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A telemedicine communication exchange network in Gorno-Badakhshan Autonomic Oblast in collaboration with Swiss Surgical Teams

Intizor Mamadnabiev[1,*], Stephan Imfeld[2,*], Lorenz Gürke[3,4], Markus Aschwanden[2] and Andrej Isaak[3,4]

Abstract

Introduction: The purpose of this article is to report on the implementation of a telemedicine network serving as a second opinion pool for a surgeon in a remote area of a developing country.

Methods: This study involved an international collaboration between two members of Swiss Surgical Teams at a tertiary referral hospital and a surgeon in a remote area in Gorno-Badakhshan Autonomic Oblast, Tajikistan, which established a second opinion pool discussing diagnostics and therapeutic options via a messenger application. A retrospective analysis of response times was performed using a series of 50 challenging cases.

Results: The median time to receive a first telemedical response from any of the two contacts was 24 min (interquartile range 6–73). Urgent and emergent pathologies accounted for 57% of cases. The suggested treatment was carried out in 90% ($n = 44$) of cases.

Conclusions: Timely and convenient telemedicine support to provide diagnostic and therapeutic reassurance and improve treatment quality for patients presenting to a general and vascular surgeon in the large and remote region of Gorno-Badakhshan Autonomic Oblast can be installed via a messenger application.

Keywords

Telemedicine, teleconsultation network, e-medicine, developing country, surgical education

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Introduction

Gorno-Badakhshan Autonomic Oblast (GBAO) is the largest of four administrative regions in Tajikistan covering almost 50% of the territory of the whole country but, with a population of around 250,000, it is also the least densely populated area in the country. Tajikistan, as a developing country in Central Asia, has a growing public health system, but no medical insurance system. Swiss Surgical Teams (SST) is a small group of predominantly surgically active medical doctors, anaesthesiologists and technical operation assistants who dedicate a part of their free time to the transfer of medical knowledge to colleagues in developing countries. The basic idea is to choose a country, a region or just one hospital and visit the same location at least twice a year for 2–3 weeks over a minimum period of 5 years to do (mainly) teaching to a constant local team.

In the largest GBAO Regional Hospital in Khorog, treatment for patients with vascular diseases such as crossectomy and stripping of superficial veins, therapy of acute arterial and venous thrombosis were solely based on anamnesis and physical examination. No vascular imaging modality was available until autumn 2017. The accuracy of diagnosis in vascular diseases

[1]General Surgery, Khorog Regional Hospital, Tajikistan
[2]Angiology, University Hospital Basel, Switzerland
[3]Vascular and Endovascular Surgery, Cantonal Hospital Aarau, Switzerland
[4]Vascular and Endovascular Surgery, University Hospital Basel, Switzerland

*Intizor Mamadnabiev and Stephan Imfeld have equally contributed to this work.

Corresponding author:
Andrej Isaak, Vascular and Endovascular Surgery, Cantonal Hospital Aarau, Tellstrasse 25, CH-5001 Aarau, Switzerland.
Email: andrej.isaak@ksa.ch

plays a crucial role in the choice of treatment modality and, therefore, in patient safety. For example, information concerning the extent of reflux in varicose veins and underlying contraindications for varicose surgery such as a post-thrombotic syndrome were challenging or even impossible to detect without imaging, resulting in unnecessary and potentially harmful operations or medical treatments.

Ultrasound is regarded as the mainstay to evaluate vascular pathologies but for a long time it was unavailable in GBAO. In response to this diagnostic lack, a mobile GE Logiq ultrasound was donated by SST in autumn 2017 to the surgical unit at the Khorog Regional Hospital (KRH). A local general and vascular surgeon received theoretical and practical training in vascular ultrasound from a Swiss angiologist (MA, tutor and course leader of Swiss Society of Ultrasound) during the SST missions in KRH in 2017 and 2018. The teaching consisted of daily courses in theory of about 1 h over a period of 3 weeks and practice whenever possible. The theoretical part of the teaching was focused on two of the most common vascular problems in GBAO – venous pathologies of the deep and superficial system and peripheral arterial disease, both in the lower extremities.

Patients who were candidates for vascular surgery were examined to discuss the indication for intervention and to establish a treatment plan. In such a way ultrasound findings and preoperative mapping became a new standard in, for example, the operative treatment of varicose veins.

Telemedicine is considered one of the best tools available to allow healthcare personnel to communicate with each other irrespective of distance, in order to discuss specific cases and to exchange opinions regarding diagnostics and treatment. The value of a tele-based second-opinion model in developing countries has been reported for many specialities using different types of software and hardware.[1–4] A project in the Middle East (Iraq, Pakistan, Kuwait) and Afghanistan, where physicians were able to ask for a remote consultation on critical cases by sending out e-mail messages to their colleagues in developed countries, reported improved care for individuals as well as effective case-based learning for the local doctors.[5] A telemedicine network using a dial-up Internet connection in teledermatology, teleradiology and telepathology was also implemented in Ethiopia in 2004.[6] To the best of our knowledge, no evaluation of telemedicine focussing mainly on vascular diseases in a remote and deprived area has been published.

Material and methods

A telemedicine network called the "Vascular Team" (VT) consisting of a trained Tajik surgeon (IM), a Swiss angiologist (MA) and a Swiss vascular surgeon (AI) was created. A mobile application (app; WhatsApp), which is generally not considered a platform that meets most medical, privacy and security requirements, was used to discuss diagnostic and treatment options for all cases that the local surgeon classified as challenging (Figure 1). After collecting the anamnesis, conducting an initial physical and non-invasive medical examination, IM photographed all findings including diagnostic images (radiographic and sonographic) with a smartphone and transferred all relevant, anonymised information to the senior doctors for

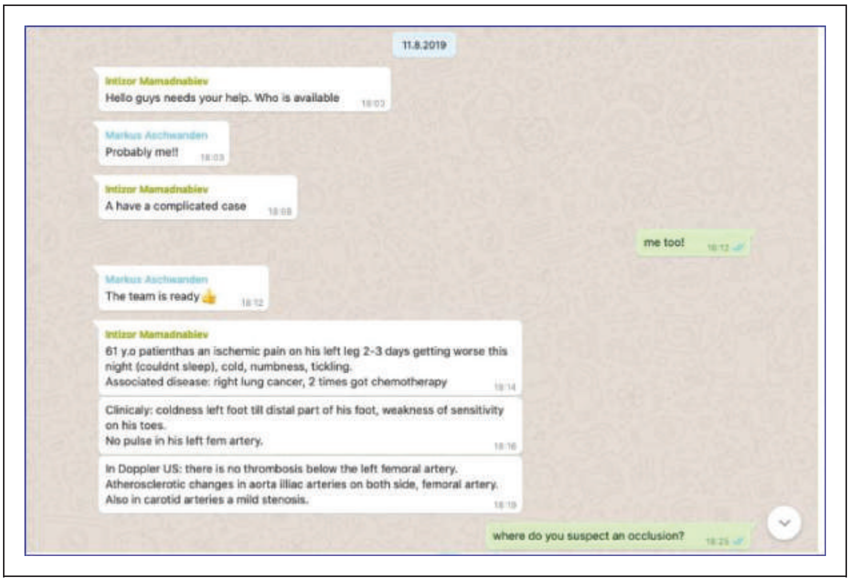

Figure 1. Vascular Team initiating to discuss a challenging case via WhatsApp.

decision making via the messenger app. The material consisted of x-ray images, computed tomography (CT) scans, images or videos of vascular ultrasound examinations and laboratory results, and these items were displayed on a smartphone on the receiving side. In addition, phone conferences were conducted in selected and emergent cases, to discuss treatment options and initiate immediate management. Both specialists independently proposed treatment after evaluating the adequacy of the information provided. The time interval between request and response was documented, as well as the treatment modality that was finally applied. Follow-up was recorded according to local conditions (distances, travel expenses etc.) when feasible.

The observation period ran from 1 October 2018–30 September 2019. Demographic data, patient history, clinical examination and imaging as well as working or definite diagnosis and proposed treatment were collected from chats and patient charts and documented on a prepared case report form (CRF).

All patients were asked to consent to clinical information being forwarded for a second opinion via the app. Confidentiality was respected by the anonymization of each case record, and no personal data except sex and age were transmitted.

Descriptive statistics were conducted using SPSS software (IBM SPSS Statistics Version 22). Patient-related continuous variables are presented as mean (±SD) and median (range), non-normally distributed parameters as median and interquartile range (IQR).

Results

Over the 12 months, 50 patients with a mean age of 54 years (±16) with 58% females were evaluated at the KRH by the VT collaboration. One patient was excluded from the analysis due to Internet outage at that time. Vascular pathologies (49%) were most frequent, followed by diabetic foot syndrome (14%) and other surgical pathologies in 37% of patients (Table 1). The mean distance that patients travelled for a consultation to KRH was 86±148 km (Figure 2).

The median time to receive a first telemedical response from either of the two contacts was 24 min (IQR 6–73). The median response time for the surgeon/angiologist was 37 (10–222) min, and 38 (18–128) min (Figure 3) respectively. Consultations were divided into non-emergency ($n=21$) and emergency ($n=28$) cases. The median response time of consultations for emergency patients was 30 (4–186) min and 33 (18–114) min, and for non-emergency 40 (14–263) min and 42 (22–146) min for the surgeon/angiologist, respectively. Due to Internet outage, the response time in one case was delayed for 2 days though this did not influence the positive outcome of healing in this patient with deep venous thrombosis. The initial information for evaluating the case was considered sufficient in 49% of cases in order to make a suggestion, make a conclusion and give feedback, while 27% resulted in minor and 24% in major information requests. Suggested treatment by the local surgeon was agreed upon in 59% of cases, while in 16% of cases minor changes and in 25% of cases major changes were suggested. The treatment suggested by the senior physicians was carried out in 90% ($n=44$) of cases. All patients with diabetic foot syndrome ($n=7$) were re-evaluated after initial conservative treatment with antibiotics to determine the appropriate moment for debridement or amputation.

Table 1. Summary of pathologies treated by the telemedical second-opinion service.

Pathologies	*n* (%)
Vascular	24 (49)
Arterial	10 (20)
Venous	12 (25)
Lymphatic	2 (4)
Diabetic vasculopathy	7 (14)
Other	18 (37)
Neoplastic	7 (14)
Trauma	6 (12)
Infectious	3 (6)
Visceral	2 (4)
Total	49 (100)

Although long-term follow-up information was difficult to obtain, 67% of patients presented a mean of 43 days (±46) after treatment and follow-up data was documented. Three patients died during the follow-up from concomitant conditions. Out of 33 patients with a short-term follow-up, 25 (76%) healed. Six patients (18%) could not benefit from telemedical second-opinion service for reasons that were independent of the technology. The causes were palliative care situations for metastatic cancer disease ($n=2$), limited therapeutic resources or lack of specialised surgical expertise ($n=2$), refusal of proposed treatment ($n=1$) and chronic venous insufficiency with non-healing ulcer ($n=1$). In two cases (6%), the outcome remains unknown.

After receiving the treatment suggestion in KRH, three patients consulted specialists at a tertiary referral hospital in the capital, Dushanbe, for a second opinion. One returned and continued to consult the local surgeon after receiving the same treatment suggestion. The other two never consulted the local surgeon again and, thus, their outcomes remain unknown.

Discussion

This retrospective case series describes a telemedicine network serving as a second opinion pool for a doctor

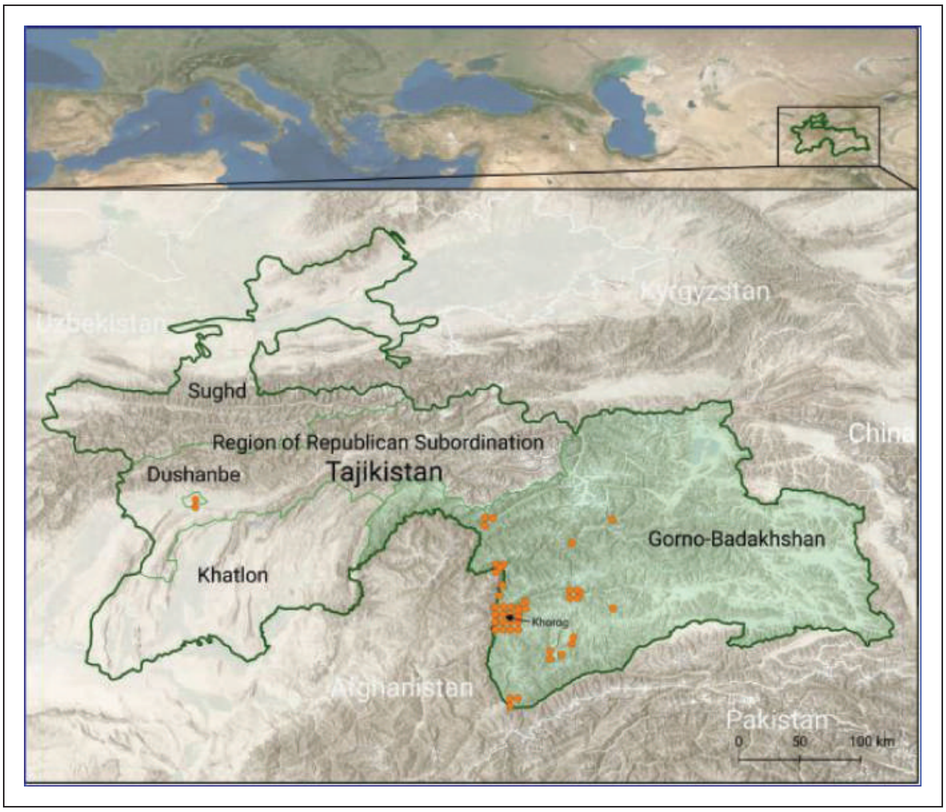

Figure 2. Patients origin travelling for a consultation to KRH, Khorog.

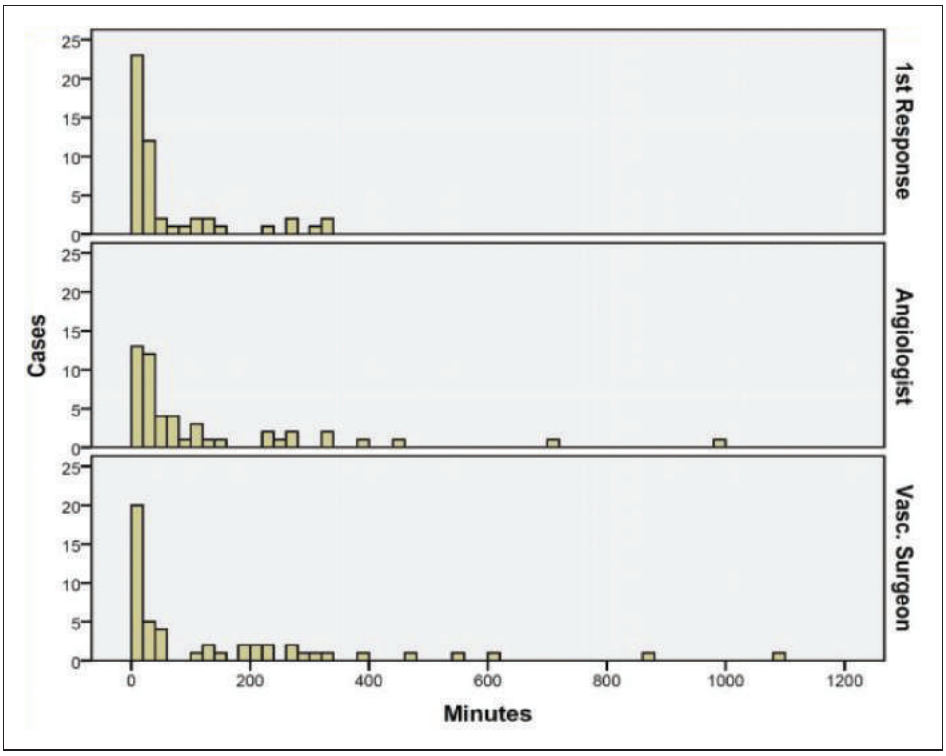

Figure 3. Response times to first request for fastest response, response by the angiologist and the vascular surgeon.

in a developing country. We report on the implementation, communication speed and clinical evaluation, as well as outcomes and its acceptance.

In contrast to the classical understanding of telemedicine i.e. videoconferences with larger groups of involved participants, we used WhatsApp Messenger, a communication tool that is used mainly for social contacting. The app is a promising tool as it allows exchange of information between healthcare professionals and has been utilised as a learning platform in the past.[7–9] There are some disadvantages to WhatsApp, such as reduced imaging quality, uncertainties about data protection and Internet outage which can render the app unavailable, but nonetheless there are many advantages. There was no need of a fixed time schedule for all of the participants to come together which allowed us to communicate whenever a challenging case was presented. From a technical point of view, in contrast to a video conference, the messenger app is stable on mobile devices and there is no need for sophisticated technical equipment. However, our personal commitment for continuous medical education was the main driver to establish a successful telemedicine network.

The very fast responses to requests with a median first response time of 24 min despite a time-zone difference of 3 h and the normal working activity of all involved was impressive. Even using the messenger app in silent mode (by AI) did not influence the timely support.

In addition to the direct effect on the treatment of an individual patient, we were able to use the app to continue medical education beyond our time-restricted personal contact during the SST missions. Medical services for the population in remote areas are difficult to maintain, as access to specialists is complicated by long distances and financial limitations. Furthermore, standards regarding clinical evaluation, documentation and application of treatment vary when compared with contemporary guidelines. The knowledge transfer also allowed improvement in the management and treatment of diseases, for example, the implementation of early mobilization or even ambulatory therapy in deep venous thrombosis of the lower extremity.[10] As local people came to know about SST and to accept the progression made in patient treatments, the knowledge that their local doctor was getting a second opinion from senior colleagues in Switzerland increased their acceptance. This could be deduced from the fact that most patients were happy to be treated on site, and only a handful of patients sought a second opinion, requiring lengthy and costly travel to the capital, Dushanbe, a form of behaviour that had previously been more frequent. Concomitantly, the number of visits increased (data not shown) as a further indication that patients were increasingly confident with the local situation, indirectly showing satisfaction with the use of teleconsultation.

While this retrospective case series has several limitations as it evaluated only a small number of selected patients, our limited data provide important insights into the implementation of a telemedicine network in a remote area of a developing country using a common messenger app.

To establish a sustainable telemedical second-opinion service, several key factors need to be addressed. Aside from organizational aspects such as funding and involvement of local authorities, a careful assessment of the local situation (e.g. knowledge of healthcare standards, therapeutic limitations, culture and the availability of technology) needs to be performed. This can be facilitated by initially creating a trusting, co-working relationship for a short period of time (e.g. 6 weeks within a period of 2 years) at the location receiving the telemedical support in order to establish the needs of the healthcare personnel and the patients. During such missions, knowledge transfer, both theoretical and practical (in our case mainly vascular ultrasound), is mandatory. To transform this relationship to the digital world, costs, availability and sustainability factors must be carefully considered and evaluated for a successful implementation.

In conclusion, notwithstanding a lot of dedication from all parties, we believe a timely and convenient process of support has been successfully implemented that provides diagnostic as well as therapeutic reassurance and improves treatment quality for patients presenting to a general and vascular surgeon in the large and remote region of GBAO.

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ORCID iD

Andrej Isaak https://orcid.org/0000-0001-9660-0729

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