Osteoporosis in Parkinson's Disease: In Search of the Best Prediction Tool

Metabolic bone disease in chronic neurological disorders remains an active area of research now. Parkinson's disease (PD) is one of the commonest neurological disorders, characterized by tremors, rigidity, and slowness of movement and is associated with significant morbidity in the advanced stages. On the other hand, osteoporosis, which is characterized by low bone mineral density (BMD) (≤2.5 T-score and Z-score), a surrogate marker of decreased bone strength, is another chronic condition common among the elderly population. These two conditions can go hand in hand in the elderly population and confer a significant risk of fragility fracture and morbidity. PD is associated with a significant risk of lower BMD at all the sites (femoral neck, lumbar spine, and total hip region) in a recently performed meta-analysis.[1] PD patients have consistently increased fracture risk at different sites, such as vertebral and hip fractures, compared to controls.[2,3] Apart from low BMD, the propensity to repeated falls, decreased muscle strength, low vitamin D levels, and drugs like levodopa can play an important role in the fracture occurrence in PD.[4] All these factors often are present in tandem with PD patients, making them vulnerable to osteoporotic fractures. Moreover, PD by itself can increase fracture risk in a BMD-independent manner.[5] Thus, it is essential to look for additional factors beyond BMD. A study by Schini and colleagues also suggested to include PD as an independent factor in the Fracture risk assessment (FRAX) score calculations.

The lowering of BMD in PD is often evident at an early stage of the disease,[3,6] but the outcomes are not conclusive to provide evidence-based recommendations on early screening for osteoporosis in all patients with PD. In this context, it is interesting to see if newer tools like trabecular bone score (TBS) adds to the diagnosis of osteoporosis in PD. TBS is a relatively new tool which uses pixel-to-pixel variation in the gray area level in the lumbar spine image derived from dual-energy X-ray absorptiometry. It gives a better idea about the skeletal textur, is an indirect indicator of bone microarchitectures, and improves the fracture prediction independent of BMD measurements.[7]

In this issue of this journal, the study by Sooragonda BG, *et al*. has explored the difference in BMD, TBS along with hip structural analysis in male PD patients compared to healthy controls (ref, current study[8]). The interesting finding is lower TBS in PD patients despite no significant difference in BMD as compared to controls. This study also found a lower trend of TBS in severe PD but did not reach statistical significance, possibly due to a low sample size. Thus, the study explored a new tool (TBS) in a relatively understudied area of osteoporosis in men that too in a vulnerable group of PD patients.

This study further consolidated the finding of low vitamin D in PD patients with severe disease.

However, this certainly does not explain the finding of the low TBS in this population. BMD data in PD has always been conflicting and BMD seldom reflects the microarchitectural deterioration in neurological disease, for which TBS can be a useful adjunct. However, as discussed earlier, many factors other than bone-related parameters are involved in the pathogenesis of osteoporosis and fracture in PD; fracture data is certainly required. It would be very much interesting to see the fracture prevalence in the PD group as compared to controls and whether this correlates with low TBS. Moreover, a longitudinal follow-up of this cohort is warranted to gain further insight if low TBS can predict incident fracture in PD population.

Moreover, if we want to provide good quality of life to PD patients, the fracture has to be prevented. Whether medications bisphosphonates will have any role? This remains an interesting point to ponder and whether low TBS at baseline can be a guide for therapeutic intervention? Possibly, we need multiprong strategies including strict fall prevention measure, improvement in muscle strength through structured exercise programs including adequate vitamin D supplementation. There is an ongoing randomized clinical trial going on the impact of bisphosphonates (zoledronic acid) in PD patients, which might provide evidence for therapeutic intervention in PD patients.[9] Having said that, bone strength and bone quality measurement should be considered in PD patients, preferably at an early stage to prevent fracture and ongoing search should continue to have a reasonable predictive tool or model for clinical use.

Ayan Roy, Dukhabandhu Naik[1]

Department of Endocrinology and Metabolism, All India Institute of Medical Sciences (AIIMS), Kalyani, West Bengal, [1]Department of Endocrinology, Jawaharlal Institute of Post Graduate Medical Education and Research (JIPMER), Puducherry, India

Address for correspondence: Dr. Dukhabandhu Naik, Department of Endocrinology, 4th Floor, SS Block, Jawaharlal Institute of Post Graduate Medical Education and Research (JIPMER), Puducherry - 605 006, India.
E-mail: drnaik2000@gmail.com

References

1. Liu B, Chen G, Yu Z, Ji C, Liang T, He J, *et al*. Bone mineral density and related scores in Parkinson's disease: A systematic review and meta-analysis. World Neurosurg 2021;146:e1202-18.
2. Tan L, Wang Y, Zhou L, Shi Y, Zhang F, Liu L, *et al*. Parkinson's disease and risk of fracture: A meta-analysis of prospective cohort studies. PLoS One 2014;9:e94379.
3. Park SB, Chung CK, Lee JY, Lee JY, Kim J. Risk factors for vertebral, hip, and femoral fractures among patients with Parkinson's disease: A 5-year follow-up in Korea. J Am Med Dir Assoc 2019;20:617-23.
4. Figueroa CA, Rosen CJ. Parkinson's disease and osteoporosis: Basic and clinical implications. Expert Rev Endocrinol Metab 2020;15:185-93.
5. Schini M, Bhatia P, Shreef H, Johansson H, Harvey NC, Lorentzon M, *et al*. Increased fracture risk in Parkinson's disease-An exploration of

mechanisms and consequences for fracture prediction with FRAX. Bone 2023;168:116651.
6. Ozturk EA, Gundogdu I, Tonuk B, Umay E, Kocer BG, Cakci A. Bone mineral density and serum vitamin D status in Parkinson's disease: Are the stage and clinical features of the disease important? Neurol India 2020;68:394-400.
7. Rajan R, Cherian KE, Kapoor N, Paul TV. Trabecular bone score-an emerging tool in the management of osteoporosis. Indian J Endocrinol Metab 2020;24:237-43.
8. Sooragonda BG, Sridharan K, Benjamin RN, Prabhakar AT, Sivadasan A, Kapoor N, *et al*. Do bone mineral density, trabecular bone score, and hip structural analysis differ in indian men with Parkinson's disease? A case-control pilot study from a tertiary center in Southern India Ann Ind Acad Neurol 2023;26:496-501.
9. Available from: https://clinicaltrials.gov/ct2/show/NCT03924414.

Submitted: 08-May-2023 **Accepted:** 16-May-2023
Published: 11-Sep-2023

DOI: 10.4103/aian.aian_400_23