

## Revision Total Knee Arthroplasty

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### Abstract

**Background:** Revision total knee arthroplasties are performed with increasing frequency due to the increasing numbers of primary arthroplasties.

**Objectives:** To retrospectively analyze 71 patients who underwent 78 revision total knee arthroplasties during the years 1991 to 1999

**Methods:** We evaluated the revised knees using the Knee Society Clinical Rating System after an average follow-up period of 3 years and 9 months (2–10 years). The indications for revision included pain and instability, deep infection of the joint, complaints linked to the patella, or post-trauma to the operated knee.

**Results:** The average knee score (evaluation of the knee joint itself) calculated after the revision was 74.5. The results on the knee score were excellent (> 85) in 48% of patients and poor (< 60) in 22%. The functional results (patient's ability to walk and climb stairs) were only 48.3.

**Conclusion:** Although the revision of total knee replacements is known to be problematic, most patients show good results on knee examination, and reasonable functional results given the factors involved.

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The increase in primary total knee arthroplasties performed and the decrease in the age of the operated patients have resulted in a rise in revision arthroplasties [1]. It is estimated that 0.5–1% of arthroplasties show signs of failure every year [2]. The revision arthroplasties have accounted for 4–5% of all arthroplasties performed [3]. Poor implant design in the past has increased the frequency of revisions in some centers. Reports reveal high rates of failure and complications and deal extensively with the technical difficulties [2–4].

The indications for revision include aseptic loosening, material failure, or deep knee infection [Figure 1]. Causes of instability include ligamentous imbalance and incompetence, malalignment and late ligamentous incompetence, a deficient extensor mechanism, inadequate prosthetic design, and surgical error. Another indication for revision is severe pain and functional disability with no obvious clinical or radiologic cause [2–4]. Relative contraindications for revision include active infection, severe bony deficiency, ligamentous instability, extensor mechanism incompetence, or extremely poor medical conditions. In addition, there are technical difficulties facing the surgeon performing the procedure. Considering these difficulties and the older age of the patients, it is clear that the revision arthroplasty is considerably more demanding than the primary surgery. The revision of infected primary arthroplasties is even more problematic. These are commonly treated in two stages: excisional arthroplasty and antibiotic intravenous therapy, and a second-stage revision surgery [4].

While some authors report good results on small series and relatively short follow-up [5], others have focused on the devastating results of the failed infected cases [6]. The Knee Society developed a rating system in which separate scales for knee rating and functional assessment are used. This rating system has been widely used during the past 10 years for the evaluation of arthroplasties [7]. A few small series (30 to 40 patients) of intermediate follow-up (average of 20 months to 5 years) have dealt with revision arthroplasties [8–11].

We present a retrospective analysis of all revision cases performed during the years 1991 to 1999 by the Orthopedic Department of the Hadassah University Hospital (Ein Kerem and Mt. Scopus campuses) in Jerusalem, Israel.

### Methods

Seventy-eight revisions of total knee arthroplasties were performed in the Hadassah University Hospitals on 71 patients between 1991 and 1999. At revision, the average age of the patients, 53 women and 18 men, was 70.4 years. There were various etiologies leading to the revision surgery. Of the 78 patients who underwent knee surgery, 23 suffered pain (29%) and 18 suffered pain and instability (23%). Eighteen were diagnosed with infection (10%), 8 had sustained prior trauma (10%) and 12 had patellar pain (15%).

The recovery and rehabilitation programs were standard as for any primary knee arthroplasty, including gradually inclining range of continuous passive motion and full weight-bearing limited by pain. Chemical thrombophylaxis was used in all patients. Antibiotic therapy was given prophylactically for 24 hours in cases with no



**Figure 1.** Severe metallosis in aseptic loosening of primary total knee replacement at revision surgery.

suspicion of infection. The therapy was extended to 5 days (until final results of tissue cultures were obtained) in cases with low suspicion of infection, and 6 weeks in those with high suspicion or

**Table 1.** Patients' categories and results graded according to the Knee Society Clinical Rating System (n = 71)

Patients by categories of the Knee Society Clinical Rating System (n=71)		
		% of patients
A	Unilateral or bilateral (opposite knee successfully replaced)	5.3
B	Unilateral, other knee symptomatic	31.6
C	Multiple arthritis or medical infirmity	50.9
X	Exitus	12.3

**Results graded using the Knee Society Clinical Rating System**

		Score (range)
Knee Score	Pain	33.3 (0–50)
	Range of motion	19.9 (4–25)
	Stability	24.3 (15–25)
	Total	74.5 (40–100)
Functional Score		48.3 (0–100)

**Table 2.** Revision of total knee arthroplasties: surgical procedures performed (n = 84)\*

	No. of knees	%
One-stage revision	57	68
TKR to TKR	45	53
Unicondylar to TKR	8	11
Unicondylar revision	3	4
Two-stage revision for infected TKR	11	13
Patellar component revision	13	15
Arthrodesis	3	4

\* The number of procedures includes six knees that underwent two procedures each. The percents depicted are of the total number of procedures.  
TKR = total knee replacement

proven infection (positive cultures prior to and during the revision surgery). The patients with infection were treated with a two-stage approach including excisional arthroplasty, a temporary block spacer of antibiotic cement, intravenous antibiotic therapy for 6 weeks, and the revision surgery at the end of the antibiotic therapy. The Knee Society Clinical Rating System [7] was chosen as a tool for the follow-up of patients [Table 1]. The results were assessed at the outpatient clinic. During the follow-up (ending April 2002), seven patients died of causes unrelated to the knee surgery. Of the remaining 64 patients (70 knees), 8 (patients and knees) were lost to follow-up.

The average period between primary and revision surgery was 4.3 years with a wide range of 3 months to 18 years. The average hospitalization stay was 14.7 days with an average follow-up of 3 years and 9 months (range 2–10 years).

The different procedures performed are summarized in Table 2. A few of the patients underwent more than one revision of their arthroplasty. Two patients had revision of the patellar component of the arthroplasty after the tibial and/or femoral components were revised. One patient had revision of the patellar component followed by revision of the other two components. In our results we scored each patient according to his or her state during the final follow-up examination. Three patients underwent revision surgery followed by arthrodesis and were not included in the scoring. The patients were also analyzed according to the procedures they underwent, as shown in Table 3.

## Results

### Knee and function scores

According to the Knee Society Clinical Rating System, most of the patients in the series were classified as having multiple arthritis or medical infirmity [Table 1]. Only 5% of the patients could be classified as suffering solely from unilateral knee pathology (or bilateral with opposite knee successfully replaced). The average knee score at final follow-up was 74.5 (range 40–100), with pain being the main problem. Forty-eight percent of the knee score

**Table 3.** Patients' data and results graded according to the Knee Society Clinical Rating system and the procedures performed

Revision procedure	No.	Time between primary surgery and revision (yrs)	Hospitalization period (days)	Complications	Follow-up (yrs)	Knee Society Clinical Rating System	
						Knee score	Functional score
TKR to TKR	45	5.6	14	Peroneal nerve injury, wound infection, arthrodesis for infected revision	3.7	73	48
Unicondylar to TKR	8	2.2	12	Two patients with DVT	3	79	65
Unicondylar revision	3	4.2	9		4	51	50
Patellar component revision	13	4.7	11	Wound infection	3.7	71	61
Two-stage revision for infected TKR	13	2.5	26	Two patients treated with arthrodesis for persistent pain. Patellar tendon tear	3.8	74	48

results were excellent (>85), 10% were good (70–84), 20% were fair (60–69), and 22% were poor (<60). The functional score was 48.3 (range 0–100). A functional score of 0 was given to a severely debilitated patient at follow-up. Approximately 50% of the patients were found to be suffering from multiple arthritis or medical infirmity.

### Complications [Table 3]

Ten patients (14%) suffered from complications during the post-operative period. Three had wound infection and two had septic knees. There were two events of deep vein thrombosis and one patient suffered a myocardial infarct complicated by pulmonary edema. Two complications occurred during the operation: a complete tear of the patellar tendon, and damage to the peroneal nerve that did not recover. Three of the arthroplasties were finally treated with arthrodesis; two of these were infected cases of primary arthroplasties. There were no revisions ending in excisional arthroplasty.

### Discussion

Revision of total knee arthroplasty is considered a highly demanding procedure, with inferior results as compared to primary surgery. Correct alignment and normal ligamentous balance are essential for the success of the surgery, but these are much more difficult to achieve in revision surgery.

The results of the revision surgery have been inferior and the rate of complications higher when compared to primary arthroplasties. Complication rates at revision surgery have been reported to occur in as many as 15–30% of cases [3]. The average knee scores of arthroplasties after revision surgery were reported to range from 78.3 for total knee revision after unicompartmental knee replacements [8] to 83 for revisions utilizing cemented long stem prosthesis or a condylar constrained prosthesis [9,11]. The assessed failures account for approximately 10% (knee score <60) [8,11]. The functional score has been reported at 56–67.7 points [8–11].

The presented series of 78 revision arthroplasties is a combination of diverse indications. The knee score was chosen to quantify the clinical outcome of the patients and was found to be a simple yet adequate tool for this purpose. The average knee and functional scores after an average follow-up of 3 years and 9 months were 74.5 and 48.3 respectively, close to other series of revisions with similar follow-up, and of course lower than results after primary surgery [12–15].

Some reports of revision surgery have shown good results, approaching those achieved with primary surgery [8–11]. However, it is obvious that success is dependent on the population chosen for the analysis. The series quoted did not state the distribution of patients with regard to their medical infirmity or state of osteoarthritis, and generally analyzed relatively small population groups (29–40 patients). The large majority of elderly patients, with diffuse arthritis and medical problems, would express itself in the functional score [16]. Our series included a large majority of such debilitated patients. We also chose to include patients who had infection as a complication of the primary surgery and not only aseptic loosening. It should be taken into account that the patients

with a two-stage revision after infection to the knee show inferior results after revision, as compared to the other etiologies [17]. A large majority of our patients with poor results complained mainly of pain, yet no objective cause could be found to explain the source of pain. This finding has been reported previously [11]. Peters et al. [1] reported a rate of radiolucent lines in 33% of knees but no complete or progressive radiolucencies and no correlation with clinical or radiographic failure.

Considering the variability in patient selection, the differences in results are probably insignificant and the scores are comparable with those observed in the literature.

When comparing the different groups of patients [Table 3], although some of the groups are small, we can still see relatively good results with the unicompartmental to total knee revisions and of the patellar revisions. These patients have reserved soft tissue enabling the performance of technically simple and balanced revision arthroplasties. In patients who had unicompartmental revisions the results were worse, although the number of these patients in our series was insignificant. We may need to consider further the revision of a unicompartmental prosthesis with another unicompartmental prosthesis, but a considerably larger group of patients should be examined for this purpose. Patients undergoing total knee revision in one stage for pain or loosening, or in two stages for infection, had comparable results – good knee function, yet relatively worse functional grading. The patients suffering from infection had longer hospitalization stays, and shorter duration between primary and revision surgery. Two of these patients were treated with arthrodesis because of pain. On the other hand, among the patients with non-infected revisions there was a large proportion of patients (70%) with medical infirmity and multiple joint arthritis (patient category C), a significant cause of function disability. This could explain why the infected cases did not show significantly lower grades (only 33% in category C). We also relate this to the aggressive approach taken for each of the infected cases, including a two-stage revision and prolonged antibiotic therapy.

Two patients were diagnosed with DVT during the postoperative period. Both had a unicompartmental prosthesis revised to a total knee replacement. Both were treated with standard prophylactic low molecular weight heparin and had pulmonary complications. We could not find a specific reason for these occurrences other than the small percent of patients with DVT, even though they had been treated appropriately [18–20].

In conclusion, the revision arthroplasties are demanding for both the surgeon and the patient, and the results are not always good. Moreover, the preoperative condition is debilitating and unsatisfactory. A rise in the frequency of revision surgery is expected in conjunction with the rise in primary surgery performed today. The decrease in the age of patients at revision may improve the results, and the increase in frequency will enable technical improvements and solutions for the various problems facing the surgeon. A large series with long-term follow-up of the different etiologies requiring revision surgery is very much needed.

DVT = deep vein thrombosis

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