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TROCHANTERIC AND SUBTROCHANTERIC FRACTURES

The Operative Results in a Prospective and Comparative Study of Ender Nailing and McLaughlin Osteosynthesis

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A comparative and prospective study was performed in order to evaluate the advantages or disadvantages of the Ender operation in comparison with the McLaughlin technique. The series included 145 patients, 72 operated by the Ender method, and 73 by the McLaughlin method.

There were no differences between the two groups as regards anaesthesia time, operation time, mean stay in hospital, morbidity and mortality.

Technical problems were encountered in 40 of the Ender operated fractures (56 per cent), whereas the figure for the patients treated with the McLaughlin method was 17 (23 per cent). Ten (14 per cent) patients in the Ender group but only 2 (3 per cent) in the McLaughlin group needed re-operation. Three deep infections occurred in the McLaughlin group, but none in the Ender group.

It was concluded that the only advantage which could be demonstrated in the Ender group was a low infection rate. Many disadvantages were revealed, the most outstanding being the many technical problems encountered and the great number of re-operations required.

Key words: comparative study; Ender nailing; fracture fixation; McLaughlin osteosynthesis; operative results; trochanteric and subtrochanteric fracture

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Several types of operations have been used in the treatment of trochanteric and pertrochanteric fractures (Evans 1949, 1951, McLaughlin & Garcia 1955, Dimon & Hughston 1967, Ender & Simon-Weidner 1970, Collado et al. 1972, Sahlstrand 1974, Zickel 1976, Sarmiento & Williams 1970). The McLaughlin nail-plate is one of the most frequently used methods although technical complications are often encountered (Foster 1958, Jensen & Michaelsen 1975). A more recent method, Ender nailing, has been reported to reduce the number of complications (Ender & Simon-Weidner 1970, Kuderna et al. 1976, Hult & Nilsson 1978, Raugstad et al. 1979, Pankovich & Tarabishy 1980). Both methods have been used in the treatment of stable as well as unstable fractures of the trochanteric region.

The aim of the present study was to compare the two methods by an analysis of the operative results, correlated with the type of fracture.

PATIENTS AND METHODS

The series includes 145 consecutive and operable patients with a fracture of the femur, located in the area between the lateral insertion of the hip joint capsule and a level 5 cm below the minor trochanter. The patients were admitted to the hospital in the period April 1976 to September 1978.

The patients were allocated to the Ender or the McLaughlin operation by the principle of random numbers.

The fractures were divided into trochanteric and subtrochanteric, and the trochanteric fractures were classified into stable and unstable fractures according to

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a modified system of Evans (1949). Fractures with a medial cortical defect, a posterior cortical defect, or a vertical fracture line were considered unstable.

The number of McLaughlin operations was 73 (61 females and 12 males), while Ender osteosynthesis was carried out in 72 patients (50 females and 22 males). The average age of the patients was 76 years in both groups (range 19 to 88 years).

There was no significant difference in the incidence of chronic diseases in the two groups. On admission 39 patients suffered from severe cardio-pulmonary diseases, 19 from diabetes, 38 from senile confusion or chronic mental disease, and 42 from other chronic diseases.

Heparin, 5000 units subcutaneously, was given two times daily, and continued until the patient was mobilized after the operation. The reduction of the fracture was made on the traction table. The McLaughlin nail and plate was inserted through a lateral incision. For the Ender osteosynthesis, 3–4 pins were introduced through a short incision above the medial femoral condyle. The pins were only bent in one plane. The insertion was monitored on an image intensifier.

A general programme of exercises was started from the first day after the operation. If the postoperative X-ray showed the fracture and the osteosynthesis material to be in a satisfactory position, the patients were allowed to walk with weight-bearing and a pair of crutches from the seventh day. If this was not the case the patients were mobilized without weight-bearing.

Many of the patients were admitted to special training hospitals as soon as possible, the average waiting time being 3–4 weeks. Patients from other districts were usually returned to their local hospitals within 2 weeks.

Clinical and X-ray examinations were performed 1, 3, 6 and 12 months after the operation.

RESULTS

The present series included 121 trochanteric and 24 subtrochanteric fractures. Of the 121 trochanteric fractures 69 were considered stable, and 52 unstable (Table 1). There was no significant difference as regards the fracture types represented in the two groups.

Table 1. Classification according to the type of fracture and the operation method

	Ender	McLaughlin	Total
Stable trochanteric fractures	32	37	69
Unstable trochanteric fractures	28	24	52
Subtrochanteric fractures	12	12	24
	72	73	145

The postoperative X-ray showed that there was no significant difference in the total number of anatomical reductions in the Ender and the McLaughlin groups (Table 2). Neither did differences occur in the two groups if stable and unstable trochanteric fractures were regarded individually. In almost one-third of the cases in both groups diastasis of the fracture occurred, exceeding 4 mm in the frontal and/or the lateral projection. A greater number of anatomical reductions were achieved in the stable trochanteric fractures in both groups.

The various technical problems encounted in the operations are shown in Table 3. The total number of patients in whom technical problems occurred was 40 in the Ender group and 17 in the McLaughlin group. This difference is significant (Chi square test: $P < 0.001$). In the McLaughlin group the majority of problems involved the unstable trochanteric fractures, while in the Ender group there was almost the same number of fail-

Table 2. Results of the reduction related to the type of fracture and the operation method

	Ender		McLaughlin	
	Anatomical	Diastasis	Anatomical	Diastasis
Stable trochanteric fractures	26	6	33	4
Unstable trochanteric fractures	17	11	11	13
Subtrochanteric fractures	8	4	6	6
	51 (71%)	21 (29%)	50 (68%)	23 (32%)

Table 3. Technical problems in 145 Ender and McLaughlin operations

	Ender			McLaughlin		
	Stable	Unstable	Subtrochanteric	Stable	Unstable	Subtrochanteric
Poor position of the osteosynthesis material	4	3	1	0	2	2
Penetration of the femoral head	3	0	5	0	4	1
Penetration of the acetabulum	0	0	0	0	3	1
Failure of the nail-plate junction				0	1	0
Sliding Ender nail >1 cm	13	11	3			
Varus position >10°	2	1	0	3	2	0
External rotation >20°	11	9	7	0	0	0
Fracture of the femur	1	4	2			
Number of fractures with technical problems	17	15	8	3	11	3
Re-operations	2	5	3	0	2	0

ures in the stable and unstable trochanteric fractures. The major technical problems in the Ender group were caused by a postoperative external rotation of the leg of more than 20 degrees (38 per cent), and by distal sliding of the nails in 38 per cent. The mobility of the knee was less than 90 degrees in 15 patients in the Ender group at discharge. Fifteen patients had pain in the knee for more than half a year. As a consequence of these various problems, re-operations were performed on 14 per cent of the patients in the Ender group, but only on 3 per cent of the patients in the McLaughlin group.

One case of non-union appeared in the McLaughlin group, but none in the Ender group.

The average time of anaesthesia was 131 minutes in the McLaughlin group, and 125 minutes in the Ender group; the average operation times were 76 and 65 minutes, respectively. The patients in the McLaughlin group were allowed weight-bearing on an average 15 days after the operation compared with 18 days in the Ender group. The mean stay in the hospital was 26 days for patients in both groups.

The mortality was the same in the McLaughlin and the Ender group (Table 4). Also the number of complications were rather similar in the two groups (Table 5). Deep infections occurred in 3 patients in the McLaughlin group (4 per cent), but did not occur in the Ender group.

Table 4. Mortality after Ender and McLaughlin operations

	Ender group	McLaughlin group
1 month after operation	5	3
6 months after operation	11	12
12 months after operation	15	16

Table 5. Postoperative complications in 145 Ender and McLaughlin operations

	Ender group	McLaughlin group
Pneumonia	12	9
Cardiac complications	4	5
Pulmonary embolia	3	1
Deep thrombophlebitis	3	2
Pressure sores	2	7
Mental confusion	4	1
Haematoma	3	4
Superficial infection	1	1
Deep infection	0	3

DISCUSSION

The comprehensive literature concerning the treatment of extracapsular hip fractures contains only a few series of comparative analyses of dif-

ferent operation methods (Wynn Jones et al. 1977, Kyle et al. 1979, Jensen et al. 1980). In contrast to these series, the present material is prospective and controlled.

It is generally accepted that classification of trochanteric fractures into stable and unstable has a prognostic significance. Several classifications have been described (Boyd & Griffin 1949, Sarmiento 1963, Dimon & Hughston 1967, Jensen 1980). The majority of these are modifications of the classification described by Evans (1949). The present higher frequency of stable trochanteric fractures (57 per cent) compared with the frequency of unstable fractures, follows the pattern of other series (Kuderna et al. 1976, Raugstad et al. 1979). But in contrast to this, Jensen (1980) had only 26 per cent stable fractures. In accordance with Seinsheimer (1978) the subtrochanteric fractures in the present material were considered unstable.

In some reports it has been mentioned that an advantage of the Ender operation is the short operation time and the reduced blood loss (Kuderna et al. 1976, Raugstad et al. 1979, Pankovich & Tarabishy 1980). We could not demonstrate this difference, possibly because the operations were performed by many surgeons as part of the daily routine. Neither did we find a significant difference as regards the number of anatomical reductions, the stay in hospital, general complications or mortality.

Regarding the technical problems of the two methods, these must be considered individually, because the two methods of operation are different, and each method creates its own problems.

In our Ender series we had no deep infections, as also reported in other materials (Kuderna et al. 1976, Raugstad et al. 1979). However, an infection rate of 3 per cent has been described (Jensen & Sonne-Holm 1980). Distal sliding of the Ender nails is a common problem in all materials (Kuderna et al. 1976, Wynn Jones et al. 1977, Raugstad et al. 1979, Jensen & Sonne-Holm 1980, Pankovich & Tarabishy 1980).

In other series with McLaughlin osteosynthesis, the infection rate is reported to be between 3.4 per cent and 16 per cent (Kolind-Sørensen 1975, Jensen et al. 1980). The same authors found failure of the nail-plate junction to be a common problem. The only case of failure at the nail-plate junction in the present series was a broken washer. Two other patients developed a varus angulation of more than 10 degrees, but less than 20 degrees, possibly due to loosening of the nut.

Nail penetration of the femoral head is a well-known complication of the McLaughlin method. Our frequency of 6 per cent is in accordance with other series. Three nails penetrated the head at the operation, but only one as a result of resorption at the fracture site.

As expected, there were more patients with technical problems in the unstable trochanteric and subtrochanteric groups. It was necessary to re-operate on two patients (3 per cent). The percentage of re-operations in another series was 5.9 per cent (Jensen & Michaelsen 1975).

It appears from this prospective and comparative study that only one of the stated advantages of the Ender method could be demonstrated, viz. the low infection rate. The operation time was almost the same in the two groups, and the patients did not return to functional ambulatory status in a shorter time. Moreover, the Ender method was associated with a large number of technical problems, and subsequent re-operations.

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