ORIGINAL ARTICLE

Teleconsultation in paediatric orthopaedics in Djibouti: Evaluation of response performance

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KEYWORDS
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Summary
Background: Djibouti has no paediatric orthopaedics department and three options are available for difficult cases: transfer of the patient to another country; overseas mission transfer to Djibouti by a specialised surgical team; and management by a local orthopaedic surgeon receiving guidance from an expert. The extreme poverty of part of the population of Djibouti often precludes the first two options. Telemedicine can allow the local orthopaedic surgeon to receive expert advice.

Hypotheses and study design: We prospectively recorded all the paediatric orthopaedics teleconsultations that occurred between November 2009 and November 2011. Our objective was to assess the performance of the teleconsultations. We hypothetized that this option was influential in decision making.

Materials and methods: We assessed the influence of the teleconsultation on patient management (i.e., change in the surgical indication and/or procedure). We then used the electronic patient records to compare the actual management to that recommended retrospectively by two independent orthopaedic surgeon consultants who had experience working overseas. Finally, we assessed the clinical outcomes in the patients.

Results: Of 48 teleconsultations for 39 patients, 13 dealt with diagnostic problems and 35 with therapeutic problems. The teleconsultation resolved the diagnostic uncertainties in 90\% of cases. Advice from the expert modified the management in 37 (77\%) teleconsultations; the change was related to the surgical indication in 18 cases, the surgical technique in 13 cases, and both in six cases. Agreement between the advice from the independent consultants and the treatment delivered by the local surgeon was 2.2/3. Clinical outcomes were good or very good in 31 (81\%) of the 38 treated patients.

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Conclusions: This study establishes the feasibility and usefulness of paediatric orthopaedics teleconsultations in Djibouti. The introduction of telemedicine has changed our approach to challenges raised by patients in remote locations or precarious situations. Input from experts considerably benefits patient management.

Level of evidence: III, prospective comparative study.

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Introduction

The Republic of Djibouti, located in the horn of Africa, has a population of about 800,000. The healthcare facilities are concentrated in Djibouti, the capital, and include a general hospital (the Peltier hospital) and a medical-surgical hospital staffed by French military medical personnel (the Bouffard hospital). Paediatric orthopaedics is among the many medical and surgical specialties that are lacking in Djibouti. Whereas simple cases can be easily managed by adult orthopaedic surgeons, complex cases raise major challenges that can be met by transferring the patient to another country, flying in specialised surgeons, or having a local adult orthopaedic surgeon manage the patient after receiving expert advice. The extreme poverty of part of the population usually precludes the first two solutions and constitutes a limitation to the obligation of means. Telemedicine can help the local surgeon to better meet this obligation.

Telemedicine encompasses several components, although the vector is the same and the modalities comparable. Teleconsultation is among these components and consists in using telecommunication methods such as the Internet to send medical data (text files, still images, and videos) produced at a healthcare facility to another healthcare facility having a greater level of expertise, with the goal of obtaining a second opinion about the diagnosis, help in defining the treatment, or adjustment of the management strategy [1]. Many authors [1–3] have suggested that telemedicine may improve the management of patients in numerous fields of medicine, including orthopaedics. The use of telemedicine may also diminish healthcare costs by limiting transport costs and unnecessary physician visits [4, 5]. Telemedicine also appears particularly well suited to developing countries such as Djibouti, as it improves access to medical care, most notably in specialised domains, thereby decreasing inequalities with the richest countries [6].

Here, our objective was to establish a prospective case-series to evaluate the feasibility of teleconsultation in paediatric orthopaedics and its performance in Djibouti.

Materials and methods

We conducted a prospective single-centre study of consecutive patients over a 2-year period (from 1 November 2009 to 1 November 2011). We included all the teleconsultations requested by a single surgeon (AB). The patients were selected subjectively based on the challenges raised, which involved the diagnosis and/or the treatment.

All the requests for advice about paediatric orthopaedics cases were sent to the same expert (FL), located in Marseille, France, and having experience with humanitarian surgery. The data were sent via a standard Internet connection to an e-mail address. The requests contained no information about patient identity, and broad consent of the parents or family was obtained in every case. The case-reports provided detailed information on the medical history and findings from a thorough physical examination to avoid requests for additional data from the expert. Finally, the message always contained a suggested diagnosis or treatment, depending on the setting. Radiographs were photographed using a digital camera (1 million pixels) and sent without compression (230 kilo-octets per photograph on average). In emergencies, an international telephone call was placed immediately after the message was sent, to alert the expert about the problem (the time difference between continental France and Djibouti is 1 or 2 h). The analysis of the reply from the expert and the selection of the treatment strategy were performed in discussion with the family of the patient.

To evaluate the performance of teleconsultation, we started by determining whether the advice given by the expert changed the diagnosis and/or therapeutic management (surgical indication and/or surgical procedure) of the patients. We then conducted a retrospective comparison of the actual management and of the management recommended by two independent senior orthopaedic surgeons who were not specialised in paediatric orthopaedics and who had experience working overseas (PC, LM). These two consultants reviewed the electronic patient files on average 12 months after the initial management and suggested a diagnosis and a treatment strategy. An index [4] was used to assess agreement between the two consultants. The value of the index was 2 when the two consultants agreed and 1 when they disagreed; a half-point was assigned for partial agreement. Diagnostic agreement and therapeutic agreement were rated separately. We rated the level of agreement between the treatment used by the local surgeon after receiving expert advice and the treatment suggested by the independent consultants: the score was 3 if the surgeon’s treatment was identical to that recommended by both consultants, 2 if it was identical to that recommended by one consultant, and 1 if it differed from the suggestions of both consultants. Finally, we evaluated patient outcomes, as follows: very good if the patient and surgeon were completely satisfied, good if the patient was satisfied, fair if there was an improvement without a complete cure, and poor if the condition worsened or failed to improve.
Results

Characteristics of the case-series

During the study period, paediatric orthopaedics accounted for 30% of the visits to the surgeon who used teleconsultation, i.e., 550 visits per year; and 38% of surgical procedures performed, i.e., 165 procedures per year.

Over the 2-year study period, 158 teleconsultations occurred overall in all specialties and 48 (30%) in paediatric orthopaedics. This proportion placed paediatric orthopaedics in second place, after neurosurgery (58 teleconsultations). Paediatric orthopaedics teleconsultations occurred for 4% of all paediatric orthopaedics visits.

The 48 teleconsultations in paediatric orthopaedics occurred for 40 patients; seven patients had at least two teleconsultations each. Mean age was 7 years (1 month–14 years) and the sex ratio was 2.3 (28 boys and 12 girls). The reasons for the 48 teleconsultations were limb deformities (n = 14), traumatic injuries and their sequelae (n = 22), spinal deformities (n = 2), tumours (n = 6), and limping (n = 4). Advice about both the diagnosis and the treatment was requested in 13 cases and advice about the treatment only in 35 cases (Table 1). The mean number of e-mail attachments sent per teleconsultation was 2.6 (range, 0–4).

Replies of the expert

The expert replied to all the teleconsultations. Mean time to the reply was 6 h (range, 0.1–24 h). One (2%) case was an emergency that required an international telephone call, which was followed 5 minutes later by the response of the expert (suspected subperiosteal abscess in a patient with evidence of severe infection who was finally proven to have an Ewing’s sarcoma). The expert requested additional information for 6 (12.5%) cases.

The diagnosis was established in nine of the 10 patients (13 teleconsultations) for which diagnostic advice was requested; the remaining patient had a swelling of the ankle that could not be investigated by magnetic resonance imaging, for financial reasons. The advice from the expert modified the management in 37 (77%) of the 48 teleconsultations: the change involved the surgical indication in 18 cases, the surgical procedure in 13 cases, and both in six cases.

Impact on therapeutic management

The treatment was surgical in 16 (40%) patients and medical in 22 (55%) patients; it had not yet been performed in the remaining two (5%) patients. Of the 16 patients who underwent surgery, 11 (69%) had multiple procedures. After surgery, one (2.5%) patient died, because of the underlying disease (Ewing’s sarcoma).

The outcome was classified as very good in 25 (63%) patients, good in six (15%), fair in four (10%), poor in three (7%), and non-assessable in two (5%). In the three patients with poor results, the locally available resources did not allow appropriate treatment; one of these patients had an Ewing’s sarcoma and died shortly after a surgical biopsy of the femur, one had congenital brevity of the femur, and one had residual damage from knee osteitis and arthritis. The four patients with fair results underwent multiple surgical procedures; the diagnoses were congenital pseudarthrosis of the tibia, chronic osteomyelitis of the fibula, a hip disorder responsible for a limp, and a post-traumatic forefoot deformity.

Suggestions by the two consultants

The two senior orthopaedic surgeons who were not specialised in paediatric orthopaedics and who had experience working overseas provided recommendations for all the cases, for a total of 96 responses. Mean time from the initial management to the assessment by the consultants was 12 months.

The correct diagnosis was made in five (50%) of the 10 patients with diagnostic requests, and the diagnostic agreement index was 1.6/2. An analysis of the treatment suggestions showed that the treatment agreement index was 1.5/2. The two consultants agreed about the therapeutic management (index = 3/3) in 21 (55%) cases and disagreed completely (index = 1/3) in 10 (26%) cases. Agreement between the various suggestions made by the consultants and the treatment used by the local surgeon who requested the teleconsultations was 2.2/3.

Discussion

Feasibility and performance of teleconsultation in paediatric orthopaedics

The worldwide availability of the Internet has allowed the introduction of telemedicine in developing countries such as Djibouti. Over a 2-year period, we performed 48 paediatric orthopaedics teleconsultations using the local Internet network. These teleconsultations resolved 90% of diagnostic uncertainties and changed the therapeutic management in 77% of cases, with the change involving the surgical indication in nearly two-thirds of cases. Obtaining advice from consultant orthopaedic surgeons who were not specialised in paediatrics would have resolved 50% of diagnostic uncertainties and led to extremely contradictory treatment suggestions (with three different opinions) in slightly over one-fourth of the cases. These findings illustrate clearly the usefulness of obtaining advice from a paediatric orthopaedic surgeon. The values of the indices for diagnostic agreement and therapeutic agreement between the two consultants support the reproducibility of the teleconsultation in our study. The 81% rate of good and very good outcomes among treated patients is evidence of the good performance of teleconsultation.

All the parents accepted that advice from an expert in France be requested before a treatment decision was made. Many parents were aware that their child’s case raised challenges, and the use of teleconsultation reassured them about the treatment strategy. The surgeon requesting the teleconsultations also benefited from the process, as the advice from the paediatric orthopaedic surgeon facilitated and validated the treatment choices.
Use of telemedicine in orthopaedic surgery

According to the literature, the use of telemedicine in orthopaedic surgery has been confined to teleradiology. Teleradiology has been shown to allow reproducible and useful surgical decisions [2–7], even when the images are sent by mobile phone [3]. An evaluation based on electronic patient records was found feasible in 96% of cases and was reproducible both in foot and ankle disorders [4] and in upper limb disorders [8]. These data support the reliability of teleconsultation.

Analysis of our study design

Our sample size and the heterogeneity of our patient population precluded a statistical analysis. In addition, the subjective selection of the cases based on the competencies of the local surgeon was a source of bias. Paediatrics accounts for a substantial part of the activity of orthopaedic surgeons in tropical developing countries (40% in our study). Thus, in our hospital, paediatric orthopaedic cases are the second most common reasons for teleconsultation, after neurosurgery cases.

Data transmission by e-mail is simple, fast, and inexpensive (the only equipment needed is a computer, a digital camera, and an Internet connection) and, importantly, available in Djibouti. The technical performance of the connection consistently allowed the transmission of uncompressed images. When compression is needed, it seems to have no effect on the interpretation by the expert [2,3].

E-mailing provides access to experts anywhere in the world. Although the confidentiality rules for e-mailing are the same as those for postal mail (article 432-9 of the French Penal Code), we removed all mention of the patients’ names from the files sent to the expert.

Taking digital pictures of documents that were acquired digitally may seem paradoxical [4]. Direct online transmission of digitised images, although logical, requires the use of encrypted networks whose cost exceeds the resources available at our facility in Djibouti. Videoconferencing is a promising method that allows a real-time discussion. However, the high-speed connection needed for videoconferencing is rarely available in developing countries, and arranging for all those involved to be available at the same time raises logistical challenges.

Limitations of teleconsultation for supporting development

The efficiency of teleconsultation depends on the quality of the inputs from the initial examiner and expert [1,6]. Crucial factors for the expert are knowledge of the country, local epidemiology, and local equipment availability, as well as experience with teleconsultation (probabilistic approach, decision tree, and pragmatism). Woolston suggested that, for telemedicine used to support development, the ideal expert comes from the country where the patient is located [6].

One of the limitations of telemedicine in developing countries may be related to the difficulty encountered by physicians (or surgeons) in asking for help. A request for help emphasises one’s own limitations and constitutes an admission of dependency on a third party, thereby weakening one’s status as an expert. Paradoxically, this process requires considerable self-confidence. Expatriates trained in western countries may, for cultural reasons, be more likely to ask for help. Similarly, the use of telemedicine may be perceived as a form of “healthcare imperialism”. One solution may consist in having the local regulatory authorities develop telemedicine networks, to lessen the impression of “losing control” of the patient and treatment [6].

Teleconsultation raises a number of problems. The expert must be readily available, as advice is often needed on an emergency basis. The expert should receive compensation, as teleconsultation, particularly in emergencies, should not have to rely only on the selfless goodwill of the expert. This point is in line with a principle derived from Thatcherism, according to which delivering public services at no charge adversely affects efficiency. Nevertheless, telemedicine used to support development (including in the field of paediatric surgery) is, and will probably remain, an unremunerated activity, as is the rule at present in humanitarian medicine.

Finally, there is general agreement in Europe that telemedicine can decrease healthcare costs, most notably by decreasing transportation costs and the number of unnecessary visits [4,5]. This point does not apply to Djibouti, where most people cannot afford international travel, leaving treatment by the local surgeon as the only option.

Conclusions

This study established that telemedicine, although not a substitute for training and experience in local surgeons, can contribute usefully to improving the management of paediatric orthopaedics patients under the conditions of resource-limitation and isolation prevalent in Djibouti. We believe the benefit of teleconsultation resides in its simplicity of use; a strict protocol for the initial evaluation; and the high quality of the exchanges, with these last being facilitated by personal ties, or even bonds of friendship, between the requesting surgeon and the expert.

| Table 1 Requests for diagnostic advice and therapeutic advice depending on the type of disorder. |
|----------------------------------|---------|-------|----------------|----------------|-------|-----|
| Total                            |         |       |                |                |       |     |
| Diagnosis and treatment          | 3       | 2     | 5              | 3              | 0     | 13  |
| Treatment                        | 11      | 2     | 1              | 19             | 0     | 35  |
| Total                            | 14      | 4     | 6              | 22             | 2     | 48  |
Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

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