

Comparative Assessment of a Smartphone Otoscope for the Diagnosis and Management of Acute Otitis Media

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Purpose: Accurate diagnosis of acute otitis media (AOM) depends on reliable visualization of the tympanic membrane. We evaluated the reliability and acceptability of an otoscope attachment for a handheld smartphone (CellScope-oto) in the diagnosis and management of AOM in symptomatic children.

Methods: We conducted a prospective, single-site assessment among a convenience sample of children with upper respiratory tract symptoms presenting for care at a metropolitan Emergency Department (ED) between May and December 2012. Following the provision of clinical care, each subject underwent bilateral otic videoscopy with the CellScope-oto and a camera-fitted conventional otoscope in random order. Record review, a parental acceptability survey, and blinded physician panel review of images obtained with both devices was conducted. Descriptive statistics, tests for statistical significance, and tests of correlation and trend were performed.

Results: Video-imaging was obtained from 63 (90%) of subjects, (mean age 2.9 years, standard deviation 3.5 years). Forty-nine (67%) subjects received a clinical diagnosis of AOM by an ED practitioner; 35 (71%) were ≤ 2 years, 30 (61%) were male, and fewer than 5% had a history of ≥ 6 episodes of recurrent AOM. Over 95% of parents approved the ability to visualize their child's middle ear and stated that CellScope-oto image capture improved their understanding of their child's management. Ninety-percent of parental respondents stated that the CellScope-oto would be easy to use and would feel comfortable using it to transmit images to a provider. Four physicians independently scored 62 videos from 26 subjects; 31 from the CellScope-oto and 31 with a camera-fitted conventional otoscope. There was no difference in the diagnostic quality or confidence ratings between devices for the physician raters ($r_s=0.889$ vs. $r_s=0.848$). There was no association between physician and diagnosis or antimicrobial use when evaluating the devices independently. Image quality was significantly correlated with diagnostic confidence (AOM or not AOM); 3 of the 4 physicians had $r_s>0.70$. Overall, physician raters of the CellScope-oto images were in fair agreement ($K=0.375$, $p<0.05$) with the clinical ED diagnosis of AOM. In contrast, two of the raters had a moderate to substantial agreement with the ED diagnosis and two of the raters had poor agreement with the ED diagnosis from images obtained with the conventional device. There was a significant correlation between antimicrobial use and image quality ($r_s=0.434$, $p<0.05$), indicating that higher quality images were more likely to be associated with a definitive diagnosis.

Conclusion: Image quality and diagnostic confidence from images captured by the CellScope-oto and a conventional device were comparable. Acceptability, image-capture, transmission, and parental involvement through sharing of images care were rated highly. The CellScope-oto has the potential to improve diagnosis and management and reduce expenditures related to AOM in children.