

Proximal Femoral Canal-Diameter Ratio Is a Predictor of Fractured Neck of Femur in Osteoporotic Patients

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Purpose: Osteoporosis is an independent risk factor for fragility fractures, especially of the neck of femur (NOF). Dual energy x-ray absorptiometry (DEXA) is the gold standard for diagnosing osteoporosis. This is not always readily available or accessible and requires specially trained personnel. Also, poor bone mineral density (BMD) will not necessarily predict the risk of fragility fracture. We have assessed a simpler radiological method that correlates well with BMD scores, to be used along with clinical assessment to pre-empt medical treatment. The proximal femoral canal-diameter ratio (CDR) has been described previously, but this has not been correlated against DEXA scores of patients with or without NOF fractures. The purpose of the study was to ascertain the correlation of CDR in this select group of patients, against DEXA scan results.

Methods: A retrospective, observational, case-control study was conducted collecting data from electronic radiographs and DEXA scan results of patients treated in our institution. 110 patients with NOF fractures who had DEXA scans within a year of the injury were included. The unaffected femur was used to measure CDR in patients with NOF fracture, using annotation tools on a standard AP radiograph of the pelvis. Patients with intracapsular fractures and extracapsular fractures were subgrouped into A and B respectively. 54 patients with no proximal femoral fracture were included as subgroup C. DEXA scan results were interpreted as normal, osteopenia, osteoporosis, and severe osteoporosis. Pearson's correlation coefficient was calculated to identify correlation between CDR values and the DEXA results within a group and Student's unpaired t test to compare the groups.

Results: There was no statistically significant difference in the CDR measurements between groups A and B or between male and female patients within any group, but there was an extremely significant statistical difference ($P < 0.0001$) when both fracture groups were compared with group C (Table 1). Pearson's correlation coefficient was 0.465, when the CDR measurements were compared to DEXA results in patients with NOF fracture (moderate positive correlation) and 0.651 in patients without fracture (strong positive correlation). The odds ratio was 6.55 (95% confidence interval: 21.5 to 19.9) if the CDR value 0.61 was taken as a cut-off, to identify abnormal (osteopenic and osteoporotic) in the proximal femur ($P = 0.009$). Table 1. Statistical analysis of CDR data

| GROUPS | Mean CDR | Mean Std Dev | Std Error of Mean | Numbers |
|------------|----------|--------------|-------------------|---------|
| in females | 0.62 | 0.0638 | 0.0061 | 110 |
| in males | 0.60 | 0.0638 | 0.0061 | 57 |
| A & B | 0.62 | 0.0638 | 0.0061 | 77 |
| C | 0.55 | 0.0638 | 0.0061 | 42 |
| (F=77) | 0.60 | 0.0638 | 0.0061 | 33 |
| (M=33) | 0.61 | 0.0638 | 0.0061 | 54 |

Conclusion: Simple and methodical radiological measurement of the CDR of the subtrochanteric region gives a reliable estimate of patient's BMD. There is a significant difference in the CDR of patients who had an NOF fracture when compared with patients who did not. The study supports and reinforces the use of CDR as a surrogate marker of abnormal BMD to easily identify patients at risk of developing NOF fracture, if the CDR is > 0.61 .