

UNSTABLE TROCHANTERIC FRACTURES TREATED WITH THE SLIDING SCREW-PLATE SYSTEM

A Biomechanical Study of Unstable Trochanteric Fractures III

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Eighty unstable trochanteric fractures were treated with the sliding screw-plate system. Early weight-bearing was encouraged and mobilization was obtained within the first week in 47 per cent of the cases (37/78). Technical complications were encountered in 5 per cent of the patients (4/76) but none required re-operation. Telescoping of the screw occurred in 49 per cent (37/76). Through this secondary fracture impaction a stable load transmission system was established. Fracture union in the postoperative position was obtained in 49 per cent of the patients (37/76) and non-union did not occur.

Key words: osteosynthesis; rehabilitation; trochanteric femoral fractures

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The major problems encountered in the internal fixation of trochanteric fractures are mechanical, especially in unstable fractures (Evans 1949) where the implant alone has to transmit the load from the hip joint to the femoral shaft (Jensen 1978). The load on the hip joint during normal level walking has been calculated to be about six times the body weight (Paul 1971).

The technical complications experienced are either penetration or cutting by the nail due to osteoporosis of the femoral neck and head or bending and breakage of the hip nail-plate due to cyclic loading of the implant, which can also lead to pulling out of the screws. Internal fixation with conventional hip nail-plates of the Jewett type has been followed by technical complications of this nature in 16-51 per cent of cases (Dimon & Hughston 1967, Parker 1955, Robey 1956, Sarmiento 1963, Wade et al. 1959) and with the McLaughlin type in 15-44 per cent of cases (Foster 1958, Friedenbergs et al. 1972,

Jensen & Michaelsen 1975, Laros & Moore 1974).

In 1964, Clawson introduced the sliding screw-plate system for internal fixation of trochanteric fractures and rather encouraging results have been reported recently (Ecker et al. 1975, Harrington & Johnston 1973, Mulholland et al. 1972). In the present series our preliminary experiences with this fixation method will be reported.

PATIENTS AND METHODS

During the period January 1976 to July 1977 the sliding screw-plate system was used in the treatment of 80 unstable trochanteric fractures. The method was applied in fractures classified as unstable either due to lack of postero-lateral bone support or lack of medial bone support over the fracture line or a combination of these factors (Evans 1949).

The average age of the patients was 78.5 years (range 40-96 years) and 86 per cent (69/80) were

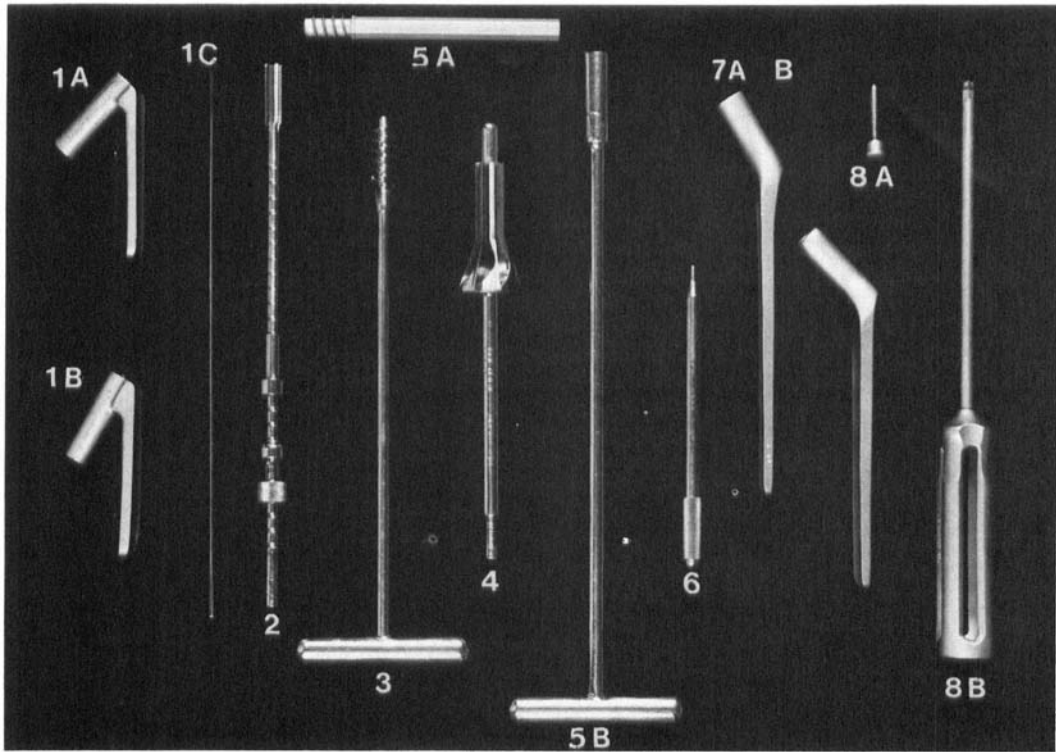


Figure 1. Instrumentation for the insertion of the sliding screw-plate.

1 A + B + C. 135° angle guide and 150° angle guide with K-wire.

2. cannulated central reamer.

3. cannulated lag screw tap.

4. cannulated barrel reamer.

5 A. hexagonal hip lag screw.

5 B. cannulated lag screw insertion wrench.

6. barrel guide.

7 A + B. 135° and 150° side-plate with 5 holes.

8 A + B. compression screw with screwdriver.

women. Seven patients died within 3 months after the operation giving a mortality rate of 8.8 per cent (7/80). Seventy-three patients were followed until fracture union was achieved. In this follow-up series an additional three patients are included, as technical complications or telescoping of the screw were encountered before their death.

The operation was performed with the patient supine on a fracture table under X-ray image intensification. After attempted anatomical reduction of the fracture a lateral surgical exposure was made. The instrumentation needed for the internal fixation is shown in Figure 1. A guide wire was passed through the angle guide and drilled through the lateral femoral cortex and the femoral neck into the subchondral area of the femoral head. After measuring the protruding length of the guide wire this was tapped through

the acetabular roof so that it would not be accidentally removed during the following steps. A channel for the screw was reamed and tapped and in addition the lateral femoral cortex was reamed for the barrel of the side-plate. A hip lag screw of suitable length (~1.5 cm less than the distance from the subchondral area to the lateral cortex) was inserted over the guide wire and fastened firmly in the subchondral area. By means of a barrel guide the side-plate was positioned over the screw. In this series the Howmedica Inc. modification (catalogue No. 6465-0-000) was used with a barrel-plate angle of 135° or 150°. Rotational stability is secured by an edge in the round barrel and the hexagonal shape of the screw. After having fixed the plate to the femoral shaft the traction was released and compression applied over the fracture line by means of a

special compression screw, which was removed after impaction.

In cases with greater medial diastasis in the fracture line a primary medial displacement of the femoral shaft was performed in order to establish bony contact.

Mobilization with full weight-bearing was encouraged after the first postoperative period of 2-3 days and postoperative X-ray examinations were performed at 3 weeks, 6 weeks and 3 months. In the follow-up study the primary X-rays and subsequent review X-rays were evaluated taking into consideration the technical results.

RESULTS

In the present series 58 screw-plates with an angle of 135° and 22 with an angle of 150° were applied.

The distribution of the fracture types according to Evans (1949) is shown in Table 1; 61 per cent (49/80) of the fractures were 4-fragmentary.

Early weight-bearing was encouraged and Figure 2 demonstrates the time interval before full weight-bearing was achieved; in 47 per cent (37/78) it was within the first week.

The reduction of the fracture was evaluated on the postoperative X-rays and the results are shown in Table 2. In 44 per cent (35/80) of the cases a mechanically stable reduction which allowed load transmission

Table 1. Classification of unstable trochanteric fractures (Evans 1949).

3-fragmentary without postero-lateral support	23
3-fragmentary without medial support	8
4-fragmentary	49
Total	80

Table 2. Radiological fracture reduction in 80 unstable trochanteric fractures.

Mechanically stable reduction	35
- screw fixation of lesser trochanter	1
- medial displacement of femoral shaft	17
Medial or lateral diastasis ≥ 0.5 cm	21
Anterior or posterior diastasis ≥ 0.5 cm	24

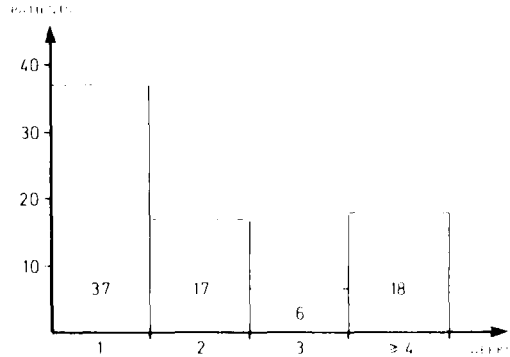


Figure 2. Time interval before full weight-bearing achieved (78 patients - 2 died before mobilization).

through bony contact was obtained. In 17 cases stability was established through medial shaft displacement and in one case through anatomical reduction and screw fixation of the lesser trochanter. In the remaining cases there was a diastasis of more than 0.5 cm at the fracture line.

The results of the follow-up of the 76 patients are shown in Table 3. There was one case of deep infection but no instance of non-union. Forty-nine per cent of the fractures (37/76) healed in the postoperative position. Telescoping of the screw took place in 49 per cent (37/76). In 29 of these 37 cases the reduction was considered mechanically unstable as judged by the postoperative X-ray. As a result of this secondary displace-

Table 3. Radiological follow-up in 76 unstable trochanteric fractures.

Fracture union in postoperative position	37 (48.7%)
Telescoping of the screw	37 (48.7%)
Technical complication	4 (5.3%)

Table 4. Technical complications in 76 unstable trochanteric fractures.

Penetration of the screw head	1 (5.3%)
Cutting of the screw head	3 (5.3%)
The screw head was displaced outside the confinements of the femoral head.	

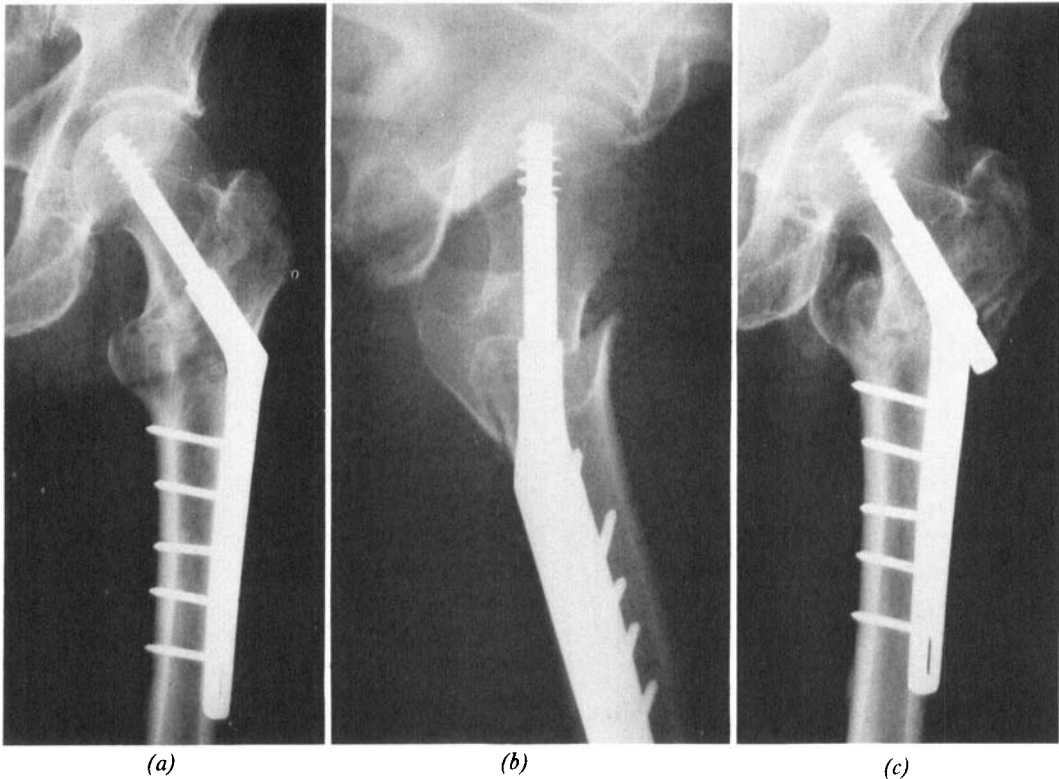


Figure 3 A, B. Postoperative reduction of the fracture. Note anterior diastasis on the sagittal roentgenogram. C. Result after telescoping and established bony support after 3 weeks of full weight-bearing.

ment of the fracture a stable load transmission system through bony contact was obtained. Figures 3 and 4 demonstrate cases where sliding of the screw took place and resulted in a mechanically reliable system. The telescoping took place within the first 4 weeks in the majority of cases (29/37). The patients often complained of pain during weight-bearing in this period.

Technical complications were encountered in 5 per cent of the patients (4/76) as shown in Table 4. In all these patients the screws were placed less than 10 mm from the cartilaginous border. Penetration as well as cutting of the screw resulted in a varus angulation of the fracture. In two cases this amounted to less than 10° and to $20\text{--}30^\circ$ in the other two. Bony contact, however, was established and the fracture healed in the varus position. No further treatment was needed.

DISCUSSION

Most authors dealing with unstable trochanteric fractures treated with conventional hip nail-plates recommend non-weight-bearing until the fracture has healed (Laros & Moore 1974, Parker 1955, Robey 1956). In the series reported by Jensen & Michaelsen (1975) 15 per cent (25/169) significant mechanical complications (i.e., penetration of the nail, bending, loosening or breakage of the nail or plate) were encountered although a postoperative period of non-weight-bearing of 8 weeks was practised. In the first report on the sliding screw-plate Clawson (1964) recommended non-weight-bearing until fracture union was encountered, but later series permitted early weight-bearing (Ecker et al. 1975, Harrington & Johnston 1973, Mulholland et al. 1972, Sahlstrand 1974). Bosacco et al. (1973) and

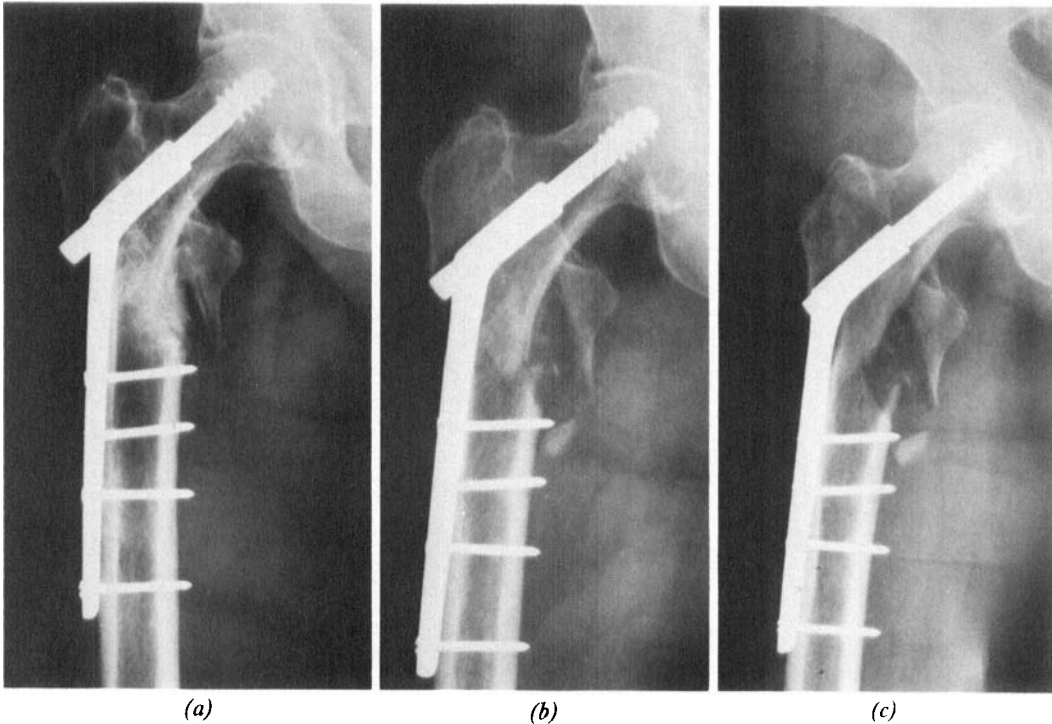


Figure 4 A. Postoperative reduction of 4-fragmentary fracture. Note medial diastasis. B. Telescoping has taken place after 2 weeks of full weight-bearing. C. Healing result in mechanically stable position.

Sahlstrand (1974) stressed the importance of early mobilization in the treatment of these elderly often debilitated patients. It is possible that the unusually low mortality rate in our series might be a consequence of the early mobilization.

As regards the technical complications following internal fixation of unstable trochanteric fractures the complication rate in series of Jewett nail-plate osteosynthesis has been about 30 per cent (Robey 1956, Wade et al. 1959), although Parker (1955) stated 15 per cent and Dimon & Hughston (1967) as many as 51 per cent. The McLaughlin nail-plate system seems to give slightly better results with complication rates of 15–23 per cent in most series (Foster 1958, Jensen & Michaelsen 1975, Laros & Moore 1974), although Friedenberg et al. (1972) stated 44 per cent. In contrast to this, however, encouraging results have been reported from USA with the use of the sliding screw-plate

system with technical complication rates as low as 4–7 per cent (Ecker et al. 1975, Harrington & Johnston 1973, Mulholland et al. 1972). Friedenberg et al. (1972), however, encountered complications in 18 per cent in a small series of 27 cases including 4 per cent that were re-operations. In the present series technical complications were found in only 5 per cent of cases (4/76). We fully approve of the basic idea of the sliding screw-plate fixation, viz., that a primary stable internal fixation is unobtainable in these osteoporotic three- and four-fragmentary fractures. The telescoping effect allows the fracture ends to impact during weight-bearing until bony support is established across the fracture line. In the present series telescoping of the screw actually took place in 49 per cent of the cases (37/76). Reports on this subject are difficult to compare as no one fracture classification system is generally accepted. In the present

series the Evans classification (1949) was used as it also was in a previous paper by one of the authors (Jensen & Michaelsen 1975). The radiological evaluation was based on the same principles too. In the 1975 series (Jensen & Michaelsen) significant technical complications were encountered in 15 per cent of cases (25/169) following McLaughlin osteosynthesis. This necessitated re-operations in 6 per cent (10/169). In the present series technical complications were encountered in only 5 per cent (4/76) of cases and no re-operations were necessary.

In conclusion we find the sliding screw-plate system to have distinct advantages, because it allows early weight-bearing which is essential for successful rehabilitation and because the telescoping leads to bony support which is essential for the mechanical load transmission.

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