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Original Research Article

Effectiveness of smartphone otoscope in management of ear ailments at primary healthcare level

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ABSTRACT

Background: To work out efficacy of smartphone otoscope for managing ear ailments at primary healthcare level.
Methods: Prospective study carried out at a co-located primary care clinic and secondary referral facility. With this plan, the PHC was equipped with a smartphone otoscope for diagnosing common ear problems. The doctor then forwarded patient's ear imaging to the referring hospital's otolaryngologist. The otolaryngologist reviewed the history to make remote diagnosis before providing the PHC provider with recommendations for treatment. Information on patients' demographics, outpatient diagnoses, symptom durations, affected side, treatments received, and outcomes was collected. This information was used to determine whether or not a smartphone otoscope may be used to improve healthcare for patients suffering from common ear illnesses without sending them to more specialized facilities.
Results: 150 patients were enrolled; 53.3% were male and 46.7% female. Participants aged between 3 and 83 years, with a mean of 44.6. Eighty-two (48%) of the cases presented with left ear, sixty (40%) with right ear, and eighteen (12%) for both sides. The typical course of ear infection lasted 6.5 (2, 15) days. Out of 150 patients, 33 (22%) were deemed cured, 117 (78%) demonstrated improvement in symptoms. The technique was praised by primary care physicians, who said they learned more about otolaryngology.
Conclusions: The ability of primary care physicians to manage common and straightforward ear ailments is greatly enhanced by the use of smartphone otoscopes. Thus, improving patient satisfaction and the strain on medical facilities.

Keywords: Smartphone otoscopy, Telemedicine, Primary health care, Common ENT ailments

INTRODUCTION

As the first point of contact between patients and the healthcare system, primary healthcare centres (PHCs) are crucial hubs. In addition to being the easiest place for people to get the healthcare they need; it also serves as the population's first point of contact. There has been tremendous development and ongoing transformation in the Indian health care system over the years. More than 200,000 Government Primary Health Care Facilities (GPHCFs) may be found throughout the country today, providing care to people in both rural and urban locations.[1] However, existing GPHCFs are not up to par and only offer a limited selection of health services because of shortage in personnel, equipment, and education. This means that the infrastructure remains unused. According to reports, just 11.5% of persons in

rural areas and 3.9% of people in urban areas who needed healthcare services were able to obtain them in 2013-14, despite the widespread network available to them. Unfortunately, primary healthcare (PHC) in India is inadequate, since many patients instead choose to go to more specialised government hospitals for their care. Individuals can also choose to use non-government healthcare providers, which will result in Out-of pocket expenditures (OOPE). As a result, both situations place strain on an already-stressed healthcare infrastructure. These problems have brought to light the shortcomings of India's basic healthcare system.

With the goal of increasing government investment for health to 2.5% of GDP by 2025, up from 1.18% in 2015-16, India's National Health Policy (NHP) of 2017 suggested the improvement of PHC systems.[2,3] The Ayushman Bharat Programme (ABP) was launched by the government of India in February 2018 as a continuation of the National Health Policy (NHP) 2017. Health and Wellness Centres (HWCs): The goal of this section is to ensure that all members of the population have ready access to high-quality, all-encompassing primary health care. Primary care is centred on the Health and Wellness Centres, which provides a comprehensive set of medical services need.

Pradhan Mantri Jan Arogya Yojana (PMJAY): Secondary and tertiary hospital care for India's bottom 40% of families is the subject of this section. The goal of PMJAY is to ensure that people from economically disadvantaged backgrounds have access to and can afford high-quality healthcare. The government's goal in implementing the aforementioned aspects of the ABP is to improve primary healthcare delivery via Health and Wellness Centres and to expand access to secondary and tertiary care for economically disadvantaged populations via PMJAY.[4] Unfortunately, many community health centre physicians who provide primary health care lack the necessary expertise in certain medical fields. Furthermore, the effectiveness of PHC is diminished due to the lack of specialised devices at community health centres. Telemedicine, CVD prevention, care for the elderly, and hearing screening are just few of the healthcare areas that have benefited from smartphone applications.[5-8]

The smartphone otoscope (SO) is one of the more recent examples of such an electronic item being put to good use. Using a specialised app on a smartphone, doctors can take pictures and videos of a patient's tympanic membrane (TM) and external auditory canal.[9] Captured images can be easily shared amongst medical professionals, patients, and researchers. Thanks to the portability and accessibility via digital media. Clinical diagnostics, telemedicine, procedural skill improvement, medical student education, and even animal research have all found success with the SO's use.[10-14] The purpose of this research was to examine how well smartphone otoscopes work for diagnosing and treating ear problems in primary care settings.

METHODS

Patients

Medical inspection (MI) centres in Jorhat a city of North-east India were included in this prospective observational study alongside the referral hospital, which acts as both a tertiary referral centre and a teaching hospital. Participants with ear problems who went to the outpatient clinics at the Medical inspection centres between January 2022 and May 2023 of that year. Patients were considered if they met the following criteria: they had an external or middle ear condition; they were adults; they were accompanied by a parent; and they had an ear disease that could be treated medically. Patients who were unable or unwilling to participate in the evaluation of treatment outcomes were excluded, as were those with ear problems requiring surgical intervention. Informed written consent was obtained from all study participants. The informed consent form was signed by the minor and a parent or legal guardian if the participant was under the age of 18.

Procedure

Outpatient settings in primary care clinics were used for initial patient assessments in the study. Patients who met the trial's inclusion criteria were referred to the study by primary healthcare (PHC) practitioners. Patients' principal complaints and full medical histories were recorded on the first PHC appointment. To examine the ears of their patients, they downloaded an otoscope app for smartphones and used it as a smartphone otoscope (SO).

Figure 1: Smartphone otoscope.

The gadget communicates with mobile phones with its own app. It has an internal 1.3-megapixel camera that can record video at 640 x 480 P and shoot still images at 1280x720 P. The PHC providers then sent the otolaryngologist the photographs and videos they had taken on their smartphones. They also used phone calls and text messages to relay important patient information. Within a short time of obtaining the data, the otolaryngologist had made a remote diagnosis and presented treatment suggestions to the patient's PHC physician. Otolaryngologists consult with primary care

physicians, who then prescribe medicine and schedule follow-up appointments in the Otolaryngology OPD (Outpatient Department).

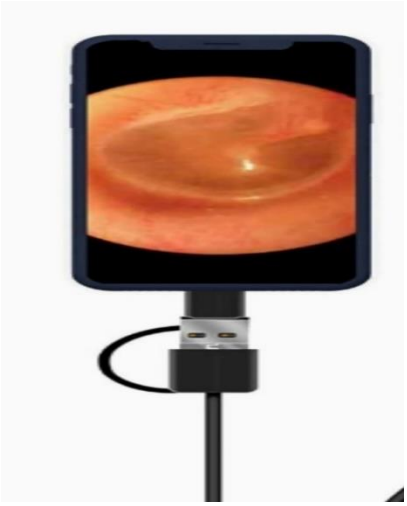

Figure 2: Smartphone otoscope connected to cellphone.

The otolaryngologist evaluated the PHC provider's suggested treatment strategy and validated the diagnosis with an otoendoscopy utilising a standard rigid 4 mm 0-degree endoscope during the subsequent OPD visit. By working together, PHC providers and otolaryngologists improved patients' access to information and care.

RESULTS

One hundred fifty individuals were included in the study, with seventy being female (46.67%) and eighty being male (53.3%). Participants ranged in age from 3 to 83 years old, with a mean age of 44.6 19.7. Eighty-two (48%) of the cases were located on the patient's left side, sixty (40%) on the patient's right side, and eighteen (12%) on both sides. The typical course of ear infection lasted 6.5 (2, 15) days. The (Table 1) lists the patients and their individual features.

Table 1: The characteristics of the patients and the outcomes of the treatment (n=150).

Characteristic and outcomes	N (%)
Gender	
Male	80 (53.3)
Female	70 (46.67)
Sides	
Left	72 (48)
Right	60 (40)
Both	18 (12)
Disease duration (days)	6.5 (2, 15)
Treatment outcomes	
Cured	33 (22)
Improved	117 (78)
Ineffective	0 (0)

The (Table 2) displays the various ear diseases experienced by the study's 150 participants.

Table 2: Types of ear disease in patients enrolled in a smartphone otoscope study.

Type of Disease	N (%)
Fungal otitis externa	40 (26.6)
Acute otitis externa	28 (18.66)
Traumatic tympanic membrane perforation	8 (5.33)
Acute otitis media	38 (25.33)
Otitis media with effusion	28 (18.66)
Granular Myringitis	8 (5.33)

Out of a total of 150 patients, 33 (22%) were deemed cured, and another 117 (78%) demonstrated improvement in their symptoms at their subsequent otolaryngologist appointment. The study and smartphone otoscopy were praised by primary care physicians, who said they learned more about otolaryngology and became more interested in the area as a result.

DISCUSSION

This study set out to determine how useful the smartphone otoscope (SO) is for treating ear problems in a primary care setting. Patients who have used this service have generally had a positive experience, which may be linked to the high quality of care provided and the ease with which it is accessed. Our research shows that SO has greatly improved the primary care identification and management of ear problems. It has also been shown to be useful for teaching primary healthcare providers' skills, which has resulted in happier providers and better patient outcomes. Positive outcomes have been observed after using SO in primary care settings, which is good news for both patients and medical staff.

There is a wealth of published research documenting the usefulness of smartphone otoscopes in otolaryngology. The accuracy of SO in detecting acute otitis media in young children was shown to be comparable to conventional otoscopy in a research conducted by Mousseau et al.[10] Tympanostomy tube monitoring using SO was investigated by Don et al who found that it may be used to keep tabs on kids' tubes from afar and improve parents' experiences.[11-14] In the COVID-19 era, Meng et al investigated the efficacy of a smartphone otoscope in a rural medical consortium in East China.[15] During the COVID-19 pandemic, otolaryngology clinics are particularly vulnerable because to the high viral load of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) in the nose and throat.[16,17,18] As a result, research has focused on how to best employ SO for telemedicine applications. Patient self-monitoring after surgical correction of TM retraction was reported by Bayoumy et al indicating that SO can be an effective technique for regular follow-up.[16] An otolaryngologist can be notified of a patient's condition after a thorough examination of

the ear canal and tympanic membrane (TM) is performed using a smartphone otoscope (SO). The otolaryngologist can visually inspect the patient's ear with the help of the obtained still images. The video data also allows them to assess live elements, such the TM's motion. PHC providers and otolaryngology professionals may better communicate with one another and make more informed decisions about the patient's ear health thanks to this extensive visual data. Smartphone otoscopes allow for more efficient and timely interaction between ENT doctors and general practitioners. Through online forums, they are able to instantly share knowledge, discuss problems, and get help with technological issues. This allows otolaryngologists to offer round-the-clock assistance and direction to PHC providers, guaranteeing that they always have access to specialist expertise and insight. Patients can benefit from SO in a number of ways, including financial and time savings. These patients no longer have to make repeated trips to distant specialised medical centres for appointments. Instead, they can easily have access to the remote medical services, which will save them time and money. Involvement like this boosts the quality of treatment they receive.

Limitations

Limitations of current study were- the study was carried out at a single centre over a short period of 14 months. Therefore, the data collected for drawing the results was limited and not comparable with other centres having different equipment. The equipment required for sharing of data through media was same throughout the study. Hence, there is a possibility of inferior image quality due to compression of the media file leading to missing of subtle abnormalities. The smart otoscopic images do not show a great difference in tissue texture or colouration. Thus, the clinical decisions could been impacted. This can be dealt with using a better HD quality modality and hence, improve decision making.

CONCLUSION

To sum up, Smartphone otoscopy is an excellent tool in helping primary care physicians better manage common ear, nose, and throat conditions. Additionally, it prevents patient discomfort and higher centre referrals, which saves time and money and boosts patient satisfaction. There has been favourable comment on how this technology has helped PHC providers upgrade their training and education. Naturally, this method has the potential to lessen the concentration and movement of patients in otolaryngologic clinics, hence lowering the danger of cross-infection and generating novel strategies for preventing and controlling HAIs.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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