

DVO-Guideline

Osteoporosis in the Older Person

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1. Introduction

1.1 Objects of the Guideline

The objects are prevention, diagnosis and therapy of primary osteoporosis in older women (older than age 75). This age limit was applied as from this age on an exponential increase in fractures – especially fractures near the hip – is seen. For younger age groups we refer to the guideline on “Osteoporosis in Postmenopausal Women” and for secondary osteoporosis we refer to the guideline on “Glucocorticoid-induced Osteoporosis”.

1.2 Patient target groups

The target group of this guideline are older women (older than age 75) who are undergoing primary medical treatment because of acute back pain, elevated risk factors, or a fracture. The age limit was chosen due to the following reasons:

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- Primary target parameter is a fracture near the hip, the frequency of which is highly increased above age 75.
- Evidence with regard to risk factors, diagnosis and therapy differs significantly from young age groups as for example many therapy studies exclude older persons.
- Fractures at a higher age are normally the result of an interaction between neuromuscular functions (fall) and the condition of the bone and, therefore, require to additionally take into consideration that people suffer from falls.

Due to the weak evidence situation for osteoporosis in men this target group will presently only be considered marginally.

2. Methods

The recommendations of this guideline are based on a systematic literature search and assessment guided by key questions and focusing on publications between 1996 – 4.2002. The search and assessment concentrated mainly on guidelines, HTA (Health Technology Assessment) reports, meta-analyses, systematic surveys and randomized clinical trials (RTC) as well as mainly epidemiological cohort studies and diagnostic studies. If the evidence situation was not sufficient older publications, dating from 1990 - 1995, were also considered. Animal trials as well as other experimental trials and trials, which were not published in German or English were not considered.

It was either looked for general entries („osteoporosis“, „fracture“) or special entries for the different topics („therapy“, „calcium“, „diagnosis“, „risk“, etc.).

Search was done in the following databases:

- MEDLINE (user interface: WINSPIRS)
- CURRENT CONTENTS
- COCHRANE Library
- Database for guidelines of the ÄZQ (*Ärztliches Zentrum für Qualität in der Medizin* – Agency for Quality in Medicine), of the *Deutsches Institut für Medizinische Dokumentation und Information* (DIMDI – German Institute of Medical Documentation and Information) as well as the US National Guidelines Clearinghouse
- Web pages of the major HTA institutes and of institutions specialized on guidelines
- Web search tools such as Google

As age limits cannot be defined very well by search names, first a broad literary search was performed and then all relevant data for the group of women age ≥ 70 was manually identified. In the case of lack of or low evidence trials with women age ≥ 65 were considered as well. Fundamental endpoints for all trials

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are fractures. In this age group fractures near the hip are the most frequent fracture types. Bone density was only regarded as a surrogate parameter as in epidemiological trials as well as in RCT bone density alone does not represent a sufficiently reliable value for the assessment of the fracture risk due to the fact that the causes for fractures might be numerous. Therefore, trials with this endpoint give only indirect evidence for diagnosis, prognosis and treatment of osteoporosis. Only intervention with drugs for which presently approval for the prevention and treatment of osteoporosis exists was considered.

3. Epidemiology and social importance

Osteoporosis is the most frequent bone disease. It is described as a disease the characteristics of which are low bone mass and deterioration of the micro-architecture of bone tissue and which leads to an increased bone fragility and, consequently, to an increased fracture risk. Osteoporosis is mainly defined by bone mineral density (BMD) and not by a clinical endpoint (e.g. fracture). This definition takes into consideration that there is a close relation between BMD and fracture risk but that there might also be other factors that could influence the fracture risk.

The World Health Organisation (WHO) operationally defined osteoporosis based on bone mineral density measurements (regardless of the measurement site) as follows:

- normal: bone density not lower than one standard deviation (SD) below the average of young adult women (T score above -1)
- osteopenia or lower bone density: BMD between 1.0 and 2.5 SD (T score between -1 and -2.5)
- osteoporosis: bone mineral density 2.5 SD or higher below the average value (T score < -2.5).

Women in this risk group who already had one or more fractures can be categorized as having a “severe” or “manifest” osteoporosis.

The epidemiology of osteoporosis can be discriminated between statements regarding

- Incidence and prevalence of the individual stages of osteoporosis
- Risk factors for the individual stages of osteoporosis
- Morbidity, mortality, ability obstructions and quality of life after fractures
- Social burden of the disease (e.g. health economy)

The clinically most relevant parameter, also for patient information, is the risk of a woman to have a bone fracture during lifetime or during a defined period of time (10 years). The risk of a 75-year old woman to fracture a bone near the hip during lifetime is at approximately 20 %, of a man of the same age at approximately 9 %.

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Studies examining the consequences of a fracture near the hip show that these fractures with a mortality risk of 20–25 % within the first 6 months lead to a dramatic excess mortality. Equally important are the functional deficiencies of those who survive, which in many cases cause a committal to a home for the aged or a nursing home, an increased necessity for nursing and severe restrictions of quality of life. Due to their frequency, their morbidity and mortality as well as their socio-economical importance fractures in the region of the hip therefore represent the most important clinical endpoint of all statements in this guideline.

In the discussion epidemiological risk factors are discriminated between reduction of bone mineral density (osteoporosis without fractures), fractures (near the hip) and falls. No single risk factor including bone mineral measurements is sensitive and specific enough for an early detection of osteoporosis. Therefore, a (population-based) screening is not recommended (**D**). In the focus of diagnosis should therefore be the identification of high-risk patients.

In many epidemiological studies numerous risk factors were examined for the different stages of osteoporosis (age, bone mineral density, weight and/or weight loss, reduction in body height, fractures in family history, fracture history, reproductive risk factors, smoking, consumption of alcohol, drinking of coffee, physical inactivity, calcium intake, vitamin D synthesis, other diseases and risk factors for falls). In order to judge the evidence it has to be discriminated whether these risk factors should be used for fracture prediction or as an indication for a bone mineral density measurement. Similar to the blood pressure measurements in case of hypertony or lipid determination in case of hyperlipidemia by a bone mineral density measurement the disease is defined as well as an assessment is made of the consequential risk (stroke, myocardial infarction, fracture). It is true that a reduced bone mineral density does represent an important risk factor but its predictive importance is limited. The more risk factors, the higher the fracture risk. Which combination of single risk factors increases the precision of fracture prediction clinically relevantly, however, is bound to further studies. For diagnosis and treatment information regarding bone mineral density, risk factors and fall disease should therefore be combined.

4. Diagnosis of osteoporosis

In the area of outpatient treatment older patients (age 75 and older) can be divided into three groups with regard to osteoporosis treatment:

- I:** Older woman with an acute or older (postmenopausal in case of inadequate trauma) vertebral fracture
- II:** Older woman with high risk factors (including peripheral fractures, see below)
- III:** Older woman with/without fracture / in high need of care / institutionalised / immobile

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Due to the high prevalence and incidence of osteoporosis in this age group verification whether the woman suffers from osteoporosis as well as a fall disease should be part of the routine medical care.

The aim of diagnostic verification is the assessment of the fracture risk and the exclusion of secondary osteoporosis or other diseases, which are mainly:

- Family history, determination of risk factors and physical examination
- Determination of bone mineral density in the case of determined suspicion that an osteoporosis exists or in the case of prevalent fractures
- Image giving procedures (conventional x-ray)
- Base laboratory
- Asking for falls

4.1. Risk factors

All existing scores or lists of risk factors which were studied empirically only have low practical relevance due to clinimetric features, therefore, no advice can be given with regard to a score system or any other fixed combination of risk factors **(B)**. The number of existing risk factors is of predictive importance **(B)**. Especially women with several risk factors and a low bone mineral density represent a high risk group for (further) fractures **(B)**.

Due to existing evidence the following risk factors should be taken into consideration for further diagnostic and therapeutic measures:

High risk factors for fractures **(B)**:

- Fracture history (acute or since menopause without higher trauma)
- Reduction of body height > 4 cm since age 25 or > 2 cm since the last measurement (see also vertebral fractures)
- Low body weight (BMI < 20) or unintended reduction of weight > 10 % during the recent past
- More than one fall during the last 6 months which was not caused extrinsically (i.e. falls which cannot be explained as being caused by outside forces)

Furthermore, some diseases include a high risk for a secondary osteoporosis such as:

- Serious chronic liver and kidney malfunctioning
- Glucocorticosteroid intake (> 7.5 mg prednisone equivalent for more than 6 months)
- Hyperthyreosis
- Malabsorption syndrome (e.g. Crohn's disease)
- Rheumatoid arthritis
- Primary hyperparathyroidism

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- Systemic inflammatory diseases
- Antiepileptics

These forms of secondary osteoporosis are not the object of this guideline. In case of such a disease an examination should be carried out by a specialist if this is regarded as necessary.

For a lot of other risk factors (e.g. family history, geometry of femoral neck) only limited evidence for clinical relevance is given **(B)**.

Regular gathering of information on family history and physical examination including measurement of height and weight are the foundation for osteoporosis diagnostics **(D)**.

4.2. Measurement of bone mineral density

The main indication for a measurement of bone mineral density is the existence of a high risk factor or the suspicion for a vertebral fracture **(B)**. As said before, bone mineral density is an important part of diagnosis as well as one essential risk factor for fractures. For the determination of bone mineral content different procedures can be used. The DXA (dual-energy x-ray absorptiometry) measurement is the essential diagnostic procedure. Internationally, a T score of -2.5 is regarded as the clinical relevant threshold **(D)**. There are several other procedures such as quantitative (QCT) and peripheral quantitative CT (pQCT) as well as ultrasound. Based on present data CT procedures (especially pQCT) can neither be recommended for primary diagnosis nor for therapy control purposes. This recommendation should, however, soon be discussed again due to continuous research.

The same applies to ultrasound (osteosonometry). On the basis of epidemiological studies a pathological value (device-specific) constitutes a high risk factor, the data situation is, nevertheless, better for ultrasound than for QCT. But we have not seen any evidence for using it as screening procedure or for routine diagnosis. For these questions research has to be done urgently.

DXA

By means of DXA procedures bone mineral density can be measured at the spine, the femoral neck, the forearm or at the whole body. The different measuring sites have different testing characteristics (e.g. sensitivity and specificity) **(B)**. Measurements done only at one site have a considerably worse predictive value than a combination of values taken from several measuring sites **(B)**. Bone mineral density at the femoral neck has the highest predictive importance for fractures near the hip joint and should therefore be done in any case **(B)**. It is well proven that bone mineral density has the highest predictive value for fractures at the measuring site **(B)**. Based on existing evidence it is recommended to perform one measurement at the spine as well as one at the femoral neck **(B)**. As a measurement at the spine of older persons is influenced by particular technical problems (aortic sclerosis, degenerative changes, etc.) this should not

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be done with women age 75 or older in the first place. **(B)** For them the total femoral neck should be measured first (so-called total hip value). If the T score at this site has a value of > -2.5 SD a measurement at the spine is not necessary as this would not give any further information relevant for the treatment.

Whether a DXA measurement for women with several fractures, especially at the spine, is of additional use is not clear **(D)**. There are very different statements with regard to the time interval between measurements. Due to the test characteristics of DXA procedures follow-up measurements are only useful after 2 years at the earliest **(C)**. Data from RCT also show that control measurements at an earlier point in time do not have any practical relevance e.g. with regard to change of medication **(B)**. Therefore, control measurements should only be done at the end of a therapy and/or after 2 years at the earliest. Also for the verification of bone mineral density measurements, which were done in the scope of prevention a follow-up measurement is recommended after 2 years at the earliest. The working group is aware of the fact that the present diagnostic situation in medical care is not yet sufficient to implement this recommendation in all places.

For the determination of the individual fracture risk (near the hip) bone mineral density, age, and risk factors should be considered **(C)**.

Conventional X-ray

Due to problems with standardised execution and assessment conventional x-ray of the thorax and the lumbar spine is not a measuring procedure for the assessment of bone mineral density **(D)**. Information with regard to fractures obtained from examinations done for another purpose, however, should be integrated into the risk assessment. The main indication is the verification of a suspected fracture or another clinical problem. Therefore, a conventional x-ray of the thorax and the lumbar spine should always be done as a routine if the bone mineral density values are between -1 SD and -2.5 SD. Below the threshold of -2.5 SD an x-ray is optional and should only be done if there is a precise clinical indication or if the findings are relevant for the decision with regard to therapy. Above the value of -1 SD conventional x-ray should not be done as a routine.

4.3. Base laboratory

If there is reasonable clinical suspicion for osteoporosis a so-called base laboratory should be done in order to exclude e.g. other diseases or references for secondary osteoporosis **(D)**. This should at least consist of ESR/c-reactive protein; blood count, calcium, phosphate, alkaline phosphatase, gamma-glutamyl transpeptidase, protein electrophoresis, creatinine, and TSH **(D)**.

Biomarker

At present several biochemical markers of the bone metabolism have been examined. Neither the (patho)physiological interpretation nor the test characteristics, however, admit to use them for the diagnosis of osteoporosis as a routine. They should only be used by experts for a differential diagnosis in special situations.

4.4. Verification of falls

Besides osteoporosis falls are in the focus when avoiding fractures. As the *Deutsche Gesellschaft für Allgemeinmedizin und Familienmedizin* (DEGAM – German Society for General Medicine and Family Medicine) has issued evidence-based guidelines for this problem and it is not regarded as opportune to develop a new similar guideline for reasons of acceptance, the main sections are described here as follows (with minor modifications). According to these guidelines a fall is an involuntary, sudden, uncontrolled falling or gliding down of the body to a lower level when standing, sitting or lying down. Falls are among the 8 most common causes for death of older persons. Approximately 30 % of persons above age 65 suffer a fall at least once a year. 30-40 % of them suffer grave injuries, fractures of the femoral neck being the most common. With approximately 120,000 fractures of the femoral neck and a mortality rate of approximately 20-25 % within the first 6 months the complication of “osteoporosis” constitutes a challenge with regard to health aspects as well as to economical and social aspects. Approximately 40 % of all committals to homes for the aged result from a fall.

The most important steps for a strategy to avoid (further) falls are:

- Risk assessment
- Verification of causes
- Intervention

Risk assessment

The most important step for risk assessment of a fall disease is to place the question whether a fall or almost a fall was suffered during the last weeks or months. Most of the falls of older people have several causes and are not mono-causal results of a disease or of a functional deficiency.

Therefore, the following reasons for falls are distinguished:

- Extrinsic falls (falls which obviously were caused by forces influenced from the outside).
- Syncopal falls (falls which were caused by a loss of control - limited in time, and (patho)physiologically understandable - of the locomotor system with or without losing consciousness, e.g. transient ischemic attack, cardiac dysrhythmia)
- Locomotor falls (falls from patients with functional deficiencies in routine conditions or activities)

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In most cases it is a combination of situational, exogenous, iatrogenic and/or endogenous factors. Besides outer risk factors as inappropriate shoes, etc. “inner” features associated with the fall are to be considered, such as

- Being female
- Positive fall history
- All pareses (motorical/sensitive)
- Parkinson’s disease
- Visual limitations, especially limitations in three-dimensional sight
- Limitations in hearing
- Persisting neurological deficiencies, condition after apoplectic insult
- Deformations at the lower limbs
- Variations in blood sugar
- Variations in blood pressure
- Muscular atrophy
- Cachexy, consumptive base disease
- Dementia
- Acute or chronic dizziness
- Depression
- Misuse of alcohol or drugs
- Functional limitations in daily life (ADL; IADL)
- Malfunction in walking or balancing
- Delirium in case of acute infection, and/or exsiccosis
- Insecure handling of helping devices

Further risk factors are iatrogenic features associated with falls, such as

- Taking of psychotropic medicine, especially benzodiazepines, neuroleptics, antidepressants
- Antihypertensives, diuretics
- Multi-medication (> 4 drugs)

And situational features associated with falls (e.g. overestimation of one’s own capacities)

Verification of causes

It is useful to assign the causes for the falls to 3 etiopathogenetic groups:

- extrinsic
- syncopal
- locomotor/postural

The analysis of the individual situation of a patient who is at risk of falls can in many cases identify factors the change of which probably causes a reduction of the fall risk **(B)**. The most important diagnostic means is the question whether a fall or nearly a fall happened, which has to be placed at least once a year, depending on the condition of the patient **(D)**.

In case of a fall the following diagnostic measures should be taken:

- **(Further) medical history** asking
 - what was the occupation/activity immediately before the fall happened
 - at what time of the day did the fall happen
 - whether there were falls before
 - whether the patient feels an insecurity when walking
 - specific questions for extrinsic falls
 - specific questions for syncopal falls (obstructions in consciousness, prodromal symptoms, etc.)
 - whether the activities of the daily life are increasingly obstructed
 - precise drug history
- **internal and neurological status**
- **geriatric assessment** for all patients with geriatric syndromes (e.g. incontinence, dementia, poly-pathia)
 - Evaluation of deficiencies in hearing and seeing
 - Evaluation of the cognitive-emotional functions using standardised instruments
 - Depression (e.g. geriatric depression scale, GDS)
 - Demential syndromes (e.g. mini-mental state examination, MMSE)
- **Testing for fall risk**
 - Rising test
 - Standing on one leg or tandem
- Further diagnosis depending on suspicion diagnosis (prolonged ECG, CCT, Schellong test, etc.)

For a complete fall verification and further test it is referred to the relevant guidelines of the DEGAM.

5. Prevention and treatment of osteoporosis

Non-medical and medical intervention can be part of the primary prevention and treatment of osteoporosis. Preventive measures for older persons aim at the following endpoints:

- Improvement of bone metabolism
- Strengthening of the neuromuscular function (tendency to falls)

- Maintenance and/or improvement of the functionality after falls
- Control of body weight and body fat proportion
- Control of quality of life and thus of the physical and social activities

Due to the high fracture risk of older women and the low evidence for primary preventive approaches in this age group (exception: movement) all therapeutic options for the three patient groups with a typical constellation of findings are combined. As diagnosis and therapy for all groups consist of single modules they are represented thematically. Their importance for the treatment of single patient groups can be taken from the different algorithms, which are given in the annex. For all therapeutic options except for the hip protectors it is to be said that trials with patients older than age 80 are not known and that therefore only extrapolated evidence exist.

5.1 Non-medical treatment and prevention

5.1.1 Calcium

By means of a sufficient calcium intake bone mineral density can be influenced effectively **(A)**. Existing evidence is, however, mostly related to younger age groups. For older persons a low nutritional calcium intake was proven **(B)**. Whether fractures can be reduced effectively just by optimising the nutritional calcium intake is not proven sufficiently **(B)**. Although the given doses range from 1-1.5 g it is advisable to use the upper limit as an aim for older women **(D)**.

5.1.2 Movement

Although the general geometrical features of bone are genetically determined the internal architecture, BMD and other bone features can change due to environmental influences. Mechanical strain of the bone is the most important factor. The effect of mechanical strain on bone is only local, i.e. changes are generally seen at those skeletal sites, which are exposed to the strain. It is of importance that the strain is dynamic and not static. From a physiological point of view it is decisive that the strain is relatively high. Several epidemiological single trials for the age group which is considered here show that for bone mineral density **(B)** as well as for fractures **(C)** a positive association can be seen for physical activity considering the restrictions made above. Numerous studies of differing quality have investigated the effect of different movement therapies on bone mineral density. The majority of the studies shows in the intervention group a significant increase of BMD at different skeletal sites including spine, radius, femoral neck or calcaneus **(A)**. Although most of the studies were small and did not take a long time, studies with a longer observation period also show that the positive effect at least lasts for the duration of the trial. The intervention programmes, however, vary between the different trials. Some relate exclusively to forced walking, whereas others compare practicing with weights and aerobic exercise or different degrees of intensity of the same movements practiced. The majority of the participants in the control groups were not treated. Due to the intervention programmes, measuring sites and study designs which were different in

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all trials no valid comparison of all trials can be made. Observation studies as well as clinical studies show that all movements which exert tension and pressure on the bone have an anabolic effect on bone metabolism and thus can lead to conservation or even to an increase in bone mass. There is sufficient evidence that specific physical movement increases bone mineral density even in the case of older women **(B)**, although only general statements can be made about the efficiency of certain forms of practising due to non-uniform intervention programmes. Whether physical movement and the consequent increase in bone mineral density can reduce the fracture risk caused by osteoporosis is not sufficiently verified at present **(C)**. Due to the frequency of falls for older persons and the importance of the neuromuscular function, however, physical movement plays an important role from a preventive point of view.

5.1.3 Avoidance of falls

There is evidence for sole physical exercise (e.g. Tai Chi) as intervention for avoiding falls especially for high risk groups (over age 80 and with several fall risk factors) **(A)**. More effective are interventions which take into consideration several risk factors **(A)**. Both statements are also valid for people who live in an old-age home **(A)**.

Important measures are:

- Adjustment of medication
- Behaviour practice
- Improvement of mobility (balance/force/walking exercises)
- Reaction practice
- Optimising of the domestic environment (shoes, lighting, things which could cause stumbling, furniture)
- Optimising of the supply of auxiliary material
- Hip protectors

Only very few trials with the endpoint „fractures“ have been performed so far. These show that by these measures fractures can be avoided **(B)**.

5.1.4 Hip protectors

In several trials the positive effect of hip protectors in avoiding fractures near the hip has been proven **(A)**. The use of hip protectors can reduce the fracture rate by 60 % **(A)**. Most of the studies were performed with inhabitants of old-age homes or with very decrepit persons. The efficiency is, however, reduced because of problems in acceptance under normal circumstances **(A)**. Therefore, the acceptance should be assessed before using hip protectors.

5.1.5 Other interventions

For all non-medical interventions no evidence is known.

5.2 Medical treatment

5.2.1 Calcium and vitamin D

The evaluation of the efficiency of a sole medical calcium substitution for fracture prevention is extremely difficult as the results between studies differ considerably due to different characteristics of the study population, the treatment methods and the generally very low number of cases (C). Furthermore, even in qualitatively good studies a combination therapy of calcium and vitamin D was also used in the placebo groups. Therefore, only few studies, which investigated a combination treatment can be used for the assessment of the efficiency. These show a significant reduction of the number of fractures near the hip (approximately 30 %) for inhabitants of old-age homes (A). There was also proof for an increase in bone mineral density (A). On the basis of the present data for older women the joint administration of calcium (1,000-1,500 mg/d) and vitamin D (400-800 I.U./d) is to be considered as base therapy (A).

5.2.2 Bisphosphonates

Bisphosphonates are the best investigated therapy option. For the three drugs approved in Germany for osteoporosis treatment, alendronate, etidronate and risedronate there exist several RCTs, which show, regardless of differences in the study design, that a bisphosphonate therapy can effectively influence bone mineral density as well as fracture risk.

Alendronate trials with women with prevalent vertebral fractures show that the risk for fractures near the hip could be reduced by approximately 50 % (A). The fracture risk was influenced in a similarly effective way (A). The increase in bone mineral density at the spine and the femoral neck was consistent, too (A). For women with no fracture history but low bone mineral density (T score ≤ 2.5 at femoral neck) a considerable reduction of the fracture risk near the hip was shown (A). A low fracture risk at the spine and a clear increase in bone mineral density was also shown for women with solely reduced bone mineral density (A). As no difference was verified between daily and weekly administration of alendronate (70 mg) (A), alendronate administered once a week can be regarded as equivalent to daily administration.

In smaller studies with women with fracture history and reduced bone mineral density a significant effect could only be shown with etidronate for vertebral fractures and vertebral bone mineral density (B). For women without manifest osteoporosis only data for a significant increase of bone mineral density exist (A).

For risedronate a significant reduction in the number of fractures of the femoral neck could be seen for women with risk factors and a T score < -3 (femoral neck) or without risk factors and a T score < -4 (femoral neck) (A). Trials with risedronate show a significant reduction of the fracture risk at the spine for women with fracture history (A). For women who only had a reduced bone mineral density (-3.3 T

score, spine) a significant reduction of the number of fractures near the hip (**A**) and of vertebral fractures (**B**) and a significant increase in bone mineral density was shown (**A**). As no difference was shown between daily and weekly administration of risedronate (35 mg) (**A**), risedronate administered once a week can be regarded as equivalent to daily administration.

5.2.3 Hormone therapy (HT)

With one exception (WHI-trial) there are no hormone therapy trials with the primary endpoint “fractures near the hip” for the age group in question. An assessment of the effects by a meta-analysis did not show any effect, therefore, only low evidence for a positive effect on the fracture risk exists presently (**A**). The evidence for a positive influence on bone mineral density is also based on studies, which do not allow definite statements due to methodological problems (**B**). Further discussion about considerations on damages and benefits should therefore be waited for.

5.2.4 Raloxifene

Evidence for the reduction of the risk of fractures near the hip is not known. Data from existing studies show that for women with fracture history a considerable reduction of the number of vertebral fractures was achieved (**A**). Bone mineral density is influenced positively (**A**).

5.2.5 Further treatment options

There is no evidence for a reduction of the number of fractures near the hip for **vitamin D analogues** (alfacalcidol, calcitriol). Existing studies show inconsistent results with regard to the number of vertebral fractures and bone mineral density (**B**). A convincing proof of the efficiency of a therapy with vitamin D analogues is still to be seen. There are only few trials for the treatment with calcitonin for older women. These show inconsistent results with regard to fracture rate and bone mineral density. There is, however, a reduction of the number of fractures near the hip at a low dose and for vertebral fractures at a medium dose (**B**). In all trials an increase in bone mineral density is reported (**A**). But the inconsistent dose-effect relation and the trial characteristics make it difficult to come to a final assessment. A positive effect on bone mineral density at the spine and femoral neck was shown in the relevant primary trials for the treatment with fluorides (**A**). Fracture trials show contradicting data for all fracture sites (**B**). In total, due to different subject population, different intervention and very variable trial duration no clear statements can be made with regard to fluoride treatment for older osteoporosis patients.

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With regard to the efficiency of other therapeutic options, which, however, are not approved for osteoporosis treatment, only few trials exist. Pharmaco-epidemiologic data and one RCT for thiazide diuretics show for example a positive influence on the fracture risk. Before a final assessment can be made, however, further trials have to be waited for. The data for inhibiting hormones are inconsistent. No sufficiently expressive trials exist for this age group for tibolone and ipriflavone. Further therapy options are parathyroid hormone, strontium salts, and others for which, however, sufficient clinical data was not published when this guideline was published. For vertebroplasty some smaller studies and single case observations were published. Due to existing evidence this therapy is to be regarded as experimental at present.

5.2.6 Alternative therapy

For the (few) patients who cannot be treated (e.g. intolerability) or who do not want to be treated (patient preference) with bisphosphonate or with raloxifene according to the recommendations some alternative therapies exist, the evidence of which has already been shown. These are:

- Etidronate (**B**)
- Calcitonin (**B**)
- Fluorides (**B**)
 - Sodium fluorides (NaF)
 - Monofluorophosphate (MPF)
- Hormone therapy (**B**)
 - Sole oestrogen therapy
 - Combination therapy (oestrogen/progestin)
- Vitamin D analogues (alfacalcidol, calcitriol) (**B**)

Evidence for this list can be found in the long version of the guideline.

6. Recommendation

The aim of the treatment of older women with osteoporosis is a reduction of the fracture risk and fractures near the hip are of major importance. An increase of bone mineral density alone cannot be regarded as primary treatment aim and studies for this endpoint can only give indirect evidence for an osteoporosis treatment. On the basis of this background the existing evidence for medical treatment of the three major patient groups can be summarized as follows (see algorithm):

- I:** Older woman with acute or older (postmenopausal in case of inadequate trauma) vertebral fracture
- II:** Older woman with high risk factors
- III:** Older woman with/without fractures / in high need of care / institutionalised / immobile

6.1 Diagnostics

The following **base diagnostics** should be carried out for all patient groups:

- Family history and physical examination (**D**)
- Risk factor determination (**A**)
- Assessment of fall risk (**A**)
- Base laboratory (**C**)

For **I** and **II**:

- Conventional x-ray in case of well-founded suspicion in order to exclude a fracture or for further diagnostics
- Determination of bone mineral density in case of well-founded suspicion (high risk factors) for an osteoporosis or if a fracture had already occurred.

6.2 Treatment

For all groups medical advice should be given with regard to:

- Adequate physical exercise (**B**)
- General preventive measures (risk factors, nutrition) (**D**)
- Base therapy with calcium (1–1.5 g) and vitamin D (400-800 I.U.) (**A**)
- Fall risk (treatment of geriatric syndromes / fall prevention / hip protectors) (**A**) and
- Preferences of the patient

I: *Older woman with acute or older (postmenopausal, in case of inadequate trauma) vertebral fracture*

Women with fracture history and bone mineral density < -2 (T score) should primarily be treated with alendronate (**A**) for at least 3 years. If the aim of the therapy is a reduction of vertebral fractures it is possible to prescribe raloxifene for at least 3 years (**A**).

II: *Older woman with high risk factors*

Older women with a bone mineral density of < -2.5 (T score) should be treated with alendronate (**A**) or with risedronate (**A** in case of fractures of the femoral neck; **B** in case of vertebral fractures) for at least 3 years. For raloxifene there is only evidence for vertebral fractures (**A**).

III: *Older woman with/without fracture / in high need of care / institutionalised / immobile*

The treatment of older women in high need of care should include three main treatment options:

- Calcium and vitamin D substitution at a high dose (**A**)
- Fall reducing intervention (**B**)
- Hip protectors (**A**)

6.3 General remarks

6.3.1 Combination treatment

So far, no evidence exists for a determined combination treatment (with the exception of the base therapy) **(C)**.

6.3.2 Duration of therapy

So far, there is only evidence for the duration of the different trials (3-4 years). Whether a treatment above this time is effective has to be proven by further studies. The existing evidence indicates that a first treatment term should last 4-5 years **(D)**.

6.3.3 Follow-up examinations of bone mineral density when receiving therapy

At present no good studies exist which prove the efficiency of a follow-up measurement. Due to the phenomenon “regression to the middle” seen in RCTs a follow-up measurement seems to be meaningful after 2 years at the earliest **(C)**. It should only be done if practical consequences such as change or termination of therapy are considered. Whether effective changes can really be reached by a DXA measurement, an increase in the acceptance of the therapy or the compliance is not proven for older women and is to be proven by further studies.

7. Osteoporosis in men

Prevalence and incidence of osteoporosis in men is definitely lower than in women. The share of men at fractures near the hip is, however, at approx. 25–30 % and compared to women the mortality and morbidity is higher. The data with regard to diagnosis and therapy shows a great lack in evidence. Therefore, all statements are subject to high uncertainty. The same thresholds (T score in relation to young, healthy men) as for women should be used. With regard to therapy there is only evidence for treatment with alendronate together with base therapy for men with low bone mineral density and fracture history **(A)**.

8. Treatment of fractures

8.1 Fractures near the hip

For older persons fractures near the hip represent a maximum threat to their independence in normal day life. Therefore an optimal management is to be required. This should at least fulfil the following criteria:

- Immediate committal to a hospital
- Treatment according to the guideline
- Peri-operative close-meshed control because of frequent complications
- Interdisciplinary early mobilisation and early rehabilitation
- Fall verification
- Osteoporosis therapy
- Rehabilitation in adequate houses if the prerequisites are met

8.2 Other fractures

In the case of other fractures, especially vertebral fractures, an adequate pain therapy and a consideration of psycho-social factors (fear of pain, depression, social withdrawal) should be taken into consideration besides a specific therapy. Apart from sufficient analgesia especially avoidance of unwanted side effects and immobility are in the centre of pain therapy. A verification of the fall and the therapy of osteoporosis should be followed consistently if indicated.

9. General recommendations

9.1 Quality assurance

- Standardisation of bone mineral density measurements
- Validation of device and method specific reference values
- Standardisation of diagnosis and treatment after (femoral neck) fractures
- Standardisation of verification of falls and treatment
- Definition of interaction between GP and specialist
- Quality assurance of rehabilitation after fractures

9.2 Need for research

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- Diagnostics
 - Trials investigating the clinimetric and practical relevance of risk scores (individual fracture risk)
 - Trials investigating clinimetric and practical relevance of fall tests
 - Comparison of different diagnosis procedures such as ultrasound, biomarker, etc.
- Therapy
 - RCT with the endpoint „fractures near the hip” for patients age > 75 for therapeutic agents for which such data do not yet exist
 - Long-term trials for all relevant interventions for the determination of the optimal duration of the treatment and the relation between benefits and damages
 - RCTs with the endpoint „fractures near the hip” for interventions of fall avoidance
 - High quality studies investigating the importance of non-medical intervention, especially for
 - Physical exercise
 - Physiotherapy
 - High quality studies investigating the efficiency of
 - Prevention of falls
 - Fall intervention
- Research on care situation
 - Representative analysis of present osteoporosis treatment
 - Representative analysis of the present treatment after a fracture had happened
 - Trials on intervention for optimal implementation of the guideline
 - National fracture register
 - Model projects for different cooperation forms of the physicians and institutions participating in the care
 - Outcome-project („naturalistic“) studies for the determination of benefits and costs of an osteoporosis and fall treatment according to the guidelines