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Survival of knee arthroplasties for rheumatoid arthritis

During a 15-year period, 498 primary knee arthroplasties for chronic rheumatoid and related arthritides were performed. Ninety arthroplasties where prosthetic components were added, removed or replaced were recorded as failures. Eighty-one revisions were exchange arthroplasties, eight attempted arthrodeses and one an above-the-knee amputation. Survival rates were calculated with a life table technique. The cumulative 5-year survival rate was 76 per cent for tibial hemiprostheses, 78 per cent for unicompartment prostheses, 100 per cent for tricompartment prostheses, 87 per cent for stabilized prostheses and 84 per cent for hinge prostheses. Continuous deterioration was observed in the tibial hemiprostheses. The improved surgical technique, with guide instruments and release procedures for better alignment and stability, and to some extent the improved prosthetic design may explain the good early results with tricompartment prostheses.

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Most reports on knee arthroplasties contain information on technical and operative experience with a short clinical follow-up. Only a few reports cover an observation time exceeding 5 years (Hamilton 1982, Marmor 1982, Insall et al. 1983). Data are still lacking on the long-term results for many knee arthroplasties. Dobbs (1980) advocated the survivorship method of comparing long-term results for various endoprostheses and observation times, and this method has been applied in three reports on knee arthroplasties. Tew & Waugh (1982) reported three types of knee arthroplasties for osteoarthrosis and chronic arthritis with an annually increasing risk of revision and a cumulative 5-year survival rate of 78 per cent. Grimer et al. (1984) and Lettin et al. (1984) reported cumulative 5-year survival rates of 85 and 86 per cent, respectively, in Stanmore hinge arthroplasties used for the same indications.

Our experience with knee arthroplasty extends over more than 15 years. This is a report on the long-term results of five different types of knee endoprostheses used as primary replacements in chronic rheumatoid and related arthritides, analyzed with the survivorship method.

Patients and methods

During the 15-year period 1969 through 1983, 498 primary knee arthroplasties were performed at our department in patients with chronic rheumatoid and related arthritides (Table 1, Figure 1). The vast majority had rheumatoid arthritis. The exceptions were mainly juvenile chronic arthritis, psoriatric arthritis and Bechterew's disease.

There were 380 arthroplasties in female patients and 118 in male patients. The patients were controlled annually. Ninety-six patients died during follow-up.

The original procedures of the McIntosh hemiarthroplasty and the Guepar, Shier, Attenborough and tricompartment arthroplasties were used. The original Marmor procedure was abandoned early for the onlay technique which was performed using a tibial resection guide. During the 1980's, the St Georg Schlitten tibial component was used together with the Marmor femoral component. Patellar resection was performed instead of prosthetic replacement in most cases. All patients except those receiving the McIntosh arthroplasties were given prophylactic antibiotics.

In this report the survivorship method as described by Dobbs (1980) was used. Success was defined as the endoprosthesis remaining *in situ* at the end of the follow-up regardless of complications and clinical scoring. Consequently, failure was scored for arthroplasties where prosthetic components had been added, removed or replaced. In the final review the status of each arthroplasty by December 31,

Table 1. Type of knee replacement and age of patient in 498 primary arthroplasties for rheumatoid arthritis

Type	No. of replacements at follow-up			Mean age (range)
	Inserted	5 years	10 years	
Tibial hemi (McIntosh)	72	49	31	53(25–74)
Unicompartment (Marmor, Marmor + St Georg Schlitten)	181	106	–	60(23–79)
Tricompartment (Total Condylar, Kinematic, PCA)	92	1	–	59(20–78)
Stabilized (Attenborough)	89	24	–	56(18–78)
Hinge (Guepar, Shier)	64	43	10	64(29–77)

1983, was recorded. The observation time was determined for each patient, either to the date of the final review, the death of the patient or the date of the revision or arthrodesis. Survivorship tables were then constructed using 12-month intervals. For each interval after the operation the following was recorded: the total number of surviving arthroplasties entering the interval; the number of successes and failures in patients who had reached the end of their follow-up during the interval; the number of patients at risk (of being a failure) calculated as the total number of survivors entering the interval reduced by half the number of successes during the same interval; and the yearly probability of survival calculated as the number at risk reduced by the number of failures divided by the number at risk. The numbers of successes and failures were subtracted from the total number of survivors to give the number of survivors to enter the next interval. The cumulative probability of survival was obtained by successive multiplication of the yearly values.

The survival distribution of tricompartment replacements was tested against that of the remaining arthroplasties for the initial 6 years, using the Mantel and Haenszel chi-square test (Lee 1980).

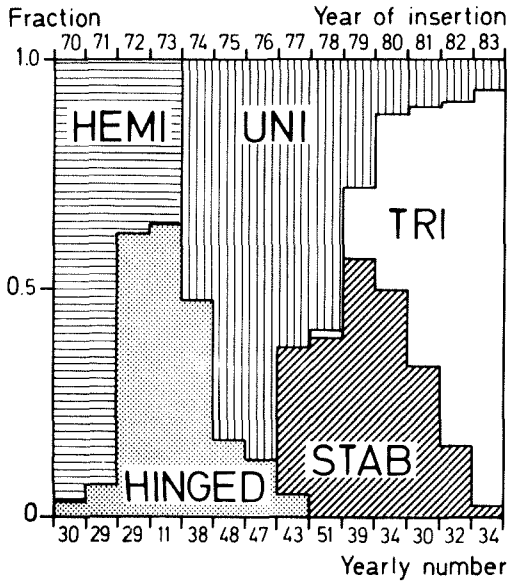

Figure 1. Relative distribution and the yearly number of five types of primary knee arthroplasty (495 knees) in Lund for rheumatoid arthritis 1970–1983.

Results

Failure was recorded in 28 of the 72 McIntosh hemiarthroplasties, 41 of the 181 Marmor arthroplasties, none of the 92 tricompartment arthroplasties, eight of the 89 Attenborough stabilized arthroplasties and 13 of the 64 hinge arthroplasties (Table 2). There were eight attempted arthrodeses (1.6 per cent) and the amputation rate was 0.2 per cent. The cumulative survival rates during the initial 6 years of tricompartment arthroplasties was higher than that of the remaining arthroplasties (chi-square = 5.80, $P<0.05$ (Figure 2)).

Discussion

The survivorship method of analysis gives an early warning of poor designs as well as a means of comparing results. The cumulative survival rates (Figure 2) indicate that the change of prosthetic design at our department has, by and large, been favourable, and our

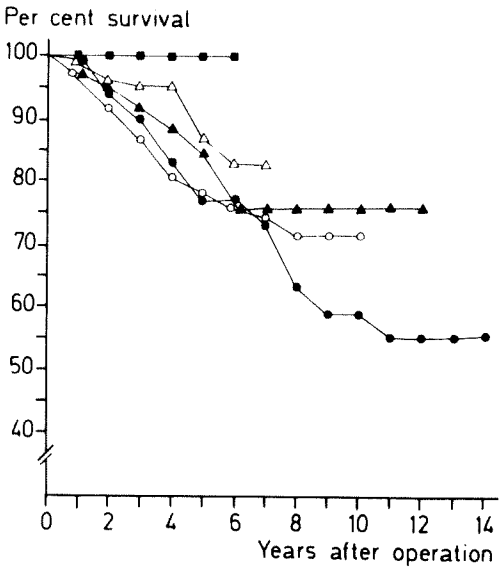

Figure 2. The cumulative survival rates of five types of primary knee arthorplasty used in Lund for rheumatoid arthritis. ● tibial hemi, ○ unicompartment, ■ tricompartment, △ stabilized, ▲ hinge.

cumulative survival rates correspond well with those given by others reporting similar designs (Tew & Waugh 1982, Grimer et al. 1984, Lettin et al. 1984).

The comparison of survival rates for various endoprostheses must, however, be made with some caution. The survival rate depends on many factors: for instance, the degree of knee destruction, prosthetic design, instrumentation, surgical skill, operative asepsis and the use of antibiotic prophylaxis. These factors have not been constant during the period studied and there was som selection of patients, although one type of endoprosthesis at a time was preferred regardless of the knee condition.

The survival rate also depends on whether revision is instituted or not. This might be influenced by the attitude of the surgeon and the patient and by the possibilities at hand (Table 2). Compartmental prostheses are usually easier to replace than hinged prostheses and mechanical complications easier to revise than infections. If a patient and the surgeon prefer to treat an infected arthroplasty with antibiotics instead of revising or fusing the knee, this arthroplasty will not appear as a failure in this study because of the definitions used.

Many of the arthroplasties in this study have been included in earlier short-term clinical follow-ups from our department. Only 23 of 67 McIntosh arthroplasties were rated as satisfactory after 3 years (Andersen 1979). Femoral attrition, subsidence and translatory instability were the main causes of poor results.

After 2 years, 76 of 109 Marmor arthroplasties were clinically satisfactory (Andersen 1979). The main problems were loosening, especially of the thin (6 mm) tibial component no longer used (Knutson et al. 1981, Marmor 1982), translatory instability, patellar impingement, and failure due to progressive destruction of the remaning compartment in demi-arthroplasties.

Thirty of 64 primary and secondary hinge arthroplasties were rated as clinically satisfactory after 3 years (Andersen 1979). The major problems were infection, patellar dislocation and mechanical loosening.

Twenty-nine of 74 primary and secondary Attenborough arthroplasties were clinical or potential radiographic failures, mainly because of loosening or subsidence (Boegård et al. 1984). These problems were strongly correlated to postoperative malalignment, which remained a problem in spite of improved instrumentation.

Tricompartment prostheses have been the most frequently used since 1979. So far there

Table 2. Type of revision in 90 failed primary knee arthroplasties

	Revised to						
Primary prosthesis	Hemi	Uni	Tri	Stab	Hinge	Arthrodesis	Amputation
Tibial hemi	3	10	3	6	5	1	–
Unicompartment	–	10	6	18	2	5	–
Tricompartment	–	–	–	–	–	–	–
Stabilized	–	–	1	6	–	1	–
Hinged	–	–	–	2	9	1	1

have been no failures. The designs and instrumentation are being continuously refined with increased contact area, metal backing of the tibial component, soft tissue release procedures for better alignment and stability and, though still at an experimental stage, cementless fixation. Favourable results were also reported by Laskin (1981) with only four revised failures in 117 Total Condylar Replacements in RA with a 2-4-year follow-up.

With the exception of the hemi-endoprostheses, there was a higher annual survival rate after 6 years in designs with longer observation time. This was also reported by Lettin and associates (1984) but not by Tew & Waugh (1982). In hip replacements this pattern is not seen; instead, the annual success rate is slowly declining (Dobbs 1980). It is possible that the success rate during the first 5–6 years mainly reflects surgical skill and technique, joint stability, and alignment, operative asepsis and selection of patients, whereas the later survival rate more closely reflects the soundness of the prosthetic design. New prosthetic designs should therefore not be generally accepted without at least a 5-year follow-up and a survival rate comparable to or exceeding that of earlier designs. A better surgical technique compared with earlier years may explain our initially good results with tricompartment prostheses, and only extended observation time will reveal the durability of these designs.

In our department today, only extremely unstable knees are treated with a stabilized prosthesis (Figure 1). The unicompartment replacement is reserved for cases of burnt-out rheumatoid arthritis with localized derangement in a fairly stable knee. A tricompartment prosthesis seems to be the rational choice for the majority of destroyed knees in patients with chronic rheumatoid or related arthritides.

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