

153 — A NEW APPROACH FOR QUANTIFYING BMD CHANGE AND TEST PRECISION

William D. Leslie, MD, MSc, Professor of Medicine and Radiology, University of; Alireza Moayeri, MD, Department of Public Health and Primary Care, Institute of Public Health, University of Cambridge, Cambridge, UK; Mohsen Sadatsafavi, PhD, (3) Center for Clinical Epidemiology and Evaluation, Vancouver Coastal Health Institute, Vancouver, Canada; Liqun Wang, PhD, Department of Statistics, Faculty of Science, University of Manitoba, Winnipeg, Canada

The effect of precision study sample size is not considered in current recommendations for assessing BMD change. Intuitively, a larger sample size should provide greater confidence in the derived LSC, which should translate into a more confident determination of change. A continuous metric for estimating the significance of an observed change in BMD was constructed that simultaneously considered the magnitude of the change, the LSC point estimate, and the sample size from a conventional reproducibility study. Monte Carlo simulation (10,000 runs) was used to estimate confidence that change had occurred, denoted the sample size responsive p-value (SSR-p). This approach is illustrated using a large reproducibility population (198 spine-pairs and 193 hip-pairs, mean interval 6 days) and clinical monitoring population (1420 monitored patients, mean interval 21 months). Precision study sample size was varied from 10 df to 500 df. Compared with the pooled LSC, 30 df showed inconsistent patient categorization in BMD change (95% CI from 13.0% underestimation to 9.2% overestimation for the spine, from 11.5% underestimation to 11.0% overestimation for the total hip). The SSR-p showed a progressive increase in the ability to identify BMD change using larger precision study sample sizes (see Table). A sample size of 100 df was needed to give results within 5% of the reference value. We conclude that a sample size of 30 degrees of freedom (df) for BMD precision studies is insufficient for reliably categorizing change. Approaches that consider the error in the LSC estimate may provide more robust measures of BMD change.

Table: Proportion of the clinical monitoring population classified as showing BMD change (sample size responsive p-value <.05) with comparison to the pooled LSC point estimate (reference).

Table: Proportion of the clinical monitoring population classified as showing BMD change (sample size responsive p-value <.05) with comparison to the pooled LSC point estimate (reference).

	Spine change	vs pooled	Total hip change	vs pooled
Pooled LSC (reference)	30.7%	--	40.1%	--
Sample size 10	12.4%	-18.3%	21.4%	-18.7%
Sample size 20	17.2%	-13.5%	27.5%	-12.6%
Sample size 30	19.2%	-11.5%	29.8%	-10.3%
Sample size 40	20.7%	-10.0%	31.1%	-9.0%
Sample size 50	22.5%	-8.2%	32.9%	-7.3%
Sample size 75	24.9%	-5.8%	34.6%	-5.5%
Sample size 100	25.6%	-5.1%	36.5%	-3.7%
Sample size 125	26.5%	-4.2%	36.5%	-3.7%
Sample size 150	26.5%	-4.2%	37.7%	-2.4%
Sample size 175	27.3%	-3.4%	37.7%	-2.4%
Sample size 200	27.3%	-3.4%	37.7%	-2.4%
Sample size 300	28.1%	-2.6%	38.7%	-1.4%
Sample size 400	28.1%	-2.6%	38.7%	-1.4%
Sample size 500	28.9%	-1.9%	38.7%	-1.4%

105 — ASSESSMENT OF FRACTURE RISK SHOULD BE PERFORMED SEPARATELY FOR THE CERVICAL AND TROCHANTERIC HIP FRACTURES

P. Pulkkinen, M.Sc., PhD Candidate, University of Oulu, Oulu, Finland; F Eckstein, Paracelsus Medical Private University, Salzburg, Austria; E-M. Lochmüller, Ludwig-Maximilians-Universität, München, Germany; V. Kuhn, Medical University, Innsbruck, Austria; T. Jämsä, University of Oulu, Oulu, Finland

Different risk factors for the osteoporotic fractures have widely been studied. It is known that bone strength is determined by several factors, including bone material properties, geometry and architecture. However, determinants for the different hip fracture types may be different, and are partly unknown. Also, the behaviour of fractures at different failure load levels is unknown. Thus, we investigated whether there are differences in geometrical determinants and failure load levels between fracture types for elucidating, should the fracture risk evaluation be performed separately for the cervical and trochanteric fractures.

The sample comprised left femurs of 140 cadavers (77 females, mean age 81.7, 63 males, mean age 79.1). The bones were radiographed and a set of geometrical parameters was determined from the digitized X-rays. The femurs were mechanically tested in a side impact configuration, and the fracture patterns were classified into cervical and trochanteric. The statistics was performed by fracture load quartiles.

The fracture type distribution differed significantly across load quartiles in females ($p = 0.025$), but not in males ($p = 0.205$). At the lowest load quartiles, 94.7 % of fractures in female and 62.5 % in male were femoral neck fractures. At the highest quartiles, in contrast, only 52.6 % of fractures in female and 33.3 % in male were cervical fractures. Neck-shaft angle was the best geometrical predictor of fracture type, with higher values in subjects with cervical fractures. This finding was made in females ($p < 0.001$) and males ($p = 0.02$) and was consistent across all failure load quartiles.

As a conclusion, both the failure loads and geometrical determinants differed significantly between fracture types, indicating that the fracture mechanism is different for the different types of fractures. Thus, we suggest that the fracture risk evaluation should be performed separately for the cervical and trochanteric hip fractures.