

Age- and Sex-Related Variations of Skull Density Ratio (SDR) Among Latin American Patients with Parkinson Disease and Essential Tremor

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Abstract

Introduction: The Skull Density Ratio (SDR) is a key imaging biomarker used in determining eligibility for Magnetic Resonance-guided Focused Ultrasound (MRgFUS), especially in movement disorders such as Essential Tremor (ET) and Parkinson Disease (PD). While SDR is widely used in preoperative planning, its variability by age, sex, and diagnosis remains insufficiently described, particularly in Latin American populations. This study aimed to evaluate SDR distribution, stratify patients using clinically meaningful SDR intervals, and analyze age- and sex-related correlations in a cohort of Latin American patients referred for MRgFUS evaluation.

Method: We retrospectively analyzed SDR data from 400 consecutive Latin American patients (36.5% female) assessed for MRgFUS treatment at a tertiary center in Santiago, Chile. All patients had confirmed diagnoses of PD or ET. SDR values were extracted from preoperative CT scans using standard MRgFUS planning software. Descriptive statistics were computed by sex and diagnosis. SDR values were stratified into four categories: <0.35, 0.35–0.39, 0.40–0.45, and 0.46, or more. Spearman correlations were calculated to assess relationships between age and SDR in the full cohort and by sex. Independent t-tests were performed to compare SDR across sex and diagnostic groups.

Results: The mean age of the cohort was 63.2 years (SD ±10.9). Overall, 87% of patients had SDR over 0.40, with

26.5% in the 0.40–0.45 range and 60.5% with SDR 0.46 or more. SDR between 0.35–0.39 was found in 10% (n=40), and only 3.0% (n=12) had SDR below 0.35. No significant differences in mean SDR were observed between males and females within either diagnostic group. However, a moderate negative correlation between SDR and age was identified in females ($p = 0.0042$), suggesting an age-related decline in SDR among women. No such trend was observed in males.

Discussion: This study provides the first detailed SDR characterization in a Latin American cohort with PD and ET. The high prevalence of favorable SDR is consistent with reports from North American and European populations, indicating similar anatomical suitability for MRgFUS in this region. The observed sex-specific correlation with age suggests a potential biological or structural difference in skull density dynamics between males and females. These findings underscore the importance of age- and sex- specific interpretation when considering SDR-based eligibility for MRgFUS.

Conclusions: Most Latin American patients evaluated for MRgFUS in this cohort demonstrated favorable SDR profiles. The results support the broader implementation of MRgFUS programs across the region and highlight the need for prospective, outcome-based studies to refine SDR thresholds and better understand sex-based variability.