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COMPRESSION OSTEOSYNTHESIS BY THE McLAUGHLIN APPARATUS IN INTERTROCHANTERIC DISPLACEMENT OSTEOTOMY

Results in 186 Cases of Osteoarthritis of the Hip

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Intertrochanteric displacement osteotomy is used to a marked extent, and with good results, in the treatment of mild and moderately severe osteoarthritis of the hip. However, non-union at the osteotomy site is still an important and common problem. Collecting 9 publications from 1962-1967 on 821 osteotomies, Jerre & Tilling (1969) found an average rate of non-union amounting to 9.5 per cent (3-28), although a number of different osteosynthesis materials had been used.

Below, the results of compression osteosynthesis by the McLaughlin apparatus will be reported.

METHOD

Through a lateral approach the vastus lateralis muscle is detached by a diathermy knife from the femur along the lateral part of the superior edge and the posterior edge. With a Gigli saw the femur is divided (plane surface) from the upper edge of the lesser trochanter in the oblique, lateral-distal direction, the osteotomy forming an angle of about 105° with the long axis of the femur. Before the compacta is sawn laterally, a three-flanged nail is driven into the neck and head of the femur through a triangular hole chiselled into the lateral aspect, below the greater trochanter and just above the osteotomy line. However, the last 1½ cm are not driven in. The plate is then fixed to the nail by the top screw and to the lateral aspect of the femur by 3 screws. Not until then is the osteotomy completed. It must be entirely straight. Then the remaining part of the nail is driven in by a hammer, striking direct on the head of the top screw. At the same time, the shaft of the femur is displaced medially and proximally into the direction of the nail. This gives a marked compression upon the osteotomy site, the nail and osteotomy forming a medially open angle. Only a moderate displacement is obtained, one-

Table 1. Number of intertrochanteric displacement osteotomies by sex and age.
Displacement osteotomies

		Right-sided	Left-sided	Bilateral
♀	82	48	34	11
♂	104	61	43	12
Total	186	109	77	23

Table 2. Number of simple and angled intertrochanteric displacement osteotomies fixed by McLaughlin's apparatus.

Displacement osteotomies	132
Angled displacement osteotomies	
varus	41
valgus	7
varus-backwards	4
backwards	2
Total	186

quarter of the diameter of the bone, but in return the contact surface is wide. This affords the great advantage that throughout the operation the two fragments are in firm contact. It is only in the relatively few cases in which correction osteotomy is to be performed that it is necessary, after driving in the nail, to saw the bone right through in order to be able to remove a wedge of the bone. In these cases too, however, compression osteosynthesis is carried out, the last part of the nail not being driven in until the plate has been fixed to the nail by the top screw and to the femur by screws. After the vastus lateralis has been sutured and the wound closed, the leg is placed on a Braun splint.

On the day after the operation the patient is taken out of bed into a chair, and from about the 10th day he is ambulated with elbow canes, without weight-bearing on the operated leg, but he is allowed to touch the floor with his foot. When the patient is able to manage simple duties he is discharged, as a rule in 3-4 weeks, and seen in the out-patient department 3 months after the operation. If X-rays show union of the osteotomy, full weight-bearing is allowed. Since empirically varus osteotomies show less tendency to unite, they are seen 6 and 12 weeks after the operation. No patient is ever allowed full weight-bearing until radiological union has occurred.

MATERIAL

From 1st August 1965 to 1st January 1970 a total of 186 osteotomies were done on 163 patients (23 bilateral cases), 109 on the right and 77 on the left hip (Table 1). The patients ranged in age from 30 to 72 years. 83 per cent were over 50. Of the operations 132 were simple displacement osteotomies, 41 varus and 7 valgus

osteotomies. In 6 cases a flexion contracture was corrected by wedge osteotomy, the base of the wedge facing backward. Four of these patients also had varus osteotomy (Table 2).

RESULTS

The result in respect to union was assessed 10 months to 5 years after the operation (Table 3). In 153 cases there was clinical and radiological union 3 months after the operation. All the angulation osteotomies united in less than 6 months. Out of the simple displacement osteotomies 4 had not united until at 7 months. Two of them had secondarily become displaced into varus and one into unintended varus. One patient did not present himself until 11 months after the operation. There was radiological union, and the patient had subjected the leg to full weight-bearing and had been working from 3 months after the operation.

Only one case did not exhibit primary union. After simple displacement osteotomy a 54-year-old woman showed primary diastasis at the osteotomy site, there being a small, laterally open angulation be-

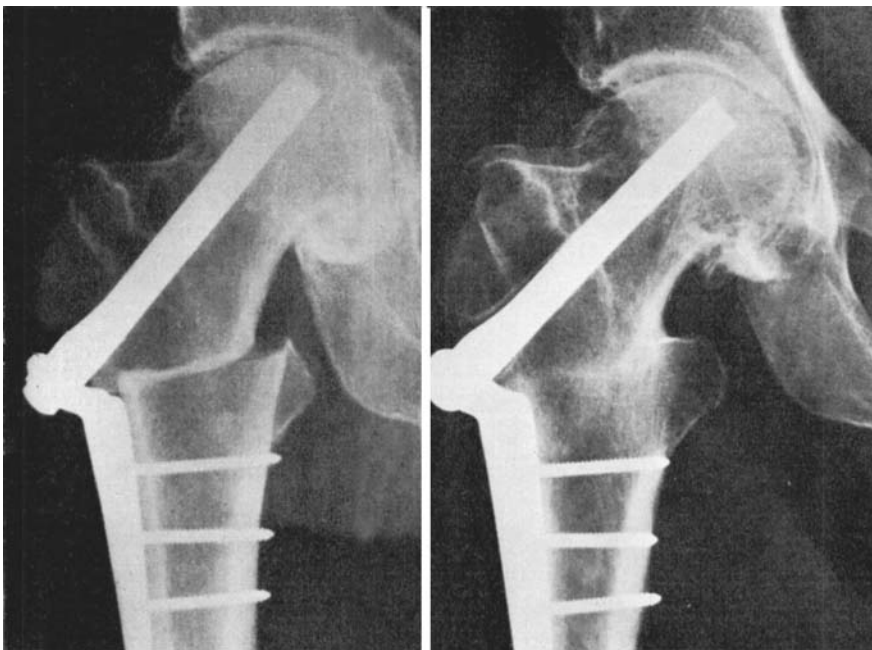


Figure 1. Radiographic appearances immediately after intertrochanteric displacement osteotomy and 2 years later when the osteotomy shows sound union.

Table 3. Time required for union following intertrochanteric displacement osteotomy.

Months	Time of weight-bearing (= radiological union)						
	3	4	5	6	7	8	19
Displacement osteotomies	115	5	4	3	4		1
Angled displacement osteotomies	38	3	10	3			
Total	153	8	14	6	4		1

tween the osteotomy and the nail. Re-osteosynthesis was performed 3 months later, and 4 months thereafter X-rays showed union. After full weight-bearing for 6 months the patient sustained a slight trauma. She began to have pain on weight-bearing, and X-rays showed instability. Following re-osteosynthesis, clinical and radiological union was obtained in 5 months, and 2½ years later there was still solid union. The lacking primary union in this one case was thus due to a technical error.

Three patients developed thrombophlebitis. Anticoagulant medication was not given as a routine. Five patients showed haematomas in the scars. Eight developed subcutaneous fat necrosis with a fistula over the head of the nail, but the osteotomy united normally. In 47 cases the nail and plate have later been removed because of local complaints. On the day after the operation one patient had a severe gastric haemorrhage, and gastric resection had to be carried out. There was no mortality.

DISCUSSION

Primary union of the osteotomy depends upon several factors. A displacement exceeding half the diameter of the bone, a steep osteotomy, or varus angulation considerably increases the risk of non-union (Green 1967, Rosborough & Stiles 1967, Scott 1967). An incidence of non-union up to 50 per cent has been reported following varus osteotomy (Gudmundsson 1970).

The numerous types of straight plates which are driven from the osteotomy surface through the greater trochanter, and whose lower end is fixed to the femoral shaft with screws, cannot properly prevent rotation at the osteotomy site or angulation, secondary varus angulation being common. Moreover, the displacement is often marked, one-half the diameter of the bone or more. The various types of fixed-

angle plates which are also in common use, require an extremely exact placement, if contact and thereby fixation at the osteotomy site is to be sound. Merely a minor shift from the ideal placement in a given situation will increase the risk of non-union. However, there is probably no osteosynthesis material which can alone fix the osteotomy so soundly that the limb can carry full weight-bearing before the osteotomy has united. In our experience, this takes at least 3 months. Indeed, early weight-bearing increases the rate of non-union which Rosborough & Stiles (1967) found to be 20 per cent if weight-bearing was allowed after 4 weeks, but only 9 per cent if it was not allowed until 8 weeks after the operation.

McLaughlin's apparatus is ideal, because the angle between the nail and plate may be varied and adapted to the given situation, although in driving in the nail some regard has to be paid to its possible angulation with the plate. By the present technique further fixation is obtained by compression, the two cancellous surfaces being pressed against each other over a wide surface owing to the moderate displacement. After the operation, the muscle traction tends to maintain the compression.

A displacement of $1/4$ – $1/3$ diameter of the bone is sufficient, and it is widely agreed that the extent of the displacement has no influence upon the effect of the osteotomy (McFarland 1954, Adam & Spence 1958, Nicoll & Holden 1961, Lucht & Tarp 1967).

Our material differs from those published previously, being treated by a well-known and widely used osteosynthesis material, but by a technique which incorporates the modern compression principle, and in not being allowed weight-bearing until there is radiological healing and never earlier than 3 months after the operation. By paying particular attention to the varus osteotomies, owing to their greater tendency to non-union, we obtained union in all cases by this method. By these simple precautions non-union could be entirely avoided, except in one case in which an incorrect placement of the nail gave rise to diastasis at the osteotomy site.

SUMMARY

In 186 cases of osteoarthritis of the hip intertrochanteric displacement osteotomy was carried out using fixation by the McLaughlin apparatus and a special technique in which the osteosynthesis is not completed until the plate has been fixed to the nail and to the shaft of the femur. After completing the osteotomy, the last $1-1\frac{1}{2}$ cm of the nail is driven

in, and this simultaneously produces compression at the osteotomy site. The patients were mobilized on the day after the operation, but were not allowed weight-bearing until there was radiological union and not earlier than 3 months after the operation, at which union had occurred in 153 cases. 32 osteotomies had united in 4–7 months. In one case union was not obtained until re-operation had been performed, because the nail had primarily been driven into the neck of the femur in a way so that it approached the osteotomy line medially and therefore caused diastasis. All the varus osteotomies united. The mortality was nil, and there were no serious complications.

To obtain optimum union results in intertrochanteric osteotomy a solid fixation is required, using compression and a medial displacement of less than $1/3$ of the diameter of the bone and weight-bearing not until radiological union, not earlier than 3 months after the operation.

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