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BRIEF COMMUNICATION

Exploring the Effects of Telemedicine on Bariatric Surgery Follow-up: a Matched Case Control Study

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Abstract

Telemedicine offers a potential solution for bariatric surgery (BS) aftercare for patients living in rural areas with limited access to healthcare services. This study aimed to compare post-BS appointment adherence, psychosocial, and body mass index (BMI) outcomes in patients that did or did not use telemedicine. In total, 192 (96 telemedicine and 96 non-telemedicine) patients were matched on gender, age, time since surgery, BMI, and travel distance from program. Additional psychosocial and demographic variables including rurality index (RIO) were collected. Telemedicine users had a significantly higher RIO ($p < 0.001$) than non-telemedicine users. Appointment attendance, BMI, and psychosocial outcomes were not significantly different between the two groups. Therefore, our results suggest that telemedicine could help overcome geographical barriers to provide comparable quality healthcare services to more remote regions.

Keywords Bariatric surgery · Telemedicine · Adherence · Rural · Attrition

Introduction

The prevalence of obesity has been increasing in many developed countries [1]. Bariatric surgery is a durable treatment for obesity that is associated with long-term improvement in obesity-related comorbidities and quality of life [2].

Post-surgical attendance has been shown to have a positive relationship with weight loss outcomes [3]; however, attending post-surgical appointments can be challenging for patients who live in rural areas with limited access to healthcare resources [4]. Patients who live in closer proximity to bariatric centers are more likely to have a higher post-surgical attendance [4]. Telemedicine videoconferencing is a potential solution to ensure that patients living further away can still access adequate resources. Furthermore, an effective telemedicine program can potentially save time and money for patients enrolled in the program.

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To date, only a few studies have examined the relationship between telemedicine videoconferencing and appointment adherence. In the USA, a veteran study concluded that the veterans prefer telemedicine instead of traditional in-person visits [5]. Moreover, the use of telemedicine resulted in time and cost savings while still being able to reach veterans across a total area of 400,000 square miles [5]. Despite this finding, there is a need for further analysis of the impact of telemedicine to support post-bariatric surgery aftercare, including examination of additional variables, such as psychosocial factors, and examination of telemedicine use in additional countries. In this study, we aimed to analyze the relationship between post-surgical appointment adherence and post-operative bariatric surgery outcomes among patients that did and did not use telemedicine.

Methods

Telemedicine Context

Telemedicine has been a focus in Ontario, Canada, to improve access to healthcare in remote and underserved areas [6]. In Ontario, 6% of physicians are employed in Northern Ontario, and 71% of these physicians are employed in areas in urban Northern Ontario [7]. Given the limited access to specialist

providers in rural Ontario, rural clinicians have been shown to have higher use of telemedicine services than clinicians from other parts of Ontario [7]. Telemedicine is supported by a provincial telemedicine service across the province where telemedicine videoconferencing suites are set up throughout the province to provide technical support for telemedicine in these rural communities.

Patient Population

Patients enrolled in the Toronto Western Hospital Bariatric Surgery Program (TWH-BSP) who used telemedicine videoconferencing technologies from March 1, 2010, to September 1, 2015, were included in our analysis. TWH-BSP provides patients with up to 5 years of follow-up after bariatric surgery. All patients were offered telemedicine services regardless of geographical distance. During the study period, 1262 patients underwent bariatric surgery at the TWH-BSP and 487 of these patients received care via telemedicine. A total of 192 of the 487 telemedicine patients consented to participate in this study. We matched telemedicine patients with non-users (non-telemedicine) from the same study period based on their sex, age (± 5 years), date of surgery (± 3 months), pre-surgery body mass index (BMI; ± 5 kg/m^2 units), and distance from the site of appointment (± 20 km; either from the TWH-BSP or telemedicine suite).

Measures

We compared telemedicine and matched control participants' adherence to treatment based on percentage of appointment attended and rate of dropout (i.e., patient not attending any scheduled appointments in the two most recent years). We calculated percentage of appointment attended for each patient based on attended appointment divided by total appointments scheduled, while dropout rate was measured based on the number of dropouts divided by the total number of patients in the telemedicine and non-telemedicine groups.

Additional study measures included weight change from pre-surgery (T1) to 1-year post-surgery (T3) and BMI between telemedicine and control participants. Telemedicine and control participants' anxiety (GAD7), depression (PHQ9), physical (SF-PCS), and mental (MCS) health at T1 were examined to compare physical and psychological factors.

Lastly, we calculated telemedicine and control groups' Rurality Index of Ontario (RIO), which was based on patients' postal code and calculates the level of rurality for the individual in the province [8]. The RIO classifies patients into urban (0 to 39), non-urban (10 to 39), and rural (above 40) [8].

We analyzed data using the SPSS statistical package (version 24). Independent samples *t* test was computed to measure statistical differences between the telemedicine and non-telemedicine groups across the psychosocial measures. The RIO between the telemedicine and non-telemedicine groups was compared using independent samples *t* test in order to determine if rurality plays a factor in appointment adherence.

Results

Demographic Data

The mean follow-up duration after surgery for the study group was 2.59 years. The mean age of the entire study sample was 43.6 years (SD 8.7, range 21–61), and 78% were women. The study group was divided into 96 pairs of patients from the telemedicine group and the non-telemedicine group. On average, the patients in the control group were 18 km (range 1–64 km) away from TWH-BSP, while the telemedicine patients were 383 km (range 57–924 km) away. As specified above, patients in the telemedicine and non-telemedicine groups were matched on age, date of surgery, pre-surgery BMI, and distance from the TWH-BSP or telemedicine suite in their local community for the telemedicine group.

Physical and Psychosocial Outcomes

An independent samples *t* test was conducted to compare physical and psychosocial outcomes between the telemedicine and non-telemedicine groups. There was no significant difference in pre-operative BMI ($p = 0.601$), GAD7 ($p = 0.531$), PHQ9 ($p = 0.434$), MCS-SF ($p = 0.762$), and PCS-SF ($p = 0.124$) between the telemedicine and non-telemedicine groups.

Mean RIO scores for the non-telemedicine group (2.39) were significantly lower ($p < 0.001$) than the telemedicine group (24.54).

Attendance

There was no significant difference in appointment attendance between telemedicine patients (93%) compared with non-telemedicine patients (89%), despite differences in distance from the TWH-BSP and rurality ($p = 0.06$). Similarly, there was no significant difference in the rates of patients being lost to follow-up at 2 years post-bariatric surgery between the telemedicine (20%) and the non-telemedicine (14%) groups ($p = 0.676$).

Conclusion

This study aims to add to the literature on clinical follow-up strategies in bariatric surgery aftercare to improve appointment adherence and patient engagement. Our study did not show a

significant difference in appointment attendance rates and patient attrition to follow-up care over the course of 2 years despite the high RIO scores for telemedicine users. This finding is relevant as we hypothesized that those patients living in more rural areas are more likely to have difficulties adhering to follow-up care and limited access to healthcare resources influencing post-surgery outcomes. Given that our study showed comparable outcomes on the measures in this study, our data suggest that telemedicine can be used to bridge rurality gaps and can result in comparable appointment attendance and engagement rates.

Our study adds to the existing literature more broadly and supports the use of telemedicine to maintain therapeutic relationships and engage patients in their bariatric surgery follow-up care. It is important to note that this level of engagement was achieved by using local telemedicine suites; however, there is a growing array of telemedicine tools allowing patients to receive follow-up in their homes as opposed to telemedicine suites. Nonetheless, the use of telemedicine to continue patient follow-up engagement is an important vehicle for supporting patients with long-term behavioral changes and to monitor for potential complications. Studies have shown that patients often experience psychological difficulties beyond year 1 after bariatric surgery, which underscores the role of technology to monitor and mitigate these early difficulties when possible [9, 10].

Effective implementation of telemedicine services within bariatric surgery programs is contingent on access to appropriate technology, administrative support to coordinate telemedicine appointments, and clinician competency in delivering care via this modality. Examples of telemedicine competencies include clinical team members' technical skills to operate telemedicine equipment, ability to adapt bariatric clinical assessments for a telemedicine context, ability to navigate medico-legal challenges emerging during telemedicine assessment, and communication skills within a telemedicine setting [11].

Despite our matched case control approach and use of additional psychosocial measures, our study findings should be interpreted in the context of the following study limitations. First, the sample size was a convenience sample, and as a result, our sample size was limited. Second, we conducted the study in a Canadian context; however, we aimed to study telemedicine impact on attendance outcomes and feel this will help with generalization of the impact of telemedicine on bariatric surgery care. Lastly, long-term data are needed to fully understand the role and impact of telemedicine on bariatric surgery aftercare adherence.

In summary, this study reinforces the role of telemedicine in supporting bariatric surgery patients living in more rural areas. Patients receiving telemedicine can achieve comparable post-surgery follow-up rates and patient outcomes based on our short-term study data. Future research can further examine the experience of patients followed by telemedicine after bariatric surgery using qualitative methodology and longitudinal study designs.

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Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

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