Artificial Intelligence and Telehealth as Diagnostic Approach to Middle Ear Disease- Advances in Otology

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As with other subspecialities, remote otoscopy commonly regarded as telehealth is being studied as a new approach for diagnosis of middle ear diseases. As in covid-19 pandemic, otolaryngologists were the most affected health care professionals as aerolized particles were a hurdle to conduct routine upper airway and ear canal examination, telehealth gain popularity, also to justify shortage of PPE. Beside this, reduction in post operative follow up visits, and cost savings in terms of greater access for rural populations were the major attractions to adopt remote otoscopy in ENT.[1]

In recent literature, telehealth in accordance with artificial intelligence has proven to have diagnostic accuracy of 78.7% of middle ear pathologies. The video otoscope tympanic membrane image is uploaded in android application, that process the image on smartphone. Connected server perform the task of feature extraction and ultimately, diagnosis of the disease. Broadly the disease is classified into four categories, namely, normal, abnormal, obstructed wax and chronic perforation. The abnormal division is actually the group of pathologies such as acute otitis media. Therefore, this system also, triage patients appropriately.[2] Two specialist comparative diagnosis by Livingstone et al, and cross checking of images by primary author from medical records was done in a study by cha et al. this learning via machine had high precision of images for otitis media.[3] Chen et al., formulated a smartphone-based edge artificial intelligence application that divided common middle ear diseases into ten known ear pathologies through transfer learning. This model was meticulously superior to previous experiments, as those used cloud computing techniques requiring access to internet and latency connections.[4]

Thirty-nine studies were systematically evaluated for artificial intelligence-based otoscopy processes. With the accuracy of 90.7%, AI was successful in discriminating between normal and abnormal images. Overall precision of 97.6% was reported. Equated against manual classification, human evaluators are outpaced by artificial intelligence in classifying otoscopy images (93.4% versus 73.2% accuracy respectively).[5]

In conclusion, the lack of Ent specialists in underdeveloped countries, general practitioners are forefront to treat medical issues related to ear, despite of the fact that they may not have enough training to make correct diagnoses in this field. Therefore, to discourse this issue, a computer-aided system based on machine models and image processing techniques, also known as artificial intelligence, or telemedicine acts as a support for a more exact diagnosis of ear disorders at primary care before specialist referral.

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REFERENCE:

1. Ezzibdeh R, Munjal T, Ahmad I, Valdez TA. Artificial intelligence and tele-otoscopy: A window into the future of paediatric otology. Int J Pediatr Otorhinolaryngol. 2022 Sep;160:111229. DOI: 10.1016/j.ijporl.2022.111229

2. Pedersen, J. E. N. (2020). Digital otoscopy with AI diagnostic support: making diagnosis of ear disease more accessible. ENT & Audiology News.

3. Sandström J, Myburgh H, Laurent C, Swanepoel DW, Lundberg T. A Machine Learning Approach to Screen for Otitis Media Using Digital Otoscope Images Labelled by an Expert Panel. Diagnostics. 2022; 12(6):1318 DOI: https://doi.org/10.3390/diagnostics12061318

4. Chen YC, Chu YC, Huang CY, Lee YT, Lee WY, Hsu CY, Yang AC, Liao WH, Cheng YF. Smartphone-based artificial intelligence using a transfer learning algorithm for the detection and diagnosis of middle ear diseases: A retrospective deep learning study. EClinicalMedicine. 2022 Sep 1;51:101543. DOI: https://doi.org/10.1016/j.eclinm.2022.101543

5. Habib, A-R, Kajbafzadeh, M, Hasan, Z, et al. Artificial intelligence to classify ear disease from otoscopy: A systematic review and meta-analysis. Clin Otolaryngol. 2022; 47: 401–413 DOI: DOI: 10.1111/coa.13925