Concordance between real-time telemedicine assessments and face-to-face consultations in paediatric otolaryngology

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ABSTRACT

Objective: To determine agreement between diagnoses and management plans made during an initial videoconference appointment and subsequent face-to-face consultations in paediatric ear, nose and throat (ENT) surgery.

Design and setting and participants: A paediatric ENT clinic servicing patients from Bundaberg, Queensland, was conducted through the Centre for Online Health at the Royal Children's Hospital (RCH) in Brisbane. Between January 2004 and February 2006, 152 consultations with 97 patients were carried out. We retrospectively audited patients' charts to compare the diagnosis and management plan formulated at the initial videoconference and the eventual diagnosis and surgical management after face-to-face consultation. The clinical outcomes for children who were not recommended for surgery at the RCH were ascertained by telephone survey.

Main outcome measures: Agreement between videoconference and face-to-face consultation findings.

Results: Of the 97 patients, 75 were recommended for surgical management at the RCH. The remaining patients were either referred back to their general practitioner (9), followed up by the regional paediatrician (10) or lost to follow-up (3). At the conclusion of the study, seven patients were still awaiting surgery and were excluded. Among the 68 patients seen via videoconference and in person, the recorded diagnosis was the same in 99% of cases (67). Surgical management decisions were the same in 93% of cases (63). Telephone follow-up with paediatricians and GPs confirmed that there were no missed diagnoses or ongoing ENT-related problems in the 19 patients referred back to their care.

Conclusions: Decisions about ENT surgical interventions for children assessed during videoconference clinics are in close agreement with decisions made by the same surgeon at face-to-face consultation. The way is open to employ telemedicine more widely for pre-admission ENT assessment. However, as in any telemedicine work, widespread application requires care.

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The health department in Queensland, like departments in most other states in Australia, is faced with challenges related to delivering health services to patients in regional and remote areas. In Queensland, most specialist health services are in the south-east corner of the state. Therefore, most patients living in rural and remote areas have to travel great distances if a specialist appointment is required. At an annual cost of about $30 million, Queensland Health assists regional patients by subsidising travel costs.[1]

Ear, nose and throat (ENT) services are among the specialist services offered at the Royal Children's Hospital (RCH) in Brisbane. Specialist ENT services are delivered in a number of ways. The most common method is for patients to attend a specialist appointment in person at the RCH. Alternatively, patients may have the opportunity to see a specialist during regional outreach clinics, held infrequently in district hospitals, which are usually much closer to the patient's home. Other less common options include the use of telemedicine, either as a videoconference appointment (real-time telemedicine), or a specialist's review of prerecorded information (eg, digital images, video clips, clinical histories and audiograms) collected by a primary health care provider (store-and-forward telemedicine).[2,3]

The use of telemedicine as a means of reviewing patients in rural Queensland is a way of overcoming the inconvenience of long-distance travel and time away from home. After initial work that demonstrated the feasibility of tele-otoscopy for patients in remote areas,[4,5] we showed the potential value of telemedicine for assessing children before transfer to the specialist hospital, saving families at least one journey to Brisbane.[1] Outcomes, including patient satisfaction and a reduction in family costs, distances travelled, and time off work for parents of these patients, are all substantially improved with the use of telemedicine.[6,7]

Despite the data supporting videoconferencing as a viable method of pre-admission assessment of paediatric ENT patients, there is limited evidence to support the accuracy of decisions made during an ENT telemedicine consultation. Using videoconferencing for the initial assessment of children and development of a treatment plan, instead of the usual face-to-face appointment, has enormous potential in terms of travel costs saved; however, it is important to demonstrate the clinical effectiveness of telemedicine before it is widely adopted.

The aim of the study was to establish whether diagnoses and management decisions formulated during the initial specialist ENT consultation (via videoconference) were in agreement with the clinical findings when the patient was seen by the same specialist in person. We reviewed the clinical records of paediatric ENT surgical patients who had been referred from one selected regional hospital in Queensland to the ENT specialist in Brisbane.

METHODS

Between January 2004 and February 2006, videoconference clinics were held at the RCH in Brisbane. All of the patients seen in these clinics were residents of Bundaberg, located about 500 km north of Brisbane.

Patients in Bundaberg who needed referral to an ENT specialist were allocated an appointment at the next available monthly telepaediatric clinic and seen via videoconference instead of travelling to Brisbane. All referrals, including those by Bundaberg general practitioners, were managed centrally by the regional paediatrician. Clinics were attended by an ENT surgeon at the RCH, and a regional paediatrician, the patient and the family in Bundaberg. Telepaediatric coordinators were available at both hospitals to help with any technical problems. At the end of the consultation, the specialist dictated a letter which was retained in the

1 The regional paediatrician uses a video-otoscope to send images to the specialist via videoconference

2 Images sent via videoconference are viewed by the specialist at Brisbane's Royal Children's Hospital

patients' medical record. Copies were forwarded to the regional paediatrician or GP or both.

A full history of the patient's presenting problem was taken by the ENT surgeon during each telemedicine consultation. A detailed ENT examination was performed using the telemedicine audiovisual equipment. The equipment consisted of a video-otoscope (Flexible Microvision ENT Camera, Inline Systems, Sydney, NSW) connected to the local videoconference system (ViewStation FX, Polycom, Sydney, NSW). An accessory device, which provided a diffuse light source for examination of the oral cavity, was available for interchange with the otoscopic attachment. The regional paediatrician in Bundaberg was responsible for using the video-otoscope (Box 1) and obtaining images of the ears, nose and throat — under the remote guidance of the ENT specialist, who could offer advice and comments (Box 2). Information, such as results of hearing tests and x-rays, photographed with a video document camera, could be transmitted via videoconference. Consultations were conducted from the telemedicine studios at the Centre for Online Health at the RCH, by using digital telecommunication lines (ISDN) at a bandwidth of 384 kb/s.

Patients who were recommended surgical management were later seen at a face-to-face consultation with the ENT surgeon at the RCH before their procedure. This consultation was either on the day of surgery or the day before, depending on the travel arrangements. The original notes recorded during the videoconference appointment were not accessible to the ENT surgeon at this appointment. A full history and examination were repeated at these consultations to determine whether the diagnosis and management plan formulated at the videoconference had been appropriate.

A senior medical officer with ENT experience reviewed all patients' medical records. Demographic information as well as details of the videoconference and face-to-face consultations were collated. Specifically, the diagnosis and management plans formulated during both consultations were recorded. Data on secondary diagnoses, ongoing management strategies, and any requirement for future follow-up consultation were also documented.

Data on the patient's initial videoconference diagnosis and management strategy were compared with the eventual primary diagnosis and definitive care.

For the group of patients who did not attend the RCH and instead were referred back to their GPs or paediatricians for follow-up, medical records (if available) were reviewed, and each primary carer was telephoned to investigate whether there were any ongoing ENT problems or missed diagnoses since the videoconference appointment.

Permission to conduct this study was granted by the ethics and management committees at the RCH.

RESULTS

We conducted 19 telepaediatric ENT surgical clinics during the study period, from January 2004 to February 2006, inclusive. A total of 152 consultations were undertaken with 97 patients (43 girls, 54 boys; age range, 14 months to 15 years; median, 6 years; interquartile range [IQR], 3–9 years). Each patient had only one presurgical assessment by videoconference. Repeat consultations occurred only when postoperative review was recommended by the surgical specialist.

The average number of patients seen per clinic was eight, and the median duration of each clinic was 120 min (IQR, 90–135). The average time between the telemedicine assessment and the face-to-face assessment was 4 months (range, 1–7 months).

At the completion of the study, 68 patients had had both a videoconference and a face-to-face consultation and had undergone subsequent definitive surgical management, as appropriate. Of the remaining patients, seven were awaiting a surgical appointment at the RCH when the review was conducted, three had failed to attend a surgical appointment scheduled at the RCH, and 19 were deemed not to require an appointment with the ENT surgeons at the RCH. Of these, 10 attended follow-up with the paediatrician in Bundaberg and nine were referred back to their GPs.

Diagnosis

In all cases, a diagnosis was recorded during the videoconference by the consulting ENT surgeon (Box 3). The most common diagnosis was recurrent tonsillitis, which accounted for 26 of the 97 diagnoses.

Clinical management

During the videoconference, the ENT specialist recorded a management plan for all cases (Box 3).

3 Diagnoses made and management plans established during paediatric ear, nose and throat telemedicine consultations ($n = 97$)

	n
Diagnosis	
Recurrent tonsillitis	26
Bilateral glue ear or serous otitis media	17
Obstructive sleep apnoea	12
Recurrent otitis media	11
Review of grommets	9
Rhinitis or sinusitis	6
Other*	16
Management	
Adenotonsillectomy	32
Referral to general practitioner or paediatrician, and/or medication	19
Grommets	11
Tonsillectomy	9
Adenoidectomy and grommets	7
Adenotonsillectomy and grommets	7
Other†	12

* Tinnitus, impacted ear wax, headaches, febrile convulsions and recurrent epistaxis.
† Bronchoscopic examination, lateral neck x-rays, referrals to other specialists and removal of wax. ◆

Of the nine referred back to the GP, two were prescribed antibiotic ear drops or nasal sprays. After telephone contact with all of the GPs, we were able to confirm that there were no missed diagnoses in the patients referred back to their care.

A review of the correspondence available from the paediatrician for all 10 patients being followed up did not reveal any evidence of ongoing ENT problems or missed diagnoses.

Agreement

The initial videoconference diagnosis was confirmed for 67 of the 68 patients after face-to-face review by the same specialist at the RCH (99% agreement). The eventual definitive surgical management was shown to correlate with the videoconference management strategy in 63 cases (93% agreement).

The one patient who had a different diagnosis after review had an initial diagnosis of unilateral perforated tympanic membrane and serous otitis media involving the other ear. After face-to-face review, about 6 months after the initial videoconference, the patient received a diagnosis of bilateral perforated tympanic membranes. Of the five patients who had surgery different from that suggested at the videoconference, four had minor alterations, including or excluding adenoidectomy, tonsillectomy and grommet insertion (Box 4). The remaining patient underwent myringoplasty for a perforated tympanic membrane after conservative management failed.

DISCUSSION

Our study shows that clinical assessments of children with potential ENT-related conditions can be conducted via videoconference with reasonable confidence. The high concordance for diagnosis and management decisions is very encouraging. Previous studies have investigated the feasibility of store-and-forward telemedicine applications, including the transmission of video clips, still digital images and audiometry results, and overall concordance has been between 80% and 84%.[3,8-10]

Apart from our own experience of providing a real-time tele-otology service to patients in Bundaberg,[1] there are no other reports of tele-otology in Queensland. Tele-otology studies in Alaska, Scandinavia and Western Australia have been reported,[4,5,8,9] mainly in relation to the transmission of prerecorded still images of the ears, nose and throat. The use of videoconferencing to transmit ENT images to a specialist for an opinion has been shown to be technically feasible, but there remains limited evidence to justify clinical effectiveness and cost-effectiveness.

The Alaskan study investigated the accuracy of assessments made by two independent observers. A series of still video-otoscopic images were collected from a group of 40 patients requiring tympanostomy tube follow-up. Interobserver concordance was about 84% for the telemedicine application, which was reported to be similar to the interprovider concordance observed when patients were examined face-to-face.[8]

In WA, researchers investigated whether prerecorded information (including a clinical history, still otoscopic images, audiometry and tympanometry) could be used to make accurate diagnoses and management decisions. One specialist conducted all face-to-face consultations and was also responsible for reviewing the prerecorded information one month later. This study reported concordance ranging from 72% to 85% between assessments during the initial face-to-face appointment and decisions made after review of the prerecorded information.[9]

In previous work, we compared decisions made by a single specialist who saw patients and then reviewed prerecorded information (including video clips and limited history) at least 2 months later. With the prerecorded information, very limited histories were available for review — if any at all. Overall agreement was about 80%.[3] We suspect that one of the reasons for the higher concordance in the current study may be that the specialist was able to undertake a complete patient history and ask specific questions during the videoconference appointment, rather than rely on information collected by another clinician.

4 Details of four cases where surgical management recommended during the videoconference consultations and during the face-to-face consultations were different*

Specialist's initial recommendations from videoconference	Subsequent recommendations from face-to-face consultation	Rationale for change in management
Adenotonsillectomy	Adenotonsillectomy and grommets	Developed ear problems during waiting period
Adenotonsillectomy and examination of ears under anaesthesia	Adenotonsillectomy and grommets	Fluid detected on examination, then decision to insert grommets
Adenotonsillectomy and grommets	Adenotonsillectomy	Fluid resolved spontaneously during waiting period
Grommets	No treatment	Fluid resolved spontaneously during waiting period

* A fifth patient had an operation after planned conservative management failed. ◆

There are some limitations in our methods. For logistical and ethical reasons, the study could not be conducted as a randomised controlled trial, and therefore the findings may not be generalisable to a wider population. Second, it was not possible for two or more specialists to see each patient via videoconference, and therefore we were able to compare only the documented notes made by one specialist. Because the study relied on a single observer, there is potential for some unconscious bias in decisions made when each patient was seen in person.

We can conclude from this study that decisions about ENT surgical interventions for children assessed during videoconference clinics are in close agreement with decisions made by the same surgeon at face-to-face consultation. The way is therefore open to employ telemedicine more widely for pre-admission ENT assessment. However, like any telemedicine work, widespread application must be done carefully. In a state as large as Queensland, this has the potential to substantially reduce travel costs. In other work, we have documented large savings as a result of telepaediatrics; the avoided travel for burns follow-up has amounted to 1.4 million km over 6 years, which is equivalent to a return journey from Earth to the Moon, twice.[11,12]

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COMPETING INTERESTS

None identified.

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