Osteoporotic Vertebral Fracture in Clinical Practice. 669 Patients Diagnosed Over a 10 Year Period

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ABSTRACT. ***Objective.*** Few data are available on clinically diagnosed vertebral fracture. Information about osteoporotic vertebral fracture has mainly been obtained via inferences from epidemiological studies of vertebral deformity. We evaluated the characteristics of patients with osteoporotic vertebral fracture diagnosed in a rheumatology department over a 10 year period.

Methods. Patients with back pain and vertebral fracture diagnosed between January 1990 and December 1999 were recruited from our data base. Patients with high energy trauma, malignancies, and metabolic bone diseases other than osteoporosis were excluded. These variables were analyzed: sex, age at diagnosis, type of osteoporosis (primary vs secondary), number of fractures at diagnosis (single vs multiple), and percentage of admissions and length of stay.

Results. Of the 669 patients, 534 (80%) were women and 135 (20%) were men. Age at diagnosis ranged from 30 to 91 yrs, mean 67.1 ± 9.1. Secondary osteoporosis was diagnosed in 177 (26%) patients and the frequency was significantly higher in men than women (55% vs 19%; $p < 0.001$); the most common associations for secondary osteoporosis were oral corticosteroids, chronic obstructive airway disease, and rheumatoid arthritis. At diagnosis, half of the patients presented with multiple fractures. One hundred twenty (18%) patients were admitted; length of stay ranged from 5 to 56 days, mean 15.9 ± 7.7. The frequency of admissions was higher in men than women (27% vs 16%; $p < 0.001$), higher in patients with secondary osteoporosis than in those with primary osteoporosis (33% vs 12%; $p < 0.001$), and higher in patients with multiple fractures than in those with single fractures (27% vs 8%; $p < 0.001$).

Conclusion. Characteristics of patients recruited from a clinical setting differ significantly from those of subjects included in the epidemiological studies. In a rheumatology practice, frequency of secondary osteoporosis, mainly associated with corticosteroid treatment, is notably high. Admission is by no means a rare event. (J Rheumatol 2001;28:2289–93)

Key Indexing Terms:
VERTEBRAL FRACTURE OSTEOPOROSIS BACK PAIN SPINE CORTICOSTEROIDS

Osteoporosis is a systemic skeletal disease characterized by low bone mass and microarchitectural deterioration of bone tissue, leading to enhanced bone fragility and thus an increased susceptibility to fractures[1]. Osteoporotic fracture is now recognized as a major public health problem. Its medical, social, and economic consequences are becoming increasingly serious[2,3].

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Submitted January 8, 2001; revision accepted April 25, 2001.

Vertebral fractures are the most frequent fractures associated with osteoporosis[4] and may result in major back pain, spinal deformity, and functional impairment[5].

A clear distinction should be made between clinically diagnosed fractures and vertebral deformities. Data available on clinical fractures in both sexes are limited[6], and information on osteoporotic vertebral fractures has been obtained fundamentally via inferences from epidemiological studies[7,8], focusing primarily on radiologically defined vertebral deformity.

According to recent estimates[5,9], only one out of 3 vertebral deformities is attended clinically. Moreover, vertebral deformity may result from a multitude of causes other than osteoporosis[10-12], including malignancy, Scheuermann's disease, osteomalacia, hyperparathyroidism, and, above all, high energy trauma.

Further, epidemiological studies provide no information on 2 important clinical issues: the frequency of secondary osteoporosis and the percentage of patients admitted to hospital. We describe an approach to osteoporotic vertebral fracture in clinical practice from a rheumatological perspective.

MATERIALS AND METHODS

The study was performed at the Rheumatology Department of the Ciutat Sanitària i Universitària de Bellvitge, a 1000 bed teaching hospital in Barcelona, Spain. The rheumatology department has a 14 bed unit for admissions and 4 outpatient clinics, one in the hospital and 3 in affiliated primary care health centers. In our area, patients with suspected osteoporotic fracture are usually referred to rheumatology staff members for specialized opinion.

Study protocol. The department has an established protocol for evaluation of patients with vertebral fractures. The following procedures are performed: (1) a thorough history to identify a potential cause of osteoporosis and to detect possible high energy trauma (high energy trauma is considered when the fracture is due to a traffic accident or a fall from greater than standing height); (2) a complete physical examination; (3) a basic analytical study (erythrocyte sedimentation rate, full blood count, chemistry panel including serum levels of calcium, phosphorus and alkaline phosphatase); and (4) plain radiographs of the spine.

When malignancy is suspected, we usually perform analysis of tumoral markers, protein electrophoresis, technetium bone scanning, mammography, and computerized tomography of chest and abdomen. In selected cases, a magnetic resonance investigation of the spine is also performed.

When a metabolic bone disease other than osteoporosis is suspected, specific diagnostic procedures are carried out. For example, if osteomalacia is the presumptive diagnosis, a bone biopsy is performed.

Patients. Patients with vertebral fracture diagnosed between January 1990 and December 1999 were recruited from our data base. A 20% reduction in the height of the anterior, midposterior, or whole vertebra was taken to indicate the presence of a fracture; all radiographs were examined individually.

We included only patients who consulted for back pain; asymptomatic patients in whom diagnosis was established on the basis of radiological studies performed for other clinical problems were not considered.

We excluded patients with high energy trauma, patients with malignancies, and patients with metabolic bone diseases other than osteoporosis.

Six hundred sixty-nine patients were included in the study; back pain was attributed to vertebral fracture in all of them.

Data collection. The chart of each patient was retranscribed onto a standard itemized form. The data analyzed included sex, age at diagnosis, type of osteoporosis (secondary vs primary), and number of fractures at diagnosis (single vs multiple).

In admitted patients, the length of stay was also calculated. Admission and discharge dates were recorded; hospital days were numbered sequentially, Day 1 representing the day of admission. We did not preestablish criteria for admissions; in our department, the 2 main reasons for hospitalization are control of pain and the suspicion of malignancy.

To establish the effect of osteoporotic vertebral fractures on hospitalization in the rheumatology department, the number of admissions during the study period was recorded. In all cases, only data relating to the first consultation were considered.

Statistical analysis. Results are expressed as mean ± standard deviation. The relation between categorical variables was established by chi-squared test. For differences between groups, analysis of variance was applied. Correlations were calculated by Pearson's test. A p value < 0.05 was considered significant.

RESULTS

Demographic data. Of 669 patients studied, 534 (80%) were women, 135 (20%) were men. Age at presentation ranged from 30 to 91 yrs (mean 67.1 ± 9.1 yrs). There were differences between the mean age of men and women (63.7 ± 9.7 vs 67.8 ± 8.6 yrs; $p < 0.001$). Two-hundred sixty-four (39%) patients were over 70 yrs, and 18 (3%) were under 50 yrs.

Secondary osteoporosis. Secondary osteoporosis was diagnosed in 177 (26%) patients, 103 women and 74 men. The frequency was significantly higher in male than in female patients (55% vs 19%; $p < 0.001$). No significant difference in the mean age of patients with secondary and primary osteoporosis was found (66.2 ± 9.9 vs 67.3 ± 8.6 yrs).

Table 1 shows the etiological factors observed in patients with secondary osteoporosis. The most common association for secondary osteoporosis was use of oral corticosteroids; it accounts for 66% (117/177) of cases. Table 2 gives the conditions requiring corticosteroid treatment.

Number of fractures. Fractures were single in 330 (49%) patients and multiple in 339 (51%). The prevalence of patients with multiple fractures was similar in male and in female patients (58% vs 49%). Differences in the mean age of patients with one or several fractures were observed (65.8 ± 8.7 vs 68.2 ± 9.1 yrs; $p < 0.01$). The prevalence of multiple fractures was higher in patients with secondary osteoporosis than in those with primary osteoporosis (66% vs 45%; $p < 0.001$). In corticosteroid treated patients, the prevalence of multiple fractures was 68% and in patients with excessive alcohol consumption it was 71%.

Table 1. Etiological factors observed in 177 patients with secondary osteoporosis.

	Male, n = 74	Female, n = 103
Longterm treatment with oral corticosteroids	43	74
Rheumatoid arthritis	—	4
Excessive alcohol consumption	15	4
Ankylosing spondylitis	10	4
Non-alcoholic chronic hepatopathy	2	11
Hyperthyroidism	1	6
Cushing's disease	1	—
Hypogonadism	2	—

Table 2. Medical conditions in 117 patients who required corticosteroid treatment.

	No. of Patients
Chronic obstructive pulmonary disease	47
Rheumatoid arthritis	35
Giant cell arteritis/polymyalgia rheumatica	13
Systemic lupus erythematosus	3
Inflammatory bowel disease	3
Necrotizing vasculitis	3
Idiopathic interstitial lung disease	2
Autoimmune hemolytic anemia	2
Mixed cryoglobulinemia	1
Idiopathic thrombocytopenic purpura	1
Atopic eczema	1
Pyoderma gangrenosum	1
Psoriatic arthritis	1
Dermatomyositis	1
Myasthenia gravis	1
Relapsing polychondritis	1
Idiopathic chronic uveitis	1

Admissions. One hundred twenty (18%) patients, 83 women and 37 men, were admitted to hospital. There was no difference in mean age between admitted and nonadmitted patients (68.3 ± 10.4 vs 66.7 ± 8.6 yrs). The frequency of admissions was higher in male than in female patients (27% vs 16%; $p < 0.01$), higher in patients with secondary osteoporosis than in those with primary osteoporosis (33% vs 12%; $p < 0.001$), and higher in patients with multiple fractures than in those with single fractures (27% vs 8%; $p < 0.001$).

Length of stay ranged from 5 to 56 days (mean 15.9 ± 7.7 days). There was no relation between length of stay and patient's age. No difference in mean length of hospital stay was observed between male and female patients (16.3 ± 9.6 vs 15.8 ± 6.7 days) or between patients with secondary and primary osteoporosis (16.7 ± 8.8 vs 15.2 ± 6.3 days). Patients with a single fracture underwent a longer hospital stay than those with multiple fractures (16.8 ± 8 vs 13 ± 5.3 days; $p < 0.05$).

No hospital readmissions due to vertebral fractures were found. During the study period, 2909 patients were admitted to the rheumatology department; thus osteoporotic vertebral fractures were responsible for 4% of admissions.

DISCUSSION

As specialists in the musculoskeletal system, rheumatologists play a key role in diagnosis and management of patients with osteoporosis, particularly those with vertebral fractures and back pain[13]. Surprisingly, no clinical series of patients with osteoporotic vertebral fractures diagnosed in a rheumatological setting have been reported in the literature.

We describe a large series of patients seen in our rheumatology department over the last 10 years. The study reflects the experience of rheumatologists both in a teaching hospital and at primary health care centers. Our findings should be interpreted in the light of several considerations.

Although we systematically questioned patients about the existence of a high energy trauma, it is possible that an episode may have been overlooked. Nonetheless, we are confident that the effect of this possibility on the overall series is extremely low.

Our study protocol excluded non-osteoporotic causes of vertebral fracture, but it is not exhaustive enough to include conditions associated with secondary osteoporosis. It is conceivable that some patients with primary osteoporosis were incorrectly classified. However, the most prominent causative mechanisms[14,15], such as corticosteroid treatment, alcoholism, and diseases that decrease bone mineral density, were all adequately recorded.

As we did not preestablish criteria for admissions, there may have been a lack of uniformity regarding the decision to hospitalize particular patients; no guidelines are currently available for admission of patients with osteoporotic vertebral fracture. Moreover, we make no distinction between the 2 main reasons for hospitalization, control of pain and the suspicion of malignancy; medical records do not clearly reflect these data in many cases.

Finally, radiographs were not digitized when we measured the reduction in the vertebral height.

Despite these criticisms, the results may be useful to clarify certain issues concerning osteoporotic vertebral fracture in practice and to establish an approach to the profile of patients attended by rheumatologists.

The demographic characteristics of our sample were particularly revealing. Our female to male ratio was 4:1. In contrast, in a recent multicenter, population based European study[7] that included randomly selected subjects, vertebral deformity defined by digitized radiographs was equally frequent in men and women. Interestingly, they had more men aged 50–64 years with a prevalent deformity than women of similar age, possibly as a result of greater exposure of men to high energy trauma during their working life, implying that the deformity probably should be considered as traumatic.

Our data are more closely in agreement with the results of Cooper, *et al*[6] in a population based study of clinically diagnosed vertebral fractures; men accounted for 17.5% (40/228) of symptomatic vertebral fractures due to moderate trauma. A recent European consensus report on the treatment of male osteoporosis[16] estimated a female to male ratio of 2 to 3:1 for hip and vertebral fracture in the elderly.

Factors that may contribute to the differences in fractures have not been clearly established. The following have been suggested[16-19]: differences in bone geometry with greater bone size, high bone mineral density, high bone mass index, a more progressive pattern of changes in sex steroid exposure, and the shorter life expectancy in men.

Our study seems to show that patients with back pain and nontraumatic fractures seen in clinical practice are mainly older[6]. The existence of an exponential relationship of fracture rate to age is well established[4]; further, attitudes toward back pain in the elderly and the more frequent access to health care may also help explain this finding[5].

In this study, male patients were older than had been described in previously reported series[20]. Nevertheless, their mean age was very similar to that observed by Evans, *et al*[21] in a recent large series that includes, as in our study, men with symptomatic vertebral fractures.

In this study, a potential cause of osteoporosis was found in a quarter of our patients. The frequency of secondary osteoporosis was clearly higher in male than in female patients. By far, the most common association for secondary osteoporosis in both sexes was use of oral corticosteroids.

When a diagnosis of osteoporotic vertebral fracture has been established, a potential causative mechanism should be identified. The concept of primary and secondary osteoporosis remains ill defined[14]. Indeed, bone loss is a multifactorial process depending on intrinsic factors (e.g., age, sex steroids, genetics), but on extrinsic factors as well (e.g., immobility, diseases, pharmacological therapies). In some cases, it is very

difficult to establish the relative contribution of each factor in an individual.

It is well established that in women primary osteoporosis is the most common type of osteoporosis[22]. Frequency of secondary osteoporosis in women has been rarely described — it is estimated[14] that only about one-tenth can be defined as secondary. In contrast, in men, a definite causal factor can be identified in about half of cases[16-21,23].

Corticosteroid treatment seems to be the major causative mechanism of secondary osteoporosis. However, data regarding corticosteroid induced osteoporosis are very difficult to interpret since, in a great many cases, the underlying disease may also affect bone metabolism[24,25]. From our study we do not know whether the fractures were due to corticosteroids or the severity of the underlying disease.

Obstructive airway disease was the most prevalent underlying process observed in our series; the importance of vertebral fractures in patients with this disease has recently been highlighted[26].

Interestingly, the underlying diseases were rheumatological in almost half the cases in our sample; as expected, rheumatoid arthritis[27,28] and polymyalgia rheumatica/giant cell arteritis[29,30] were the most prevalent.

We also found a variety of causes of secondary osteoporosis. As described elsewhere, alcoholism was a major causative mechanism, especially in men[15]. The frequency of ankylosing spondylitis (AS) was higher than previously reported. Osteopenia has long been a common finding in patients with AS, but fractures are considered rare. Nevertheless, more recent studies[31,32] have established that fractures are more prevalent in those patients than in the general population, and are frequently observed in patients with more advanced disease and large syndesmophytes.

It is possible that rheumatological diseases are overrepresented in this study, since the patients were recruited from a rheumatology department. However, our results stress the importance of vertebral fracture as an extraarticular manifestation of some inflammatory rheumatic diseases[33].

Fractures were multiple in half of the cases. As expected, patients with multiple fractures were older. The prevalence of cases with multiple fractures was higher in patients with secondary osteoporosis, probably reflecting the effect of corticosteroid treatment and alcoholism.

No data are available about the percentage of patients with osteoporotic vertebral fracture admitted to hospital. Estimates from the United Kingdom suggest that perhaps 10% of vertebral fracture cases are hospitalized[34]. In our department, one in 5 diagnosed patients was admitted; the effect on overall hospitalization was low but noticeable.

Frequency of admissions was higher in men, probably because of greater suspicion of malignancy, higher in patients with multiple fractures, because of greater intensity of back pain, and higher in those with secondary osteoporosis, probably for investigation of the comorbid status.

Length of stay was similar to that reported in other European countries but higher than the estimates for the United States[34]. Interestingly, patients with a single fracture underwent a longer hospital stay than those with multiple fractures; it is possible that physicians use more diagnostic tests in these patients because of greater uncertainty about the presence of a neoplasm.

We conclude that patients with osteoporotic vertebral fracture who attended clinic present certain characteristics that distinguish them from subjects with vertebral deformities included in epidemiological studies. In a rheumatological setting, frequency of secondary osteoporosis, mainly in relation to corticosteroid treatment, is a frequent condition and hospital admission is not a rare event. More studies in a clinical setting are needed to confirm our data.

REFERENCES

1. Peck WA, Burckhardt P, Christiansen C, et al. Consensus development conference: diagnosis, prophylaxis and treatment of osteoporosis. Am J Med 1993;94:646-50.
2. Genant HK, Cooper C, Poor G, et al. Interim report and recommendations of the World Health Organization task-force for osteoporosis. Osteoporosis Int 1999;10:259–64.
3. Center JR, Nguyen TV, Schneider D, Sambrook P, Eisman JA. Mortality after all major types of osteoporotic fracture in men and women: an observational study. Lancet 1999;353:878–82.
4. Riggs BL, Melton LJ III. The worldwide problem of osteoporosis: insights afforded by epidemiology. Bone 1995;17 Suppl:505S–11S.
5. Nevitt MC, Ettinger B, Black DM, et al. The association of radiographically detected vertebral fractures with back pain and function. Ann Intern Med 1998;128:793–800.
6. Cooper C, Atkinson EJ, O'Fallon WM, Melton LJ III. Incidence of clinically diagnosed vertebral fracture: a population-based study in Rochester, Minnesota, 1985-1989. J Bone Miner Res 1992;7:221–7.
7. O'Neill TW, Felsenberg D, Varlow J, Cooper C, Kanis JA, Silman AJ. The prevalence of vertebral deformity in European men and women: the European Vertebral Osteoporosis Study. J Bone Miner Res 1996;11:1010-8.
8. Burger H, Van Daele PLA, Grashuis K, et al. Vertebral deformities and functional impairment in men and women. J Bone Miner Res 1997;12:152–7.
9. Black DM, Cummings SR, Karpf DB, et al. Randomised trial of effect of alendronate on risk of fracture in women with existing vertebral fractures. Lancet 1996;348:1535–41.
10. Ziegler R, Scheidt-Nave C, Leidig-Bruckner G. What is a vertebral fracture? Bone 1996;18 Suppl:169S–77S.
11. Venkatachalam S, Dennison E, Sampson M, Hockey P, Cawley MI, Cooper C. An unusual cause of back pain in osteoporosis: lessons from a spinal lesion. Ann Rheum Dis 1999;58:327–31.
12. Oostveen JCM, van de Laar MAFJ. Magnetic resonance imaging in rheumatic disorders of the spine and sacroiliac joints. Semin Arthritis Rheum 2000;30:52–69.
13. Dequeker J, Westhovens R. Osteoporosis: a matter of concern to rheumatology! Scand J Rheumatol 1995;24:130–4.
14. Raisz LG. Secondary osteoporosis. In: Papapoulos SE, Lips P, Pols HAP, Johnston CC, Delmas PD, editors. Osteoporosis 1996. Amsterdam: Elsevier; 1996:369-76.
15. Tannirandorn P, Epstein S. Drug-induced bone loss. Osteoporosis Int 2000;11:637-59.
16. Kaufman JM, Johnell O, Abadie E, et al. Background for studies on the treatment of male osteoporosis: state of the art. Ann Rheum Dis 2000;59:765-72.

17. Eastell R, Boyle IT, Compston J, et al. Management of male osteoporosis: report of the UK Consensus Group. Q J Med 1998;91:71–92.
18. Seeman E. Osteoporosis in men: epidemiology, pathophysiology and treatment possibilities. Am J Med 1993;95 Suppl 5A:22S–8S.
19. Bilezikian JP. Osteoporosis in men. J Clin Endocrinol Metab 1999;84:3431–4.
20. Kelepouris N, Harper KD, Gannon F, Kaplan FS, Haddad JG. Severe osteoporosis in men. Ann Intern Med 1995;123:452–60.
21. Evans SF, Davie MW. Vertebral fractures and bone mineral density in idiopathic, secondary and corticosteroid associated osteoporosis in men. Ann Rheum Dis 2000;59:269–75.
22. Scheiber LB II, Torregrosa L. Evaluation and treatment of post-menopausal osteoporosis. Semin Arthritis Rheum 1998;27:245–61.
23. Baillie SP, Davison CE, Johnson FJ, Francis RM. Pathogenesis of vertebral crush fractures in men. Age Ageing 1992;21:139–41.
24. Adachi JD, Olszynski WP, Hanley DA, et al. Management of corticosteroid–induced osteoporosis. Semin Arthritis Rheum 2000;29:228–51.
25. Van Staa TP, Leufkens HGM, Abenhaim L, Zhang B, Cooper C. Use of oral corticosteroids and risk of fractures. J Bone Miner Res 2000;15:993–1000.
26. McEvoy CE, Ensrud KE, Bender E, et al. Association between corticosteroid use and vertebral fractures in older men with chronic obstructive pulmonary disease. Am J Respir Crit Care Med 1998;157:704-9.
27. Sinigaglia L, Nervetti A, Mela Q, et al. A multicenter cross sectional study on bone mineral density in rheumatoid arthritis. J Rheumatol 2000;27:2582-9.
28. Haugeberg G, Uhlig T, Falch JA, Halse JI, Kvien TK. Bone mineral density and frequency of osteoporosis in female patients with rheumatoid arthritis. Arthritis Rheum 2000;43:522-30.
29. Mateo L, Nolla JM, Rozadilla A, et al. Bone mineral density in patients with temporal arteritis and polymyalgia rheumatica. J Rheumatol 1993;20:1369-73.
30. Dolan AL, Moniz C, Dasgupta B, et al. Effects of inflammation and treatment on bone turnover and bone mass in polymyalgia rheumatica. Arthritis Rheum 1999;40:2022–9.
31. Ralston SH, Urquhart GDK, Brzeski M, Sturrock RD. Prevalence of vertebral compression fractures due to osteoporosis in ankylosing spondylitis. BMJ 1990;300:563-5.
32. Cooper C, Carbone L, Michet CJ, Atkinson EJ, O'Fallon WM, Melton LJ III. Fracture risk in patients with ankylosing spondylitis: a population based study. J Rheumatol 1994;21:1877-82.
33. Goldring SR. Osteoporosis and rheumatic diseases. In: Favus MJ, editor. Primer on the metabolic bone diseases and disorders of mineral metabolism. Philadelphia: Lippincott-Raven; 1996:299–301.
34. Johnell O, Gullberg B, Kanis JA. The hospital burden of vertebral fracture in Europe: a study of national register sources. Osteoporosis Int 1997;7:138-44.