# Evaluation by means of radius bone densitometry of the fracture risk due to osteoporosis in post-menopause

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*Summary:* The aim of this work is to establish the predictive value of radius bone density with reference to the risk of fracture in postmenopausal women. Our data confirm a significant predictability of the radius for limb and rib fractures, but not for vertebral bones.

*Kay words:* Osteoporosis; Radius bone density; Fracture risk; Postmenopause.

## INTRODUCTION

Non-invasive measuring methods of the bone mass have made a considerable contribution to the knowledge of bone mass loss patterns in physiological and pathological conditions, opening new perspectives in diagnosing osteoporosis in act and in early recognition of fracture-risk subjects.

Wrist and vertebral fractures generally increase linearly in the female population from 55 to 60 years of age, while collum femoris fractures increase very considerably from 70 years onwards (Ettinger B. & Coll., 1985).

The predictive value of the osseous density of the radius on the risk of fracture is still not interpreted without ambiguity. In fact, Hui & Coll., 1989, showed an inverse correlation between the bone mass of the radius and the fracture risk of the hip, while Gardsell & Coll., 1989, concluded in a perspective study of theirs that the bone mass of the radius cannot be considered as a predictive indication of hip fractures in women over 70 years of age.

Our study proposes to examine the predictive value of the radius bone density on the fracture risk for osteoporosis in the menopause, measured by a single-ray photonic densitometer which, according to Christiansen & Coll., 1987, and Nilas & Coll., 1989, represents an investigative method that answers the requirements of reliability, easy reproduction and relatively low cost.

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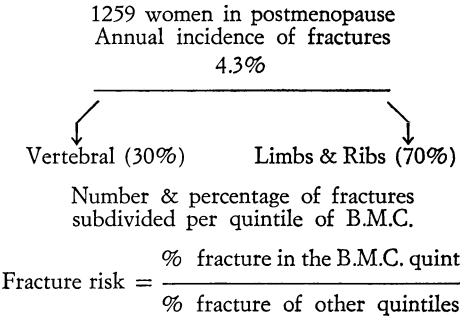
## MATERIALS AND METHODS

With the aim of assessing the predictive value of bone density on the fracture risk from osteoporosis, we calculated the annal fracture

incidence in 1259 postomenopausal women, average age 68 years, correlating it with the bone density measured at the medial and distal points of the radius of the nondominant limb by single-ray photonic densitometry. The bone densities found were divided into quintiles of density according to densitometric values of only those women with fractures, subdividing the fracture cases in this way per quintile.

The fracture risk is expressed by the ratio between the fracture percentage observed in the population of the quintile with the highest density and that of the other quintiles. The correlation of fracture incidence in the various quintiles of bone density was evaluated by means of analysis, using the $x^2$ test, of the percentage variations of fractures per quintile of the bone mineral content (BMC) (Fig. 1).




## RESULTS

In 1259 postmenopausal women we observed 53 (4.3%) new fractures, 16 (30%) of which were vertebral and 37 (70%) of limbs and ribs. Table 1 illustrates the percentage and fracture risk for both vertebrae limbs and ribs, subdivided per quintile of bone density at the distal and mid point of the radius of the women studied. The fracture risk of those belonging to the lowest bone density quintile, calculated at the distal and mid point of the radius, was, respectively, 10.3 and 17.3 times greater than that observed in the highest bone density population: the total incidence of fractures was inversely correlated to the bone mineral content of the radius ($p<0.01$).

In Table 2and 3 the percentage and risk of non-vertebral and vertebral fracture, again subdivided per quintile of bone density at the distal and mid point of the radius of the postmenopausal women examined, are separately evaluated.

The non-vertebral fracture risk (limbs and ribs) is inversely correlated to the radius bone mineral content( BMC) in a statistically significant manner ($p<0.01$) whi-

Table 1. – *Percentage of fracture risk subdivided per quintile of bone density at the distal and mid point of the radius of postmenopausal women.*

| Quintiles of bone density (mg/cm²) | Total No. of patients | No. of new fractures | %Age of fractures | Fracture risk | |
|---|---|---|---|---|---|
| 187-226 | 44 | 10 | 22.7 | 10.30 | |
| 338-418 | 17 | 5 | 29.4 | 17.30 | |
| 227-265 | 135 | 14 | 10.4 | 4.73 | |
| 419-498 | 119 | 10 | 8.4 | 4.90 | |
| 266-303 | 262 | 13 | 5,0 | 2,27 | $p<0.01$ |
| 499-579 | 167 | 16 | 10.2 | 6.0 | |
| 304-342 | 262 | 13 | 5.0 | 2.27 | |
| 580-659 | 223 | 15 | 6.7 | 3.90 | |
| 343-381 | 228 | 5 | 2.2 | 1 | |
| 660-739 | 406 | 7 | 1.7 | 1 | |

Statistical analysis: $\chi^2$ test.

Table 2. – *Percentage of non-vertebral fracture risk subdivided per quintile of bone density at the distal and mid point of the radius of women in postmenopause.*

| Quintiles of bone density (mg/cm²) | Total No. of patients | No. of new fractures | %Age of fractures | Fracture risk | |
|---|---|---|---|---|---|
| 187-226 | 49 | 7 | 14.3 | 7.7 | |
| 338-418 | 17 | 4 | 23.5 | 13.8 | |
| 227-265 | 129 | 10 | 7.7 | 4.1 | |
| 419-498 | 119 | 7 | 5.9 | 3.5 | |
| 266-303 | 268 | 6 | 2.24 | 1.2 | $p<0.01$ |
| 499-579 | 173 | 9 | 5.2 | 3.05 | |
| 304-342 | 256 | 10 | 3.8 | 2.04 | |
| 580-659 | 223 | 10 | 4.5 | 2,6 | |
| 343-381 | 227 | 4 | 1.85 | 1 | |
| 660-739 | 406 | 7 | 1.7 | 1 | |

Statistical analysis: $\chi^2$ test.

Table 3. – *Risk percentage of vertebral fracture subdivided per quintile of bone density at the distal and mid point of the radius of postmenopausal women.*

| Quintiles of bone density (mg/cm²) | Total No. patients | No. of fractures | %Age | Frarture risk | |
|---|---|---|---|---|---|
| 172-207 | 23 | 2 | 8.7 | 12.4 | |
| 393-448 | 22 | 1 | 4.5 | 7.0 | |
| 208-241 | 62 | 3 | 4.8 | 6.8 | |
| 449-502 | 64 | 3 | 4.7 | 7.4 | |
| 242-276 | 184 | 4 | 2.2 | 3.2 | N.S. |
| 503-557 | 126 | 5 | 4.0 | 6.25 | |
| 277-310 | 259 | 5 | 1.9 | 2.75 | |
| 558-611 | 195 | 4 | 2.0 | 3.2 | |
| 311-345 | 284 | 2 | 0.7 | 1 | |
| 612-666 | 312 | 3 | 0.64 | 1 | |

Statistical analysis: $\chi^2$ test.

le no significant correlation with radius BMC was met with in the case of vertebral fractures.

## CONCLUSIONS

In the light of our results we may conclude that the predictive value of radial bone density measured with single-ray photonic densitometry, with reference to the non-vertebral fracture risk in postmenopausal women, is sufficiently reliable and significant.

As for the vertebral fracture risk, instead, our data would seem to indicate the scarce predictability of radius bone density, contrary to what was reported by Wasnich & Coll., 1987.

This datum of ours must, however, be evaluated with some reserve due to the small number of vertebral fractures observed.

In conclusion, the preliminary data of this study indicate that the fracture risk from osteoporosis can be efficiently predicted by measuring radius bone density with the single-ray photonic densitometer. We propose, however, to continue this study, enlarging the case histories as well as evaluating the fracture risk, corrected according to patients ages.

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