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Variable Pressure Scanning Electron Microscopy (VP-SEM) preserves the native hydration state of biological specimens, enabling high-resolution imaging without dehydration artifacts. This study assesses VP-SEM's potential in evaluating cholesteatoma surgery outcomes by comparing manual and CADISS-assisted dissection techniques.
Sixty-seven human incus bone samples from cholesteatoma surgeries were analyzed using VP-SEM. Samples were divided into manual dissection (n = 35) and CADISS-assisted dissection (n = 32) groups. VP-SEM imaging was conducted under low-vacuum conditions, utilizing backscattered electron mode (BSE) to differentiate bone from residual soft tissue. Quantitative analysis of tissue removal efficiency was performed using image processing software, measuring the clean area-to-total area ratio. Statistical comparisons were conducted using the Mann-Whitney U test.
VP-SEM imaging revealed significantly improved tissue removal in the CADISS-assisted dissection group. The mean clean area-to-total area ratio was 0.2095 (SD = 0.0709) in the CADISS group compared to 0.0478 (SD = 0.0204) in the manual dissection group ($p < 0.0001$). BSE imaging confirmed superior removal of residual cholesteatoma debris in CADISS-assisted specimens, highlighting its enhanced surgical precision.
VP-SEM effectively evaluates cholesteatoma surgical outcomes, demonstrating CADISS-assisted dissection's superiority over manual techniques in minimizing residual disease. This method offers a novel approach for surgical pathology assessment, providing quantitative insights that could refine intraoperative decision-making and improve patient prognosis. Further research should explore VP-SEM's real-time applications in otologic and broader surgical fields.

Palavras-chave : Variable Pressure Scanning Electron Microscopy, Middle ear morphology, Cholesteatoma pathology