P13: Pathogenesis Of Falls And Fractures As Basis For A Combined Therapy Both By Exercise And Alfacalcidol

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Multifactorial falls are a common event among certain groups of elderly people, accounting for 87 % of all fractures in the age of 65 years and older (NCIPC). A third of all elderly people (age > 65 years) fall each year. About 5 % of these falls result in a fracture, a fifth of these fractures are hip fractures. From another perspective, more than 90 % of hip fractures are caused by a fall. Furthermore falls cause injuries of soft tissue and cerebrum, chronic impairment of mood and self-esteem and lead to long-lasting self-restrictions of physical activity. Hip fractures, as the most serious consequences of a fall, have an exponential age-related increase and result in a 15-25 % increase of mortality in the successive year and a 20 % increase in nursing home admissions. The pathogeneses of age-related neuromuscular decline, falls, bone strength and non-vertebral fractures are inextricably interconnected as a pathogenetic cascade. Rather than having a single cause, falls and fall-related fractures are the result of a combination of intrinsic, situational, and environmental factors. This process is highly age-related: falls occur among elderly people in a significantly higher rate and with different fall mechanisms, especially as sideway fall with impact to the greater trochanter. The majority of falls occur without disruption of consciousness as non-syncopal falls during normal daily activities without extraordinary demand to the equilibrium and without overwhelming external force. Non-vertebral osteoporotic fractures of hip, humerus, pelvis and wrist result from a combination of falls and reduced bone strength. This combined pathogenesis demands a combined diagnostic and therapeutic approach comprising both bone strength and fall risk. The key finding is: special characteristics differentiate fallers from non-fallers, and these fall risk factors accumulate in one person as an individual cluster of impairments. Interventions against age-related falls and fractures have to be targeted on these patients with high risk who can be identified by their individual aggregation of specific fall risk factors. Falls as a sign of locomotor decline are also a marker of the frailty syndrome.

Basis for a successful prevention is a risk stratification of the elderly by a fall risk assessment, in order to identify the high-risk population. An evidence-based fall risk assessment addresses parameters which have proven to be independent fall risk factors in multivariate analyses of prospective studies:

Impairments of:

1) muscle power of lower extremities, measured by chair rise test,
2) postural capacity (balance), measured by tandem manoeuvres,
3) vision.
4) Multiple medications as indicator of high co-morbidity.
5) Fall-associated drugs with specific impairment of postural capacity.
6) Cognitive impairment.

Examining muscle function and gait and balance disorders requires age-, sex- and race-related reference values which are collected (cf. www.mobility-clinic.de). Muscle function and postural competence, which both have been proven independently correlated to fall risk, can be measured respectively with the chair rising test and tandem tests, and with the newly developed Leonardo mechanography.

There is a growing body of evidence that falls can be prevented by multi-factorial interventions with muscle and balance training and review of medications (Tinetti et al 1994, Close et al 1999). Until now the traditional pharmacological approach concentrates on increasing bone strength, but neuromuscular functions and postural capacity are apparently open to pharmacological regimens. As therapeutic conclusion fall risk should be counteracted by a combined approach, both by exercise programs and pharmaceutical therapy. In the field of exercise beside traditional approaches side-alternating vibration therapy has been proven effective in improving fall-related neuromuscular functions (muscle power and lateral balance).

Goal of exercise programs can be summarized as motor learning. Motor learning can not be accomplished by drugs, but perhaps exercise effects can be enhanced by drugs. There is emerging clinical evidence that Alfacalcidol, a D-Prohormone, improves muscle power (S_rensen et al. 1979, Scharla et al. 2000, Verhaar et al. 2000). A study has already demonstrated the reduction of falls by D-Hormone in elderly patients, aged 65 - 77 years with normal Vitamin D status (Gallagher et al. 2001). Dukas et al. have shown that 1 μg Alfacalcidol daily reduce significantly the number of falls (-54%) and fallers (-55%) in community-dwelling elderly women and men with a total calcium intake of more than 500 mg daily and normal vitamin D serum levels (Dukas, Bischoff et al 2004). A reduced creatinine clearance (CrCl) of < 65 ml/min is significantly associated with low D-hormone serum levels and with a significant four times increased risk of falls. 36 weeks of treatment with Alfacalcidol (1 μg daily) significantly and safely reduces in community-dwelling elderly women and men with a CrCl of < 65 ml/min the low CrCl associated increased number of fallers (- 74%) and the high risk of falls (-71%) (Dukas, Schacht et al 2004). Based on further confirmation of these findings, Alfacalcidol opens a new therapeutic strategy for treating osteoporosis by simultaneously increasing bone strength and decreasing falls. It has a double impact on fall- and osteoporosis-related fractures, but should always combined with exercise.