Cervical hip fractures do not occur in arthrotic joints

A clinicoradiographic study of 256 patients

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We studied endogenic factors for the occurrence of cervical hip fractures in 256 patients. 230 underwent hemiarthroplasty, and 26 were treated with internal fixation or without surgery. The condition of the fractured hip and of the ipsilateral knee, as well as the mobility of the patient before the fracture, were studied in all 256 patients. The removed femoral heads were examined, photographed and radiographs were taken with sensitive film. The acetabulum and the femoral head were macroscopically normal in all 230 cases and there was no radiographic evidence of arthrosis.

64% of the patients were fully mobile before the fracture, 34% were mobile with the aid of a cane and 2% were dependent. In 88%, the ipsilateral knee was normal both clinically and radiographically, and in 12%, there was moderate arthrosis.

When comparing the mobility before the fracture and the condition of the ipsilateral hip and knee in 100 patients having a cervical fracture with 100 patients having a trochanteric fracture matched for age and sex, we found that a normal hip joint was sine qua non while a normal ipsilateral knee and a fully mobile individual were important additional conditions for the occurrence of a cervical hip fracture, instead of a trochanteric one, after a fall in an elderly person.

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Previously, we have studied the significance of certain factors concerning the type of hip fractures (Dretakis and Christodoulou 1983). We found that cervical fractures occurred mainly in osteoporotic postmenopausal women who were physically active for their age, while trochanteric fractures of the upper femur often occurred in older persons, with muscular weakness, especially with paresis or arthrosis of the hip or knee of the affected leg.

Several investigations, based on radiographic material, have shown that intracapsular fractures rarely occur in arthrotic hips (Östrup 1970, Weintroub et al. 1982, Pedersen et al. 1987, Wand et al. 1992). Arthroplasty for cervical hip fractures offers the possibility of detailed direct macroscopic examination of the anatomy of the femoral head and the acetabulum. Our aim was to find out whether cervical fractures occur in arthrotic hips or in other conditions affecting the mobility of the joint.

Patients and methods

During 1993–1995, 256 patients (198 women) with a cervical fracture were admitted to the 2 orthopedic departments in our region. Based on a common protocol, 230 patients (180 women) who were aged 70 or more underwent hip hemiarthroplasty for displaced fractures. The remaining 26 cases included 15 patients younger than 70, in whom internal fixation with pins and screws was performed and 11 patients, older than 70, with undisplaced fractures, who were either operated on or treated without surgery. All 26 patients were examined clinically and with radiographs of the hips and knees.

In the hemiarthroplasty group (230 patients), information regarding the mobility of the patient and the condition of the fractured hip and the ipsilateral knee before the fracture was recorded. The knees were examined clinically and A/P radiographs of the hips and knees were taken. During hemiarthroplasty, the mobility of the femoral head prior to its removal from the acetabulum was examined, by moving it, using the

Table 1. Pre-fracture mobility in 256 cases with cervical hip fracture

	Hemiarthroplasty group	No hemiarthroplasty group
Fully mobile	146 (64%)	20
Used a cane	79 (34%)	6
Dependent	5 (2%)	–
Total	230	26

Table 2. Pre-fracture mobility of patients with cervical (n 100) and trochanteric (n100) fracturs matched for age and sex

	Cervical	Trochanteric
Fully mobile	62	40
Used a cane	37	60
Dependent	1	–
Fractured hip arthrosis	0	18
Ipsilateral knee arthrosis	14	45

handle of the extractor. After the removal of the femoral head, both the head and the acetabulum were examined macroscopically for the existence of arthrotic changes and the femoral heads were then color photographed and radiographed in anteroposterior and lateral projections using sensitive (mastography) films. The diagnosis of hip arthrosis was based on common radiographic criteria and the changes were classified as moderate or severe according to Danielson et al. (1964) and Östrup (1970).

The mobility of the patients was graded as fully mobile, mobile with the aid of a cane or dependent. In the last group were included those walking only indoors with the aid of other persons, or who were bedridden.

We matched 100 patients with a cervical fracture and 100 patients with a trochanteric one, according to age and sex, and compared the mobility before the fracture and the incidence of arthrosis of the hips and knees in these two groups. For statistical calculations, we used the chi-square test.

Results

All 230 femoral heads had normal shape, and no marginal osteophytes were found in either the heads or the acetabuli. The articular cartilage of the femoral head and of the acetabulum was normal in all cases. All femoral heads had a normal radiographic appearance.

Two thirds of the patients were fully mobile before the fracture (Table 1). In 203/230 patients (88%), the ipsilateral knee was clinically and radiographically normal and only in 27 patients did the knee show clinical and radiographic signs of moderate arthrosis. Among the 26 patients not subjected to replacement of the femoral head, the ipsilateral knee was normal in 24 patients, 2 patients had moderate arthrosis.

In 100 age- and sex-matched patients with cervical and trochanteric fractures, their mobility before the fracture was as follows: 62% of patients with cervical fractures were fully mobile, 37% used a cane and 1% were dependent. The corresponding figures in patients with trochanteric fractures were 40%, 60% and 0% ($p < 0.001$). Moderate-to-severe arthrosis was observed in 18 fractured hips and 45 ipsilateral knees in the group with trochanteric fractures whereas 0 hips and only 14 ipsilateral knees had moderate arthrosis in the group with cervical fractures ($p < 0.001$) (Table 2).

Discussion

Several factors have been related to the incidence and location of fractures of the upper end of the femur such as falls, osteoporosis, mobility, sex, age, body weight and height of the individual, the hip axis length, the neck shaft angle and status of the fractured hip and/or the ipsilateral knee joint. Osteoporosis, closely associated with age, is a general predisposing factor (Cummings et al. 1993, Faulkner et al. 1993), but there is no agreement regarding its role concerning the location of these fractures. Several authors (Riggs et al. 1982, Bohr and Schaadt 1983, Chevalley et al. 1991, Dretakis et al. 1995, Dretakis 1996) found no significant difference in bone mineral density at the upper femoral end, in patients with cervical and trochanteric fractures. On the contrary, Eriksson and Widhe (1988) as well as Mautalen and Vega (1993) observed reduced bone mineral density in trochanteric fractures, as compared to cervical fractures.

Falls are decisive factors in hip fractures. Most of the fractures occur after a fall on the hip. It has been stated that, with this mode of falling, both cervical and trochanteric fractures occur (Lauritzen et al. 1992). However, the traumatic stamp produced at the point of impact of the fall indicates that cervical fractures often occur with a fall on the posterior aspect of the tip of the greater trochanter, while trochanteric fractures are often caused by falling on a larger surface of the lateral aspect of the greater trochanter (Dretakis 1996).

The association of geometric characteristics of the upper femoral end, with a possible risk for hip frac-

ture, was studied by several authors (Hagberg and Nilsson 1977, Dretakis and Christodoulou 1983, Ferris et al. 1989, Faulkner et al. 1993, Cummings et al. 1994). Faulkner et al. (1993) found that a longer than average hip axis was an independent risk factor in hip fracture and this was present in both cervical and trochanteric fractures.

Our findings in this study confirm our long-standing clinical observation that the existence of a normal hip with normal range of movement is an indispensable precondition for a cervical fracture to occur. Limitation of hip movement, whatever the cause does not allow rotation and consequent displacement of the femoral head in the acetabulum. A normal ipsilateral knee and a fully mobile individual are important but not indispensable conditions for cervical fractures. It is possible that the mobility of the knee and the condition of the muscles of the thigh—especially of the two joint muscles—determine, by dissipation of kinetic energy (Tronzo 1973, Smith et al. 1996), and eccentric muscle contraction (Frankel and Nordin 1989, Norkin and Levangie 1992), the way in which the fall occurs and the location of the fracture.

Bohr H, Schaadt O. Bone mineral content of femoral bone and the lumbar spine measured in women with fractures of the femoral neck by dual photon absorptiometry. Clin Orthop 1983; 179: 240-5.

Chevalley T, Rizzoli R, Nydegger V, Slosman D, Tkatch L et al. Preferential low bone mineral density of the femoral neck in patients with a recent fracture of the proximal femur. Osteoporos Int 1991; 1: 147-54.

Cummings S R, Black D M, Nevitt M C, Browner W, Cauley J, Ensrud K, Genant H K, Palermo L, Scott J, Vogt T M. Bone density at various sites for prediction of hip fractures. Lancet 1993; 341: 72-5.

Cummings S R, Cauley J, Palermo L, Ross P D, Wasnish R D, Black D, Faulkner K G. Racial differences in hip axis lengths might explain racial differences in states of hip fracture. Osteoporos Int 1994; 4: 226-9.

Danielson L G, Dymling J F, Heripret G. Coxarthrosis in man studied with external counting of Sr^{85} and Ga^{47}. Clin Orthop 1964; 31: 184.

Dretakis E K. Unpublished data from a prospective study on hip fractures in Crete, 1996.

Dretakis E K, Christodoulou N A. Significance of endogenic factors in the location of fractures of the proximal femur. Acta Orthop Scand 1983; 54 (2): 198-203.

Dretakis E K, Kontakis G M, Steriopoulos K, Dretakis K, Kouvidis G. Broadband ultrasound attenuation of the os-calcis in female postmenopausal patients with cervical and trochanteric fractures. Calcif Tissue Int 1995; 57 (6): 419-21.

Eriksson S A, Widhe T L. Bone mass in women with hip fracture. Acta Othop Scand 1988; 59: 19-23.

Faulkner K G, Cummings S R, Black D, Palermo L, Gluer C, Genant, H K. Simple measurement of femoral geometry predicts hip fracture. The study of osteoporotic fractures. J Bone Miner Res 1993; 8 (10): 1211-7.

Ferris B D, Kennedy C, Bhamra M, Allwood W M. Morphology of the femur in proximal femoral fractures. J Bone Joint Surg (Br) 1989; 71: 475-7.

Frankel V H, Nordin M. Basic biomechanics of the skeletal system, 2nd ed, Lea & Febiger, Philadelphia 1989.

Hagberg L, Nilsson B. Can fracture of the femoral neck be predicted? Geriatrics 1977; 32: 55-61.

Lauritzen J B, Petersen M M, Lund B, Juhl E. Hip fractures prevented by external hip protectors. A randomized nursing home study. In: Fractures of the upper end of femur (Ed. Emm K Dretakis), Crete University Press 1992: 77-88.

Mautalen C A, Vega E M. Different characteristics of cervical and trochanteric hip fractures. Osteoporos Int (Suppl I) 1993: 102-6.

Norkin C, Levangie P K. Joint structure and function. E A Davis, Philadelphia 1992.

Pedersen N W, Schmidt S A, Christensen F, Kjaersgaard-Andersen P. Osteoarthritis of the hip in patients with proximal femoral fractures. J Bone Joint Surg (Br) 1987; 69: 529.

Riggs B L, Wahner H Z , Seeman E, Offord K P, Dunn W L, Mazess R B et al. Changes in bone mineral density of the proximal femur and spine with aging. Differences between the postmenopausal and senile osteoporosis syndromes. J Clin Invest 1982; 70: 716-23.

Smith L K, Weiss E L, Lehmkull L D. Brunnstrom's clinical kinesiology. Davis Company 1996.

Tronzo R G. Surgery of the hip joint. Lea & Febiger, Phildelphia 1973: 112.

Wand J S, Hill D, Reeve J. Coxarthrosis and femoral neck fracture. Clin Orthop 1992; 278: 88-94.

Weintroub S, Papo J, Ashkenazi M, Tardiman R, Weisman S L , Salama R. Osteoarthritis of the hip and fractures of the proximal end of the femur. Acta Orthop Scand 1982; 53: 261-4.

Östrup L T. Fracture of the femoral neck in cases with coxarthrosis on the affected side. Acta Orthop Scand 1970; 41: 559-64.