TREATMENT OPTIONS FOR BASICERVICAL FRACTURES OF THE FEMORAL NECK A CLINICAL FOLLOW-UP

by H. O. M. KUOKKANEN

Forty basicervical fractures of the femur were treated operatively. Local complications were recorded in 8 cases. In this mostly geriatric group of patients only 18 patients were alive after a mean follow-up of 63 months. Five of the 19 hips showed excellent results. Eight hips were evaluated as poor. No radiological signs of osteonecrosis were observed. Only one nonunion and one delayed union were noted. Surprisingly, the rigid nailplate (ASIF, Jewet) fixation appeared superior to the more up-to-date means of fixation, i.e. the dynamic hip screw. Although the material is limited and heterogenous owing to the relatively few numbers of basicervical fractures in the large entity of the femoral neck fractures in general, this difference was obvious and merits technical consideration. Due to its conical shape the dynamic hip screw is most obviously unstable in rotatory stresses, and an additional cancellous screw would probably solve this problem. Some fractures of the series were treated by multiple pins, hemiarthroplasty or Ender nails. The number of cases so treated was small, but still notable for local complications. Thus it remains questionable whether these methods would result in a better response even with more common clinical use, when this special entity of femoral neck fractures is considered.

Keywords : femur ; fracture ; basicervical ; internal fixation.
Mots-clés : fémur ; fracture ; basicervicale ; ostéosynthèse.

RÉSUMÉ

H. O. M. KUOKKANEN. Comment traiter une fracture basicervicale du fémur ? Revue clinique.

Revue de 40 fractures basicervicales du fémur, traitées par ostéosynthèse. Des complications furent signalées dans 8 cas. La plupart de ces malades ayant atteint un grand âge, seuls 18 patients étaient en vie lors de la revue des cas au 63e mois postopératoire. Cinq hanches sur 19 pouvaient être considérées comme un résultat excellent. Huit hanches avaient un résultat médiocre. On ne nota aucun signe radiologique d'ostéonécrose. Il y avait une pseudarthrose et une consolidation retardée. Contre toute attente, les systèmes rigides (lame-plaque AO, ou Jewet) se révélèrent supérieurs aux systèmes plus en vogue actuellement, notamment le DHS. Quoique le nombre des cas suivis soit limité et hétérogène vu le nombre relativement peu élevé de fractures basicervicales sur l'ensemble des fractures du col fémoral, la différence des résultats peut être considérée comme significative et mérite analyse. Par sa forme conique, la vis dynamique de hanche semble instable lorsqu'elle est soumise à une sollicitation en rotation ; une vis à spongieux supplémentaire peut améliorer la stabilité. Certaines fractures de cette série furent traitées par montage à l'aide de plusieurs vis, hémi-arthroplasties ou enclouage de Ender. Le nombre des cas traité par cette technique fut limité, mais peut être retenu dans l'étude des complications. On peut se demander si ces techniques donneraient de meilleurs résultats, si elles étaient plus fréquemment employées pour ce type de fracture.

SAMENVATTING

H. O. M. KUOKKANEN. Behandelingstechnieken van basicervikale frakturen van de femurhals. Klinische studie.

Veertig laterale frakturen van het collum femoris werden chirurgisch behandeld. Lokale complicaties

University Central Hospital, Department of Orthopaedics and Traumatology, Helsinki, Päijät-Häme Central Hospital, Lahti (Finland).

werden gezien in 8 gevallen. Van deze meestal geriatrische patiënten waren er slechts 18 nog in leven bij de follow-up na 63 maanden. Vijf heupen hadden een uitstekend resultaat. Acht heupen werden bestempeld tot slechts resultaten. Er waren geen radiologische tekenen van osteonecrose. Er was één geval van pseudarthrose en één van vertraagde consolidatie. Tot hun verwondering stelden de auteurs vast dat de rigiede systemen (hoekplaat AO of Jewet) betere resultaten gaven dan de meer aktuele technieken zoals de DHS.

Ofschoon het materiaal vrij beperkt en heterogeen is, o.m. voor het relatief klein aantal basicervikale frakturen in de grote groep van de femurnekfrakturen in het algemeen, was het verschil vrij opvallend, zodanig dat een verdere analyse hier enselijk blijkt. Door zijn conische vorm is de DHS onstabiel bij rotatoire krachten ; een aanvullende spongiosa schroef zou dit kunnen verhelpen. Sommige frakturen van deze groep werden behandeld met multipele pennen, hemiarthroplastiek of Endernageling. Het aantal gevallen, behandeld met deze technieken, was beperkt maar niet vrij van complicaties.

Het blijft een vraag of deze technieken betere resultaten zouden geven indien zij meer gebruikt waren bij dit bepaald type femurhalsfrakturen.

INTRODUCTION

Fractures of the femoral neck are commonly classified as intracapsular and extracapsular fractures. The treatment of the "unsolved" intracapsular fractures is still a matter of controversy (2, 11, 12). On the other hand, the operative treatment of extracapsular, i.e. basicervical, fractures is regarded as nonproblematic (3, 10, 13). The true picture of basicervical fractures may nevertheless be obscured by the fact that they are, almost invariably, included in the broader group of fractures of the trochanteric region (1, 5, 8). The purpose of this study was to assess the outcome of the treatment of basicervical fractures as a separate entity. Emphasis was placed on the selection of the surgical method and possible complications and pitfalls.

PATIENTS AND METHODS

During the 9-year period from January 1977 through December 1985, 40 basicervical fractures of the femur of 38 patients were treated operatively at the Päijät-HämeCentral Hospital. Only distinctly extracapsular fractures of the neck of the femur were included in the series. Thus, oblique transcervical fractures and fractures of the trochanteric region were excluded. Thirteen of the patients were men. The patient's mean age was 72 years (range 29-95 years). The operations were performed under spinal or general anesthesia. Mean loss of blood was 420 ml (range 50-1800 ml). Duration of the operation averaged 76 min. (range 25-185 min.).

Six different methods were used during the period of study. Jewet nails were employed from 1976 to 1983, ASIF 130° nailplates from 1978 to 1981, Knowles pins from 1978 to 1981, Ender nails from 1980 to 1981, hemiprostheses from 1982 to 1985 and dynamic hip screws (DHS) from 1982 to 1985 (table I). Two of the hemiarthroplasties were performed with Christiansen endoprostheses and two with Müller endoprostheses. In the Ender group, three to four nails were used for osteosynthesis, in each case. In DHS, Jewet and ASIF 130° groups four-to six-hole plates were used. The subgroups with Jewet and ASIF 130° nailplates were combined and regarded as "rigid nailplates", respectively.

The retrospective assessment was performed in May 1987, at which time 18 patients were still alive. Ten patients were admitted for clinical evaluation. The remaining 8 patients could not come to the follow-up study, and they received a questionnaire for subjective evaluation. The follow-up time of the living patents was 21 to 111 months (mean 63 months). The clinical outcomes were graded according to Harris' scoring system, in which a score of 90-100 indicated an excellent, 80-89 a good, 70-79 a fair and less than 70 a poor result (4). The 8 patients who returned their questionnaires were assessed according to their subjective pain evaluations (7). Thus, a painless hip and the ability to walk without support indicated a good result, a hip that was painless at rest but painful on walking, or the use of a walking support indicated a fair result. Hips which produced pain even at rest were classified as poor. The X-rays of all hips were analyzed. The state of bony union, development of deformity, arthrosis or avascular necrosis were recorded.

Table I. — Description of primary operations

Method of primary operation	Number of cases	Mean age yrs (range)	Mean duration of the operation min (range)	Mean loss of blood ml (range)
Rigid nailplate (ASIF, Jewet)	16	68 (29-88)	80 (30-185)	450 (50-1300)
Dynamic Hip Screw	14	74 (45-92)	63 (25-145)	340 (150-1000)
Hemiarthroplasty	4	86 (79-95)	118 (35-145)	1080 (200-1800)
Knowles pins	3	65 (49-90)	50 (30-70)	75 (50-100)
Ender nails	3	76 (68-80)	35 (25-50)	80 (50-100)
Total	40	72 (25-185)	420 (50-1800)	

RESULTS

Three of the 38 patients had died of cardiopulmonary complications within 30 days of the operation. These were operated by DHS, Müller hemiprosthesis and Jewet nailplate. Thus the primary mortality was 7.9%. A further 4 patients died within 12 months of the operation ; at the time of assessment (mean 63 months, range 21-111 months postoperatively), 20 patients had died (53%). The subjective evaluations received from 8 patients revealed 3 good hips, 3 fair hips and 2 poor hips. None of the clinically evaluated patients who had received rigid nailplates showed a poor result. Conversely, none of the DHS, Ender or hemiprosthesis patients demonstrated excellent or good results (table II).

On follow-up X-rays a retroversion deformity of 20-30° was recorded in 3 and varus deformity of 15-40° in 5 cases. Shortening of the proximal femur by 1-2 cm because of compression of the fracture was recorded in 5 cases (table II).

A total of 5 hips had an excellent and 6 hips a poor Harris score. Excellent hips had been set with a rigid nailplate in 3 cases and with Knowles pins in 2 cases. Only 1 of these 5 hips showed radiological deformity. Five of the 6 poor hips had been fixed with a dynamic hip screw and 1 with Ender nails. Five of these showed radiological deformities (table II).

Primary and secondary surgical complications were recorded in 8 cases. One pseudarthrosis with deep infection (DHS) and one delayed union (AO 130°) were recorded. Failures of osteosynthesis were recorded in 3 cases. One hemiprosthesis had dislocated. In 2 cases the nail had perforated the cortex of the femoral head during late impaction of the fracture. One of these patients had received an ASIF 130° nailplate. The nail perforated the cortex by 5 mm and was not removed before the patient died nine months postoperatively. The other patient's fracture had been set with a Jewet nailplate. Seven years after the primary operation the nail had perforated the cortex by 3 mm. Nine years postoperatively the hip was classified as good according to subjective evaluation (patient 11). One delayed union was recorded in the rigid nailplate group. Bony union took place between 12 and 18 months postoperatively (patient 4).

Four re-operations had been performed. Three of these were undertaken because of failure of osteosynthesis. In 1 case Knowles pins were removed and re-osteosynthesis attempted with a rigid nailplate. The patient died three years after the primary operation. In 2 cases, Ender nails had started slipping, threatening to perforate the skin at the distal end of the femur. Therefore, the nails were removed two and three months postoperatively. In both cases bony union was achieved without secund internal fixation. One of the two developed a 30° varus deformity (patient 5), and the result was classified as poor. The other developed a shortening of the proximal femur by 1 cm. According to subjective evaluation the hip was classified as poor (patient 17). Closed reduction of the dislocated hip with a hemiprosthesis was performed under general anesthesia, and after tibial traction for three weeks no redislocation occurred. The final result was classifed as fair (patient 15).

Table II. — Individual outcome of surviving patients
(DHS = dynamic hip screw)

Patient no.	Method of operation	Radiological result	Clinical result	Age at follow-up (years)
1 (right)	Rigid nailplate	good	100 (exc.)	57
2 (left)	Rigid nailplate	good	96 (exc.)	57
2	Knowles pins	good	97 (exc.)	65
3	Knowles pins	good	93 (exc.)	59
4	Rigid nailplate	retroversion deformity 30°	90 (exc.)	69
5	Ender nails	varus deformity 30°	56 (poor)	75
6	DHS	good	65 (poor)	76
7	DHS	pseudoarthrosis varus deformity 40°	40 (poor)	54
8	DHS	retroversion deformity 20° shortening 2 cm	58 (poor)	85
9	DHS	varus deformity 20° shortening 2 cm	64 (poor)	82
10	DHS	varus deformity 15° shortening 1 cm	57 (poor)	82
11	Rigid nailplate	varus deformity 30° shortening 1 cm	good	89
12	Rigid nailplate	good	good	82
13	Rigid nailplate	good	good	82
14	Rigid nailplate	valgus deformity 20° retroversion deformity 20°	fair	78
15	Hemiarthroplasty	good	fair	88
16	Ender nails	good	fair	85
17	Ender nails	shortening 1 cm	poor	86
18	DHS	good	poor	81

The difference between the clinical results of rigid nailplates and dynamic hip screws is statistically significant ($p = 4.66 \times 10^{-3}$), Fisher's exact test for two-tail distribution.

DISCUSSION

The present results support the view that the rate of nonunion is low after the treatment of basicervical fractures (3, 10, 13). Moreover, none of the patients showed signs of avascular necrosis of the femoral head, which is also in accordance with previous results (10, 13).

The present results are also in line with the earlier conclusion that Ender nails may not be appropriate for basicervical fractures (1, 6). The current opinion is that hemiarthroplasty is also not indicated in basicervical fractures (10). The hemiarthroplasties performed in this series appear to have been problematic in 3 of the 4 cases, as indicated by long duration of surgery and marked loss of blood. In addition, one of the hips so operated dislocated. Three patients were operated using Knowles pins. In 1 case osteosynthesis failed and in 2 cases the result was excellent. The use of multiple pins or screws may be hazardous, since the distal fragment is fixed only at a very short distance from the fracture line to the lateral cortex. Thus, this mode of fixation should probably be reserved to the fractures of the intracapsular region of the femoral neck. In this series 20 fractures were fixed by rigid nailplates, with no major local complications. It appears that this old mode of fixation can still be recommended as the clinical and radiological results are generally superior to the other fixation procedures used in the present series.

During the lst years of this study, most patients with basicervical fractures of the femur were operated using the dynamic hip screw. In these recent cases additional screws were not added to secure the rotatory stability. Five clinically evaluated patients of this group all had a poor Harris score. In following X-rays of these patients the bony union was good in 4 cases. Nonetheless, 4 of the 5 patients had developed a gross deformity. In addition, one of them developed an infected nonunion.

If the dynamic hip screw is used, an additional screw to the femoral head for increased rotatory stability most probably improves the clinical end result, as previously suggested for femoral neck fractures in general (fig. 1) (9). In fact, the use of a device with a side-plate and two or three firm-angle sliding screws might be an ideal solution for this sometimes problematic group of fractures.

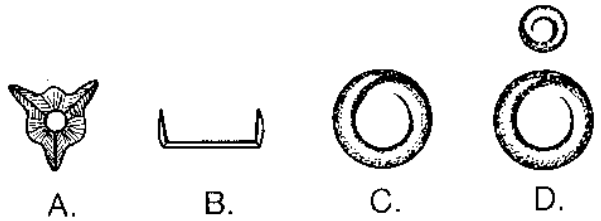
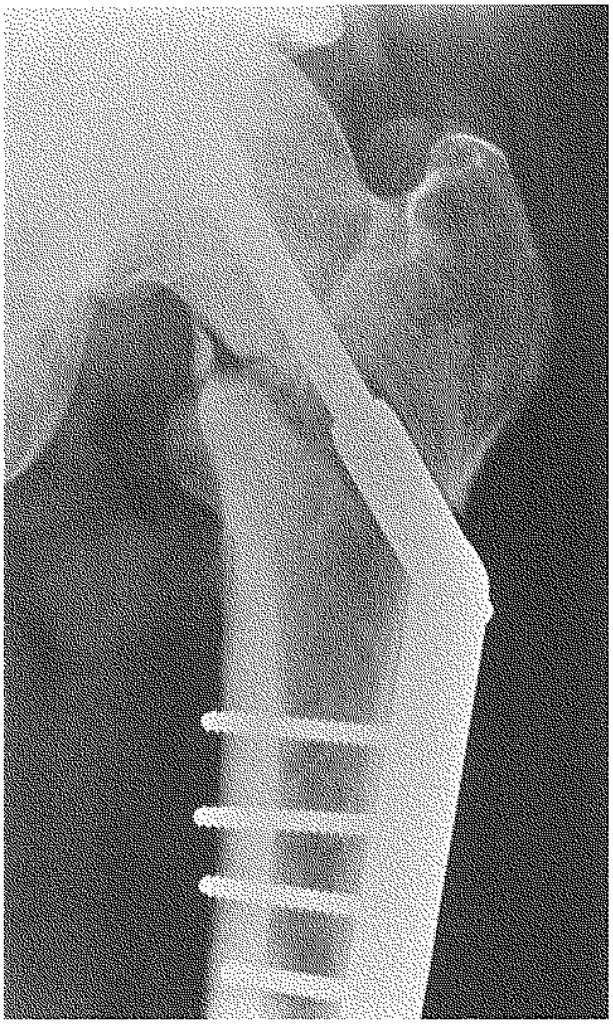


Fig. 1. - Profiles of the heads of rigid nailplates and the DHS implant, seen from the axial direction.
(A = Jewet, B = ASIF, C = DHS, D = DHS with an extra screw).



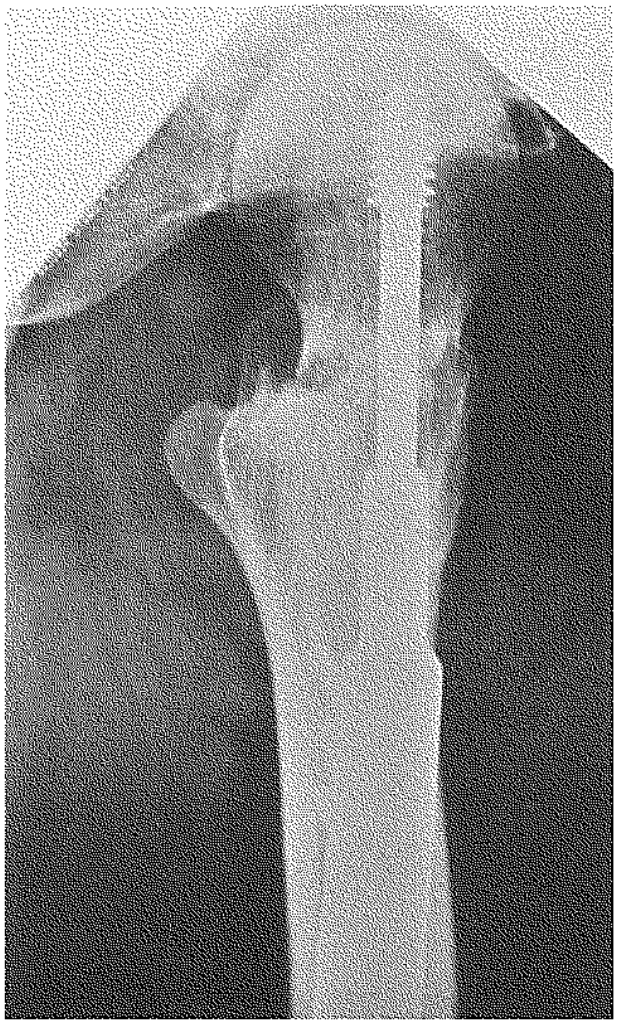


Fig. 2a

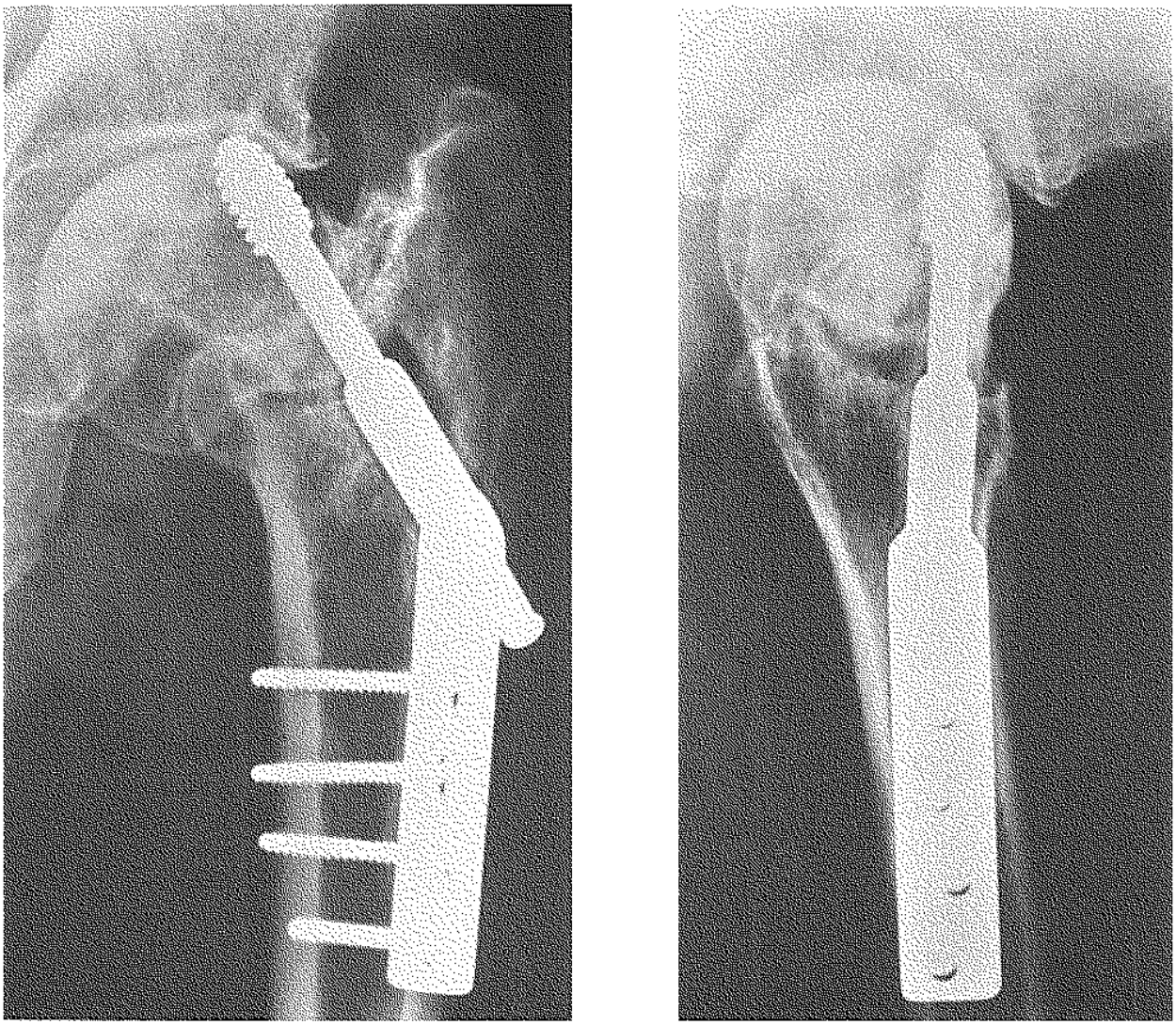


Fig. 2b

Fig. 2. — Postoperative radiographs of a 51-year-old man after fixation of the basicervical fracture by dynamic hip screw (patient 7).
a = Radiographs 18 days after the primary fixation ; b = Radiographs 3 years later. The implant was removed and an infection with pseudarthrosis occurred.

CONCLUSIONS

Basicervical fractures of the femoral neck, although relatively uncommon, are not insignificant from a surgical point of view. Indeed, the great variability of the operative techniques generally used seems to indicate that there is room for debate. In a retrospective analysis it was observed that conventional rigid nailplates (ASIF, Jewet) showed superior results as compared to the dynamic hip screw. The material is too limited for definite conclusions, but it seems probable that rotatory stability is especially important in this fracture entity, and thus a solitary round screw with side plate should be secured by an extra screw to the femoral head, for added stability of the proximal fragment.

REFERENCES

1. COBELLI N. J., SADLER A. H. Ender rod versus compression screw fixation of hip fractures. *Clin. Orthop.*, 1985, *201*, 123-128.
2. DELAMARTER R., MORELAND J. R. Treatment of acute femoral neck fractures with total hip arthroplasty. *Clin. Orthop.*, 1987, *218*, 68-74.
3. DePALMA A., F. *Fractures of the upper end of the femur.* In : *The management of fractures and dislocations.* W. B. Saunders Co., 1970, 1304-1309.
4. HARRIS W. H. Traumatic arthritis of the hip after dislocations and acetabular fractures : treatment by mold arthroplasty. *J. Bone Joint Surg.*, 1969, *51-A*, 737-755.
5. INDEMINI E., CLERICO P., FENOGLIO E., MARIOTTI U. A comparative study of trochanteric and basicervical fractures of the femur treated with Ender and McLaughlin techniques. *Ital. J. Orthop. Traumatol.*, 1982, *8/3*, 291-299.
6. KUOKKANEN H., KORKALA O., LAUTTAMUS L. Ender nailing of trochanteric fractures. *Arch. Orthop. Trauma Surg.*, 1986, *105*, 46-48.
7. KUOKKANEN H., KORKALA O. Christiansen replacement hemiarthroplasty in femoral neck fractures of the elderly. *Ann. Chir. Gynaecol.*, 1987, *76*, 104-107.
8. LEVY R. N., SIEGEL M., SEDLIN E. D., SIFFERT R. S. Complications of Ender pin fixation in basicervical intertrochanteric and subtrochanteric fractures of the hip. *J. Bone Joint Surg.*, 1983, *65-A*, 66-69.
9. MADSEN F., LINDE F., ANDERSEN E., BIRKE H., HVASS I., POULSEN T. D. Fixation of displaced femoral neck fractures : A comparison between sliding screw plate and four cancellous bone screws. *Acta Orthop. Scand.*, 1987, *58*, 212-216.
10. SISK T. D. *Fractures of hip and pelvis.* In : *Campbell's Operative Orthopedics.* Ed. C. V. Mosby, 1987, 1720.
11. SKINNER P., RILEY D., ELLERY J., BEAUMONT A., COUMINE R., SHAFIGHIAN B. Displaced subcapital fractures of the femur : a prospective randomized comparison of internal fixation, hemiarthroplasty and total hip replacement. *Injury*, 1989, *20*, 291-293.
12. STRÖMQVIST B., HANSSON L. I., NILSSON L. T., THORNGREN K.-G. Hook pin fixation in femoral neck fractures. *Clin. Orthop.*, 1987, *218*, 58-62.
13. WILSON J. N. *Injuries of the Hip.* In : Watson-Jones, *Fractures and Joint Injuries.* Churchill Livingstone 1982, 935, 957-958.

H. KUOKKANEN M.D.
University Central Hospital
Department of Orthopedics and Traumatology
Topeliuksenkatu 5
00260 Helsinki (Finland)