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# TROCHANTERIC FEMORAL FRACTURES TREATED WITH McLAUGHLIN OSTEOSYNTHESIS

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During the late 1940's several types of osteosynthesis materials were introduced for the treatment of trochanteric femoral fractures. One type has a firm connection between nail and plate (Moore, Jewett, Neufeld) and another type, the McLaughlin apparatus, has nail and plate to be connected at varying angles by means of a nut or a bolt. A Danish paper on the use of the McLaughlin apparatus was published as early as 1947 (Svend Hansen).

It soon became evident that fixation of those fractures needing medial support across the calcar femorale was problematic. This led E. Merwyn Evans (1949) to classify trochanteric fractures as stable or unstable. During the following two decades a large number of modifications of osteosynthesis materials appeared (Boyd & Andersson 1961, Holt 1963, Clawson 1964, Mulholland & Gunn 1972). By making the osteosynthesis material sufficiently strong, it was thought that varus dislocation of the fracture could be counteracted.

Partly because of this tendency and partly because of material failures, some authors (Clawson 1957, Arlt et al. 1973) still prefer conservative management with extension.

Since the late 1960's reports have come forth on medial displacement osteotomies in unstable trochanteric fractures (Dimon & Hughston 1967, Naimar et al. 1969, Roberts et al. 1972, Weigert et al. 1972). Results of these displacement osteotomies have been favourable.

Due to this debate we have made a retrospective analysis of the results of osteosynthesis with the McLaughlin apparatus in stable as well as unstable trochanteric femoral fractures.

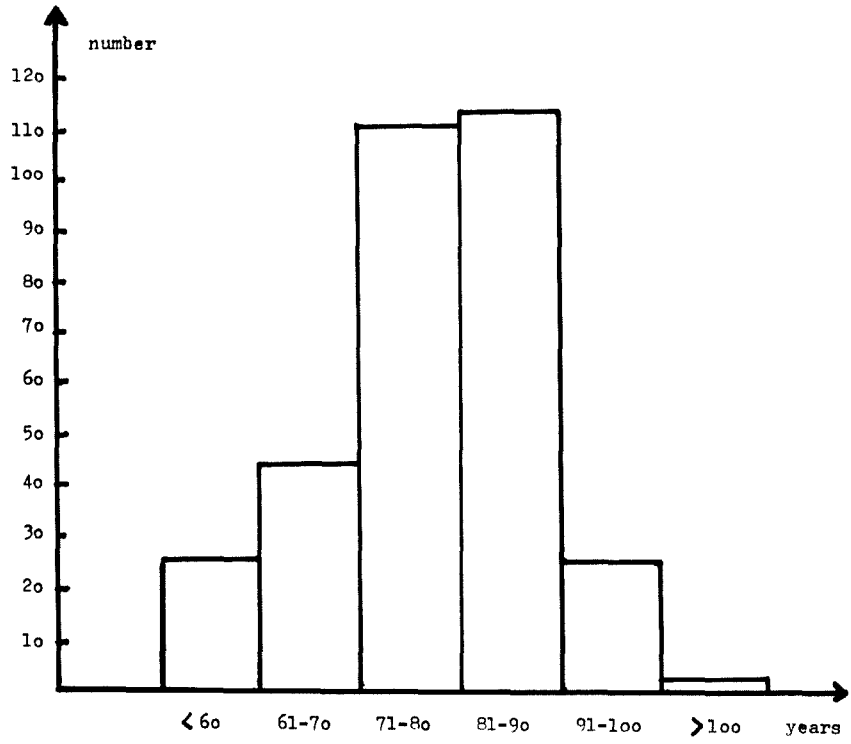



*Figure 1. Age distribution of 317 patients with trochanteric femoral fractures. Age limits: 13 to 103 years. Women: 238 patients (75.1 per cent). More than 70 years of age: 248 patients (78.2 per cent).*

## MATERIALS AND METHODS

A total of 317 patients with trochanteric fractures were treated in our department between 1967 and 1972. The age distribution is given in Figure 1. Seventy-five per cent of the patients were females. The material included one patient with spontaneous fracture; the remainder were caused by relevant trauma. Fifteen patients were on steroids (4.7 per cent) and 10 were alcoholics (3.2 per cent). Six patients (1.9 per cent) had a history of previous fracture of the same hip (one femoral neck fracture, five conservatively treated trochanteric fractures).

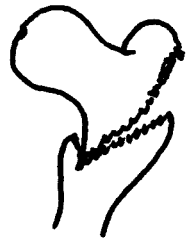
Of the 317 patients, 12 were treated conservatively, whereas 305 were treated with osteosynthesis with the McLaughlin apparatus. The implant used in our series consisted of a trifin vitallium nail which was connected by a topbolt to a flat vitallium blade plate of varying length. In 90 per cent of the cases a 5-hole plate was used, while a 7-, 9- or 12-hole plate was used in the other 10 per cent.

Of the 305 operated patients, 257 were followed until death or until the fracture had healed.

According to the Evans classification (1949) we subdivided the fractures into the five types shown in Figure 2.

STABLE

*Undisplaced 2-fragment fracture.*



*Displaced 2-fragment fracture.*

UNSTABLE

*3-fragment fracture, without posterolateral support.*

*3-fragment fracture without medial support.*

*4-fragment fracture.*

*Figure 2. Classification of trochanteric fractures according to Evans.*

## RESULTS

The mortality within 3 months was 14.5 per cent. Of the 12 conservatively managed patients, seven died, while of the 305 operated patients, 39 died (12.8 per cent). At the time of fracture, 110 patients already were nursing-home patients and among the 207 patients previously capable of caring for themselves, 36 (17.4 per cent) became

nursing-home patients. Of the 317 patients in our series, 113 sustained general complications (Table 1). Prophylactic anticoagulant therapy was not employed. This might in part explain the large number of thromboembolic events. Since the material was subdivided into stable and unstable trochanteric fractures according to Evans classification (1949), these two main groups will be treated separately.

*Table 1. General complications in 113 of 317 patients (35.6 per cent).*

| | |
|---|---|
| Haematoma, requiring evacuation | 5 |
| Superficial infection | 4 |
| Deep infection | 8 |
| Osteitis | 3 |
| Heart diseases | 13 |
| Pneumonia/atelectasis | 27 |
| Phlebothrombosis | 29 |
| Pulmonary embolism | 11 |
| Cerebral diseases | 5 |
| Decubitus ulcer | 14 |
| Peroneal paralysis | 3 |
| Others | 12 |

### *Stable trochanteric fractures*

The material included 106 (33.4 per cent) stable fractures; 40 were undisplaced two-fragment fractures, and 66 were displaced two-fragment fractures. Nine of these were treated conservatively and, of these, four patients died. Ninety-seven patients underwent osteosynthesis. We considered the results of this procedure ideal in 81.5 per cent of the cases. Our criteria for ideal osteosynthesis are those of Sarmiento (1963) and are shown in Table 2.

*Table 2. Criteria for ideal osteosynthesis according to Sarmiento.*

1. Exact reposition.
2. Steep placement of nail.
3. Nail to parallel calcar femorale.
4. Nail placed anteroposteriorly through the femoral neck.
5. Nail placed slightly posteriorly in femoral head with firm hold.
6. Nail 10 to 15 mm from cartilaginous border.
7. Plate placed slightly anteriorly along femoral shaft.

Of the 97 operated patients, 12 died during the initial hospitalization and one patient was lost to follow-up, leaving 84 patients available for follow-up. Of these 84 patients, 70 (83.3 per cent) were allowed weight-

bearing on the leg after 6 weeks, whereas in the remainder, weight-bearing was allowed after 8 weeks. Seventy-three (86.9 per cent) of the fractures healed in an unchanged position, while fracture complications were found in 11 cases. In seven patients, varus dislocation of less than 10 degrees was apparent and this displacement was of no clinical significance. The remaining four had to be re-operated. In two the nail had to be replaced with a shorter one because it had penetrated the articular surface of the femoral head. In two patients the topbolt had to be tightened because loosening had caused varus dislocation of the fracture. Thus the frequency of clinically significant fracture complications was 4.8 per cent (four of 84 patients followed up).

*Unstable trochanteric fractures*

This category included 211 fractures (66.6 per cent): 44 three-fragment fractures without posterolateral support and 73 without medial support. The remaining 94 fractures had four fragments. Three patients were managed conservatively and they all died in hospital. Osteosynthesis was performed in 208 patients. In 68.0 per cent this was ideal. Among 208 operated patients, 27 died during the initial hospitalization. Seven died during the control period, four were senile nursing-home patients who were not followed up. Four patients were lost to follow-up. Thus 166 patients were followed up until the fracture had healed, but an additional three patients are included in the follow-up group since they showed fracture complications before their death during the control period.

*Table 3. Fracture complications of unstable fractures in 62 of 169 patients followed up (36.7 per cent).*

| | |
|---|---|
| Migration of the nail | 14 |
| Penetration of the nail | 8 |
| Bending of the nail | 11 |
| Varus dislocation (loose topbolt) | 40 |
| Cutting of the nail | 2 |
| Loosening/breakage of the plate | 6 |
| Varus dislocation after removal of osteosynthesis material | 2 |
| Pseudarthrosis | 3 |
| Necrosis of the femoral head | 0 |

Weightbearing was allowed in 101 patients (59.8 per cent) after 6 weeks, and after 8 weeks in the others. A total of 107 (63.3 per cent) of

the fractures healed in an unchanged position. In 62 patients, fracture complications occurred as shown in Table 3. This table lists all changes in the fracture or osteosynthesis material, irrespective of their clinical significance. The various groups will therefore be discussed separately.

*Migration of the nail* occurred in 14 patients. In all cases it was a matter of a displacement of only a few millimeters within the head-neck area of the femur, and thus they were all without functional importance.

*Penetration of the nail* was seen in eight cases. In six of these the nail had been placed too close to the cartilaginous border initially. Five of these eight fractures belonged to the group without medial support. Four patients had to be re-operated. In three of the cases a new McLaughlin osteosynthesis was performed using a shorter nail. They healed. In the fourth the osteosynthesis material had to be removed 12 months after the procedure because of infection and, due to increasing varus dislocation and pseudarthrosis, a McKee-Farrar arthroplasty had to be carried out 18 months later.

*Bending of the nail* occurred in 11 patients. In nine the angle was less than 5 degrees. Two patients with a simultaneous greater bending and loosening of the topbolt needed re-operation. In one of these, breakage of the plate was found at the same time.

*Varus dislocation because of loosening of the topbolt* was by far the most frequent complication and accounted for 40 cases. Of these, 32 patients revealed diastasis of the fracture medially or anteriorly at the immediate postoperative X-ray control. In nine patients the varus angle was greater than 20 degrees. Seven of these required re-operation —three even twice. Two patients refused re-operation.

*Cutting of the nail,* i.e. dislocation of the nail in relation to the neck or the head, was apparent in two patients only. It was of no clinical significance as it was a matter of 4–5 mm of displacement within the confinements of the femoral head.

*Loosening or breakage of the plate* was seen in six cases. Two cases of plate breakage had to be re-operated. In four cases there was displacement of the lowermost screws, but so minimal that the fractures healed with varus displacement of less than 10 degrees.

*Varus dislocation after removal of the osteosynthesis material* occurred in two cases of pseudarthrosis.

*Pseudarthrosis* was seen in three patients. One patient was given a McKee-Farrar arthroplasty, another a valgus- and medial displace-

ment osteotomy. The third patient refused operation as she was confined to a wheel-chair.

Thus in 25 patients (14.8 per cent), 33 fracture complications of clinical significance were seen. In 10 patients (5.9 per cent) the fracture complication led to re-operation. A total of 15 re-operations were performed.

## DISCUSSION

Conservative management of trochanteric femoral fractures, including prolonged bedrest for this usually old and debilitated group of patients, led to a mortality rate amounting to 40 per cent (Clawson 1957, Arlt et al. 1973).

Since operative treatment was introduced in the late 1940's, the mortality rate has decreased significantly. In large materials it is about 13–15 per cent (Foster 1958, Holt 1963, Mulholland & Gunn 1972, Sarmiento 1963, Öhman et al. 1968). This corresponds well with the overall mortality rate of 14.5 per cent seen in our series and to the rate of 12.8 per cent among only the operated patients.

Among the published papers on osteosynthesis of trochanteric femoral fractures, only a few have followed the Evans classification (Clawson 1964, Cram 1955, Dimon & Hughston 1967, Foster 1958). Employing the McLaughlin apparatus as well as appliances with a firm connection between nail and plate (such as Jewett) the results of osteosynthesis of the stable fractures have been favourable. The incidence of complications is 5–6 per cent, which is similar to that of our series. Clawson (1964) noted a complication rate of 19 per cent, however, when the sliding screw plate fixation was used. In the case of the unstable fracture the complication rate is higher of course. Thus Clawson (1964) indicated 38.5 per cent and Dimon & Hughston (1967) as much as 51 per cent. This has led to the recommendation of medial displacement osteotomy as a routine procedure in the treatment of unstable trochanteric femoral fractures.

However, the complication rate in the case of the McLaughlin osteosynthesis can be reduced even further, also in the case of unstable fractures, if the principles of osteosynthesis as suggested by Sarmiento (1963) are followed. Cram (1955) reported 13.3 per cent complications and Foster (1958) 21.3 per cent. In our series the McLaughlin osteosynthesis has been employed routinely in the case of stable as well as unstable trochanteric fractures, with a complication rate of 11.5 per cent.

As can be expected, the number of ideal osteosyntheses decreases with the increasing difficulty of repositioning, and the number of fracture complications increases (15 of 25 patients did not undergo ideal osteosynthesis and represent eight of ten re-operated patients). In spite of this our series shows only 14.8 per cent of the patients with unstable fractures to have had significant fracture complications and only 5.9 per cent of these needed re-operation. These numbers are significantly less ($P < 0.01$) than those indicated by Dimon & Hughston (1967) for osteosynthesis with the Jewett apparatus.

Early weightbearing was found to increase the complication rate (11 of 25 patients with complications bore weight after 6 weeks, leading to varus dislocation of the fracture in seven and penetration in six cases).

Based on these results we find the McLaughlin osteosynthesis suitable for the treatment of trochanteric femoral fractures, also of the unstable type. Furthermore it is valuable that the operative procedure is rather simple. However, ideal osteosynthesis and no weightbearing for a prolonged period (more than 8 weeks) is to be recommended in unstable fractures.

## SUMMARY

Of 317 patients with trochanteric femoral fractures, 305 were treated with McLaughlin osteosynthesis. The mortality rate was 14.5 per cent. The postoperative complication rate (35.6 per cent) was dominated by cardiopulmonary (10.6 per cent) and thromboembolic (10.6 per cent) events. Wound infection was found in 3.8 per cent and osteitis in 0.9 per cent. In all, 106 patients had stable fractures according to the Evans classification. Of these, four had to be re-operated due to penetration or a loose bolt. Two hundred and eleven patients (66.6 per cent) had unstable fractures. Follow-up of 169 patients showed two-thirds to have healed in unchanged position. Only 14.8 per cent of the 169 patients had significant fracture complications, particularly varus dislocation of more than 20 degrees (nine patients) and penetration of the nail (eight patients). A total of 10 patients (5.9 per cent) had to be re-operated because of varus dislocation, broken plate or development of pseudarthrosis after removal of the osteosynthesis material. McLaughlin osteosynthesis is concluded to be a suitable method for the treatment of trochanteric femoral fractures—also of the unstable type.

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*Key words:* McLaughlin osteosynthesis; trochanteric femoral fractures; unstable trochanteric fractures

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