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Hip arthroplasty for congenital dislocation

From 1974 through 1981, total arthroplasty was performed for arthrosis following congenital dislocation in 25 hips in 17 patients. Pain was the main indication for surgery. Early complications were two dislocations and one deep venous thrombosis. One malpositioned socket and one loosening of the femoral prosthesis and socket were revised. At follow-up 2–9 years postoperatively, 16 hips were excellent, eight good, and one poor. The dysplastic pelvis and femur require implants of special design, and the original acetabulum should be prepared and reinforced at surgery. A radiographic method for calculation of the center position of the hip before and after surgery proved simple and exact.

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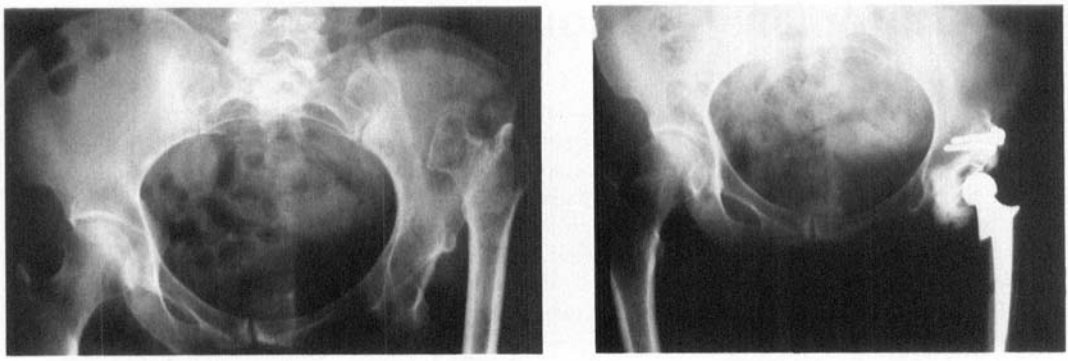
In 1973, Charnley & Feagin advised against the use of total hip arthroplasty (THA) in arthrosis following congenital dislocation of the hip (CDH) in cases with severe dysplasia of the acetabulum and high dislocation of the femoral head. The reasons were the thin pelvic bone, the shortened and atrophic abductor muscles, and the narrow canal of the femur. However, the reinforcement of the original acetabular roof by bone grafts and specially designed prostheses have brought these patients into the scope of reconstruction (Dunn & Hess 1973, Harris et al. 1977, Fredin & Unander-Scharin 1980). The few reports to date of such patients initiated our analysis.

Patients and methods

Sixteen female and 1 male CDH patient with 25 painful arthrotic hips underwent THA at the Lund University Department of Orthopedics during the year 1974 through 1981. Their median age was 51 (36–62) years. Eighteen hips had a high dislocation and seven a subluxation with destruction of the acetabular roof. Pain was the main indication for surgery, whereas limp and limitation of motion were considered less important. Fourteen operations had previously been performed on 13 hips including seven osteotomies of the femur, four shelf operations, one Chiari osteotomy of the pelvis, one acrylic prosthetic replacement, and one soft-tissue operation.

Surgical procedure. A lateral incision was used in 18 operations and a posterior one in seven. The greater trochanter was osteotomized in all but two hips. When tight, the rectus femoris muscle was released from the anterior inferior iliac spine and the iliopsoas tendon from the lesser trochanter. The femoral neck was divided with a reciprocating saw. The capsule and the teres ligament were excised. The principles of Harris et al. (1977) were used for preparation of the original acetabulum and resection of the femur. To cover the socket completely, the acetabular roof was enlarged and reinforced by a bone graft from the femoral head in 8 patients (Figure 1). The graft was fixed to the pelvis by two cortical or cancellous screws. Then, the socket component was cemented into its new location and the femur was shortened as required to achieve proper tissue tension. Mersilene® threads were pulled through drill holes for the fixation of the greater trochanter before cementation of the stem. The fascia of the gluteus medius was separated from the iliac crest to increase the length of the muscle before reattaching the greater trochanter. Because of the size of the prepared acetabulum and femoral canal, the dysplastic type of Lubinus prosthesis was used (Waldemar Link AG. Hamburg) in 13 patients, the Howse-Arden (D. Howse & Comp Ltd, London) in 6, the standard Lubinus in 4, and the standard Charnley (Thackaray, Ltd, London) in 2 patients. Until 1980, the patients received cloxacillin i.v. prophylactically every 6 h for 2 weeks, and then for 5 days.

Radiographic studies. The preoperative and postoperative radiographic examinations included an AP view of the pelvis with the central beam towards the symphysis pubis, one AP view of the hip with the



A B

Figure 1. Patient No. 3. Female, aged 54 years, with congenital dislocation of her left hip. A. Preoperative film. B. A Howse-Arden prosthesis of the minitype was inserted and a bone graft from the femoral neck was applied. The hip joint was moved down 10 cm; the leg length increased 2.5 cm.

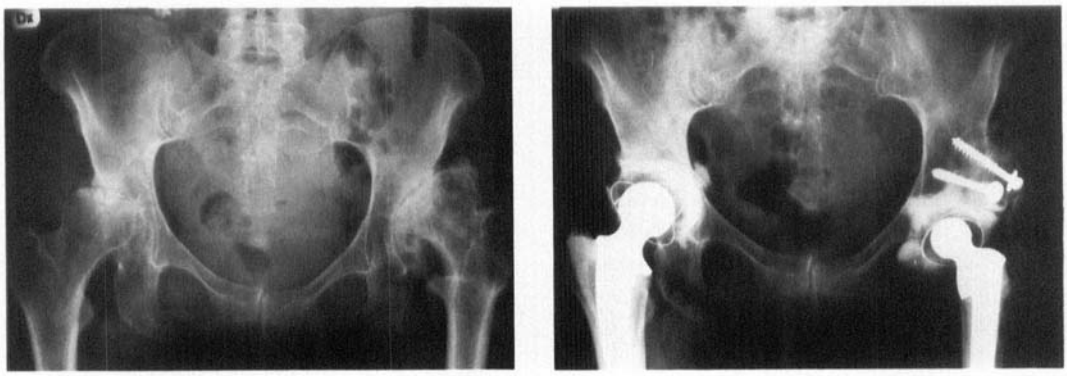


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Figure 2. Patient No. 4. Female, aged 51 years, with acetabular dysplasia of both hips. A. Preoperative film. B. The right hip was replaced with a standard Lubinus prosthesis and the left one with a Lubinus dysplasia prosthesis 1 year later; the acetabulum was reinforced by bone graft from the femoral head.

central beam towards the joint, and one lateral view of the proximal femur horizontally with the central beam directed cranially 30°. At the first two projections the patient was supine with parallel femora and femoral condyles, and at the third projection supine with the contralateral leg supported in flexion of the hip and knee. Radiograms were taken at 6 weeks, 3 and 6 months, and then each year postoperatively, and at follow-up. The position of the center of the dislocated femoral head was measured on the preoperative films. Postoperatively, the center of the head of the prosthesis was determined and the correction measured.

At the follow-up examination a radiolucent zone of more than 2 mm between cement and bone or prosthesis indicated loosening of the prosthesis (Salvati et al. 1976, Woolson & Harris 1983). Bony fusion of the graft and heterotopic bone formation were assessed.

In unilateral dysplasia the radiographic values on the side operated on (Figure 3) were compared with those on the normal side. To determine the normal position of the head in patients with bilateral dislocation, the radiographic distances a, b, c, d as defined in Figure 3 were measured in a control group consisting of 25 men and 25 women, aged 31–72 years, examined for trauma, arthrosis, or metastases, and found to be normal. The ratio b/a was found to be 0.69 ± 0.08 (2SD) (0.70 in men and 0.68 in women). The ratio d/c was 0.81 ± 0.12 (2 SD) (0.832 in the men and 0.68 in the women). There was no significant variation between the right and left sides and

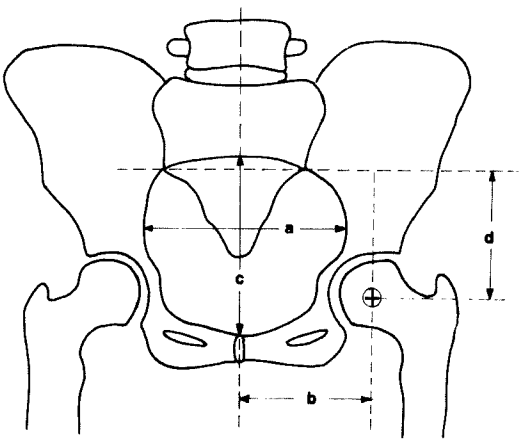

Figure 3. To express the position of the center of the femoral and the prosthetic heads, the following lines were drawn: A horizontal line connecting the lower borders of the sacroiliac joints (S-line). The midline of the pelvis, dividing the distance along the S-line between the sacroiliac joints into two equal parts, and running from the S-line to the superior part of the symphysis (c). The largest transverse diameter of the pelvic opening (a). The distance from the center of the femoral head to the prolonged midline (b). The distance from the center of the femoral head to the S-line (d).

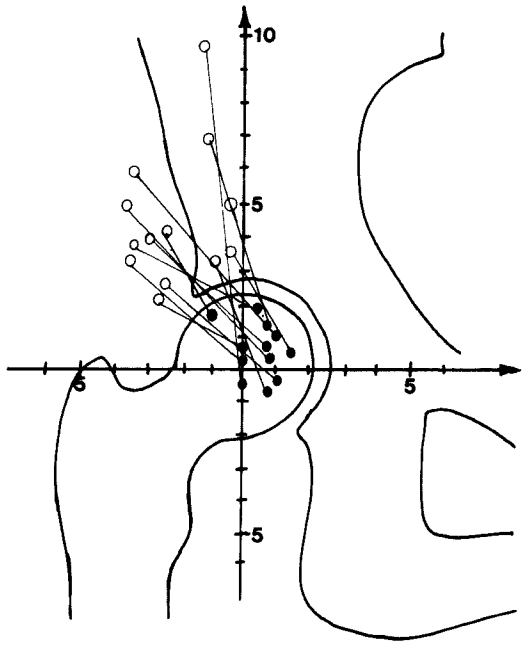

Figure 4. Determination of preoperative and postoperative positions in the 13 patients moved 3 cm or more. The calculated normal position for the head is represented by origo.

no significant variation with age. In patients with bilateral CDH, these values were used to determine the normal position of the femoral head center.

Follow-up. Preoperative and postoperative hip scores were rated according to Merle d'Aubigné & Postel (1952) concerning pain, walking ability, and range of motion (Table 1). Backache and knee pain, working ability, subjective feeling of improvement, and use of analgetics were also noted. Trendelenburg's sign was examined and leg length measured. The median radiographic and clinical follow-up was 5 (1–8) years. All patients were contacted 4–11 years after surgery and found unchanged as compared with the follow-up.

Results

Two early implant dislocations were easily reduced by closed manipulation, and traction in bed was applied for 3 and 6 weeks, respectively; no subsequent dislocations were experienced by these patients. One case was revised because of repeated subluxations due to a malpositioned socket. There were no fractures of the femoral shaft, no infections, no vascular injury or neural complications, and no deaths; Case 3 had thromboembolism but recovered. At 8 years, radiolucent zones of maximally 2 mm for the socklet and 3 mm for the stem suggesting loosening were observed in 1 patient.

All the patients had pain preoperatively (Table 1). Postoperatively, 21 patients had painless hips. Among the 4 patients with pain one hip had been revised for loosening. Average improvement in pain was from 2.3 to 5.4. At follow-up, 11 patients did not use any analgetics, while 6 required them on occasion. Improvement in walking was found in 21 patients, whereas 4 remained unchanged. The range of motion was improved in 20 patients, unchanged in 4, and worse in 1.

Back pain was reduced in 5 patients and 3 patients became worse. Trendelenburg's sign was negative in 15 and positive in 9 hips after surgery; in 7 hips a positive sign became negative following operation. Prior to surgery, 11 patients had a leg length discrepancy exceeding 2 cm. Postoperatively, the leg length discrepancy was 1.5 cm or less in 11 patients and 2–3 cm in 6 patients.

The center of 13 hip joints had been moved 3

Table 1. Patients operated with THA for arthrosis following CDH

Hip No	Previous Operations	Age at THA (yr)	Prosthesis	Bone graft	Radiographic position Before surg. x	Before surg. y	After surg. x	After surg. y	Complication	Merle d'Aubigné score Before surg. Pain	Walk	ROM	After surg. Pain	Walk	Rom	Follow-up (mo)
1		53	Ld		−3.2	−3.7	0.1	0.2	0	1	2	2	4	3	4	44
2		59	Ld		–	–	0.8	0.0	Revis socket	1	3	5	6	6	5	21/12
3		54	HA	+	0.7	9.6	0	−0.3	Cava-thromb	3	3	6	4	4	5	21
4		51	L		−1.0	2.8	0.8	2.1	0	2	3	3	6	6	6	41
5	I	52	Ld	+	−2.5	4.0	−1.5	1.4	Prim disloc	2	3	3	6	6	6	28
6		52	L		−1.2	1.1	−0.4	1.8	0	1	5	4	5	5	5	70
7	S	58	Ld		−3.3	5.9	0.6	1.2	0	1	2	4	6	5	5	75
8	I	61	HA		–	–	−0.1	2.1	0	2	2	2	6	6	4	86
9	J	62	C		−2.1	5.1	−0.6	4.3	0	2	2	3	6	6	4	99
10	S	40	Ld	+	−0.9	3.9	0.8	−0.8	0	2	2	4	6	6	5	23
11		57	Ld	+	−4.5	3.9	1.2	0.8	0	2	2	4	5	3	5	17
12		57	L		−2.0	4.0	0.3	2.9	0	1	1	3	6	3	4	22
13	I	44	Ld		−1.1	0.9	−0.8	0.9	0	2	5	3	5	5	5	54
14	I	50	Ld	+	−2.4	2.6	0.9	−0.6	0	4	2	2	6	5	5	36
15		49	Ld	+	−3.4	3.8	0.1	1.7	0	4	2	2	6	5	4	48
16	S	39	Ld		–	–	–	–	0	3	4	3	6	5	5	48
17	S	38	HA		–	–	–	–	0	2	2	1	6	5	4	69
18	I	36	C		–	–	–	–	Zone 2–3 mm	2	3	5	4	3	5	94
19		50	HA		−0.9	2.5	1.4	0.5	Prim disloc	4	3	4	6	6	4	59
20		43	Ld	+	−3.4	5.2	0.0	1.6	0	2	3	4	5	4	4	16
21	A	55	Ld		−1.7	7.1	1.0	0.8	0	3	2	4	5	4	5	48
22	I	56	Ld	+	−3.3	4.9	1.0	0.9	0	3	3	3	6	4	5	30
23	P	41	L		–	–	–	–	0	2	3	4	6	3	5	65
24		47	HA		–	–	–	–	0	3	3	6	6	6	5	85
25		48	HA		–	–	–	–	Revised (loose)	3	3	6	3	5	5	15/67
	Average	51								2.3	2.7	3.6	5.4	4.6	4.8	51

Previous operations: I Intertrochanteric osteotomy. S Subtrochanteric osteotomy. J Judet, acrylic prosthesis. S Shelf operation. A Adductor tenotomy. P Pelvic osteotomy. Prosthesis: C Charnley. HA Howse-Arden. L Lubinus. Ld Lubinus dysplasi.ROM: Range of motion.
The radiographic position is described in cm for the coordinates x and y before and following surgery. Eight hips were not evaluated due to previous operations and/or absence of AP pelvic films before operation or at follow-up.

Table 2. Published series of THA for arthrosis following CDH

Author	Year	Number of hips	Age at op (yr)	Follow-up (mo)	Number of bone grafted	Major complications	Improved hips
Charnley & Feagin	1973	27	36	>12	?	3/27	27/27
Hess & Umber	1978	22	48	37	9	2/17	20/22
Crowe et al.	1979	31	57	47	6	6/31	27/29
Fredin & Unander-Scharin	1980	20	50	18	11	4/20	18/20
Mendes	1981	7	49	32	5	2/7	7/7
Woolson & Harris	1983	55	46	55	37	11/55	44/55
Lund & Termansen	1985	21	50	51	8	1/21	21/21
Present study	1986	25	51	51	8	5/25	24/25

cm or more from the preoperative position (Figure 4). The only unsatisfactory outcome in these 13 hips was noted in the one moved 10 cm (Case 3, a female with postoperative deep-vein thrombosis and no signs of technical failure, loosening, or infection). There was no difference in walking ability among the 13 patients with hips that were corrected 3 cm or more and those corrected less. The same applied to Trendelenburg's sign preoperatively and postoperatively when compared with the grade of correction.

The patient's opinion about the result was excellent in 16 patients, good in 8 patients, and poor in 1 patient. The patient with a poor result was Case 3, a female aged 54 years who had improved walking ability and less pain, but she had decreased mobility. She had no signs of loosening or malpositioning; a postthrombotic swelling probably contributed to her disappointment.

There were no radiographic signs of loosening or infection in 16 patients at follow-up when a 2-mm zone of demarcation was accepted as normal. One patient had a 2-mm zone at the bone-cement border of the socket and a 3-mm zone at the femoral border, but no clinical signs of loosening. All eight bone grafts united without signs of resorption or change of position.

Discussion

The thin pelvic bone in congenital dysplasia or dislocation of the hip, the short and atrophic abductor muscles, and the narrow medullary canal of the femur must all be considered when total hip replacement is planned (Charnley & Feagin 1973). To normalize the position of the hip, shortening of the femur is required. Hess & Umber (1978) achieved sufficient support for the socket in 19 cases by controlled fracturing of the medial acetabular wall and bone grafting, whereas Harris et al. (1983) used a lateral bone graft from the resected femoral head in 55 hips. No late collapse of the grafted femoral head was seen in any of our cases or in the other 59 published cases (Table 2). We were able to bring down almost all the sockets to the original true acetabulum.

The postoperative risk of dislocation in dysplastic and dislocated hips is higher than in THA for primary arthrosis. Woolson & Harris (1983) noted 11 dislocations in 64 hips, whereas two occurred in our 25; Lund & Termansen (1985) had none in 21 hips.

Pain is the most important indication for THA in these patients, as in primary arthrosis. However, both back and hip pain should be assessed in patients with high dislocated hips and compensating lordosis. Limp and limited range of motion alone are not indications for surgery.

During the mean observation period of 5 years in this material, no correlation was found between the change in position before and after surgery and the functional end results.

This type of reconstruction problem is not common and will probably be reduced even further by careful hip examination of all newborn and early treatment of CDH. Because of the complexity, these operations should be performed in special centers where facilities also exist to store a large selection of implants of straight and narrow design.

Dysplasia is described as the inclination of the pelvic acetabulum to a transverse line (Sharp 1961) or the angle between the lateral edge to the head center and a vertical line (Wiberg 1939). Both methods describe sufficiently the borderline between the dysplastic and the normal acetabulum, but they do not point out the functional center of the hip, which is essential for determining the "high dislocations." The method described used an AP pelvic radiograph for an exact determination of the position of the femoral head as compared with a calculated "normal" position in an x-y coordinate diagram. The position of both the preoperative dysplastic and the postoperative artificial hip permits comparisons of different materials of patients and evaluations of performed surgery.

Lund & Termansen (1985) performed THA in the "congenital" position of the hip joint and attached a lateral bone graft to the soft tissues in 8 patients. They concluded that this healed well in the achieved position, although no fixation was used. All patients except 1 were mobilized directly following surgery, but unfortunately the grade of loading is not discussed. The need of such a graft for the first postoperative period seems doubtful if full weight-bearing is permitted, but it might be important for the late results. Although the "original" acetabulum has not been loaded for 40–60 years when performing a corrected THA, the strength of the bone seems to be as sufficient for the artificial hip as for the neoacetabulum. All of these bone grafts, although stabilized by screws, seemed to heal in achieved positions

(Table 2). The importance of changed muscular balance when the hip is moved downwards is more difficult to evaluate than the measurements of bone angles. It is impossible to compare the functional results without having an exact position of the joint, and to date the base for this is missing in the published series.

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