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The Effect of Remote Patient Monitoring on Patients with Spinal Cord Injury: A Mini-Review

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Abstract

Context: Studies revealed that remote patient monitoring can be effective in the prevention and control of complications in patients with spinal cord injury. However, there are a limited number of researches in this domain with contradictions in some cases. Thus, the current study aimed at investigating the impact of remote patient monitoring on patients with spinal cord injury (SCI).
Methods: The current descriptive retrospective study searched databases such as Elsevier, Google Scholar, and PubMed in English from 1977 to 2018. After going throw the required procedures, 40 articles were finally confirmed and enrolled in the current study.
Conclusions: The results of the current study revealed that the application of remote patient monitoring system was influential and promising in the prevention and control of complications in patients with SCI. Therefore, they can be considered in care planning for such patients.

Keywords: Spinal Cord Injury, Remote Patient Monitoring

1. Context

Spinal cord injury (SCI) is a type of damage that transforms the individual's performance in permanent or temporary form (1). These alterations happen due to lack of muscular, sensory, or autonomic nervous function in the parts below lesion level (1). The injury may occur in spinal cord at any levels, leading to complete or proportional injuries and loss, and muscular dysfunction of one or all senses (2). According to the position and severity of SCI, the symptoms can vary extensively from pain or numbness to paralysis or incontinence (1, 2). Short-term and long-term complications associated with SCI include muscular atrophy, pressure ulcers (PUs), infections, and respiratory problems (1, 2). Remote patient monitoring (RPM) is a technology that provides a platform to monitor the patients out of routine clinical system (e.g., house). Additionally, this technology increases the access to caring systems and reduces the related expenses (2). RPM can promote the quality of life of patients with chronic diseases (3). Attending to this issue helps the patients to retain their personal independence, prevent the associated complications, and minimize the costs (3). The key features of RPM indicate the remote monitoring, analysis of physiological parameters, and early diagnosis of the complications (3). Consequently, the number and duration of hospitalization are decreased (3). The saved time can improve efficiency as a result of RPM and allows healthcare providers to allocate more time to educate RPM to patients (3). The findings of studies reveal a correlation among telehealth, prevention, and treatment of a variety of diseases such as diabetes, post-discharge complications of surgical patients, the Parkinson, and colorectal diseases (4-8). In addition, the investigations present a relationship between telehealth and nervous system diseases, and technology advancements can make the caring more convenient and economical in such patients by easy accessibility (9-11). The studies show that patients with SCI are at risk for developing various complications such as PUs, hypertension, obesity, bladder infections, diabetes, and cardiopulmonary diseases (12). Previous studies showed a valuable relationship between telemedicine and the control of many diseases (13-15). The findings of studies revealed that telemedicine in patients with nervous system disorders can decrease the number of rehospitalization (16, 17). Numerous studies confirm that telemedicine application has a direct relationship with the prevention of different complications in patients with SCI (18). The results of numerous researches confirm the impact of RPM on control and prevention of various complications, es-

pecially PUs, and control of neuropathic pains in patients with SCI (19-23). Due to remarkable prevalence and expansion of SCI in the world (1) and Iran (2, 3), the numerous and significant clinical, social, mental, and economical complications of SCI (3), the contradictory findings in the studied field (19, 20, 22-25), and the limitations of the previous studies, the current study aimed at investigating the effects of RPM on patients with SCI; the study findings can be functional and practical to prevent and control complications in patients with SCI (26-28).

2. Methods

The current descriptive retrospective study searched the databases such as Elsevier, Google Scholar, and PubMed in English from 1977 to 2018. First, 150 articles related to the subject were retrieved. In the second stage, by reading the abstracts of the articles, 100 articles were selected and carefully studied by two researchers. Finally, 40 articles were confirmed and enrolled in the study.

3. Results

3.1. Telemedicine for Monitoring Neuromuscular Electrical Stimulation in Patients with SCI

Although an ordered exercise program is necessary to sustain muscle health after SCI, lack of accessible public transportation is one of barriers to this subject.

Studies show that using telehealth communication can help to solve this problem. Telemedicine is a safe, feasible, and cost-effective approach to monitor home-based NMES-resistance training (RT) in patients with chronic SCI (29-31).

3.2. Telemedicine in Managing Pressure Ulcers in Patients with SCI

Managing PUs in patients with SCI is difficult. Most patients cannot afford to self-fund healthcare services to treat PUs, thus they are willing to manage severe PUs at home that needs education about appropriate pressure relief, bed overlays, diet, and wound dressings (19). Studies show that telephone-based support provides a low-cost way to help people with SCI to manage PUs at home, especially in low-income counties (19, 32-35). The Shepherd Center (the Model Systems Center in Atlanta, Georgia) for the first time used telehealth for PU prevention and management in patients living long distance from a specialty clinic/medical center in 1990. Mathewson et al., showed the effectiveness and efficiency of monitoring a number of patients with PUs through a still-image videophone (35).

In a study evaluating 17 individuals with 20 wounds, teleassessment scored 89% of agreement versus 95% for live decisions (32). Also, in a randomized clinical trial, no significant differences were observed between the subjects receiving cares from a therapist at home vs. remotely via telehealth (36).

Although studies show some advantages of telemedicine in the treatment of PUs in patients with SCI, due to a lack of incidence reporting, the effectiveness of technologies in preventing PUs is limited (22).

3.3. Telemedicine Effect on Web-Based Physiotherapy in People with SCI

People with SCI are at a high risk for cardiovascular disease (CVD), autonomic dysreflexia, blood pressure, stroke, and diabetes, and have a higher rate of mortality after discharge from a spinal cord injury ward (37).

Web-based rehabilitation programs allow access to therapy regardless of the day, time, and geographical location. Patients acquire good compliance with web-based physiotherapy and it is beneficial for health and well-being at various stages after injury (20). The finding of a study conducted on 111 subjects randomly allocated to a video-based intervention for nine weeks showed improvement in function, mobility, and self-care in the rehabilitation of patients with SCI (37). Also, findings of an evaluation of a web-based physiotherapy for patients with SCI showed that web-based physiotherapy allowed patients to choose the desirable time of their 'therapy' to suit their own personal circumstances and finally led to more satisfaction.

Table 1. Effect of Telemedicine on the Control of Complications in Patients with Spinal Cord Injury

Therapy	Reference	Result
Monitoring neuromuscular electrical stimulation		Positive
	Sabatier et al. (29)	
	Dolbow et al. (30)	
	Gorgey et al. (31)	
Managing pressure ulcer		Positive
	Arora et al. (19)	
	Tung et al. (22)	
	Halstead et al. (32)	
	Russell (34)	
	Vesmarovich et al. (35)	
	Sanford et al. (36)	
Web-based physiotherapy		Positive
	Coulter et al. (20)	
	Dallolio et al. (37)	

4. Discussion

The results of the current review study indicated that RPM plays a role in prevention and control of many complications in patients with SCI (Table 1). The results of investigations revealed that telehealth and nervous diseases and technological advancements could make the health care convenient and economic in such patients by easy access to the program (10, 31, 38). The findings indicated that telemedicine is effective in patients with nervous disorders and it can decrease the rehospitalization time (16, 17). Numerous studies confirm that telemedicine has a direct impact on prevention of different complications, especially PUs and the control of neuropathic pains, in patients with SCI (19-23).

In contrast, the findings of some researches revealed that telemedicine and RPM had limitations, which should be investigated further (24). Limited cooperation, lack of evaluation standards and unsuitable technical infrastructures are some of the constraints and obstacles in this domain (39). Furthermore, legal consequences, safety risks for the patients, and probable professional abuse can be added to the c problems in this subject (40).

In contrast, some findings presented many challenges and limitations through RPM performance that most of them were related to the required facilities in the application of this method (39, 40). About the probable activity mechanism of RPM in patients with SCI, it can be stated that RPM intensifies patients' cooperation for rehabilitation and self-care, and prevents complications due to physical disorders of such patients and numerous problems associated with constant displacements; and considering this point, RPM leads to a few displacements and short hospitalization time, more satisfaction, and better health care quality (19, 20, 22).

4.1. Conclusions

The findings of the current study revealed that RPM was promising and effective in the prevention and control of complications in patients with SCI. According to this result, it can be applied in caring programs of such patients in order to prevent, control, and treat the complications. But, in regard to small sample sizes of patients attending in studies, any unified conclusions need future studies.

Footnotes

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