The Finnish Arthroplasty Register

Report of the hip register

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ABSTRACT – The Finnish Arthroplasty Register was established in 1980. Between 1980 and 1999, 62,841 primary and 12,224 revision total hip arthroplasties (THA) were recorded.

The annual number of both primary and revision THA has increased: in 1999, the incidence of primary THAs was 93/100,000. 174 implant designs have been used, but the 6 commonest implants comprised 82% in 1999. Since the late 1980s, more than 40% of the hips were inserted without cement. Over 47% of the cementless primary hip prostheses were used in patients younger than 60 years and over 93% of the cemented primary hips were used in patients 60 years or older.

The 10-year survival rate was 72 (95% CI 67–76)% in patients younger than 55 years and 90 (89–91)% in patients older than 70 years. The commonest reasons for revision were aseptic loosening (65%), dislocation (9%) and infection (7%). In revisions, the 5-year survival of the cementless hip prosthesis improved over time: it was 85 (82–87)% in 1985-1989, 89 (88–91)% in 1990–1994 and 92 (88–95)% in 1995–1999.

There are striking differences between the Arthroplasty Registers of Scandinavia as regards the end-point definition of survival. The Finnish Arthroplasty Register considers all reasons for revisions as the end-point of survival, but the Swedish register takes into account only aseptic loosening, so direct comparisons between registers are not possible. Recent data from the Finnish Arthroplasty Register indicate that the results of total hip replacements are improving in Finland.

With the civic registration number, one can link and match data files. For example, with use of the Finnish Cancer Register, we found no increase in the risk of cancer after a THA.

■

The Finnish Orthopaedic Association began to registar of arthroplasty operations in 1980. Its main purpose was to study and ensure the quality of prostheses for the safety of patients. In 1987, the authorities responsible for regulating and checking health care services took over the management of the register. Registration of joint replacements, which was voluntary at first, became obligatory in 1997. At present, the National Agency for Medicines maintains the Arthroplasty Register as part of the Implant Register. Here we report the results of total hip arthroplasties recorded by the Finnish Arthroplasty Register.

Patients and methods

The population of Finland is about 5.1 million. Since 1980, the Finnish Arthroplasty Register has collected data about total hip (THA), total knee (TKA) and other joint replacements. Health care authorities, institutions and orthopedic units have been obliged, notwithstanding the obligation to observe professional secrecy, to provide the National Agency for Medicines with information essential for the maintenance of the register. With the aid of the civic registration number, data from

National Agency for Medicines
Implant Register/Orthopaedic Prostheses
P.O. Box 55
00301 HELSINKI

NOTIFICATION TO THE IMPLANT REGISTER
ORTHOPAEDIC PROSTHESES

Hospital

Indentity number of patient

Date of operation

Object of operation

Joint ☐ 1 Right ☐ 2 Left

☐ 1 Hip
☐ 2 Knee
☐ 3 Femoropatellar joint
☐ 4 Ankle
☐ 5 Mtp
☐ 6 Shoulder
☐ 7 Elbow
☐ 8 Lunatum
☐ 9 Scaphoideum
☐ 10 Other structure **
☐ 11 Cmc
☐ 12 Mcp
☐ 13 Ip
☐ 14 Temporomandibular joint
☐ 15 Other **

Reason for operation

☐ 1 Rheumatoid arthritis
☐ 2 Other arthritis
☐ 3 Primary arthrosis
☐ 4 Congenital luxation of the hip
☐ 5 Other **
☐ 6 Replacement of prosthesis
☐ 7 Removal of prosthesis
☐ 8 Secondary arthrosis
☐ 9 Removal of previous prosthesis (Girdlestone)
☐ 0 Other revision (e.g., liner change)

Type of implanted prosthesis (femoral and acetabular component)

Brandname:
femur * acetabulum *

Femoral head ☐ 1 Fixed ☐ 2 Modular
Diameter of head _____ mm
Type (Chrome, Titanium, Ceram. etc.)

Revision operation

Reason for
☐ 1 Loosening (prox.comp.)
☐ 2 Loosening (dist. comp.)
☐ 3 Infection
☐ 4 Luxation
☐ 5 Malposition of prosthesis
☐ 6 Fracture of bone
☐ 7 Fracture of prosthesis
☐ 9 Patellar complication
☐ 8 Other reason, please specify **

Type of prosthesis to be replaced or removed, and date of previous operation

Brandname:
femur * acetabulum *
Date

Fixation method

	Hip prosthesis		Knee prosthesis		Patellar component	Other prosthesis
	femur	acetabulum	femur	tibia		
Cemented	☐ 1	☐ 3	☐ 5	☐ 7	☐ 9	☐ 11
Uncemented	☐ 2	☐ 4	☐ 6	☐ 8	☐ 10	☐ 12

Cementing technique ☐ 1 Ordinary ☐ 2 Pressurized

Cement mixing technique ☐ 1 Ordinary ☐ 2 Centrifuge ☐ 3 Vacuum

Brand of cement used

Brandname

Bone graft

☐ 1 Autograft ☐ 2 Allograft ☐ 3 Xenograft

Systemic antibiotic prophylaxis

☐ 1 Yes Brand of antibiotics ☐ 2 No

Primary complications

☐ 0 Anaesthetic
☐ 1 Infection
☐ 2 Haematoma
☐ 3 Tromboembolism
☐ 4 Malposition of prosthesis
☐ 5 Luxation
☐ 6 Nerve injury
☐ 7 Other primary complication **
☐ 8 Death
☐ 9 Wound necrosis

Name and telephone number of person in charge

Comments **

Please attach the prosthesis stickers on the reverse side !

Figure 1. The notification form used by the Finnish Arthroplasty Register.

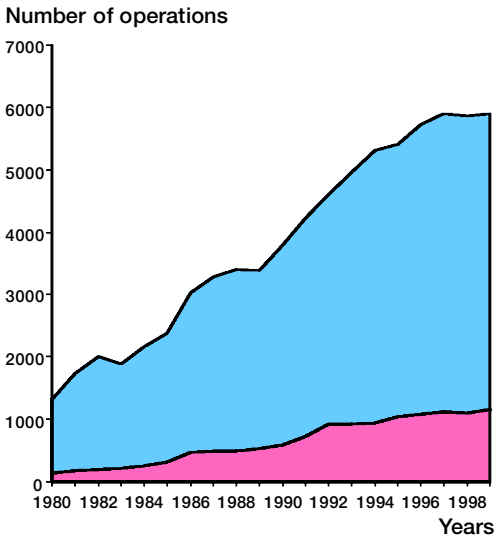

Figure 2. The annual number of primary (blue) and revision hip replacements (red).

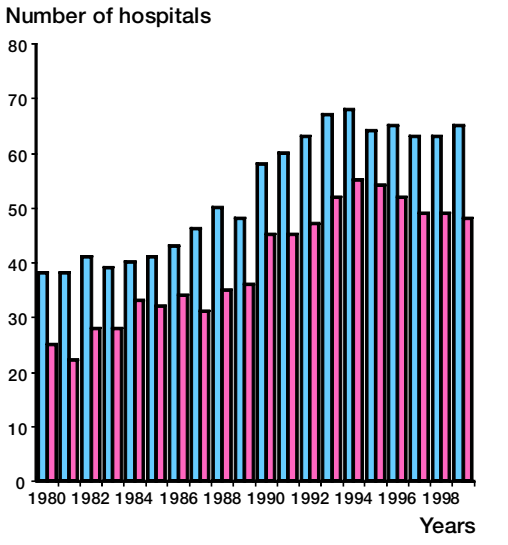

Figure 3. The number of hospitals performing primary (blue) and revision hip arthroplasties (red).

the arthroplasty register are linked and matched with other national data registers.

For a primary operation, the operating hospital, date, personal number, indication for the operation, implant design, method of fixation for each component and primary complications are recorded. For a revision arthroplasty, date of the index operation, design of the revised prosthesis, indication for revision and the new prosthesis are also recorded (Figure 1).

For calculation of survival of the hip replacement, all kinds of revisions, not only aseptic loosening, were used as the end-point.

The reliability of the register was analyzed during 1994–95. The data were compared to those from the discharge registers of the participating hospitals. If missing patients or incomplete reporting were detected, a request was sent to the hospital for correction. Missing patients were added to the register from the information on the patient record in a hospital.

The National Agency for Medicines meets all costs of the Implant Register. The annual total costs are about 0.2 million EURO.

Data in the Finnish National Arthroplasty Register and the Finnish Cancer Register have been matched in two cohorts (Paavolainen et al. 1999).

Results

Between 1980 and1999, 62,841 primary hip arthroplasties and 12,224 revision hip arthroplasties were performed. The annual number of both primary and revision hip replacements has been increasing (Figure 2). The number of hospitals performing primary and revision hip arthroplasties has also increased (Figure 3). In 1999, 4,742 primary total hip replacements and 1,158 revision hip replacements were performed in 65 and 48 different hospitals, respectively. The number of different implant designs and combinations of the components from 1980 to 1999 totalled 174. In 1999, 64 hip implant designs or combinations of components were used, but the 6 commonest hip implants comprised 82%.

The incidence of primary hip arthroplasties was 93/100,000 in 1999. The indications are presented in Table 1. Over 47% of the cementless primary hip prostheses were used in patients younger than 60 years and over 93% of the cemented primary hips were used in those 60 years or older (Figure 4).

The 10-year survival was 72 (95% CI 67–76)% in patients under 55 years and 90 (89–91)% in those over 70 years (Figure 5).

Since the late 1980s, more than 40% of the hips have been inserted without cement (Figures 6a

Table 1. Indications (in percent) for primary total hip replacements in 1999

Primary arthrosis	78
Rheumatoid arthritis	7
Secondary arthrosis	4
Congenital luxation of hip	2
Other arthritides	1
Other conditions	8

and 6b). There was no change in the survival of cemented hip arthroplasties in primary arthrosis with time (Figure 7). However, the results of cementless implants have improved with time in primary arthrosis (Figure 8). Lubinus SP II was the commonest cemented prosthesis and Bimetric was the commonest cementless prosthesis used. The 10 commonest cemented and cementless hip implants

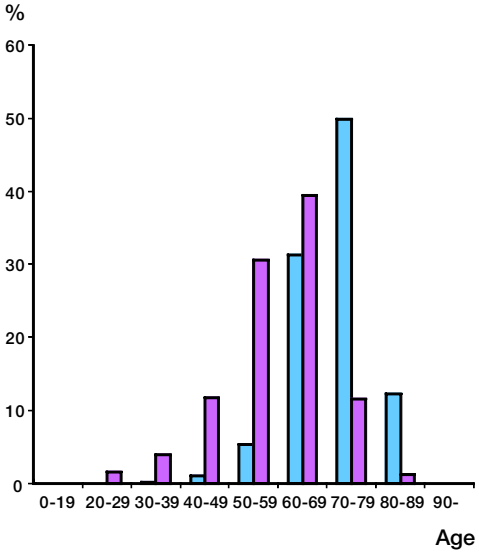

Figure 4. Age-distribution of patients with a cemented primary hip prosthesis (blue) compared to those with a cementless primary hip prosthesis (violet) from 1989–1999.

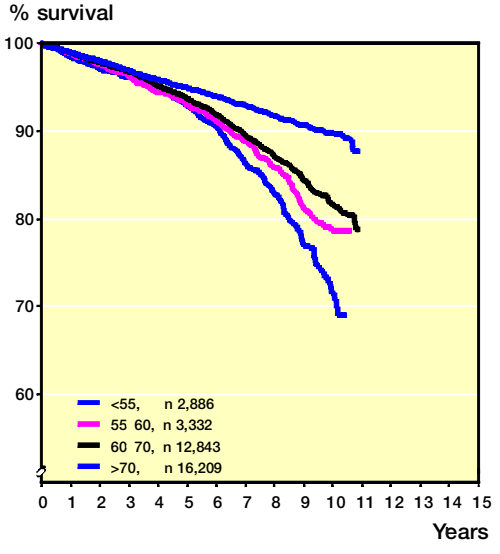

Figure 5. Kaplan-Meier survival rates in patients under 55 years, 55–59 years, 60–70 years and over 70 years from 1985–1999.

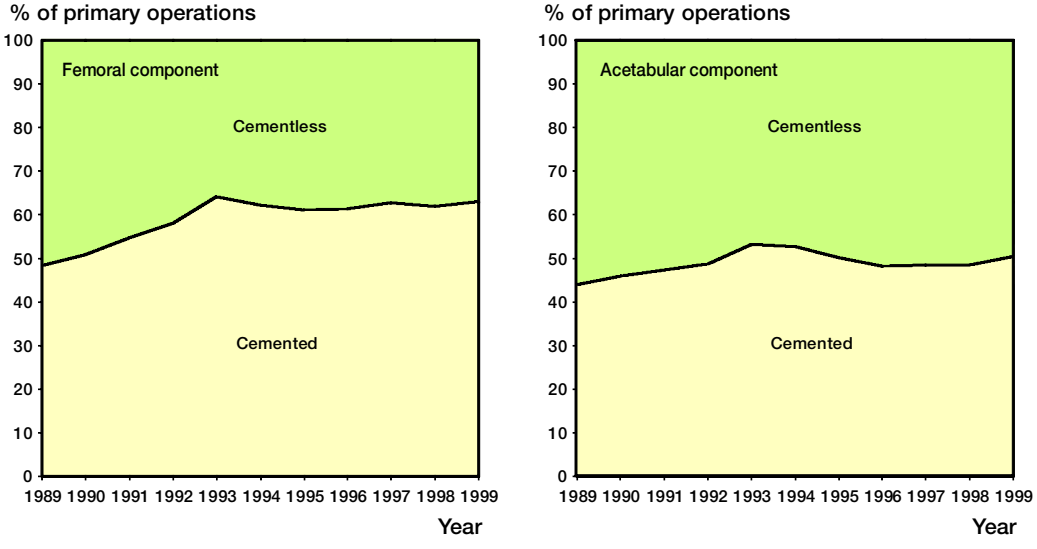

Figure 6. Distribution of the fixation method of the femoral component (left) and of the acetabular component (right) from 1989–1999.

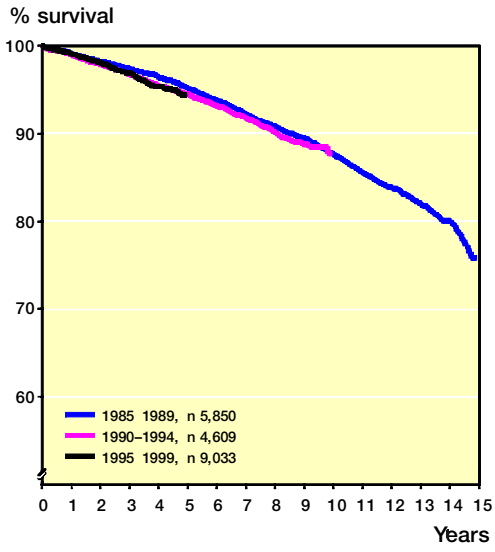

Figure 7. Kaplan-Meier survival rates of cemented hip arthroplasties in primary arthrosis from 1985–1999.

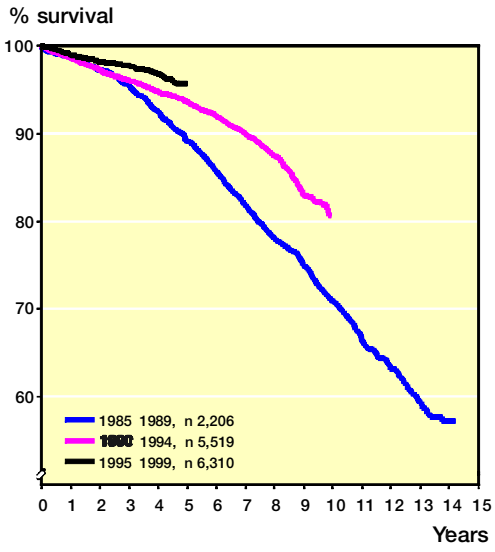

Figure 8. Kaplan-Meier survival rates of cementless hip arthroplasties in primary arthrosis from 1985–1999.

Table 2. 10 commonest cemented and cementless hip implants in Finland in 1980–1999 (total 75,065)

	n 1980–1989	n 1990–1999	% of total
Cemented			
Lubinus SP II	1062	10162	15.0
Lubinus IP	8025	699	11.6
Exeter Universal	163	6469	8.8
Muller	1972	3038	6.8
Charnley	1696	911	3.5
Elite Plus	0	1942	2.6
Exeter	1319	54	1.8
Biomet interloc	11	1108	1.5
Lubinus SP I	948	150	1.5
Christiansen	744	11	1.0
Cementless			
Bimetric [a]	1348	11641	15.5
Lord	2281	815	4.1
ABG HA	0	2448	3.7
Mathys isoelastic	1166	1259	3.2
Anatomic mesh	41	1179	1.6
PCA standard	329	717	1.4
PCA e-series	5	790	1.1
Link RS	549	242	1.1
Omnifit HA	0	750	1.0
Bimetric Head-Neck	19	661	0.9

[a] Various cementless Biomet cups

in 1980–1999 are shown in Table 2. In 1999, the 3 commonest cemented and cementless hip implants comprised 82% of all hip implants used (Table 3). These survival rates are given in Figures 9–14.

Table 3. 3 commonest cemented and cementless hip implants in 1999 (total 5900 hip arthroplasties in 1999)

	n	% of total
Cemented		
Exeter Universal	1521	25.8
Lubinus SPII	1008	17.1
Elite Plus	291	4.9
Cementless		
Bimetric	1314	22.3
ABG HA	578	9.8
Omnifit HA	129	2.2

Aseptic loosening was the commonest reason for hip revision in 1999 (Table 4).

The survival of cemented and cementless hip prostheses in revisions between 1985 and 1999 are presented in Figures 15 and 16. The 5-year survival of the cementless hip prosthesis has improved with time: it was 85 (82–87)% in 1985–1989, 89 (88–91)% in 1990–1994 and 92 (88–95)% in 1995–1999 (Figure 16).

Register-based cohort studies

Among the first cohort of 31,651 polyethylene-on-metal total hip replacement patients (199,996 person-years), 2,367 cases of cancer were seen, but, unfortunately, patients with rheumatoid arthritis (RA) were also accidentally included (Paavolainen

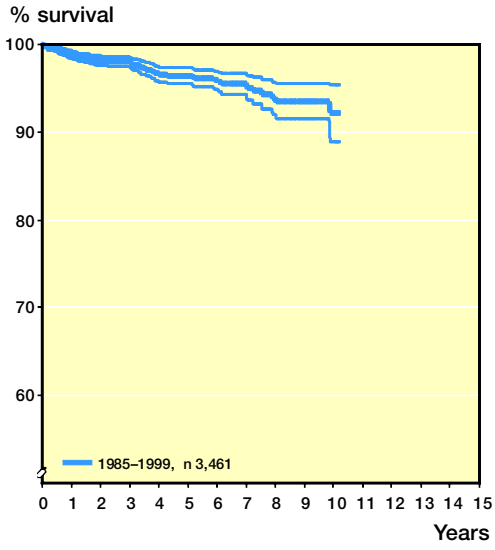

Figure 9. Kaplan-Meier survival rates of Exeter Universal with all-poly cup prosthesis.

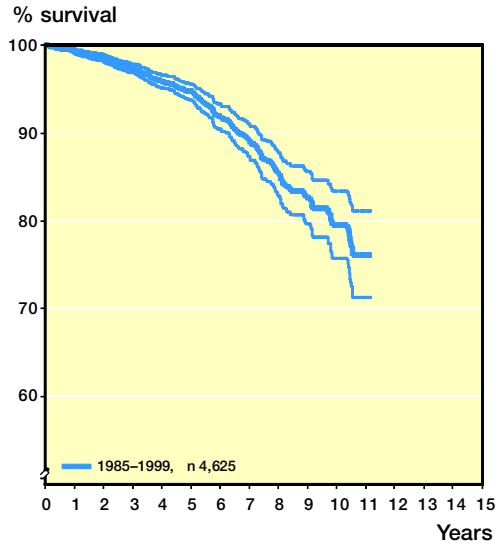

Figure 10. Kaplan-Meier survival rates of Lubinus SPII with eccentric snap-fit cup prosthesis.

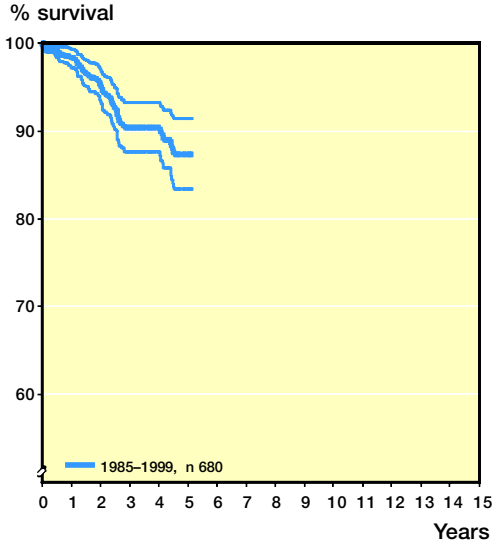

Figure 11. Kaplan-Meier survival rates of Elite plus with Elite LPW cup prosthesis.

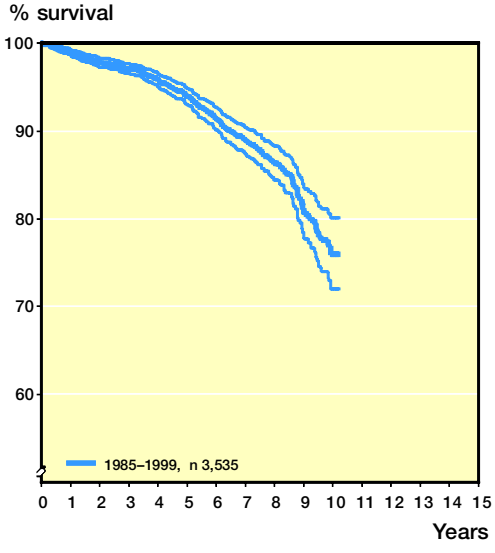

Figure 12. Kaplan-Meier survival rates of Bimetric with PFU cup prosthesis.

et al. 1999a). The corresponding numbers of patients with primary arthrosis alone were 24,638 (173,022 person years) (Paavolainen et al. 2000).

There were significantly fewer cases of cancer among those with arthrosis (standardized incidence ratio 0.91, 95% confidence interval (95% CI) 0.87–0.94.

Among the patients with arthrosis, the incidence of malignant lymphoma was as expected. Earlier reports show an increased risk of lymphoma among RA patients alone (Paavolainen et al. 1999b, 2000).

Discussion

In 1995 it was estimated that the Arthroplasty Register included almost 90% of inserted prostheses,

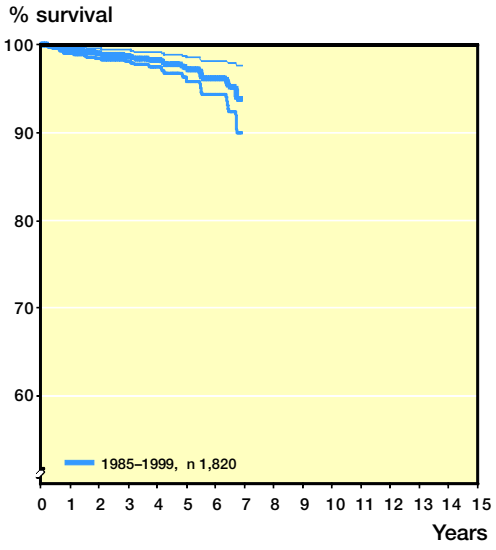

Figure 13. Kaplan-Meier survival rates of ABG HA with ABG HA cup prosthesis.

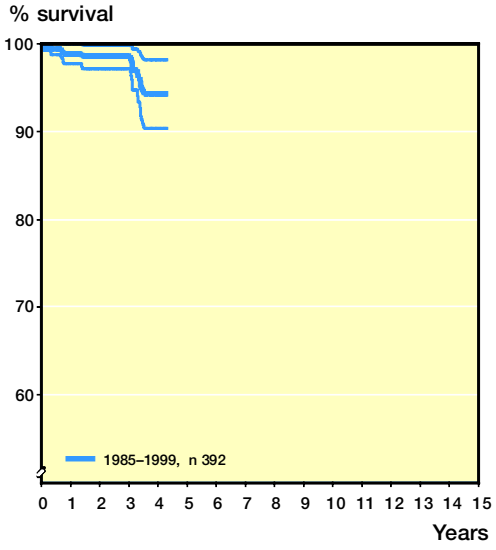

Figure 14. Kaplan-Meier survival rates of Omnifit HA prosthesis.

Table 4. Reasons (in percent) for hip revision in 1999

Aseptic loosening	65
Infection	7
Luxation	9
Malposition of endoprosthesis	2
Fracture of bone	4
Fracture of endoprosthesis	2
Other reason	11

and the percentage was increasing (Halonen et al. 1998). The average registration in 3 types of hospital was 87 (65–99)% of the patients (Puolakka et al. 1997) and the small regional hospital was best. At present, information from the Arthroplasty Register is compared to the hospital discharge notification register every few years so that currently over 95% of implantations are registered.

It has been difficult to perform detailed analyses of the data concerning hip arthroplasties in the Finnish Arthroplasty Register because the acetabular and femoral components, as well as the material and size of the femoral heads, have been recorded separately only since 1996 (Puolakka et al. 1999). The reasons for revision have also been recorded inaccurately owing to the design of the registration form. Since the needs for information are changing, continuous checking of the register's quality—for example, the design of the notification form—is necessary. More accurate data regarding the reasons for revision will be collected in future.

Human error can occur when forms are completed in the hospital or when data are transferred to the computer. We need a new, more accurate electronic registration system.

There are some differences between the Arthroplasty Registers in Scandinavia. In Finland and Norway, all prostheses are recorded in the same register (Nevalainen et al. 1997, Havelin 1999), but Sweden has separate registers for hip and knee implants. In Sweden, the number of primary hip operations and type of implant were recorded annually from 1979 to 1991 in each department, but revisions alone were registered in a more detailed manner. Since 1992, all hip operations have been recorded individually even in Sweden—as Finland did from the beginning.

The Finnish Arthroplasty Register considers all reasons for revisions as the end-point in calculations of survival, unlike the Swedish Hip Register where only aseptic loosening is included in survival data. For instance, in Sweden, an exchange of liner or head component is not considered a revision. In cementless modular hips this exclusion of reason for revision could improve survival results considerably. In Sweden, the category "other reasons" (infection, fracture, dislocation, technical error, implant fracture, pain, polyethylene

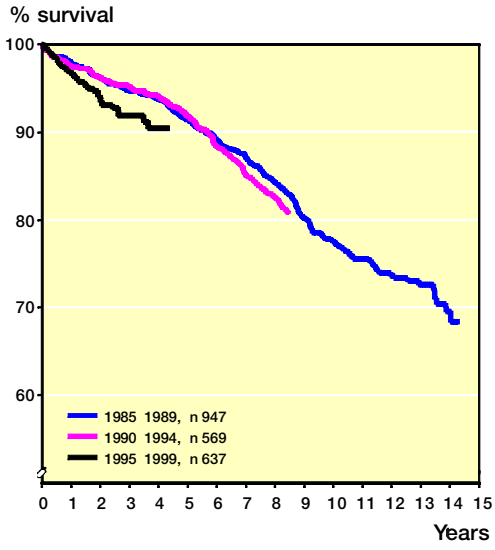

Figure 15. Kaplan-Meier survival rates of cemented hip prosthesis in revisions 1985–1999.

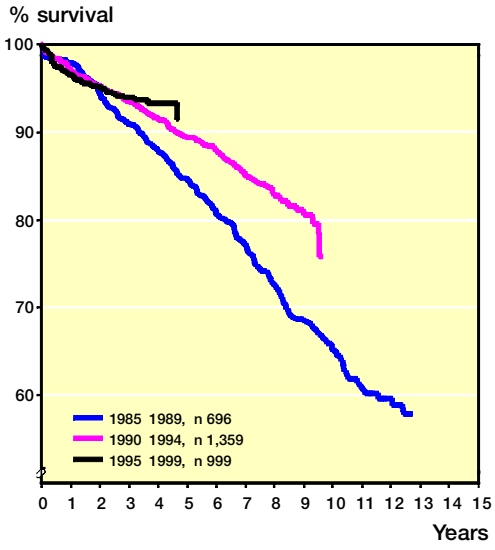

Figure 16. Kaplan-Meier survival rates of cementless hip prosthesis in revisions 1985–1999.

wear) includes nearly 25% of reasons for revision (Malchau et al. 2000), so one can not directly compare the Swedish and Finnish registers. The Finnish choice of the end-point emphasizes the point of view that it is the survival of the entire prosthesis that matters.

In Finland, the incidence of THA operations has increased; the incidence of annual THAs was 58/100,000 in 1988 (Paavolainen et al. 1991) and 93/100,000 in 1999. Nevertheless, it is lower than in Norway and Sweden (Havelin 1999, Malchau et al. 2000).

In Sweden, the results of cemented implants have improved with time thanks to modern cementing techniques. In Finland, the trend is not so clear. For example, the 10-year survival of 92% for the cemented Exeter Universal stem with all-poly cup is lower than the 96% survival in the Swedish Hip Register. Different definitions of the end-point for survival of hip prostheses may, in part, explain this. Likewise, the 10-year survival of 80% for the Lubinus SPII stem with snap-fit eccentric cup is much lower than 96% in the Swedish Hip Register (Malchau et al. 2000). Different definitions of the end-point and, possibly, different cup may explain this. Partio et al. (1994) linked the snap-fit cup to the development of impingement, leading to loosening. Savilahti et al. (1997) found survivals of 78% for both the Lubinus SP stem and eccentric snap-fit cup after 10 years.

In Finland, almost half of hip arthroplasties have been cementless since the late 1980 as compared to 3% presented in Sweden. The commonest "first- and second-generation" cementless hip implants have had a poor outcome in Finland (Puolakka et al. 1999). Over 47% of the cementless primary hip prostheses were used for patients younger than 60 years. These usually more active patients have worse results than elderly patients. Hip replacement in patients aged less than 55 years have only a 72% 10-year survival. Malchau et al. (2000) have also found a poor survival in the same age group: 81% 10-year survival and less than 50% 15-year survival.

Data concerning the years 1995–1999 show better results for cementless hip arthroplasties; the 5-year survival, including all revisions, was 95.6%. This is even better, or equal to, the survival of cemented hip arthroplasties during the same period in Finland. Third-generation cementless hips inspire optimism—for example, the 7-year survival of the cementless ABG prosthesis was 94 (95% CI 90–98)%. In an earlier multicenter study, 5-year survival was 99% (Tonino and Rahmy 2000). However, the short-term result should be interpreted with caution, since there are earlier examples of a decline in the results after 5 years (Puolakka et al. 1999).

In revision arthroplasty, the results of cementless implants have improved with time: 92% after 5 years with cementless implants, but to 90% with cement.

As for the risk of cancer, the results of the register-based cohort studies agree with those in the large cohorts from other Nordic countries (Mathiesen et al. 1995, Nyren et al. 1995, Visuri et al. 1996, Olsen et al. 1999). The risk of cancer of the respiratory system and digestive tract in THA patients has not increased in the Finnish registers.

We saw no increase in the risk of lymphohematopoietic cancers or sarcomas in any of the Nordic cohorts.

The recent data from the Finnish Arthroplasty Register indicate that the results of total hip replacements are improving in Finland.

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Halonen P J, Nevalainen J, Santavirta S. Knee arthroplasties in Finland. A survival study of 20,382 knees registered in the Finnish Arthroplasty Register 1980-1995. Presented at the 65th annual meeting of the American Academy of Orthopaedic Surgeons, New Orleans, USA 1998.

Havelin L I. The Norwegian Arthroplasty Register. In: European instructional course lectures. (Eds. Jacob R P, Fulford P, Horan F). The British Editorial Society of Bone and Joint Surgery, 22 Buckingham Street, London 1999; 4: 88-95.

Malchau H, Herberts P, Söderman P, Oden A. Prognosis of total hip replacement. Update and validation of results from the Swedish National Hip Arthroplasty Register 1979-1998. Scientific Exhibition presented at the 67th annual meeting of the American Academy of Orthopaedic Surgeons, Orlando, USA 2000.

Mathiesen E B, Ahlbom A, Bermann G, Lindgren U. Total hip replacement and cancer. A cohort study. J Bone Joint Surg (Br) 1995; 77: 345-50.

Nevalainen J, Hirvonen A, Pulkkinen P. The 1996 Implant Yearbook on Orthopaedic Prostheses, Publication of The National Agency for Medicines, Helsinki 1997.

Nyren O, McLaughlin J K, Gridley G, Ekbom A, Johnell O, Fraumeni J F, Adami H-O. Cancer risk after hip replacement with metal implants: a population-based cohort study in Sweden. J Natl Cancer Inst 1995; 87: 28-33.

Olsen J H, McLaughlin J K, Nyren O, Mellemkjaer L, Lipworth L, Blot W J, Fraumeni F. Hip and knee implantations among patients with osteoarthritis and risk of cancer: a record-linkage study from Denmark. Int J Cancer 1999; 81: 719-22.

Paavolainen P, Hämäläinen M, Mustonen H, Slätis P. Regisration of arthroplasties in Finland. A nationwide prospective project. Acta Orthop Scand (Suppl 241) 1991; 62: 27-30.

Paavolainen P, Pukkala E, Pulkkinen P, Visuri T. Cancer incidence in Finnish hip replacement patients from 1980 to 1995. A nationwide cohort study involving 31,651 patients. J Arthroplasty 1999a; 14: 1-9.

Paavolainen P, Pukkala E, Pulkkinen P, Visuri T. Cancer incidence after total knee arthroplasty. A nationwide Finnish cohort from 1980 to 1996 involving 9,444 patients. Acta Orthop Scand 1999b; 70 (6): 609-17.

Paavolainen P, Pukkala E, Pulkkinen P, Visuri T. Letters to the Editor, Erratum. J Arthroplasty 2000; 15: 136-7.

Partio E, Bonssdorff H von, Wirta J, Avikainen V. Survival of the Lubinus hip prosthesis. An 8- to 12-year follow-up evaluation of 444 cases. Clin Orthop 1994; 303: 140-6.

Puolakka T, Pajamäki J, Pulkkinen P, Nevalainen J. Cementless Biomet total hip prosthesis in the treatment of osteoarthrosis. Publication of the National Agency for Medicines, Helsinki 1997.

Puolakka T J S, Pajamäki K J J, Pulkkinen P O, Nevalainen J K. Poor survival of cementless Biomet total hip. A report on 1,047 hips from the Finnish Arthroplasty Register. Acta Orthop Scand 1999; 70 (5): 425-9.

Savilahti S, Myllyneva I, Pajamäki K J J, Lindholm T S. Survival of Lubinus straight (IP) and curved (SP) total hip prostheses in 543 patients after 4 to 13 years. Arch Orthop Trauma Surg 1997; 116: 10-3.

Tonino A J, Rahmy A I. The hydroxyapatite-ABG hip system: 5- to 7-year results from an international multicentre study. The international ABG Study Group. J Arthroplasty 2000; 15 (3): 274-82.

Visuri T, Pukkala E, Paavolainen P, Pulkkinen P, Riska E B. Cancer risk after metal on metal and polyethylene on metal total hip arthroplasty. Clin Orthop 1996; 329S: S280-9.