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OSTEOTOMY IN OSTEOARTHRITIS OF THE HIP-JOINT

A Follow-up Study

By

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THEORETICAL CONSIDERATIONS

The clinical picture of osteoarthritis of the hip is well recognized and characterized by pain and restriction of motion. At an early stage the symptoms are temporary, later chronic disturbances may cause severe disabilities. The discrepancy between the clinical and radiographic appearance is sometimes striking and the prognosis is hardly predictable (*Danielsson*). Surgical interventions will have to rely entirely on the evaluation of the patient's situation, the need changing for each individual person.

The pathomorphologic features are well recognized; the damage to the cartilage (*Chung*) gives rise to a number of phenomena, osteophytes and subchondral bone disturbances (*Pommer, Lang, Sawyer* and *Ghormley, Trueta*), intraosseous circulatory disorder (*Trueta, Hulth*), presence of granulation tissue (*Harrison, Schajowicz, Trueta*) and nerve elements close to erosion areas in the cartilage (*Miller and Kasa-hara*) and inflammatory reaction in the synovial tissues. Some physiochemical properties of blood from osteoarthritic joints have also been claimed to differ from normal (*Katayama et al.*).

There has long been evidence that cartilage can suffer from mechanical forces interfering with the physical properties of the joint surfaces. Inadequate pressure per unit cartilage area causes residual deformations of longer duration. This appears to be the case in joints where incongruency exists (*Wiberg, Hirsch, Steindler*). But even between congruent surfaces some areas are more subjected to pressure than

others. In the hip joint the pressure area is located towards the anterior superior part of the femoral head (*Trueta, Frankel, Rydell*). This is the place where early pathoanatomical changes start (*Trueta*).

All this information has yet not yielded a complete understanding of the mechanism of pain. However, attempts have recently been made to utilize the presence of subchondral tissue reactions with its nerve supply into a theory of pressure sensitive areas (*Hirsch*). Force measurements obtained from a replacement femoral head prosthesis indicated the magnitude and direction (*Rydell*). The findings suggested that the compression area of the femoral head hardly escaped mechanical strain. Walking at an increasing speed increased the force while the use of a cane and slow movements gave a marked relief. Once the compression area due to its pathology has become increasingly sensitive clinical symptoms appear. It then seems logical to look for measures by which the pressure should be decreased or distributed in other ways, allowing sensitive areas to escape to a certain extent the mechanical strain.

Clinical experience from various surgical interventions may well fit into such a mechanical way of explaining favourable results. Since the stress distribution is a function of body weight and the anatomical shape of the upper femur and muscle action, procedures such as myotomies, tenotomies, or neurotomies will alter the mechanical conditions. A similar result might arise if the anatomical relationships are altered by an intertrochanteric osteotomy. Both these procedures, muscle release and osteotomy might introduce other areas as pressure zones where none or less sensitive bone destruction is present. If the pressure zone on the femoral head as indicated above is rather limited the degree of clinical result in terms of less pain would then depend upon the type of pathology that is introduced to take over the mechanical strain. Early interventions, that is to say, in less advanced cases with good mobility would adjust the joint, preoperative limitation of movement may not.

Other theories trying to explain the effect of osteotomy take into consideration not only changing but mainly increasing the area of weight bearing whereby the pressure per unit area decreases (*Pauwels*). This leads to different types of angulation osteotomies based on mainly the evaluation of the X-rays.

CLINICAL MANAGEMENT AND
REPORTED RESULTS

To achieve a reduction of compressive forces upon the joint Pauwels stated that a release of musculature acting on the joint should be performed. Moreover a procedure increasing the weight-transmitting area of the articular surfaces, which consequently should reduce the pressure per unit area in the joint should also be carried out. By an intertrochanteric osteotomy with upward and medial displacement of the femoral shaft as described by McMurray the adductors and iliopsoas muscles are claimed to relax and thus the reduction of muscular force on the joint is obtained. The weight-transmitting area is, however, not changed and accordingly an additional procedure has to be done which entirely depends on the preoperative position of the femoral head. If on radiographs it is estimated that to increase the weight-transmitting area it becomes necessary to turn the head medially an adduction osteotomy is performed. If, however, a lateral tilt of the head is required to increase the weight-bearing area an abduction osteotomy is carried out. In both procedures internal fixation is made. In more than 400 osteotomies done according to the above principles Pauwels (1951-1963) found the results most reliable, permanent and in many cases surprisingly good.

Müller, Nissen, Harris and Kirwan among others reporting very good results advocate intertrochanteric osteotomy with internal fixation in cases of hip-joint osteoarthritis. According to these authors post-osteotomy radiological improvement has shown that osteotomy can produce arrest and partial healing of the disease. In consequence it was therefore suggested (*Nissen*), that osteotomy be carried out at a much earlier stage. This assumption has been substantiated by the investigation of *Harris and Kirwan* who compared the results of osteotomy in two series of patients the one having osteotomy early (58 years: at least 90 degrees flexion; no radiographic evidence of collapse of bone), the other late (65 years: flexion reduced to between 60 and 90 degrees without collapse of bone or 90 degrees flexion but some collapse of bone). They found that early osteotomy seldom fails to give relief of pain (95 per cent) and that in 70 per cent convincing evidence of regression indicating arrest of the arthritic process was obtained. Improved function of the joint followed this, investigated and proved by *Shepard*.

During recent years the operative technique has varied. These has been

a discussion as to how the osteotomy should be performed. The devices for internal fixation have also changed. We have only recently adopted compression methods. Certainly the procedure can be further improved.

It is obvious that surgery when discussed in terms of redistributing acting mechanical forces does not consider all the pathoanatomical conditions that may be of importance. However, many of the reports mention not only freedom of pain and improved function but also effects on the postoperative radiographic appearance, claiming that the osteoarthritic process in itself can be repaired. It is often claimed that other than pure mechanical events follow osteotomies such as improved circulation and favourable metabolic effects.

In trying a surgical procedure it is certainly important to justify the intervention by pathophysiological explanations, but this is not enough to encourage the use of the method unless the results from a pure therapeutic point of view satisfy the patient. In this report we have therefore restricted ourselves to see what we have accomplished clinically.

In 1960 one of us (*Hirsch*) studied the results obtained in late osteoarthritis by intertrochanteric osteotomies. Complete relief of pain was obtained in only 30 per cent but 80 per cent claimed an improvement. The mobility of the hip-joint did not increase and the radiographic appearance did not alter. As other reports have mentioned good results both clinically and radiographically we thought it necessary to reconsider the problem and therefore we carried out a follow-up examination of osteotomized patients from 1961 through 1965. Our main interest was centered on the following questions:

Age at onset of disease.

Age at osteotomy.

Functional and sociomedical disturbances preoperatively.

Type of internal fixation of osteotomy and its influence on the postoperative process.

The influence of the time for postoperative mobilization on end result.

Complications with regard to type of internal fixation.

Overall end results of osteotomy:

pain

mobility

walking

work capacity

radiographic appearance

PRESENTATION OF MATERIAL

Age Distribution and Joint Affections

The material for this investigation consisted of 114 operated patients during the years 1961–1965. The 114 patients represented 123 operated hip-joints. Of these 102 were personally investigated by either one of us during 1966–1967.

Table 1. Operated hip-joints

Operated hip-joint	Male	Female	Total
Right	24	36	60
Left	28	35	63
Total	52	71	123
Both	3	6	

In 6 females and 3 males both hip-joints were operated. As is noticed there is an overrepresentation for females, 58 per cent compared to 42 per cent for the males but the distribution of side is fairly equal.

The distribution of age and sex (Table 2) in this material follows what is commonly reported in the literature (*McMurray, Gade, Pauwels, Harris and Kirwan, Milch, Tillberg*). The ages varied from 40 to 78 years with an average of 59.6 years for the males and 53.1 years for the females.

Table 2. Distribution of age and sex of patients at time for osteotomy.

Age	Male	Female	Total
40–50	10	12	22
50–60	21	20	41
60–70	20	18	38
70–80	3	10	13
Total	54	60	114

The age at which the first symptoms appeared in the patients is shown in Table 3.

The predominance for females in the younger age periods is noted. As is seen in Tables 2 and 3 the material contains patients with early

osteoarthritis which from the point of view of age can be well compared with the cases of early arthritis reported by *Harris* and *Kirwan* in whose early group the average age was 58 years and in the late group 65. The length of history before operation was also ascribed some importance by *Harris* and *Kirwan* who found that for the early group it was 4 years and 9 months and for the late 6 years and 3 months. In our series the length of history before operation was three and a half years for the 40-50 year group, six and a half to seven years for the 50-60 year group and about ten years for the 60-70 year group.

Table 3. Period of age for appearance of symptoms.

Age	Male	Female	Total
40-50	11	19	30
50-60	30	34	64
60-70	13	7	20
Total	54	60	114

All patients in this material presented osteoarthritis which in 91 patients was primary and in the remaining, secondary to other structural joint abnormalities. (Table 4).

Table 4. Structural joint changes prior to osteoarthritis.

Structural change	Male	Female	Total
Congenital dislocation	1	11	12
Dysplasia	1	3	4
Perthes' disease	2	—	2
Epiphyseolysis	1	1	2
Trauma	1	2	3
Total	6	17	23

COURSE OF DISEASE

The history of most patients was rather uniform though two definite types could be detected. One was a group of patients who had continuous suffering with constant weight-bearing pain and pain at rest. They amounted to 72. The other group had considerable suffering though of an intermittent type with short periods of alleviation. This was en-

countered in 42 patients. The daily activities of most patients were strongly limited due to the considerable pain which in many cases did not recede despite rest and analgesics. In 16 patients, however, some form of activity was necessary for the alleviation of pain, the most common being continuous flexion movements in the affected hip-joint. Most patients experienced pain on standing, walking, sitting and lying in bed. Prior to osteotomy hospital admission for various types of therapy—including operative—had been necessary for 31 patients of which no less than 15 had been subjected to such surgical measures (Table 5).

Table 5. Types of surgical procedure in hip-joints prior to osteotomy.

Surgical procedure	Male	Female	Total
Voss operation	2	3	5
Exaeresis of obturator nerve	2	5	7
Coagulation of vessels and nerves	1	—	1
Osteomyelotomy	—	2	2
Total	5	10	15

Long-term stays in convalescent homes were common and previous surgery had in all instances been followed by conservative treatment like that which patients had received who had not undergone surgery such as physio-therapy (88 patients), baths (37), X-ray treatments (57), intraarticular injections (44), and medicines of various types. Of these acetylsalicylic acid was the most common (97 patients) and generally formed the basic drug which was supplemented periodically by other adjuvants such as morphine and derivatives (10 patients), muscle relaxants (10), antiphlogistic agents (17), and sedatives (8).

As the sick history of all patients had lasted for some years before the osteotomy they had had time to adjust themselves to the ailment and the limitations it imposed on their mobility and daily activities. The condition immediately prior to operation was in general good. 109 patients could look after themselves and partake in easier home life activities without too great difficulty. The work capacity on the other hand was very limited and at the time of operation only 33 were fully at work.

OPERATIVE PROCEDURE AND
POSTOPERATIVE COURSE

Number of Osteotomies and Methods

The operative method was mostly an intertrochanteric osteotomy with internal fixation according to *Kessel, Tupman, Blount* or *Wainright* respectively. In some cases no internal fixation was used. The number of osteotomies and choice of method are represented in Table 6.

Table 6. Osteotomies during 1961-65 and choice of method.

Year	Choice of method										Total
	Kessel		Tupman		Blount		Wainright		Other		
	M	F	M	F	M	F	M	F	M	F	
1961	-	1	3	4	1	-	3	9	-	-	21
1962	3	2	9	4	-	1	6	4	2	-	31
1963	-	2	2	3	1	1	9	9	-	-	27
1964	-	-	1	-	-	-	7	21	-	-	29
1965	-	-	-	2	-	-	7	6	-	-	15
Total	3	5	15	13	2	2	32	49	2	-	123

M = male. F = female.

Incision

As for the soft tissue technique a few variations were employed, the importance of which became evident in the immediate postoperative course. The incision was in most cases (116) directed obliquely from the anterior superior iliac spine to the trochanter and then continued distally for some 15 cm. In the remaining seven a straight vertical incision above and below the trochanter was used. The tensor fasciae latae was in all cases incised along the fibre direction and then cut at a right angle below the greater trochanter to release tension. The vastus lateralis was in 23 cases dissected free from its origin at the greater trochanter and gently pushed anteriorly. In 73 cases the same muscle was split in the middle along the fibre direction. No information was given as to muscular incision in the remaining 27 operations.

Osteotomy

The osteotomy was performed above the lesser trochanter in 111 cases, right through it in 5 and below in 7. The shaft of the femur was dis-

placed medialward. The degree of medial displacement as judged by radiographs was 2 ± 0.5 cm.

The instruments by which the osteotomies were carried out varied but on further investigation it did not become evident that either procedure had any influence on healing, stability, contact of resection areas or later course. It was for some time thought that the use of a high speed electric saw might cause a necrosis of bone due to the emission of heat but this could in no way be proved. In 13 cases an ordinary chisel was used, in 91 an electric saw and in 19 a Gigli saw.

Fixation

It was thought very important at the time of operation to achieve as stable a fixation and as good a bone contact as possible. In 95 cases the fixation was considered stable, in 4 rather dubious and in 2 very bad. Information about the remaining 22 is lacking. The two cases with bad fixation healed completely in due course. In these series compression devices were not applied.

The osteotomy contact was good in 90 cases, acceptable in 29 and bad in 4. In two of these in which the contact was bad pseudarthrosis developed but on the other hand delay in union (see Table 15) occurred in cases where the surgical procedure was thought to be adequate.

Postoperative Immobilization

The postoperative immobilization was in the beginning of the period very rigid with the patients in a hip spica for some 4–6 weeks. This was used in 25 patients. The remainder only had a plow in bed abducting their legs. The time in bed postoperatively differed greatly depending on varying opinions on early activity. The mean value of number of days spent in bed was 18.1 ± 10.5 . The standard deviation is no doubt great but easily explicable by the fact that it was believed that the stable fixation and good osteotomy-contact were sufficient to justify early rising from bed. As will be noticed in the paragraph on complications this policy was not remunerative in the long run.

Mobilization

Postoperative mobilization *i.e.* walking exercises after termination of bedrest, was carried out in different stages the first being walking without weight-bearing on crutches, the second weight-bearing with

crutches and finally the third free walking. The mean value in days of the first period was 16.8 ± 2.4 . Those patients who no longer needed crutches or canes postoperatively stopped using them about the fifth month postoperatively.

Postoperative Complications

Immediate complications postoperatively were clinically manifested thrombosis and wound infection. The criteria for the former group were elevated pulse rate and temperature and calf tenderness; for the latter group discharge from the wound with positive bacterial growth on culture. The observations are listed in Table 7 and divided into groups according to method used.

Table 7. Immediate postoperative complications.

Complication	Kessel = 8	Tupman = 28	Blount = 4	Wainright = 81	Other = 2	Total = 123
Clinically manifested						
thrombosis	—	7	—	25	1	33
Infection	2	3	—	6	1	12

Because of the different sizes of the groups representing various fixation techniques a comparison of the frequencies becomes futile. Certain conditions predisposing to thrombosis may, however, be mentioned *e.g.* age and nutritional state of patient, technique of incision and the surgical wound behaviour, postoperative haematomas, type of immobilization, time for institution of and energy of physiotherapy, period of bedrest and preoperative use of anticoagulants. In our series we noted a slight tendency to high thrombosis frequency in those cases where the vastus lateralis had been split lengthwise through the muscle mass. Thrombosis was also met frequently in those patients who were postoperatively immobilized in plaster. The observations, however, are made on too small a material to become significant but may nevertheless serve as a possible explanation for the formation of thrombosis. The rate of infection is higher than is commonly seen in a surgically treated material but the true culprit besides the bacteria is difficult to pursue. Most of these followed an innocent course excepting one patient who died from general sepsis.

FOLLOW-UP

The follow-up was carried out during 1966 and 1967 thus with a longest observation time of 5 years and a shortest of 18 months. Of the 114 operated patients 102 were followed-up. 12 could not be examined for various reasons as seen in Table 8. Each patient was personally approached by one of us and questioned according to a special questionnaire and also physically examined. The number of followed-up hips was 110 as seen in Table 9.

Table 8. Reasons for exempted follow-up.

Reason	Male	Female	Total
Death			5
Cancer	1	—	
Circulation	1	2	
Postop. sepsis	1	—	
Living abroad	1	—	1
Not traced	1	2	3
Refusal to present at follow-up	1	2	3
Total	6	6	12

Table 9. Followed-up hip-joints after osteotomy.

Operated hip-joint	Male	Female	Total
Right	21	33	54
Left	25	31	56
Total	46	64	110

12 patients representing 13 hip-joints have not been followed-up.

Table 10. Spontaneous pain.

	Male	Female	Total
Improved	40	45	85
Unchanged	1	4	5
Deteriorated	5	7	12
Total	46	56	102

Table 11. Weight-bearing pain.

	Male	Female	Total
Improved	33	38	71
Unchanged	5	11	16
Deteriorated	8	7	15
Total	46	56	102

The relevant questions for the follow-up in this investigation were a) spontaneous pain, b) weight-bearing pain, c) mobility from subjective and objective points of view, d) walking capacity, e) work capacity and f) general subjective evaluation.

Mobility

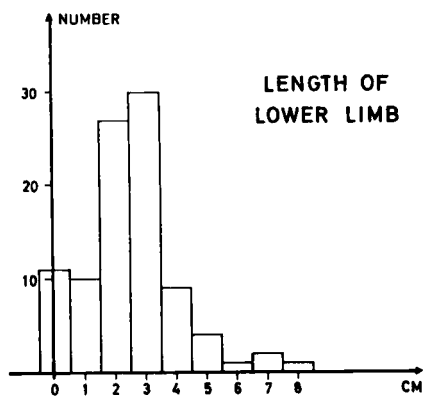
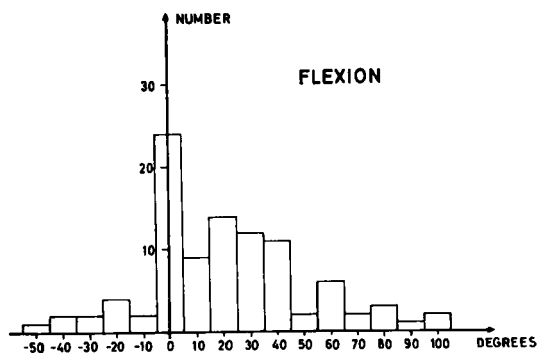
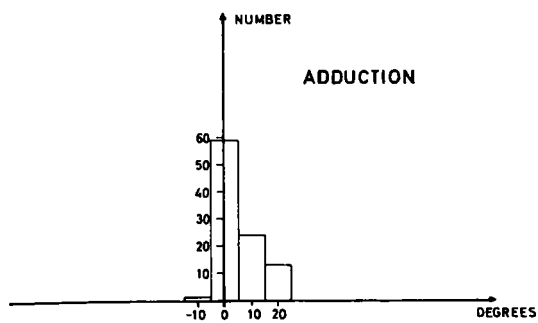
This was indicated in two ways, the first being the patient's subjective evaluation of his postoperative mobility. Great importance was paid to the patient's own estimation of his ability to put on and take off shoes, to tie shoestrings, to put on stockings, to sit comfortably both at home and in cars, and finally to climb tramcars and buses. The results are seen in Table 12.

Table 12. Subjective evaluation of postoperative hip-joint mobility

	Male	Female	Total
Improved	21	16	37
Unchanged	6	20	26
Deteriorated	17	22	39
Total	44	58	102

The second way of approach was an objective estimation of the difference in mobility before operation and after operation. At this investigation the length of the lower limb was measured. The following variables were thus studied and the values before and after operation compared; length of lower limb; flexion; adduction; abduction; outward rotation and space inward rotation. The distribution of frequency for each quality is seen in Figures 1-7.

The values have been subjected to statistical analysis according to Student's *t*-test. The test has been carried out on the 5 per cent level.

*Fig. 1.**Fig. 2.**Fig. 3.*

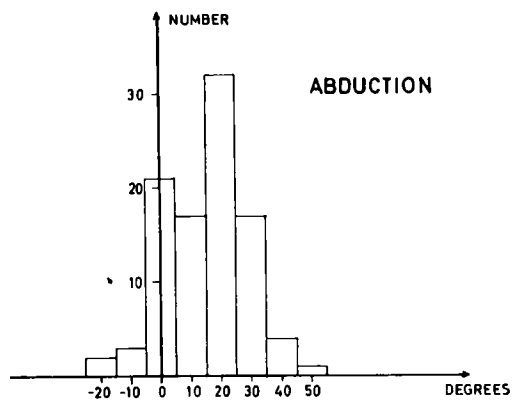


Fig. 4.

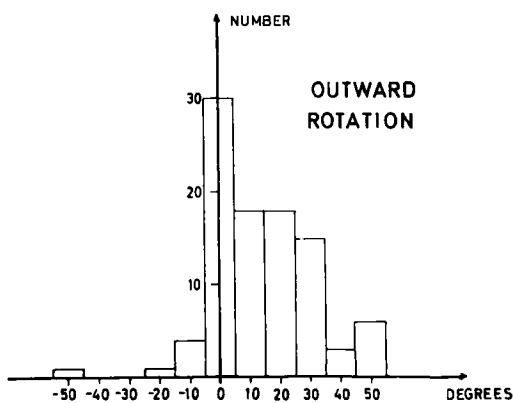


Fig. 5.

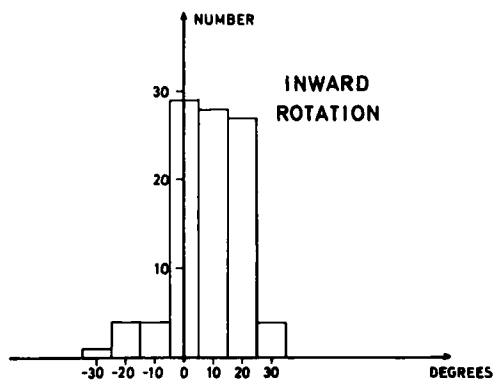


Fig. 6.

Summarizing the analysis it can thus be said that the difference of values before and after operation are significantly greater than zero *i.e.* all variables show less values after operation. On the 5 per cent level the following results were obtained.

Length of lower limb: difference is between 2 and 3 cm. See Figure 1.							
Flexion:	"	"	"	10	"	20°	"
Adduction:	"	"	"	0	"	5°	"
Abduction:	"	"	"	10	"	20°	"
Outward rotation:	"	"	"	10	"	20°	"
Inward rotation:	"	"	"	0	"	10°	"

Walking Capacity

This was mostly dependent on the use of a cane. Therefore it was thought appropriate to estimate the ability for walking in correlation to the use of the cane pre- and postoperatively as shown in Table 13.

Table 13. Walking capacity as related to the use of cane.

	Before operation	After operation	
		with cane	without cane
Use of cane	65	55	10
No use of cane	42	25	17

In judging the walking ability of osteotomized patients it soon becomes evident that the true nature of their gait is not disclosed unless a very penetrating interrogation is tactfully carried out. To many the use of a cane becomes such an ingrown habit that walking with it is not looked upon as an aid to facilitate each individual step. On attempting to walk without a stick the patient, however, becomes aware of the difficulties her gait then gives her. The most common factors met in this material were the weightbearing pain and the limp secondary to the shortening of the lower limb. Indoor walking was easier than outdoors and on interrogation it was found that the patients generally walked with the aid of chairs, tables and other objects in the home which could give some support. It was surprising to find how many patients (32) had a scheduled route to follow on moving from one part of the home to the other.

Work Capacity

On perusing the material in general the following results were obtained, Table 14, which is a rough estimate of the patients' own opinion of their capacity to carry out work with which they had preoperatively been occupied or a new occupation into which they had been introduced postoperatively.

Table 14. Work capacity.

	Male	Female	Total
Improved	15	21	36
Unchanged	10	22	32
Deteriorated	19	15	34
Total	44	58	102

Complications

The complications met in the later postoperative course were pseudarthrosis and fracture of the instrument for internal fixation, Table 15.

Table 15. Late postoperative complications.

Complication	Kessel = 8	Tupman = 28	Blount = 4	Wainright = 81	Other = 2	Total = 123
Pseud-arthritis	1	3	1	11	—	16
Fracture of fixation instrument	2	2	—	3	—	7

The rate of pseudarthrosis seems at least partly to be related to the length of postoperative stay in bed.

Thirteen of the total 16 pseudarthrosis cases had postoperative immobilization in bed of considerably shorter duration than the mean average. This was estimated at 18.1 days with a deviation of ± 10.5 days. The thirteen pseudarthrosis cases remained in bed for 9–12 days.

All pseudarthrosis cases were reoperated. In ten of these the non-united area was bonegrafted. In the remainder the area was drilled. Fifteen have healed completely whereas one despite bonegrafting remained nonunited.

The fractures of the fixation instrument were interpreted as metal

fatigue. Some patients whose osteotomies had satisfactorily healed experienced pain of another type than that of osteoarthritis. It became evident that the internal fixation instrument could cause discomfort and therefore the fixation material was extracted in a number of cases as seen in Table 16.

Table 16. Extraction of fixation instruments due to pain.

Kessel = 8	Tupman = 28	Blount = 4	Wainright = 81	Total = 123
3	14	1	14	32

All these patients were relieved of their pain after extraction.

Subjective Evaluation

How the patients experience the operation and how they appreciate their postoperative condition is seen in Table 17.

Table 17. Subjective evaluation of postoperative condition.

	Male	Female	Total
Satisfied	38	43	81
Not satisfied	15	6	21
Total	53	49	102

Thus the great majority was satisfied with the results of the operation despite weightbearing pain, certain limitation in daily activities, minor decrease in mobility and limp on the operated side. On further analysis it became evident however that the greatest appreciation was due to the abolition of spontaneous pain. The patients could enjoy a night's good sleep without being disturbed by pain and sitting was no longer an obstacle in social life. The appreciation of this was so great that other discomforts secondary to operation were almost ignored.

Radiographic Appearances

We have tried to evaluate the radiographs. The pictures vary to a great extent and there is very little correspondence between what could be

seen on X-ray and the clinical results. Rarely did the joint space increase nor did sclerosis or cystic formations disappear.

SUMMARY

On 114 patients with osteoarthritis of the hip joints 123 hips were operated with intertrochanteric displacement, osteotomy and internal fixation according to Kessel, Tupman, Blount or Wainright.

A follow-up was carried out 18 months—5 years following surgery in 102 patients, representing 110 hips. Good results were obtained in 82.3 per cent. The improvement was most pronounced in patients with constant pain at rest.

Weight-bearing pain was diminished in 72.5 per cent but a majority had to use a cane postoperatively.

The mobility had improved or remained unchanged in 64.7 per cent but deteriorated in 38.2 per cent.

Pseudarthrosis was encountered in 13 per cent and all have been reoperated with a good result excepting one patient.

The technique used ended with the neck of the femur in varus. Shortening of the lower limb was seen in all patients and experienced as great discomfort.

It is felt that improved internal fixation offering more accurate and reliable fixation should decrease the rate of pseudarthrosis and unexpected positions.

RESUME

Chez 114 malades souffrant d'ostéoarthrite de l'articulation de la hanche, 123 hanches ont été opérées par déplacement intertrochantérique, ostéotomie et fixation interne selon Kessel, Tupman, Blount et Wainright.

Un réexamen a été pratiqué entre 18 mois et 5 ans après l'intervention chirurgicale chez 102 malades représentant 110 hanches. De bons résultats avaient été obtenus dans 82,3 pour cent des cas. L'amélioration a été la plus marquée chez les malades qui avaient des douleurs constantes même au repos.

La douleur provenant du port du poids du corps a été diminuée chez 72,5 pour cent mais une majorité des malades ont été obligés de se servir d'une canne après l'opération.

La mobilité s'est accrue ou est restée inchangée dans 64,7 pour cent

des cas mais elle a été diminuée dans 38,2 pour cent. On a rencontré une pseudarthrose dans 13 pour cent et tous ces cas ont été réopérés avec un bon résultat à l'exception d'un seul malade.

La technique utilisée a abouti au placement en varus du col du fémur. Un raccourcissement du membre inférieur a été constaté chez tous les malades ce qui est ressenti comme un grave inconvénient.

On a l'impression qu'une fixation interne améliorée comportant une fixation plus minutieuse et plus stable devrait pouvoir diminuer le nombre des pseudarthroses et les positions inattendues.

ZUSAMMENFASSUNG

Bei 114 Patienten mit Arthrosis deformans der Hüftgelenke wurden 123 Hüften mittels intertrochanterer Verschiebungsosteotomie und interner Fixierung nach *Kessel, Tupman, Blount* und *Wainright* operiert.

Eine Nachuntersuchung wurde 18 Monate bis 5 Jahre nach der Operation an 102 Patienten mit 110 Hüften durchgeführt. Gute Ergebnisse wurden in 82,4 Prozent erhalten. Die Besserung war am meisten bei Patienten mit konstanten Ruheschmerzen ausgesprochen.

Belastungsschmerzen waren bei 72,5 Prozent verringert aber die Mehrheit musste nach der Operation einen Stock gebrauchen.

Die Beweglichkeit war in 64,7 Prozent gebessert oder unverändert geblieben, war jedoch in 38,2 Prozent verschlechtert.

Pseudarthrose wurde bei 13 Prozent angetroffen und alle diese wurden, absehen von einem, mit gutem Ergebnis reoperiert.

Die verwendete Technik endete mit dem Schenkelhals in Varusstellung. Verkürzung der unteren Gliedmasse wurde bei allen Patienten beobachtet und wurde als eine grosse Belästigung empfunden.

Man ist der Meinung, dass eine verbesserte interne Fixation die eine genauere und verlässlichere Ruhigstellung darbietet, das Vorkommen von Pseudarthrosen und unerwarteten Stellungen herabsetzen sollte.

REFERENCES

- Blount, W. (1952) Proximal osteotomies of the femur. Instructional course lecture. *Amer. Acad. Orthop. Surg.* 9, 1.
- Blount, W. (1964) Osteotomy in the treatment of osteoarthritis of the hip. *J. Bone Jt Surg.* 46-A, 1297-1325.
- Chrisman, O. D., Fessel, J. M. & Southwick, W. O. (1963) The effects of cartilage homogenates and their components on peripheral joint structures. *J. Bone Jt Surg.* 45-A, 1541.

- Chung, E. B. (1966) Aging in human joints. *J. nat. med. Ass.* **58**, 2.
- Danielsson, L. G. (1964) Incidence and prognosis of coxarthrosis. *Acta orthop. scand. Suppl.* 66.
- Frankel, V. (1960) The femoral neck. Almqvist & Wiksell Boktryckeri AB, Stockholm.
- Gade, H. G.: (1947) A contribution to the surgical treatment of osteoarthritis of the hip-joint. *Acta chir. scand. Suppl.* 120.
- Harris, N. & Kirwan, E. (1964) The results of osteotomy for early primary osteoarthritis of the hip. *J. Bone Jt Surg.* **46-B**, 477-487.
- Harrison, M. H. M., Schajowicz, F. & Trueta, J. (1953) Osteoarthritis of the hip. A study of the nature and evolution of the disease. *J. Bone Jt Surg.* **35-B**, 4.
- Hirsch, C. (1944) The pathogenesis of chondromalacia of the patella. *Acta chir. scand. Suppl.* 83.
- Hirsch, C. (1960) Intertrochanteric osteotomies in osteoarthritis of the hip. *Acta orthop. scand.* **30**, 129-136.
- Hirsch, C. (1966) Stress-strain and sensory mechanism in painful hips. Steindler Award Lecture. *J. Bone Jt Surg.* **48-A**.
- Hulth, A. (1958) Circulatory disturbances in osteoarthritis of the hip. *Acta orthop. scand.* **28**.
- Katayama, R., Itami, Y., Hasegawa, Y., Inue, T., Honma, M., Yonemoto, K., Nakagawa, I., Kawata, T & Yamashita, Y. (1965) Pathology and clinic of osteoarthritis of the hip: *Tokyo jikeikai medical journal.* **80**.
- Lang, F. J. (1934) Arthritis deformans und Spondylitis deformans. *Handbuch der speziellen pathologischen Anatomie und Histologie.* Henke-Lubarsch. **IX**:2, p. 254.
- Lloyd-Roberts, G. C. (1953) The role of capsular changes in osteoarthritis of the hip-joint. *J. Bone Jt Surg.* **35-B**, 627.
- Lindström, N. (1950-51) Arthroplasty and arthrodesis in arthrosis deformans coxae. A post-investigation. *Acta orthop. scand.* **20**, 242.
- McFarland, B. L. (1957) Osteoarthritis of the hip. 7e Congrès International de Chirurgie Orthopédique. p. 811. Brussels: Imprimerie des Sciences.
- McMurray, T. P. (1935) Osteoarthritis of the hip-joint. *Brit. J. Surg.* **22**, 716.
- Matumoto, Y. & Mizuno, S. (1966) Rate of the blood flow in the femoral head. A new measuring procedure and its clinical evaluation. *Med. J. Osaka University* **16**, 4.
- Miller, M. R. & Kasahara, M. (1963) Observations on the innervation of human long bones. *Anat. Rec.* **145**, 1.
- Milch, H. (1965) Osteotomy of the upper end of the femur. The Williams and Wilkins Co., Baltimore.
- Müller, M. E. (1957) Die hüftnahen Femurosteotomien 151, Stuttgart, Georg Thieme Verlag.
- Nissen, K. I. (1960) The arrest of primary osteoarthritis of the hip. *J. Bone Jt Surg.* **42-B**, 423.
- Nissen, K. I. (1963) The arrest of early primary osteoarthritis of the hip by osteotomy. *Proc. roy. Soc. Med.* **56**, 1051-1060.
- Nissen, K. I. (1964) Un cas d'ostéarthrite primitive débutante de la hanche traitée par ostéotomie avec déplacement minime. *Acta orthop. belg.* **30**, 651-662.
- Pauwels, F. (1963) Basis and results of an etiological therapy of osteoarthritis of the hip-joint. IXème Congrès de la Société Internationale de Chirurgie Orthopédique et de Traumatologie Tom II, pp. 31-50, Wien.

- Pommer, G. (1913) Mikroskopische Befunde bei Arthritis deformans. Mitteilungen aus dem Pathologisch-Anatomischen Institut der K.K. Universität Innsbruck.
- Pommer, G. (1927) Über die mikroskopischen Kennzeichen und die Entstehungsbedingungen der Arthritis deformans. *Virchows Arch. f. path. Anat.* **263**, 434.
- Rosborough, D. & Stiles, P. J. (1966) The problem of union following intertrochanteric osteotomy with internal fixation for osteoarthritis of the hip. *J. Bone Jt Surg.* **48-B**.
- Rydell, N. (1966) Forces acting on the femoral head-prosthesis. *Acta orthop. scand.*, Suppl. 88.
- Sawyer, M. H. & Ghormley, R. K. (1941) Pathologic study of hypertrophic arthritis of the hip. *Surgery* **9**, 381.
- Shaw, N. E. & Harris, N. (1960) Treatment of osteoarthritis of the hip by myelotomy. A preliminary report. *Proc. roy. Soc. Med.* **53**, 949.
- Shepard, M. M. (1960) A further review of the results of operation on the hip-joint. *J. Bone Jt Surg.* **42-B**, 177.
- Steindler, A. (1955) Kinesiology of the human body. Charles C. Thomas Publisher, U.S.A.
- Tillberg, B. (1966) Resultat av intertrochantär valgusosteotomi vid höftarthros. Nord. Ortop. Förening, Göteborg, Juni 1966.
- Trueta, J. (1963) Studies on the etiopathology of osteoarthritis of the hip. *Clin. orthop.* **31**, 7-19.
- Trueta, J. & Harrison, M. H. M. (1953) The normal vascular anatomy of the femoral head in adult man. *J. Bone Jt Surg.* **35-B**.
- Trueta, J. & Lima, C. (1959) Ageing and osteoarthritis. *Geront. Clin.* **1**.
- Wiberg, G. (1939) Studies on dysplastic acetabula and congenital subluxation of the hip joint with reference to the complication of osteoarthritis. *Acta chir. scand.* Suppl. 57.
- Wiberg, G. (1941) Roentgenographic and anatomic studies on the femuro-patellar joint. *Acta orthop. scand.* **12**.