Pilot Study of Telehealth Evaluations in Patients Undergoing Hematopoietic Cell Transplantation

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Abstract

**Background:** Telehealth involves the use of telecommunication and information technology for the delivery of clinical care and may be a mechanism to alleviate the burden of visits faced by patients undergoing hematopoietic cell transplantation (HCT). Few studies have evaluated the feasibility and acceptability of telehealth visits in the care of HCT patients.

**Methods:** We conducted 27 telehealth visits with 25 patients undergoing HCT using a videoconferencing system that allows for real-time, two-way interactions and administered satisfaction surveys to patients and providers.

**Results:** Of the 25 patients included in the study, 20 (80%) and five (20%) were undergoing autologous and allogeneic HCT, respectively. The telehealth visits were distributed as follows: 3 inpatient visits upon admission for HCT; 11 inpatient visits between 2–14 days post-HCT; 4 inpatient visits prior to discharge after HCT; 8 outpatient, post-HCT follow-up visits; and 1 handoff to a community oncologist. Out of a total of 54 provider assessments, 7 providers (13%) were unable to complete some part of the physical examination, but no provider reported being unable to manage patients’ symptoms through telehealth. 81% of patients were either satisfied or very satisfied with the telemedicine session. Overall satisfaction was higher among patients than providers (mean scores 4.12 vs. 2.64; scale 1–5, 1: very poor; 5: excellent). Technological barriers...
resulting in delays and suboptimal physical examination were largely responsible for provider dissatisfaction.

Conclusions: The use of telehealth to deliver comprehensive follow-up care to HCT patients is feasible across different HCT types but is dependent upon quality of data streaming and videoconferencing technologies.

Keywords
telehealth; telemedicine; quality of life; care delivery

Introduction

Given its complexity, hematopoietic cell transplantation (HCT) requires specialized multidisciplinary care units that are often regionalized in tertiary care centers in urban or metropolitan areas. The treatment process involves initial referral to a transplant center, which may be located far from the patient’s place of residence, followed by extensive pre-HCT evaluation, inpatient treatment, and intensive post-HCT outpatient monitoring. As a result, HCT patients face a significant ‘burden of therapy’ with regards to time commitment and travel that can be disruptive to their lives, particularly for those who live far from the transplant center. These factors are known to widen disparities in access to care and may even impact HCT outcomes. In one study, increasing driving time from a patient’s primary residence to the transplant center was shown to be an independent risk factor for decreased post-HCT care utilization and survival after allogeneic HCT; another transplant center found that patients living in rural areas experienced increased mortality after autologous HCT compared to their urban counterparts. Conversely, at transplant centers wherein telehealth strategies were employed, there was no impact of distance on clinical outcomes after allogeneic HCT.

HCT care additionally requires routine provider-to-provider communication during handoffs and transitions of care. Handoffs represent the transfer of care from one healthcare provider to another and are a source of medical mishaps caused by communication failures. Critical times of transition during SCT include handoffs from: (a) a referring community oncologist to HCT team; (b) outpatient HCT team to inpatient team; (c) inpatient team back to outpatient team; and (d) HCT team back to community oncologist.

Telehealth, or telemedicine, is the use of telecommunication and information technology for the delivery of clinical care over a distance. While technologic capabilities have grown considerably, telehealth has not been widely utilized in HCT care delivery and may be a valuable mechanism to help reduce the burden of therapy for patients, and to improve communication among healthcare providers. We sought to determine the feasibility and acceptability of telehealth visits in the care of HCT patients from patient and provider standpoints. Herein are the results of our prospective pilot study of telehealth evaluations in HCT patients.
Methods

Patients were included in the study if they were undergoing HCT, were fluent in English, had minimal comorbidities as deemed by the treating physician, and were less than 75 years of age. Telehealth visits were conducted using a ‘Mobile Telehealth Cart’, a videoconferencing system that allows for real-time, two-way, live interactions between the Cart and a corresponding functionally like system in a remote location using the Cisco Meeting App (Cisco Systems, Inc, San Jose, CA). The Cart was located at the patient’s bedside and consisted of a codec (a video conferencing device), flat panel display, high definition camera with pan tilt zoom capability and far-end camera control, and inputs for connectivity with a 3M/Littmann 3200 digital stethoscope (3M Health Care, St. Paul, MN) and a TotalExam diagnostic digital camera (GlobalMedia Group, LLC, Scottsdale, AZ) to take still images. The latter two devices required positioning by a nurse investigator at bedside. The provider (physician or nurse investigator) conducting the visit was located in an office or clinic room equipped with a computer with a video camera and videoconferencing software. All visits followed the same virtual script: patient identification, interim history, review of systems, verbal review of vital signs, and a physical examination consisting of skin, mucosa, and cardiopulmonary evaluations including assessment for lower extremity edema. At the end of each visit, patient and providers completed a satisfaction survey. All patients additionally underwent a standard, in-person evaluation by a different provider.

Results

Between 2011 and 2013, we conducted 27 telehealth visits with 25 patients. Among all patients, mean age was 53, median age was 40, and 64% were male. Twenty patients (80%) were undergoing autologous HCT and five patients (20%) were undergoing allogeneic HCT. Twenty (80%) patients had not undergone a prior HCT. Mirroring the transition points above, the telehealth visits were distributed as follows: three inpatient visits upon admission for HCT; 11 inpatient visits between 2–14 days post-HCT; four inpatient visits prior to discharge after HCT; eight outpatient, post-HCT follow-up visits; and one handoff to a community oncologist.

The average time required for connection was 2.05 minutes, ranging from 0–5 minutes except for one outlier of 14 minutes. On average, an additional 1.54 minutes lapsed from time of connection until start of visit. The average telehealth visit lasted 15.19 minutes, not including connection time. The in-person visits were not timed. Providers did not comment on increased time burden or delays and uniformly felt they had sufficient time for patient questions. Thirty-four of 54 (63%) providers reported technical problems during the telehealth visit including four who reported ‘many technical problems.’ These problems mostly related to the digital stethoscope and quality of visual assessment during the physical exam.

Despite higher ratings among providers than patients with regards to visual and auditory quality of the encounters, overall satisfaction with the telehealth visits was higher among patients than providers (Table 1). Provider ratings regarding clarity of image and sound for the purposes of mouth, skin, and cardiovascular examination ranged from 3.43 – 3.94 (1–5;
1: very poor; 5: excellent). Out of a total of 54 provider assessments, seven providers (13%) were unable to complete some part of the physical exam. Three providers (6%) reported inability complete oral grading scales based on the visual image of the mouth; two (4%) reported inability to complete skin assessment based on the visual image of the skin; and five (9%) reported inability to complete the cardiovascular assessment based on the output from the digital stethoscope. By far the most frequently reported provider complaint was suboptimal sound quality from the digital stethoscope while conducting the heart and lung examination. Many providers additionally reported inadequate image resolution for skin and oral mucosa assessments. As one provider noted, ‘the technology remains the fundamental challenge due to [impaired] visual assessment and stethoscope interference.’ Despite the technical difficulties, no provider reported being unable to manage patient's symptoms through telehealth, with many noting they felt confident about their ability to identify and address patient symptoms and complaints though this medium.

Overall, patients reported little difficulty communicating their concerns to the HCT team (Table 2). They expressed that telemedicine visits from home would make it easier for them to receive medical care, and 74% of patients felt the telehealth format did not result in inferior care. Patients were ambivalent as to whether they would ‘always prefer’ to see the HCT team in person, anticipating they would prefer telehealth visits over in-person visits when feeling well, and in-person visits over telemedicine visits when not feeling well. Eighteen patients completed the MD Anderson Symptom Inventory prior to the telehealth visit; all 18 patients reported multiple symptoms within the prior 24 hours, including 16 patients who reported moderate to severe symptoms. Out of 27 patient assessments, four patients experienced mild symptom(s) during the telehealth visit, the most common being mild fatigue.

Though comparison between the in-person and telehealth visits are limited by provider documentation, physical exam findings were consistent between the two modalities in the majority of patients. A small number of skin and oral cavity findings were detected during the in-person exam but not the telehealth exam, as well as vice versa. When compared against the MDASI, the two modalities captured moderate to severe symptoms equally well. In a few cases, the telehealth review of systems was more detailed compared to the in-person review.

**Discussion**

We determined that using telehealth to deliver comprehensive follow-up care to HCT patients is feasible and can be successfully performed across different HCT types. Patients found the telehealth platform acceptable overall and favored telehealth follow-up over in-person follow-up in general, and particularly for well visits. This mirrors findings from an Australian study in which severity of chronic graft-versus-host disease was the factor most strongly associated with patient preference for transplant center follow-up over the provision of care through a satellite site or telemedicine\(^{14}\).

Healthcare providers were generally dissatisfied by telehealth visits compared to in-person office visits mostly due to technological barriers resulting in delays and suboptimal physical
examination; despite this, providers still felt able to address symptoms and medication dosing concerns. Notably, our study was conducted between 2011 to 2013, and limited by the technology used at the time. We hypothesize that more contemporary technological advances in data streaming and videoconferencing may improve clinician usability.

Our findings of feasibility, high patient satisfaction but lower provider satisfaction are similar to findings from studies evaluating videoconferencing in the care of patients with chronic conditions\(^\text{15}\). Collectively, these data suggest that telehealth has the potential to reduce the immense burden of visits faced by HCT patients, particularly early in their HCT course. Provider feedback through pilot studies such as this one is essential for optimizing telehealth usability to achieve clinician satisfaction. Whether or not telehealth visits require more time from providers is unknown and must be determined to prevent substituting patient burden with provider burden. We intend to use the results of this study to inform larger clinical trials aimed at exploring the utility of telehealth in reducing the burden of therapy for patients and improving outcomes by enhancing communication among healthcare providers in the HCT setting.

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Highlights

- Telehealth use for follow-up care delivery is feasible across different HCT types
- Patients report greater satisfaction with telehealth use compared to providers
- Feedback is essential to optimize telehealth usability and provider satisfaction
| Question                                                                 | Mean Score | Mean Score |
|-------------------------------------------------------------------------|------------|------------|
|                                                                          | Patients (N = 27) | Clinicians (N = 54) |
| Auditory: How well could you hear the person on the monitor?            | 3.52       | 4.31       |
| (1 to 5:1 = very poor; 5 = excellent)                                   |            |            |
| Visual: How well could you see the person on the monitor?               | 3.59       | 4.15       |
| (1 to 5:1 = very poor; 5 = excellent)                                   |            |            |
| Overall satisfaction with telehealth visit                               | 4.12       | 2.64       |
| (1 to 5:1 = very dissatisfied; 5 = very satisfied)                      |            |            |

Table 1
Patient and Provider Satisfaction with Telehealth Visits
### Table 2

Patient Experiences with Telehealth Visits

| Question                                                                 | Mean Score |
|--------------------------------------------------------------------------|------------|
| I had difficulty talking with the transplant physician/nurse             | 1.56       |
| The transplant physician/nurse was able to understand my concerns       | 4.22       |
| I would have gotten better medical care today if I had seen the transplant physician/nurse in person | 1.93       |
| It will be easier to get medical care if I can do a telemedicine visit from home | 4          |
| I will always prefer to see the transplant physician/nurse in person     | 3.04       |
| When I feel well, I will prefer a telemedicine visit from home instead of seeing the transplant physician/nurse in person | 4          |
| When I don’t feel well, I will prefer to see the transplant physician/nurse in person instead of a telemedicine visit from home | 3.67       |