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COVID 19

Pilot Study Using Telemedicine Video Consultation for Vascular Patients' Care During the COVID-19 Period

Hai-Lei Li,¹ Yiu Che Chan,^{1,2} Jian-Xiong Huang,¹ and Stephen W. Cheng,^{1,2} Shenzhen and Hong Kong, China

Background: The aim of this pilot study was to evaluate the effectiveness and patients satisfaction of using telemedicine virtual communications to provide remote health care to vascular patients during the coronavirus disease 2019 (COVID-19) period in China.

Methods: Video calls using WeChat software (Tencent, Shenzhen, China) between patients and vascular surgeons were conducted in a period when there were restrictions and limitations for people's travels in China. At the end of each video call, a short questionnaire was used to evaluate the patient satisfaction level.

Results: During the COVID-19 period from 19 February to March 16, 2020, a sample of 114 from 165 (69%) patients was reached after one phone call attempt. One hundred forty-two telemedicine remote communications were made between the two vascular surgeons and 114 patients. The mean age of this cohort of patients were 60 ± 15.2 (range 25 to 90) years old, and 74 (65%) were men. Twenty-five patients (22%) were outside of our province when they received the video call. The mean duration of the video call was 11.0 ± 8.9 minutes. All of the patients thought telemedicine was a good substitute for coming to hospital, and 95% (108/114) of them preferred to have remote telemedicine rather than postpone the appointment. All the patients agreed with the advantages of telemedicine including no infection risks, no need to travel, and no need to wait for long time. All the patients were "satisfied" or "highly satisfied" with the video call and they would like to use telemedicine for follow-up in the future.

Conclusions: Telemedicine virtual communications was effective to provide remote health care with a high patient satisfaction during the COVID-19 period. Telemedicine offers support to vulnerable vascular patients without the need for travel and face-to-face hospital consultation, and so avoided transmission and infection.

Brief statement: This pilot was conducted at a COVID-19 epidemic period in China when there was nationwide stringent travel restriction. Telemedicine via video chat was effective, and offered remote support and advice for vascular patients, who would otherwise attend the hospital outpatient clinic if there was no COVID-19. The authors believe this could serve as a model worldwide, in other specialties, to offer care, advice, and compassion to all the patients.

Conflict of Interest: The authors declare no conflict of interest. All the patients expressed oral consent to the video communication. This research received no specific grant or funding.

¹Division of Vascular Surgery, Department of Surgery, University of Hong Kong- Shenzhen Hospital, Shenzhen, China.

²Division of Vascular & Endovascular Surgery, Department of Surgery, University of Hong Kong Medical Centre, Queen Mary Hospital, Hong Kong, China.

Correspondence to: Yiu Che Chan, MB BS, BSc, MD, FRCS(England), FRCS (General Surgery), FCSHK, Associate Professor, Division of Vascular & Endovascular Surgery, Department of Surgery, University of Hong Kong Medical Centre, Queen Mary Hospital, South Wing, 14th Floor K Block, Pokfulam Road, Hong Kong SAR, China; E-mail: yccchan88@hkucc.hku.hk

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INTRODUCTION

Coronavirus has in the recent past caused three large-scale pandemics, namely the severe acute respiratory syndrome (SARS) outbreak in 2003, the Middle East respiratory syndrome coronavirus in 2012, and now an ongoing new outbreak of coronavirus disease 2019 (COVID-19) caused by the novel coronavirus SARS-CoV-2 since December 2019. Although most of these earliest cases were linked to zoonotic or environmental exposures, it is now clear that human-to-human transmission occur and that the epidemic has been gradually growing.¹ Many regions of China and the world have restricted travel, with broad entry restrictions from countries or regions affected by COVID-19, temperature screening at land, air, and sea checkpoints, and mandatory quarantine of infected patients, contacts, or those deemed to be in the incubation period. Subsequently in other parts of the world, there were also suspension of school classes, universities, and large-scale social and religious gatherings, in an effort to limit the spread of the disease.

The World Health Organization advised on basic protective measures: namely strict practice and observation of personal and respiratory hygiene with covering of mouth and nose when coughing and sneezing to prevent spread of viruses, and maintenance of social distancing of at least 1 meter's distance with minimal close contact.² To combat the virus, most hospitals were inundated with treating of confirmed and suspected COVID-19 patients, with severe tail-down of nonurgent or elective surgical services, to reserve medical resources, disposable personal protective equipment, medicine and manpower for the combat of COVID-19 and to limit services to patients requiring emergency treatment only. COVID-19 had a global impact on vascular surgical services. In a survey targeted at 77 vascular surgeons from European Union, Southeast Asia, United Kingdom, Middle East, and United States of America, 90% of them reported outpatient services were either suspended or scaled down, 79% replied inpatient services were either suspended or scaled down, and 91% replied that at least some, if not all, elective vascular surgeries were canceled.³ This has led to anxiety for patients not affected by COVID-19, often elderly, vulnerable, and frail with comorbidity, who required frequent continual professional medical care and support. Telehealth or telemedicine, with the use of telecommunication techniques, could provide health care advice and allowed long-distance patient and clinician contact, care, advice, reminders, education, monitoring, and remote admissions. In many countries, such as in

China, digital health approaches have begun to transform the way in which patients and health care professionals interact, and helped patients to take a more active role in managing their illnesses via remote consultations and disease monitoring, without having to travel to the nearest hospital to see a specialist.⁴ For this to work effectively, the patient and close relatives must have reliable access to video camera/video link or smart phone. Until now, telemedicine services could not totally replace existing practices, as physical examination, blood taking, and many diagnostic tests and treatments still necessitated face-to-face interactions. However, telemedicine, when used effectively in a viral epidemic, was likely to streamline patient service and improve the quality of care.^{5–8} To date, there was no published literature reporting telemedicine on pandemic. This was one of the first studies on telemedicine conducted during the current ongoing COVID-19 period.

The aim of this pilot study was to eluate the effectiveness and patients satisfaction of telemedicine virtual communications to provide remote health care patient support service for information and advice to vascular patients during the COVID-19 period in China, when there was stringent travel and social restrictions to hinder normal face-to-face hospital consultation.

METHODS

Patients Population

This pilot study has approval from our local institutional review board (ref: 2020-68), and was conducted in the Division of Vascular Surgery, Department of Surgery, University of Hong Kong—Shenzhen Hospital, Shenzhen, China, during the COVID-19 period from 19 February to March 16, 2020, during which there were stringent restrictions for people's travels and social isolation. Our hospital has fully equipped electronic records of all our vascular patients. The two vascular surgeons taking part in our telemedicine video calls were fully registered permanent staff of the hospitals who attended normal traditional face-to-face outpatient clinics regularly. From the departmental computerized database, the names and contact details of vascular patients were identified. The vascular surgeons reviewed each patient's electronic medical record, including imaging, prior notes, and laboratory values, and then telephoned the patients using a voice telephone call, explaining to the patients that we would like to have a video call for follow-up of their vascular conditions in a virtual

telemedicine clinic setting. Patient selection was based on those patients who would usually attend outpatient clinic for follow-up of their vascular conditions. These patients need to fulfill 3 specific criteria: the patient understood the aim of the video conferencing and gave oral consent, the patient (with or without family members) has access to and the ability to use the necessary video-conferencing technology, and the patient has had previous face-to-face meetings at our outpatient clinic. It was also important that the patient had an understanding of the vascular condition, and that they (with family members) were able to conduct a conversation and retain exchanged information during the video call.

If patients agreed, then we could use video call for the telemedicine there and then, or at a later mutually convenient time when video call facilities were available. The vascular surgeon used the hospital clinic room, and the patients were at home or out of hospital. Patients who were not familiar with video conference app on their smartphones may have to wait until other family members were available to give technical support. Patients who did not have video call facilities or refused this arrangement will not be included in the study. All the patients were adult with age more than 18 years.

Conduction of Telemedicine Video Call

The vascular surgeon conducting the video consultation was located in the surgical outpatient clinic or in the ward area, where was access to the computer with the patient's clinical details. The vascular doctor would show his work badge on the video camera. At the commencement of the video call, the clinicians stated specific reasons for offering video visits. Each patient, or their close family, would be read a similar script just immediately before the video interview. The script described that "During the COVID-19 period, patients are often restricted to travel or to come to hospital. Yet we care about our patients' well-being, and to check that our vascular patients are fine, we wish to do telemedicine video call with patients with or without their families. The tele video call will be conducted between Dr. Li HL and Dr. Huang JX, vascular doctors in University of Hong Kong Shen Zhen Hospital. The primary aim is to find out how patients are, to answer their queries, and to give long-distance advice/support during the COVID-19 period. Part of the video call may be recorded for research purposes. Your face will not appear in public, and will not be used for publication. However, surgical scars/wounds/arteriovenous fistula may

be used for educational purposes and publication. Please indicate if you would or would not want to take part in this. At the end of each video call, there will be a short questionnaire to ask you about the satisfaction level to the quality of this video call, and also if there are any other suggestions you may have. Please indicate verbally that you agree to this. This script was also available in written form, and could be sent to the patients via WeChat installed on their mobile phones.

After gaining oral consent, the video consultation would commence. The telemedicine was conducted using the video-based software WeChat (Tencent, Shenzhen, China). It was free to the patient, and vascular surgeons spent approximately 10 min on each video call. During the professional video communication, the remote vascular surgeon evaluated the patient via videoconference interview with asking of any new symptoms, virtual physical examination, and then discussed medical management or surgical intervention, and determined treatment plans with the patient. Any medical question raised by the patient was also answered by the vascular surgeon. The patient's location and duration of the video visit were also recorded.

Questionnaire of Patients' Satisfaction on Telemedicine

To gauge the patients' satisfaction with the pilot process, a predetermined questionnaire was used for survey at the end of each video episode (Table I). The questionnaire was set up to show patients' satisfaction and to see how we could improve on our service offered to them in the COVID-19-affected period.

Statistical Analysis

The questionnaire was collected and data were entered into Excel (Microsoft, Redmond, WA). Cross-check was made by HLL and JXH. Data analysis was performed using SPSS Statistics, version 23.0 (IBM, Corp, Armonk, NY). Results were expressed as mean \pm standard deviation for continuous variables.

RESULTS

Patient Demographics and Characteristics

This was a pilot quality improvement project aimed to provide information and support to vascular patients during the COVID-19 period. During the study period from February 19, 2020, to March 16,

Table I. Anonymous questionnaire

Questions	Answers
1. How long have you used video chat?	
2. Who is with you during the video telemedicine?	A. Myself B. My family or friends
3. Is your home equipped with video camera/video link or smart phone?	A. Yes B. No
4. Would you prefer to postpone your appointment or have telehealth and telemedicine?	A. Postpone my appointment B. Have telehealth and telemedicine instead of going to hospital
5. Did you travel to Hubei province in the past one month?	A. Yes B. No
6. In the current COVID-19 period, do you think telehealth and telemedicine is a good substitute for coming to the hospital?	A. Yes B. No
7. What advantage does telehealth and telemedicine offer over direct contact in hospital (multiple choice)?	A. More personal B. No need to wait for long time C. No need to travel D. No infection risk E. Cheaper F. Others _____
8. Talking to a doctor during a video visit is as satisfying as talking in person.	1 (strongly disagree)-5 (strongly agree)
9. I can explain my medical problems well enough during a video visit.	1 (strongly disagree)-5 (strongly agree)
10. A doctor can get a good understanding of my medical problem during a video visit.	1 (strongly disagree)-5 (strongly agree)
11. The lack of physical contact during a video visit is not a problem.	1 (strongly disagree)-5 (strongly agree)
12. Video visits are a convenient form of health care delivery for me during current COVID 19 period.	1 (strongly disagree)-5 (strongly agree)
13. I am satisfied with this telemedicine service.	1 (strongly disagree)-5 (strongly agree)
14. I would like to use telemedicine for follow-up in the future.	1 (strongly disagree)-5 (strongly agree)

2020, 142 telemedicine encounters were reviewed for 114 patients. The video calls were conducted by two vascular surgeons. A sample of 114 from 165 (69%) patients was reached after one phone call attempt. Nine patients (9/165, 5%) were not seen due to lack of access. The mean age of this cohort of patients were 60 ± 15.2 (range 25 to 90) years old, and 74 (74/114, 65%) were men. Most (92/114, 81%) of the patients were postoperative. These included varicose veins (recent surgery), deep venous thrombosis (DVT), abdominal aortic aneurysm, peripheral arterial disease (PAD), carotid arterial stenosis, hemodialysis access, thoracic aortic dissection, and superior mesenteric artery (SMA) dissection. Three patients did not have surgery: two with lower limb DVTs and one with SMA dissection, all of them were seen at the vascular clinic before the COVID-19 outbreak. The patient demographics and characteristics were shown in [Table II](#). All of them normally would have required

routine face-to-face clinical follow-up in our vascular outpatients department for professional care and recommendation.

Twenty-five patients (21.9%) were outside of Guangdong province, China, at the time when they received the video call, as the COVID-19 took place during the Chinese New Year, when most patients would go back to their hometown to be with their families. Because of the travel restrictions, they were unable to return to Shenzhen, China, after the Chinese New Year. The average traveling distance from each patient's location at the time of the video-call to our hospital was estimated to be 324 kilometers. This was calculated to be an estimated average driving time of 194 minutes at a speed of 100 kilometers per hour. The participants had an experience of using video chat for 4.6 ± 3.0 years. All their homes were equipped with video camera/video link or smartphones. The mean duration of the video visit was 11.0 ± 8.9 min. Sixteen patients

Table II. Clinical characteristics and demographics of the 114 patients participating video communication

Variables	Numbers
Total number of telemedicine encounters	142
Total number of unique patients	114
Male (%)	74 (65%)
Female (%)	40 (35%)
Average number of visits per patient (range)	1.2 (1–3)
Age, average in years	60 ± 15.2
In Hubei province during video visit (%)	9 (7.9%)
Outside Guangdong Province during video visit (%)	25 (21.9%)
Comorbidities	
Hypertension (%)	45 (40%)
Diabetes mellitus (%)	22 (19%)
Coronary arterial disease (%)	9 (8%)
Stroke (%)	8 (7%)
Chronic obstructive pulmonary disease (%)	3 (3%)
Vascular disease for follow-up	
Varicose veins (%)	24 (21%)
Deep venous thrombosis (%)	18 (16%)
Peripheral arterial disease (%)	17 (15%)
Carotid arterial stenosis (%)	16 (14%)
Hemodialysis access (%)	14 (12%)
Abdominal aortic aneurysm (%)	10 (9%)
Superior mesenteric artery dissection (%)	9 (8%)
Thoracic aortic dissection (%)	6 (5%)
Postoperative patients (%)	92 (81%)
Patients requiring imaging assessment	16 (14%)
Experience of using video chat (years)	4.6 ± 3.0
Distance from home to hospital (km)	324 ± 678
Duration of the video visit (minutes)	11.0 ± 8.9

(14%) had ultrasound or computer tomography imaging assessment surveillance, and results of these tests (performed before the COVID-19 period) explained to them. One patient (1%) had worsening gangrene due to PAD and advice was given to seek urgent vascular care in the local hospital.

Patient Satisfaction Survey

All patients participating in the video consultation completed an anonymous survey using the questionnaire. Fifty-five patients (55/114, 48%) were with their family members during the video call. All of the patients thought telemedicine was a good substitute for coming to hospital, and 95% (108/114) of them preferred to have remote telemedicine other than postpone the appointment. All the patients agreed with that advantages of

telemedicine included no infection risk, no need to travel, and no need to wait long time. The other advantages of telemedicine over direct contact in hospital were more personal and cheaper, they were selected by 95% (108/114) and 97% (110/114), respectively. All patients “agreed” or “strongly agreed” that talking to a doctor during a video visit was as satisfying as taking in person. All of them “agreed” or “strongly agreed” they could explain their medical problems well enough and thought a doctor can get a good a good understanding of their medical problem during a video consultation. One hundred three patients (90%) agreed that lack of physical contact during a video consultation was not a problem. Regarding the overall experience of the video consultation, all of the patients were “satisfied” or “highly satisfied” with the video calls, they would like to use telemedicine for follow-up in the future. The results of patients’ satisfaction are summarized in [Table III](#).

DISCUSSION

Telemedicine virtual communications for patients’ follow-up has been around for a long time, but the great majority was in the absence of viral pandemics, social lockdown, or isolation. The first report on telemedicine for vascular patients was published in 1998.⁹ This study showed that telemedicine virtual communications was effective to provide remote health care for vascular patients during the COVID-19 period with stringent travel restriction. In this period of great concern and uncertainty, telemedicine offered support to vulnerable vascular patients without the need for travel and face-to-face hospital consultation. With widespread social isolation and restricted travel, this modality may be a feasible alternative until the pandemic passes over. The use of video conferencing with visual images for both parties can enhance the doctor-patient relationship, not only for the identification of each other, but also simulate a face-to-face professional encounter for support and advice, and is in our opinion better than a simple telephone voice call. Over the video conferencing in the absence of actual physical contact, postoperative wounds, ulcers, or foot wounds could be inspected. Ultrasound and CT scan images could be shown and explained to the patients, and advice on drug prescription can be given, for patients to go their local chemists. The Royal College of Surgeons of England recommended that hospitals and surgical teams should aim to deliver virtual clinics for outpatient appointments for the duration of the COVID-19 outbreak to support infection control.¹⁰

Table III. Patients' satisfaction with telemedicine

Questions	Score Mean \pm SD
Talking to a doctor during a video visit is as satisfying as talking in person	4.6 \pm 0.5
I can explain my medical problems well enough during a video visit	4.8 \pm 0.4
A doctor can get a good understanding of my medical problem during a video visit	4.8 \pm 0.5
The lack of physical contact during a video visit is not a problem	4.3 \pm 0.7
Video visits are a convenient form of health care delivery for me during current COVID 19 period	4.9 \pm 0.3
I am satisfied with this telemedicine service	4.9 \pm 0.2
I would like to use telemedicine for follow-up in the future	4.8 \pm 0.4

Satisfaction: 1, strongly disagree to 5, strongly agree.

The well-known advantages of telemedicine as improved access to care, decreased patient costs, and having to come to the hospital clinic particularly for people who live relatively far away,⁷ are all applicable during the COVID-19 period. Although physical contact and imaging assessment were not possible during video call, these were not critical in our cohort of patients. Since the COVID-19 outbreak, drastic measures within the health system were implicated so that most, if not all, of nonemergency or nonessential procedures (such as for nonlimb-threatening claudication or varicose veins procedures) have stopped.³ All these had a significant negative impact on the continual care of vascular noninpatients, who would otherwise regularly attend hospitals for clinical or imaging follow-up, and also for medical advice and prescriptions. These patients were often frail, elderly, and they would feel isolated, vulnerable, and helpless at home. The video call not only gives professional advice but was also a gesture of remote support and care.

Most of our patients or members of their close family had ready access to smartphones, capable of voice and video conferencing. In 2018, the number of smartphone users in China reached around 713 million.¹¹ These personal mobile devices were equipped with multipurpose messaging, social media, and mobile payment app (WeChat, Tencent). With the WeChat app, different remote parties could communicate with text messaging, hold-to-talk voice messaging, broadcast (one-to-many) messaging, video calls, and conferencing. In recent years, telemedicine in China had developed rapidly with the exponential growth of telecommunication, now 5G networks. China now had three major telemedicine networks: the Golden Health Network, the International MedioNet of China network, and the People's Liberation Army telemedicine network.¹² Many existing telemedicine platforms were episodic, replacing routine follow-up and of

research purposes only rather than for necessity, while this article addresses its use in a viral epidemic when patients' travels were largely restricted, this being very different from previous published literature which concentrated on low-risk patient populations and those who already have easy access to and comfort with the necessary technology.^{13,14} Other potential applications included two or more medical professionals discussing a patients' case over a video conference or home monitoring through continuous sending of patient health advice and support.¹⁵ Telehealth ensured better access to high quality health care providers using telehealth services in the patients' home, and in the current circumstances, acted as an important bid to control virus spread, as there was no physical contact between the different parties. We did not use telemedicine virtual clinic before COVID19. Because this study showed that telemedicine was effective to provide remote health care with a high patient satisfaction, it may be a potential basis for us to compare face to face with telemedicine virtual clinic in future.

Vascular disease is the leading cause of morbidity and mortality globally; patients are often elderly, frail, and need constant follow-up, support, and advice.¹⁶ The health care requirement to this group of patients would not be less during a COVID-19 outbreak and they need an increased awareness of their vascular ongoing problems. Telemedicine had several applications in viral epidemics. It could be used for teleconsultation for cases of emergency, so that prompt advice can be given to a home-based patient. Alternatively, the home-based asymptomatic individuals can be video-interviewed and followed up. The aforementioned would be applied to nonviral infected patients. For patients affected with COVID, they would conceivably be in hospital, and if there were vascular problems during their admission, physicians and vascular surgeons could telecommunicate in a

multidisciplinary conference setting. From a personnel perspective, such multidisciplinary networks of medical expertise could include representation from health and social services, emergency services, and these are all very important to decide the best institution to send the vascular patient to in a viral epidemic outbreak.¹⁷ We could see the faces of the patients, and vice versa, and also be able to inspect the surgical wounds or progress of the vascular disease, such as fistula, healing of foot ulcers, or postoperative changes. All these visual images were possible in the absence of direct face-to-face contact, and therefore, there would not be any possibility of direct contact transmission. This could also relieve busy hospital from nonemergency services, without the consumption of any personal protective equipment clothing or masks, which were in short supply.

The implementation of telemedicine as routine health services in the world has not yet been standardized, with a lack of scientific evidence for its clinical and cost-effectiveness over traditional clinic practice. Nonetheless, this article shows that in the event of restricted travel in the COVID 19 epidemic, the use of video conferencing technology in a Chinese hospital in place of face-to-face medical consultations is feasible, with high degrees of satisfaction from doctors and patients. Vascular doctors could offer advice better than a primary health care physician based on the reported symptoms and images seen over the video conference. There are several limitations to this study, it was conducted at a difficult time during COVID-19 epidemic, and this pure descriptive study aimed at providing support to our vascular patients, and did not provide a more in depth analysis into the advantages of this type of consultation aside from an elimination of travel needs. The cohort of patients was heterogeneous with different arterial and venous problems, and over the video conference, it may be difficult to identify patients with significant disease progression that would mandate face-to-face early clinical follow-up or emergency admission to hospital. An average time of 11 minutes per visit seems quite low for patients with complex vascular issues. There was still a lack of evidence or assessment whether this modality of follow-up can replace standard consultations.

CONCLUSION

COVID-19 pandemic poses a great challenge to health care delivery worldwide; telemedicine virtual communications was effective to provide

remote health care with a high patient satisfaction. In this period of great concern and uncertainty, telemedicine offers support to vulnerable vascular patients without the need for travel and face-to-face hospital consultation, and so avoided transmission and infection.

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