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RING TOTAL HIP REPLACEMENT IN OSTEOARTHROSIS

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A follow-up is given of the results of 40 arthroplasties with the non-cemented, vitallium-to-vitallium bearing Ring total hip prosthesis in 37 patients with osteoarthrosis. Operative indication was an intolerably painful and stiff joint. The surgery was performed by two specialists in orthopaedics. Point scores according to a modification of Merle d'Aubigné's classification showed excellent or at least good results in 52.5 per cent, and fair results in 27.5 per cent of the operations. One prosthesis was removed because of deep infection. The mortality rate was zero. In 20 per cent the total score was between 0 and 7, signifying little or no improvement. Loosening was the main problem even although it was in many cases well tolerated by the patients.

Key words: Ring total arthroplasty; hip joint; osteoarthrosis

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This article deals with the analysis of 40 total hip replacements performed by the authors during the period May 1968 to May 1974. An attempt has been made to judge the result very critically, in addition to making use of the numerical evaluation of the hip joint according to Merle d'Aubigné, as modified by pain thresholds. Efforts have also been made to point out the categories of failure and the reasons for dissatisfaction regarding the treatment.

MATERIAL AND METHODS

Endoprosthetic reconstruction of the hip joint with the non-cemented Ring vitallium 150° shaft-neck angle prosthesis (Figure 1) was performed during the period May 1968 to May 1974 on 40 hip joints of 21 male and 16 female patients at the Department of Surgery, Oulu University Hospital, Finland.

The majority of the patients were elderly (mean age 61 years, age range 44–74 years). Operative indication was degenerative osteoarthrotic changes in the hip joint (Figure 2), in one instance secondary to rheumatoid arthritis (Table 1).

The follow-up examination was performed in all cases by the research group personally. The mean length of the observation period was 3 years, range 1–6 years. The total mortality rate was zero.

In calculating the results a modified system of Merle d'Aubigné was used for summing up the point score for mobility, pain, and walking ability. However, the total score is indicated separately (Tables 2, 3).

The operations were performed by the authors. The southern incision was utilized; operative technique according to Ring (1968) was used.

The postoperative rehabilitation included verticalization after 2–3 days and walking with aids after 5 days on average.

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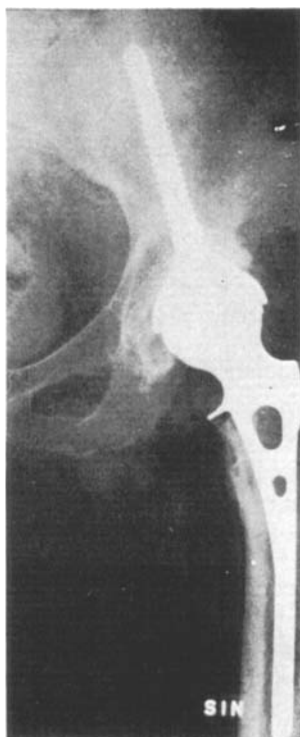

Figure 1. The non-cemented, metal–to–metal bearing, Ring total hip joint. The fenestrated, self-locking femoral component has a neck valgus angle of 150° and a standard head of 40 mm in diameter. The screw by which the cup is fixed is tapered. This anteroposterior roentgenogram shows the situation immediately after operation.

RESULTS

The pre- and postoperative scores for mobility, pain, and walking ability are summed up in Table 4. Every patient selected for operation had very severe osteoarthrosis as shown by the preoperative score. The end-results in every fifth patient had to be classified as not improved whereas 52.5 per cent of all patients belonged to the group with good or excellent results (Table 5). The reasons for failure fell into two categories: early and late complications. These are reported in detail below.

Early complications (Table 6)

During the hospital stay deep vein thrombosis was diagnosed in two patients; however, it was possible to treat this by conventional medical means without late sequelae at the time of follow-up.

Deep infection led to removal of the prosthesis and a spontaneous Girdlestone joint in one patient. A chronic low-grade fistulous infection in another was treated with antibiotics and did not require removal of the prosthesis. Both were classified as failures.

Transient peroneal paralysis in two patients did not affect the favourable outcome. No dislocations occurred. The mortality was zero.

Late complications (Table 6)

Loosening of the stem occurred frequently and seemed to be the main reason for failure. A radiolucent zone surrounding the prosthesis was seen in

Table 1. Operative indications in recent follow-up series.

	Ring (Great Britain) (1974)	Evarts et al. (USA) (1972)	Leinbach & Barlow (USA) (1973)	Paaby (Denmark) (1974)	Lindholm & Puranen (Finland) (1975)
No. of joints	1000	25	40	400	40
Years	1964–74	before 1971	1968–73	1968–74	1968–74
	Per cent	Per cent	Per cent	Per cent	Per cent
Arthrosis	89.0	50.0	57.5 (approx.)	100	97.5
Rheumatoid arthritis	3.7	15.6	7.5 (approx.)	0	2.5
Other	7.3	34.4	35.0 (approx.)	0	0.0

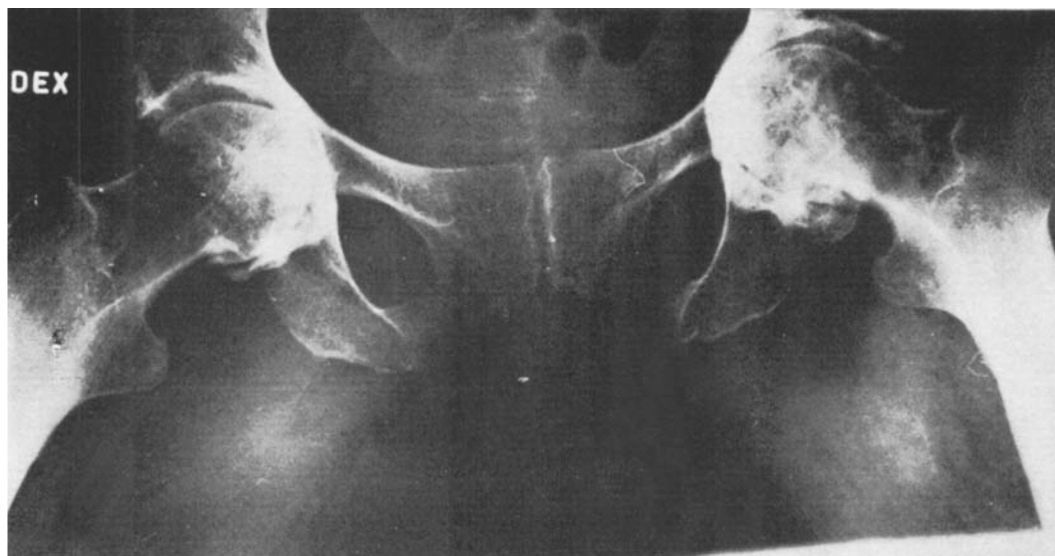

Figure 2. Intolerably painful, bilateral, primary osteoarthrosis with almost total loss of hip movements, in a female aged 67, illustrates the most readily accepted operative indication in this series.

Table 2. Numerical evaluation of the hip joint according to d'Aubigné.

Score	Pain	Mobility	Walking ability
0	Very severe continuous pain.	Ankylosis with bad position of the hip.	Unable to walk.
1	Very severe pain, preventing sleep.	Clinical ankylosis with little or no deformity.	Only with crutches.
2	Severe pain on walking. Inhibited in all work.	Flexion 0–40°. Abduction 0° or slight deformity.	Only with 2 sticks.
3	Tolerable pain interfering with work.	Flexion 0–60°.	Less than 1 hour with stick. Very difficult without stick.
4	Only pain after walking. Subsides on resting.	Flexion 0–80°. Able to lace shoes.	1 stick for long distances. Limited without stick.
5	Negligible and intermittent pain, not interfering with work.	Flexion 0–90°. Abduction $< 25°$.	A slight limp with a stick.
6	No pain.	Flexion $> 90°$. Abduction $> 25°$.	Normal.

the roentgenograms in 16 cases, of which 12 only had changes around the acetabular component. Four patients showed migration of the femoral portion. However, it is evident that the patients with this complication can be divided into two groups: the tolerable loosenings and the loosenings requiring revision.

Reoperation was performed in five cases: four prostheses were changed to Christiansen's total prosthesis and one to Moore's endoprosthesis. At replacement

Table 3. System of classification of end-result on the basis of total score modified by pain thresholds.

End-result	Score	Criterion
Poor	0–7	pain 0–2
Fair	8–12	pain >3
Good	13–16	pain >4
Excellent	17–18	

it was found that both components had loosened in two cases but only the acetabular component in three cases.

In one patient the reason for pain was unclear after the examinations and the lack of improvement had to be classified as psychogenic.

DISCUSSION

Ring's own experience from his earlier and later operations show clearly a considerable improvement in the results, a fact which seems to be closely related to the development of the prosthesis since then (Ring 1974). Ring's first model has been changed and the new modifications are now in current use. The principle of metal-to-bone fixation without cement has remained unchanged. Only architectural adjustments have been made. Tapering the screw of the acetabular component (Figure 1) has possibly improved its long-term grip in comparison with the older parallel moulded device (Figure 3).

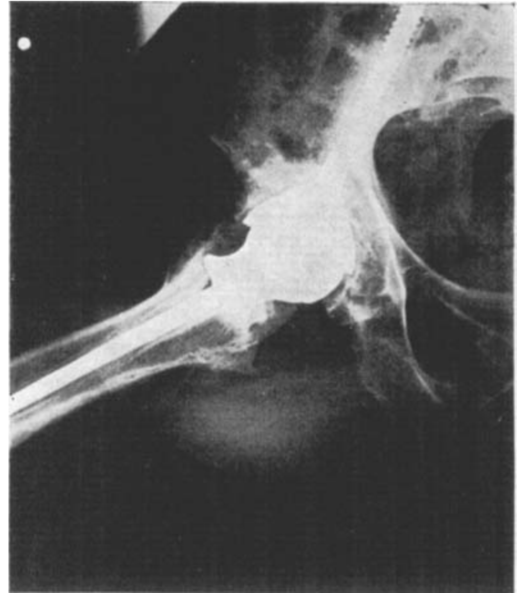

Figure 3. One of the earliest operated hips, followed up for 6 years, a male aged 68. Axial roentgenogram shows a halo effect around the non-tapered screw used in some of the earlier replacements. This is a positive indication of loosening. Symptoms, however, were tolerable. The stem of the femoral component is rigidly fixed by a grip of heavily calcified spongious bone, especially concentrated in the region of the neck and the holes of the stem. With the passage of time bone is formed, which counteracts loosening and/or migration.

Loosening has no doubt been a problem, in our series and in others (Evarts et al. 1972, Leinbach & Barlow 1973), but the need for revision has decreased (from 3.7 per cent to 1.6 per cent) as indicated

Table 4. Pre- and postoperative scores of 40 patients with the Ring prosthesis.

Score	Mobility score of the hip No. of cases		Pain score No. of cases		Gait score No. of cases	
	Preop.	Postop.	Preop.	Postop.	Preop.	Postop.
0	1	–	–	1	–	–
1	4	–	6	1	4	3
2	28	2	33	6	7	5
3	7	9	1	5	29	10
4	–	13	–	7	–	7
5	–	10	–	11	–	15
6	–	6	–	9	–	–

Table 5. Results.

	Ring (1974) Earlier (169)	Ring (1974) Later (535)	Evarts et al. (1972) (25)	Leinbach & Barlow (1973) (40)	Paaby (1974) (400)	Lindholm & Puranen (1975) (40)
	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
Excellent	45	69	12	Satisf. 90	61	17.5
Good	29	21	24	Not satisf. 10	34	35.0
Fair	10	6	24		4	27.5
Poor	16	4	40		1	20.0

Table 6. Complications.

	Ring (1974) (1000)	Evarts et al. (1972) (25)	Leinbach & Barlow (1973) (40)	Paaby (1974) (400)	Lindholm & Puranen (1975) (40)
	Per cent	Per cent	Per cent	Per cent	Per cent
Mortality	1.1	0	0	0.5	0
Morbidity					
cerebral thrombosis	0.2				
g-i haemorrhage	0.5				
deep vein thrombosis	7.0	50	7.5		5.0
Dislocation	0.3	(1)	0.0		0.0
Deep infection	0.7	(1)	0.0	0.7	5.0
Metal failure	0.5				0.0
Loosening	3.7–1.6	40	10.0	1.5	12.5* + 27.5†
Replacement anchylosis	0.7				
Peroneal paralysis					5.0
Stress fracture in acetabular rim.					2.5

* Revisions.
† Tolerated.

by Ring's earlier and later performances. It is of interest to note that loosening often remains a subclinical problem (Leinbach & Barlow 1973) and that the joint in such cases is in fact quite satisfactory and more functional than before replacement (Figure 3); even reversibility of so-called loosening in its early stages has been observed. The risk of deep infection is a serious problem in all types of endoprosthetic surgery, because if it cannot be satisfactorily treated by conventional revisions and antibiotics the prosthesis has sooner or later to be removed. This may be a difficult and traumatizing operation if cement has been used. With Ring's prosthesis it is an easy procedure and less traumatizing. Osteophytic overgrowth, known from the earlier days of femoral head replacements in osteoarthrosis, has not been encountered with Ring's prosthesis. Mortality is very low in all series, a fact related to the selectivity of this operation, which has to be carefully planned and performed without undue haste. Our experience with the Ring total hip replacement gives no cause for disagree-

ment with Ring's conclusions and recommendations regarding indications and techniques (Ring 1974, Ring 1975).

We recognize that our results are not without fault and particularly loosening of the acetabular component has been a problem. According to Evarts et al. (1972) there has been a progressive decline in point scores with the passing of time and they have concluded that the usefulness of the Ring prosthesis at present seems to be limited. We are, however, not so pessimistic and favouring the non-cemented type of fixation and the metal-upon-metal bearing one of us (R.L.) still uses the Ring total hip replacement.

REFERENCES

Evarts, C. M., Gramer, L. J. & Bergfeld, J. A. (1972) The Ring total hip prosthesis. *J. Bone Jt Surg.* **54**-A, 1677.

Leinbach, I. S. & Barlow, F. A. (1973) 700 total hip replacements. *Clin. Orthop.* **95**, 174.

Lindholm, R. V. & Puranen, J. (1975) Ring total hip replacement. Preliminary report to the VIII European Rheumatology Congress, Helsinki June 1–7, 1975. Workshop on arthroplasty of the hip. Daily Bulletin 4, p. 16. The Boots Company Ltd., Nottingham, England.

Paaby, H. (1974) Follow-up results from 11 orthopaedic surgical departments of about 400 cases of hip arthrosis, treated with Ring's total plasty. *Acta orthop. scand.* **45**, 798.

Ring, P. A. (1968) Complete replacement arthroplasty of the hip by the Ring prosthesis. *J. Bone Jt Surg.* **54**-A, 257.

Ring, P. A. (1971) Ring total hip replacement. In: *Total hip replacement,* p. 26. Ed. Jayson, M. Sector Publishing Ltd., London.

Ring, P. A. (1974) Total replacement of the hip joint. A review of a thousand operations. *J. Bone Jt Surg.* **56**-B, 44.

Ring, P. A. (1975) Risks and uses of the total hip replacement. *Brit. med. J.* **2**, 442.

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