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ORIGINAL STUDY

Outcome following total knee replacement in patients with a previous patellectomy

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Although patellectomy is a rarely performed surgical procedure, patients may still progress to develop osteoarthritis of the tibiofemoral compartments leading to total knee replacement surgery. Due to the mechanical disadvantage of a previous patellectomy, it has previously been suggested that a prosthesis with more constraint should be used, however, there are conflicting reports in the literature. We aimed to assess the effects of stability following total knee replacement in patellectomised knee with revision as a primary endpoint. We reviewed the outcome of 25 total knee replacements in our institution in patients with a previous patellectomy. Ten were posterior stabilised and 15 minimally stabilised (including those with a 'deep dish'). Five of the patients in the minimally stabilised group underwent revision surgery, and 3 of these were early revision due to instability. None of the patients in the posterior stabilised group underwent revision. We conclude that when a total knee replacement is performed in a patient with a previous patellectomy a posterior stabilised implant should be used.

Keywords : Total Knee Arthroplasty.

INTRODUCTION

Patellectomy is a rarely performed surgical procedure. Indications for patellectomy include severe anterior knee pain or patellofemoral dysfunction, trauma leading to severely comminuted fractures of the patella, tumour or osteomyelitis. *(12)* The patella normally exists to improve the efficiency of the quadriceps by increasing the moment arm of the extensor mechanism. Alterations in the biomechanics after patellectomy include loss of active and passive range of movement, alterations in gait both during walking and on stairs, and loss of quadriceps strength. *(5,6,13)* Knees which have undergone a patellectomy can go on to develop tibiofemoral osteoarthritis, and may need joint replacement surgery of the tibiofemoral portions of the knee. The weak extensor mechanism can lead to antero-posterior instability and force transmission vectors across the joint, and this may affect the function of the knee replacement prosthesis. *(12)* For this reason the surgeon has to consider the degree of stability needed for successful function, and whether to use a prosthesis that relies on the

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patients own posterior cruciate ligament or whether to use a posterior stabilised implant.

The degree of constraint is important in affecting the wear characteristics and function of the knee replacement. The rarity of patellectomy means that published data relating to total knee replacement in these patients is limited. Although in the past several studies have advocated the use of a posterior stabilised total knee replacement, more recently published data has suggested that a standard cruciate retaining total knee replacement can lead to acceptable results and function. We aim to review how the level of stabilisation affects outcome in total knee replacement with revision surgery as the primary endpoint and patients symptoms as secondary outcome measures.

METHODS

Electronic hospital records from 2001 to 2013 were searched to identify patients who had had a patellectomy followed by a total knee replacement in our institution. Exclusion criteria were patients where the total knee replacement had been performed elsewhere or where a patellectomy was performed following the total knee replacement. 25 patients were identified, 15 who had undergone a standard minimally stabilised total knee replacement and 10 whom had undergone a posterior stabilised total knee replacement. 9035 total knee replacements were performed at SPORTSMED·SA between 2002 and 2012. The mean age of the posterior stabilised group at time of total knee replacement was 62.7 years (range 47 to 84 years) and 58.1 years (range 39 to 74 years) for the minimally stabilised knee replacement group. There were 4 females in the posterior stabilised group and 7 in the minimally stabilised group. 7 of the knees were right and 3 were left in the posterior stabilised group, and 10 were right and 5 left in the minimally stabilised group. Time to total knee replacement following patellectomy where recorded in the posterior stabilised group was a mean time of 23 years (range 5 years to 35 years) although was not recorded in two cases. Time to total knee replacement following patellectomy in the minimally stabilised group was a mean of 25.5 years (range 10 to 39 years), with no information recorded in 5 cases.

Indication for total knee replacement was osteoarthritis in all patients. A list of the implants used is shown in table I. Six surgeons operated on the patients in the posterior stabilised group, and five surgeons in the minimally stabilised group. All were experienced surgeons who had a specific interest in lower limb arthroplasty surgery.

Clinical data was obtained from the patient's records, including details from all patient consultations, details on complications and any further surgical procedures undertaken. The Australian national joint registry (ANJRR) were contacted and provided with a list of patients. Patients in the ANJRR have their primary procedure linked to their revision procedures. The registry was searched to identify whether patients may have undergone revision procedures in other institutions, and thereby allowing us to confidently determine the revision rate in our study groups.

RESULTS

AONJRR data showed that 5 of the 15 patients in the minimally stabilised group had undergone

Table I. — Implants used in the study

a) Posterior stabilised total knee replacements

Femoral Component	Tibial Component	N Total
LCS PS	MBT	1
Legion PS	Genesis II	1
Nexgen LPS Flex	Nexgen	1
PFC Sigma PS	MBT	2
Score	Score	1
Scorpio PS	Scorpio+	1
Triathlon PS	Triathlon	3
TOTAL		**10**

b) Minimally stabilised total knee replacements

Femoral Component	Tibial Component	N Total
LCS CR	LCS	1
LCS CR	MBT	1
LCS CR	MBT Duofix	2
LCS Duofix	MBT	1
PFC Sigma CR	MBT	6
PFC Sigma CR	MBT Duofix	1
Score	Score	3
TOTAL		**15**

Table II. — Revision Rates of Primary Total Knee Replacement by Stability (All Diagnoses)

Stability	N Revised	N Total	Obs. Years	Revisions/100 Obs. Yrs (95% CI)
Minimally Stabilised	5	15	69	7.24 (2.35, 16.91)
Posterior Stabilised	0	10	54	0.00 (0.00, 6.85)
TOTAL	**5**	**25**	**123**	**4.07 (1.32, 9.50)**

Table III. — Type of Revision of Primary Total Knee Replacement by Stability (All Diagnoses)

	Minimally Stabilised		
Type of Revision	**Number**	**% Revision**	**% Primary**
Insert Only	2	40.0	13.3
TKR (Tibial/Femoral)	2	40.0	13.3
Femoral Component	1	20.0	6.7
N Revision	**5**	**100.0**	**33.3**
N Primary	**15**		

Table IV: Revision Rates of Minimally Stabilised Primary Total Knee Replacement by Components Used (All Diagnoses)

Femoral Component	Tibial Component	N Revised	N Total	Obs. Years	Revisions/100Obs. Yrs (95% CI)
LCS CR	LCS	0	1	14	0.00 (0.00, 26.70)
LCS CR	MBT	0	1	3	0.00 (0.00, 117.6)
LCS CR	MBT Duofix	1	2	13	7.71 (0.20, 42.96)
LCS Duofix	MBT	1	1	3	32.01 (0.81, 178.4)
PFC Sigma CR	MBT	3	6	20	15.19 (3.13, 44.40)
PFC Sigma CR	MBT Duofix	0	1	3	0.00 (0.00, 114.0)
Score	Score	0	3	13	0.00 (0.00, 28.40)
TOTAL		**5**	**15**	**69**	**7.24 (2.35, 16.91)**

revision surgery compared to 0 in the posterior stabilised group. (Table II) The mean time from primary total knee replacement to revision surgery was 32.2 months (range 5 to 82). Type of revision surgery performed is listed in table III.

Two patients underwent revision surgery at greater than 2 years post primary total knee replacement. One patient who was revised at 82 months had had a poor result following knee replacement with ongoing problems with pain and stiffness and an arthroscopy and synovectomy performed approximately 24 months after index procedure. He underwent revision total knee replacement due to osteolysis which had led to a fracture. A second patient was revised at 37 months post primary total knee replacement. The patient had received a LCS Duofix femoral component, which has been described as being susceptible to metallosis related failure due to a defect in the manufacturing process of the implant. Although the indication for revision was recorded as metallosis on the AONJRR, clinical records show that the patient had never been subjectively satisfied with the outcome following primary total knee replacement.

Three patients underwent revision surgery at less than 24 months post primary total knee replacement due to instability symptoms. Two patients initially underwent surgery to revise their components to a thicker insert, at 5 months and 24 months. One of these patients required further surgery to stabilise the knee. A third patient required revision to a posterior stabilised implant at 13 months post primary total knee replacement.

One patient in the posterior stabilised group underwent further surgery. This was a manipulation under anaesthetic due to stiffness, which took place

approximately three months after index surgery. A satisfactory outcome was achieved. Nine patients in the posterior stabilised group did not undergo any further surgery, and none of these patients complained of symptoms of instability or significant pain.

In the minimally stabilised group, four patients underwent further surgery not recorded on the AONJRR. One patient had undergone a total knee replacement at 28 years post patellectomy for anterior knee pain. He suffered from quadriceps wasting and subluxation of the extensor mechanism and underwent reconstruction using a LARS ligament. A second complained of ongoing knee instability, and after falling down a flight of stairs ruptured the lateral collateral ligament. This required surgical reconstruction. A third patient had excision of a Bakers cyst due to ongoing pain, which failed to relieve symptoms. A further patient underwent a manipulation under anaesthetic that improved range of movement. A further patient in this group complained of significant ongoing pain and instability and after a second opinion was told that nothing further could be done. Only 5 patients in the minimally invasive group reported good outcome in terms of pain relief and range of motion.

DISCUSSION

The patella has an important role in normal knee function, and forms an intrinsic part of the four bar linkage system for knee stability. *(16)* Some authors have suggested that painful antero-posterior instability may result when the patella is absent, and this may be the result of altered soft tissue tension, and for this reason it has been suggested that a posterior stabilised total knee replacement should be used. *(2)* Despite this, there have recent reports in the literature suggesting that cruciate retaining total knee replacements could be used successfully in the patellectomised knee *(4)*. In this study we aimed to see whether there was any different in minimally stabilised versus posterior stabilised total knee replacements with revision as an end point.

Our study has a number of limitations. As with other previously published work, the number of patients was small and this is a reflection of the rarity of patellectomy despite our unit being a high volume arthroplasty unit. The study was retrospective and patients were not randomised to type of implant used. Formal functional outcome scores were not recorded, although the clinical notes were obtained to assess any major clinical complications. Several different surgeons were involved in the surgery, and this could potentially have introduced bias in the results when comparing the two groups. As in many other published series, this also led to a wide variety of different implants being used in the two comparison groups.

Our results show that there was a higher early revision rate when a minimally stabilised total knee replacement was used compared to a posterior stabilised total knee replacement where patients have had a previous patellectomy. Five patients in the patellectomised group underwent a revision procedure, with three of these occurring early at less than two years, due to instability. Although clear statistical significance was not reached, this may have been a reflection on the small number of patients in each of the groups. It has been suggested previously that a deep dish provides sufficient stability after patellectomy by acting as a 'semi-constrained' knee replacement although previously published work would not support this view.*(1)* We found that implants with a deep dish did not provide sufficient stability in a patellectomised knee. Two patients in our study underwent a manipulation under anaesthetic due to knee stiffness. A higher rate of knee stiffness would be predicted in patellectomised patients as previous surgery is a known risk factor. *(15)* Reflex sympathetic dystrophy as a result of multiple operations on the knee has been suggested as another possible mechanism of complications in this group of patients.*(3)*

There have been contradictory reports in the literature as to whether a cruciate retaining prosthesis can be used successfully. Kang et al compared 18 knees with cruciate retaining total knee replacements in patellectomised knees, 14 patients with revision total knee replacements in patellectomised knees and 13 non patellectomy controls. *(8)* They found that knee society score and function score were superior in the control group. However satisfactory results were obtained in both

the cruciate retaining total knee replacement group and posterior stabilised group when knee society score and functional scores were compared. The most recent article on the topic also supported the use of a cruciate retaining implant, reviewing 33 patients with an average follow up of 9.3 years (range 2 to 14 years) who had had a cruciate retaining total knee replacement after a previous patellectomy. *(4)* The paper concluded that cruciate retaining knees in patients with a previous patellectomy allowed for good results at midterm follow-up with an average HSS score of 89 points at final follow up.

A number of other studies do not support the use of cruciate retaining implants. Poor results in terms of revision as an end point following the use of a semiconstrained knee replacement in patients with a patellectomy were reported in a series by Bayne et al 1995.*(2)* Revision in this series was however due to continuing pain. In a further series by the same authors a group of 16 patellectomised knees with constrained knee replacement there were still 5 patients with a fair or poor outcome, with two patients in the group undergoing revision surgery for pain. *(3)* Paletta and Laskin followed-up 9 posterior stabilised and 13 cruciate retaining implants, and found no revisions in either group.*(14)* Although improvements in pain were found in both groups, results were not as good in patients who had a cruciate retaining knee replacement. Larson et al reported 3 revisions in a group of 20 cruciate retaining knees, but also 2 revisions in a group of 6 patients undergoing TKR using a revision prosthesis in patients with a previous patellectomy. *(9)* Martin et al reported 2 failed total knee replacements requiring revision in a group of 22 patients (21 PS and 1 CR). *(11)* Lennox et al reported a series of 11 patients with a previous patellectomy undergoing TKR, 2 of whom needed conversion to arthrodesis. Railton et al reported no revisions in their series of 7 posterior stabilised TKRs. *(10)*

Yao *et al* have published the largest series of cases relating to total knee replacement after a previous patellectomy. They retrospectively compared a non-randomised group of 52 patellectomised knees with a group of 52 non-patellectomised knees. *(17)* They reported that when compared to a control group of non-patellectomised patients, results following TKA showed a similar improvement when measured by WOMAC score although the improvement was less when assessed by KSS. They concluded that TKA could reliably relieve pain and function in the post patellectomy patients, although results were not as good. The majority of patients in this study however had posterior stabilised implants, although the small number (four) with cruciate retaining knee replacements did not report worse outcomes.

Joshi *et al* compared the outcomes of total knee replacement in 19 patients (10 cruciate stabilising, 10 cruciate retaining) with a previous patellectomy with a matched series of knee replacements with an intact patella with a mean follow up of 63 months. *(7)* The outcome was poor in five patients, with coronal plane instability in three patients, persistent pain in four and three supracondylar fractures occurred. There were no complications in the control group versus an overall complication rate of 36% in the patellectomised knees.

CONCLUSIONS

Despite the limitations highlighted with our study, our results suggest that a minimally stabilised total knee replacement does not provide adequate mechanical stability for patients who have had a previous patellectomy, and that a posterior stabilised implant should be used for these patients

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Glossary

Observed year (Obs Yr) – A defined risk of revision over a set period of time to allow studies to be comparable, a revision rate of one revision per 100 observed component years equates to a revision rate of 1% at 1 year and 10% at 10 years.

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