-80)	0.24
Degree of stiffness	28.5 (10-80)	39.1 (0-95)	0.44
Degree of difficulty	32.3 (3-69)	34.0 (6-71)	0.84

*MOHS=Oxford Hip score, WOMAC=Western Ontario and McMaster Universities Osteoarthritis Index

Table 4: Postoperative complications

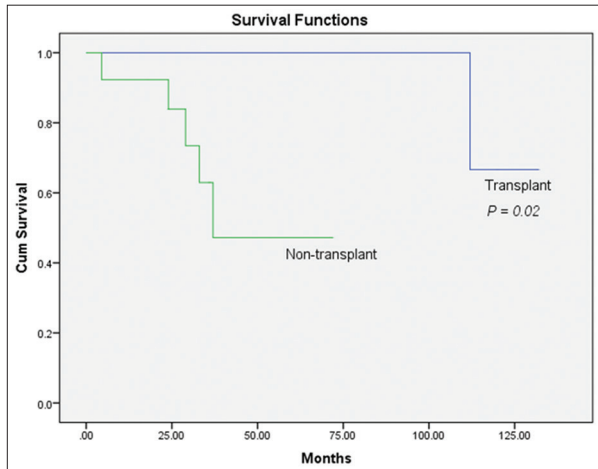| Variables	Transplant	Nontransplant (%)	Relative risk (95% CI)	*P*
Overall complications	0	6	0.600 (0.40-0.91)	0.008
Prosthetic joint infection	0	1 (6.6)		
Aseptic loosening	0	2 (13.3)		
Dislocation	0	3 (20)		
Reoperations/revision	0	2	0.87 (0.71-1.06)	0.16
Mortality				
12-month	0	1	0.92 (0.79-1.08)	0.32
Total	1	5	0.67 (0.42-1.07)	0.08

CI=Confidence interval

Figure 2: Kaplan–Meier plot depicting time to death

surgery for THR before they are severely debilitated by their hip pain. Conversely, dialysis-dependent patients may delay THR while optimizing their medical comorbidities, resulting in worsening hip pain and poorer physical function preoperatively. One surprising finding in this study was that there was no significant difference in functional outcomes postoperatively at 6 months and 2 years between the two groups. The mean increase in OHS postoperatively was greater in the nontransplant group (nontransplant-24.7; transplant-18.7), and this trended towards statistical significance (P = 0.06). This suggests that regardless of transplant status, all patients will benefit from the improvement in function after a THR.

The overall complication rate of THR in patients with functioning renal transplant is reported to be lower than patients on dialysis.[6,13] This is also consistent with our results, with a RR of complication in the transplant group 0.60 times compared to the nontransplant group (P = 0.008). The reason is likely to be multifactorial– increased susceptibility to microbial infections; repetitive exposure to pathogens during hemodialysis;[16] mineral bone disease in ESRF patients and amyloid deposition in hemodialysis patients weakening the bone matrix and causing prosthetic loosening.[17] The nontransplant group also had a significantly longer length of hospitalization postoperatively compared to

the transplant group (12.9 days vs. 8 days, P = 0.04), representative of the poorer physiological function of these patients which require more optimization before discharge. Data from the Singapore renal registry showed that from 1999 to 2013, the median survival duration for patients on dialysis was 5.6 years and the 5-year survival rate was 53.8%. Comparatively, patient survival for those transplanted between 1999 and 2013 was 92.5% at 5 years.[1] A recent database review by Cavanaugh *et al*. also found that dialysis patients undergoing total joint arthroplasty had higher rates of surgical site infections, wound complications and longer hospital stay compared to transplant patients.[18] Clearly, with good survival and good functional outcome, transplanted patients stand to benefit from a THR more.

It is known that revision rate in renal transplant and dialysis patients are higher than the general population, reported to be 15.9% and 16.3%, respectively.[19] The two revision operations in the nontransplant group, one for loosening of cemented femoral stem and another for prosthetic joint infection, gives a revision rate of 13.3%, which is similar to the reported figures.

The prosthetic joint infection rate in our study was low (3.4%) despite the use of corticosteroid in 86% of our patients. This suggests that chronic corticosteroid use may not predispose these patients to infection. The reported infection rate in renal transplant patients varies widely in the literature, from no-risk up to 19%, but most report no increased risk.[20] Given that both dialysis and transplant patients are at risk for exposure to nosocomial pathogens such as methicillin-resistant *Staphylococcus aureus*, following a preoperative decolonization protocol and appropriate perioperative antibiotics will help to reduce surgical site infections.[21]

To the best of our knowledge, this is the first study which examined short term outcomes in ESRF patients undergoing THR. However, the retrospective nature of the study and small numbers limits firm conclusions. Some of our results appeared to be clinically significant but statistically nonsignificant likely due to the small sample size. However, the inherently small numbers of this group of heterogeneous patients with limited life expectancy restrict the conduct of a large-scale, prospective, long term

study let alone randomizing it. Furthermore, the surgeries were performed by multiple surgeons with different surgical techniques and implants, as well as varying postoperative rehabilitation protocol. Our study also did not analyze the influence of other immunosuppressive medications apart from corticosteroids as there was a wide variation in the immunosuppressive regimes and this study was not adequately powered to detect an association with increased infection risk. The lack of uniformity can skew the results, especially about functional outcome. Future studies should perhaps incorporate data from multiple tertiary centers to increase the statistical power of the study.

Conclusion

ESRF patients who had THR done for various reasons report significant improvements in functional outcome regardless of their transplant status. Although patients on dialysis have no significant difference in functional outcome up to 2 years postoperatively compared to transplant patients, the overall complication rate is lower, and patient survivorship is higher in patients with a functioning renal transplant.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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