

# Management of osteoporosis-related bone fractures: an integrated concept of care

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## Abstract

**Introduction** Multidisciplinary medical management of osteoporosis and osteoporosis-related fractures is still an important treatment issue today. In view of ethiopathology of osteoporosis and the future demographic development an increasing socioeconomic burden has to be estimated. A prerequisite for an effective secondary prophylaxis of osteoporotic fractures is the implementation of a treatment network, with inclusion of all partners involved in patient's care. Therefore, special attention should be paid to formation and establishment of centres with multidisciplinary and integrated treatment concepts. This paper outlines the concept of a clinical centre for diagnosis and therapy of osteoporosis established 4 years ago. Furthermore, a concept of integrated care of osteoporosis-related fractures is introduced and the obtained data of a 2-year follow-up analysis will be presented.

**Methods** The establishment of an osteoporosis centre at a university teaching hospital as well as certification according to the Dachverband Osteologie (DVO) guidelines were

necessary. Recruitment of contract partners on both sides, health insurances and outpatient general practitioners as well as specialist doctors, was also essential. The implementation of an osteoporosis coordinator was a step to put the treatment concept into practice.

**Results and discussion** Based on the recommendations of DVO guidelines, all diagnostic and therapeutic requirements of osteoporosis can be met by the team of consultant specialists at a clinical osteoporosis centre. In the described treatment concept of integrated care, 44 patients suffering of osteoporosis with a consecutive fracture could be included. Mean age was 77. Inclusion criteria were spinal fractures (61%), proximal femoral fractures (27%) and peripheral fractures (12%). Fifty percent of patients included into the contract had not received previous osteoporosis medication. Sixty-eight patients who met the inclusion criteria could not be included due to the lack of compliance (42%), patients' disapproval (34%) or incomplete treatment and documentation algorithm (24%). Special attention should focus on the completion of standardised diagnosis and documentation. The high amount of time and personnel required has proven the importance of the introduction of an osteoporosis coordinator to be essential.

**Keywords** Osteoporosis · Osteoporosis-related fracture · Integrated care · Osteoporosis centre · Osteoporosis fracture management

## Abbreviations

DVO Dachverband Osteologie e.V. = Umbrella Organisation of German Scientific Osteology-related Societies  
REKO Regionale Expertenkommission  
Osteoporose = Regional Advisory Board  
Osteoporosis

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## Introduction

Although in the ninth year of the bone and joint decade, one still has to realise the increasing presence of patients presenting with osteologic illnesses and their complications in orthopaedic and trauma units of many hospitals across the country. The most common bone pathology to be found is the group of osteoporosis. It is defined as a systemic skeletal disease characterised by diminished bone stability and increased risk of fracture. An insufficient restoration of lost bone tissue is observed as underlying pathophysiology in osteoporosis. This can result from an increased bone resorption or reduced bone regeneration. Commonly, both processes play a role in osteoporosis. There are multiple reasons for the disturbed balance of the bone remodelling process, for example, disturbances of serum hormone levels, false or malnutrition, medication and other diseases such as rheumatoid arthritis. Other risk factors influencing the onset of osteoporosis are found in terms of personal behaviour and life style patterns.

The biomechanical loss of bone stability is based on the combination of reduced bone mass and bone quality [19]. Often the first clinical suspicion of an existing osteoporosis in a patient is obtained by the type of fracture and the trauma itself. Osteoporosis can be quantified by measurement of bone mineral density (BMD). However, it is not the singular diagnosis criterion. The osteodensitometry using dual X-ray absorptiometry (DXA) on lumbar spine and femoral neck has been established as the safest measuring instrument and is acknowledged by WHO standards. During this type of osteodensitometry, the current BMD is compared with the peak bone mass of healthy 20-year-old adults and presented in the form of standard deviation given by the T score. Only in case of a BMD T score less than  $-2.5$  in combination with a fractured bone a manifest osteoporosis is diagnosed.

Although the awareness of osteoporosis has increased amongst the medical community, this illness is still one of the frequently under diagnosed diseases [15]. Our own experiences regarding retrospective analyses are in consistency with the international literature and the diagnostic procedure is often uncompleted. Even in case of osteoporosis proven by DXA-measurement deficits are found in terms of therapy, medical documentation and information to the partners in outpatient treatment, i.e. general practitioners (GP) etc. [8, 12]. The main stress of inpatient care in patients with osteologic illnesses, especially with osteoporosis-related fractures is met by clinics of internal medicine, trauma and orthopaedic surgery. Daily routine in a university teaching hospital of 1,000 beds with a wide range of medical clinics and institutes has rarely led to a tight collaboration of rheumatological–osteologic and surgical competence. Thus, there was a need for the development of

structures and algorithms to treat bone diseases, especially in patients with osteoporosis on an interdisciplinary and comprehensive base.

A simple fall with a consecutive fracture is often the first manifestation of osteoporosis and also the main complication in an elderly osteoporotic patient [5]. On one hand, these fractures occur in a setting of a low energy trauma or simple falls. Common locations of this type of fractures are the proximal femur, the distal radius and the proximal humerus. On the other hand, a second group of fractures can be found. These are spontaneous sintering fractures mainly located in the spinal column.

The treatment of patients suffering from osteoporosis is provided by many medical partners and set within the socioeconomic profile of the underlying health-care system. In case of occurrence of an osteoporosis-related fracture, special needs are to be met by the team of medical care [16]. An insufficient diagnostic and therapeutic regimen in the treatment of osteoporosis will increase the risk of further fractures [24].

## Methods

### Osteoporosis centre

As a result of these activities for improved detection and treatment of bone diseases, a clinical osteoporosis centre was founded in 2004. All specialties of the cooperating clinics and institutes with regard to diagnosis, treatment and care of patients with bone diseases are represented within the staff of the osteoporosis working group (Table 1).

In the charter of the osteoporosis centre functions and aims were laid down. The guidelines (DVO) for osteoporosis should be the basis for the work of cooperating partners of the centre (Table 2). At an early stage, the centre has established a close cooperation with doctors in private outpatient practise (i.e. general practitioners and specialists), regional expert groups, rehabilitation centres and suppliers of orthopaedic and nursing aids. In the subunits of the centre clinical pathways for the basic and differential diagnostics as well as therapy were introduced. Meetings of all partners

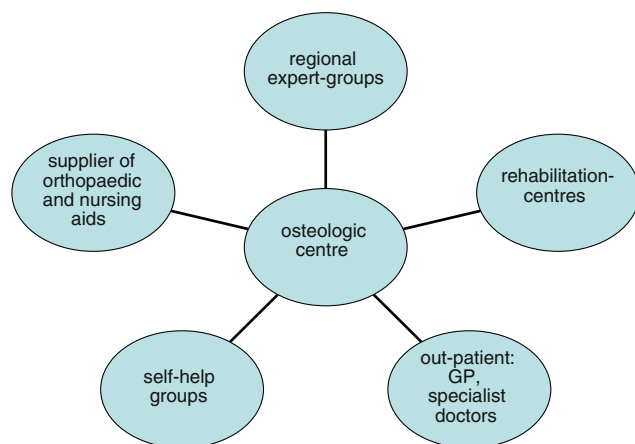
**Table 1** Cooperating clinics and institutes of the osteoporosis centre

|                     |                         |
|---------------------|-------------------------|
| Internal medicine   | Pathology               |
| Trauma surgery      | Laboratory medicine     |
| Orthopaedic surgery | Physio- and ergotherapy |
| Urology             | Dietetics               |
| Gynaecology         | Social service          |
| Radiology           | Public relations        |

**Table 2** Functions and aims of the osteoporosis centre

|   |
|---|
| Regular multidisciplinary colloquia   |
| Collaboration with doctors in outpatient care   |
| Early diagnosis and therapy of bone metabolism diseases according to the guidelines of DVO  |
| Interdisciplinary collaboration of specialists  |
| Joint discussion of problem cases   |
| Inpatient treatment and early rehabilitation of severely suffering patients, including teaching of home-based practicing programmes and generation of individual training plans |
| Optimal care of severely suffering patients with aids (nursing aids, orthopaedic aids etc.)   |
| Education on life style, reasonable and comprehensive nutrition and favourable daily activities in regard to the spine  |
| Joint efforts for scientific projects   |
| Establishing a model of integrated care for patients suffering of osteoporosis  |
| Educational efforts in collaboration with self-help groups, media and public relations  |

in the osteoporosis centre are held quarterly. Many scientific projects, events and further education courses are held by the members of the osteoporosis centre throughout the year. In the fourth year of existence, the centre could achieve the certification as main regional osteologic centre according to the national regulations (DVO). Essential for this accomplishment was the completion of a broad spectrum catalogue of clinical requirements. Besides many other prerequisites, the catalogue demands qualification of the staff in regard to osteology, provision of all modern diagnostics and therapeutic options, regular further education as well as documented collaboration with self-help groups and osteology expert groups (Fig. 1).

**Fig. 1** Organisational and cooperating structure of the osteoporosis centre

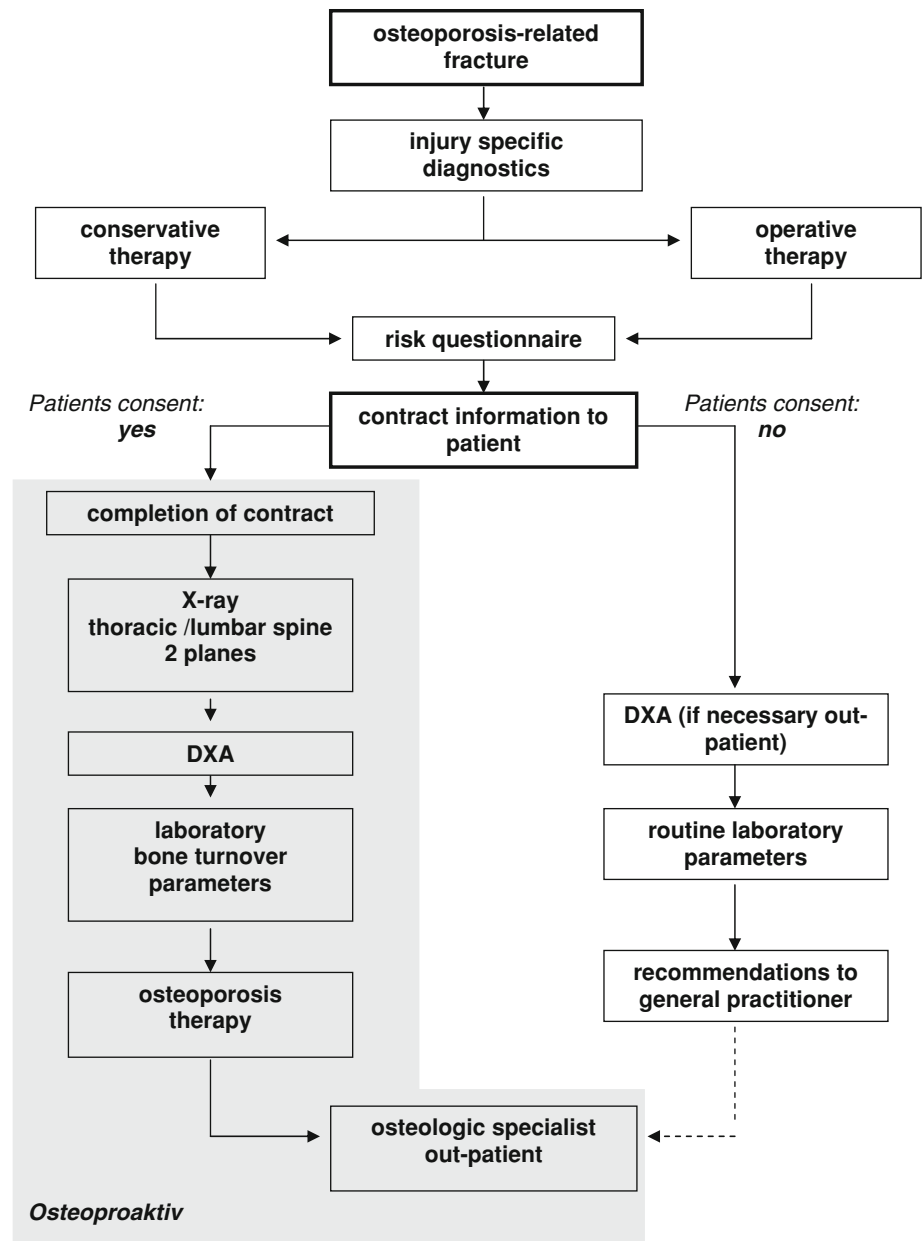
### Contract of integrated care

Supported by regional and countrywide activities, a contract for integrated care for patients suffering from an osteoporosis-related fracture (*Osteoproaktiv*) was signed in 2006. Contract partners were the largest regional health insurance of Saxony (AOK Sachsen), a group of osteologically working specialist doctors (REKO), associations of general practitioners and a large university teaching hospital with an osteoporosis centre (Hospital Dresden-Friedrichstadt, Dresden, Germany). The proclaimed aim is the formation of a regional system for the prevention of consecutive fractures, following a primary fracture in patients suffering from osteoporosis. To achieve this goal, a standardised algorithm was defined including the registration of patients, diagnostic measures and their current personal social situation as well as required home care in the outpatient setting. The participation in the programme is based on an inclusion criterion which is the occurrence of an osteoporosis-related fracture. The integration of the patients into the care contract in case of inpatient treatment has to be realised on a multidisciplinary basis and is in the responsibility of the treating doctor. If the inclusion criterion is met, a written informed consent of participation has to be signed after comprehensive information provided by the treating doctor. The algorithm includes documentation of patients' medical history, clinical examination and completion of an osteoporosis risk factor questionnaire (REKO), X-ray as well as laboratory diagnostics and measurement of BMD using DXA. The long-term experience and results of practical realisation of expert groups and regular regional osteologic meetings were used to design the algorithm [1]. The energy and time needed for organisation, patient care and documentation is putting an enormous additional burden on the personnel resources. To assure the best possible patient care, the formation of a separate personnel unit was required. The post of an osteoporosis contract coordinator was created. By following the doctor's recommendations, this specially trained nurse will be supervising contract registration, communication to health insurance, documentation as well as keeping with diagnostic and therapeutic regimens. Furthermore, the coordinator will also select and if necessary communicate to the doctor who will carry on outpatient treatment. Since implementation of the contract of integrated care for patients suffering an osteoporosis-related fracture, 44 patients could be included. The outpatient care of patients suffering from osteoporosis within the terms of this contract will be carried on by an osteologically trained general practitioner or specialist doctor who is also assigned partner within the contract. Within the settings of the contract, a regular outpatient medical check up by a doctor, diagnostic measures and a guideline-based therapy is assured (Table 3; Fig. 2).

**Table 3** Diagnostic regimen of contract “Osteoproaktiv”

| Tool                                   | Method   |
|--|--|
| Patients history, clinical examination | Forms of documentation according to Abendroth et al. [1]   |
| Risk factor questionnaire              | According to Abendroth et al. [1]  |
| X-ray                                  | Lumbar spine<br>Thoracic spine   |
| Measurement of bone mineral density    | DXA  |
| Laboratory diagnostics                 | Small blood count, calcium, phosphate, AP, gamma-GT, creatinine, TSH, protein electrophoreses<br>Bone metabolism parameters: P1NP, CTx |

**Fig. 2** Algorithm “Osteoproaktiv”



**Results**

Forty-four patients (35 females/9 males) could be included in the contract of integrated care between January 2007 and

December 2008. The mean age of the participants was 77 years. The inclusion criterion of an osteoporosis-related fracture was met in all cases. Most often, spinal fractures (61%) and proximal femoral fractures (27%) occurred.

**Table 4** Patient data

|                     | Female           | Male             | Sum             |
|---------------------|------------------|------------------|-----------------|
| Number ( <i>n</i> ) | 35               | 9                | 44              |
| Age (years)         | 79.8             | 66.2             | 77              |
| <i>t</i> score      | $-2.88 \pm 0.62$ | $-2.75 \pm 0.52$ | $-2.86 \pm 0.6$ |

Forty-one percent of patients had previously suffered an osteoporosis-related fracture. In 14% of patients, more than two fractures had already occurred. An utilisable measurement of BMD by DXA method could be performed in 73% of cases. The average T score recorded at  $-2.86 (\pm 0.6)$ . In 12 patients, the DXA measurement had no diagnostic value due to strong degenerative alterations, multiple fractures of the spinal column or the presence of metal implants at the site of the hip joints. In 41% of cases, with an osteoporotic fracture an operative intervention was required. Of those all patients with a proximal femoral fracture and 7.4% of patients with spinal fractures were treated operatively. In 22 patients (50%), who could be included into the contract, no previous anti-osteoporotic medication was found. At the end of inpatient diagnostics and therapy, almost all patients (95%) were treated with a basic medication of calcium and vitamin D. This was combined with a specific osteoporosis therapy consisting either of a bisphosphonate (68%), teriparatide (5%) or strontium ranelate (16%). Unfortunately, further 67 patients could not be included into the contract even though the inclusion criterion was met. The main reason was in 42% of cases a lack of compliance followed by patients' disapproval to the contract (34%) and incomplete treatment and documentation algorithm (24%) (Tables 4, 5, 6; Fig. 3).

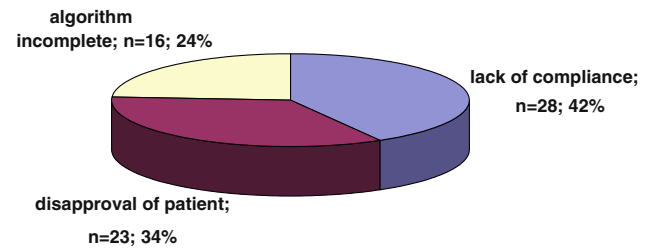
## Discussion

Osteoporosis is one of the most common illnesses of old age [18, 25]. Therefore, a dramatic picture can be drawn by looking at the demographic change in Germany and the rest of Europe. According to the Federal Bureau of Statistics in Germany by 2050 half of the German population will be over 50 years old. Almost one-third of the people will have

**Table 6** Medication data

|                    | Pre-medication | Post-medication |
|--------------------|----------------|-----------------|
| None               | 22 (50%)       | 0               |
| cal/vit D          | 7 (16%)        | 3 (7%)          |
| vit D              | 1 (2%)         | 1 (2%)          |
| cal/vit D + bispho | 9 (20%)        | 30 (68%)        |
| bispho             | 3 (7%)         | 1 (2%)          |
| cal/vit D + teri   | 0              | 2 (5%)          |
| cal/vit D + stro   | 1 (2%)         | 7 (16%)         |
| raloxifen          | 1 (2%)         | 0               |

*cal/vit D* calcium/vitamin D combination drug, *bispho* bisphosphonate, *teri* teriparatide, *stro* strontium ranelate

**Fig. 3** Reasons for exclusion of integrated care contract

already reached the 65th year of life [16]. The prevalence of osteoporosis documented by diminished BMD in 1,000 postmenopausal women shows an increase from 7 to 19% between the age of 55 and 79 [11]. The statistical probability for the occurrence of osteoporosis-related fractures in postmenopausal women was found to be more than 40% [14]. As a consequence, an increased morbidity, immobilisation and frequently a permanent need for nursing results [6, 15, 20, 23]. Osteoporotic fractures with special focus on the proximal femur close to the hip joint revealed an increased mortality, especially in the first year following the fracture [2, 15, 22]. These problems have been proven to be of important social and medical relevance and will furthermore lead to increasing health-care costs over the years to come [16]. For Germany Felsenberg et al. [12] found a prevalence of osteoporosis in 7.8 million individuals resulting in a direct financial volume of 5.4 billion Euro. Recent studies obtained figures for the direct financial

**Table 5** Fracture data

|                                 | SCF      | PPF      | DRF    | PHF    | AJF    | Sum |
|---------------------------------|----------|----------|--------|--------|--------|-----|
| Primary fracture ( <i>n</i> )   | 27 (61%) | 12 (27%) | 2 (5%) | 2 (5%) | 1 (2%) | 44  |
| Secondary fracture ( <i>n</i> ) | 5        | 7        | 4      | 1      | 1      | 18  |
| Tertiary fracture ( <i>n</i> )  | 1        | 1        | –      | 3      | 1      | 6   |
| Operative therapy (%)           | 7.4      | 100      | 50     | 100    | 100    | 41  |

SCF spinal column fracture, PPF proximal femoral fracture, DRF distal radial fracture, PHF proximal humeral fracture, AJF ankle joint fracture

burden on the European health-care systems in a range of 31.7 billion Euros [13].

Secondary prophylaxis to avoid any further fracture is of essential importance. Under these circumstances, a comprehensive recognition of osteoporosis-related fractures and the beginning of an immediate multidisciplinary diagnostics, therapy and after care regimen is necessary. Through implementation of an algorithm for diagnostics and therapy, it has been shown that quality of care can be improved [8, 10, 24]. As a result, a reduction in the treatment costs can also be expected [17]. For larger clinical institutions, it is desirable to form structures for the multidisciplinary treatment of patients suffering of osteoporosis. The presence of medical competence, specific diagnostic tools and surgical as well as conservative therapeutic options are essential requirements.

The implementation of necessary structures is very time-consuming and requires various medical specialties. Essential are multidisciplinary case discussions, regular further education and an intensive collaboration with members of outpatient medical care, health-care insurances and self-help groups.

In view of the current reduction in average length of hospital stay, the complete course of diagnostics and therapy can only be assured when the best coordination is guaranteed. A strict management is also required by adhering to the established standards of osteoporosis therapy in accordance to the guidelines. A special focus needs to be put on information exchange between inpatient and rehabilitative care on one hand and outpatient care on the other. Bahrs et al. analysed a post-hospital treatment strategy of osteoporosis-related fractures. They could demonstrate that only one-third of the suffering patients received adequate diagnostics; besides, given comprehensive information to the outpatient doctor [3]. Other authors also report a deficit in further care of patients suffering of osteoporosis and related fracture [7, 9]. Besides the post of an osteoporosis coordinator for the organisation of treatment management mentioned above, the letter of discharge is another essential element of modern concepts in care of patients suffering of osteoporosis. This letter to the doctor providing outpatient care should contain specific osteoporosis-related information as well as recommendations for therapy. The development of regional centres with a multidisciplinary integrated care management should receive special future attention.

The regional registration of patients suffering from osteoporosis-related fractures and the integration of all institutions contributing to treatment can be realised by a contract of integrated care. First experiences are described by Bogoch et al. in their post-fracture programme [4]. The authors could demonstrate a reduction in consecutive fractures and treatment costs in a group of 500 studied patients. Their described model is suggesting the implementation of a

coordinator who will look after the patients under clinical as well as outpatient treatment circumstances [21]. The implementation of such a model into clinical practice demands high quantity of time and personnel. With regard to the contract of integrated care outlined above in case of osteoporosis-related fractures, the introduction of an osteoporosis coordinator has again proven to be a good decision in analogy to the reported model of Sander et al. [21].

Despite our high effort, only 44 patients could be included into the contract of integrated care within 2 years. Overall, 112 patients met the inclusion criterion during the above-mentioned time period. One reason for those discrepancies was that the contract was only eligible for patients of one health-care insurance (AOK Sachsen). Furthermore, in 24% of the patients deficits in the completion of the agreed treatment algorithm were found and led to exclusion. This was due to short hospital stay, logistic or personnel problems. Another factor of exclusion was found to be missing cooperation or lack of compliance of the patients. Age of the patients, social aspects and neuropsychiatric diseases are often responsible for this type of exclusion. In the setting of the contract, regular outpatient medical check ups, diagnostic measures and a specific therapy according to the national guidelines of osteoporosis are guaranteed. Up to now, the development and realisation of this contract of integrated care is unique in the Federal Republic of Germany. In future, it is planned to open the contract to further districts, institutions and health-care insurances. In an another step sufficient primary prophylaxis should be declared as a final target using known risk factors of osteoporosis as an indicator to commence therapy before a first osteoporosis-related fracture occurs.

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