The effectiveness of the nucleus smartnav system in detecting and preventing electrode tip fold-overs: A multi-center retrospective analysis of 213 cochlear implantations

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Objective: To evaluate the effectiveness of the SmartNav system in detecting tip fold-over (TFO) during cochlear implantation and to compare angular insertion depth measurements obtained via SmartNav and transorbital X-ray imaging.

Methods: This retrospective multi-center study included both pediatric and adult patients with normal cochlear anatomy, comprising 163 individuals and 213 ears who underwent cochlear implantation using Nucleus CI522 and CI622 systems between February 2024 and January 2025 at Gazi University Faculty of Medicine and Gaziantep State Hospital. Intraoperative SmartNav measurements included insertion time, angular insertion depth, impedance, and AutoNRT. TFO detection by SmartNav was confirmed with intraoperative X-ray. Postoperative X-ray images were used to verify electrode array position and assess angular insertion depth.

Results: Of the 213 cochlear implantations, TFO was detected in 4 implantations (1.88%) intraoperatively with SmartNav, all of which were confirmed by X-ray, withdrawn, and successfully reinserted during the surgery. One case (0.47%) of TFO was not detected by SmartNav and identified postoperatively via X-ray imaging. SmartNav showed a sensitivity of 80%, specificity of 100%, a positive predictive value of 100%, and a negative predictive value of 99.5%. A strong correlation was found between SmartNav and X-ray angular insertion depth measurements ($r = 0.711$, $p < 0.001$).

Conclusion: SmartNav System is a reliable tool for the intraoperative detection of TFO and the assessment of angular insertion depth in patients with normal cochlear anatomy. By reducing operative time, minimizing the need for intraoperative imaging, and offering real-time insertion feedback, it functions as a practical and efficient adjunct in cochlear implantation.

Key words: Cochlear implantation; SmartNav system; Tip fold-over; X-ray

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Biography

Emirhan Akyol graduated from Hacettepe University Faculty of Medicine and is currently a final-year ENT resident at Gazi University. His main interests include otology, neurotology, and facial reanimation. He has been involved in clinical and academic projects related to cochlear implantation, facial nerve surgery, and swallowing disorders.

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