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Case Report

Stroke-Induced Hemiplegia: A Case Report Promoting Physical Activity at Home

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Abstract

Encouraging physical activity in stroke patients can help with their recovery. Apart from delaying disease progression, encouraging patient participation in regular physical activity programs can increase functional capacity and improve a patients' quality of life. This article aims to enhance the nurse's understanding of the positive effects which passive exercise training can have in a hemiplegic stroke patient. A prospective, descriptive case report was used to follow one patient who suffered from a major stroke (BI score less than 40) and who began physical therapy at 13 weeks post-stroke. Improvements in motor and cognitive function were observed over time and in response to training. Due to the lack of evidence for the efficacy of this type of intervention, this report explores the acceptability and feasibility for designing a future randomized control trial.

ABBREVIATIONS

BI: Barthel Index; CHF: Congestive Heart Failure; COPD: Chronic Obstructive Pulmonary Disease

INTRODUCTION

Worldwide, 15 million people will experience a stroke each year [1]. Of these, approximately 5 million people will die and 5 million people will experience a permanent disability [1]. In the United States, stroke is the 3rd leading cause of death (behind heart disease and cancer) and the leading cause of serious long-term disability, affecting 60% of patients [2]. Although there are different types of strokes (ischemic versus hemorrhagic) and various regions of the brain that can be affected, there are commonalties amongst patients. For the patient, stroke is a major life transformative event. One of the most severe physical outcomes of patients experiencing a stroke is hemiplegia (paralysis of the arm and leg on one side of the body).

For persons experiencing a mild stroke (as represented by a Barthel Index [BI] greater than 85 out of a possible 100), the average length of hospital stay is approximately 3-5 days and the majority (60%) of these patients have routine discharge to their home [3]. With more severe strokes (a BI score of less than 40), the hospital stay can be much longer up to 45 to 60 days, followed by discharge to long-term facilities (16-18%), short-term term facilities (5 – 7%) or even home (1-2%). Patients with a low level of functional independence post-stroke are normally referred to restorative care with regular assessment for further rehabilitation potential. Restorative care is a slower program of rehabilitation whereby patients receive physical therapy three times per week in order to restore some physical function.

Patients who choose to return home post-hospitalization face additional challenges. Transitions to home require special accommodations to be made for the stroke patient, which the patient and family should be made aware of. For the hemiplegic stroke patient, who previously may have been ambulatory and perhaps in need of a cane or walker now becomes entirely dependent and requires use of a wheel chair. Wheel chair accessibility to and within the home become a necessity (including the installation of floors that allow for wheel chair movement and ramps to enable access to the home). Additional items required include a hospital bed that can be raised or lowered (to allow for nursing care) and some form of transfer lift (to enable patient transfers) (for example a full-body transfer lift or a weight-bearing transfer aid). Other accommodations to be considered include a urinal and/or a commode and washroom access for shower or bathing (bed baths are also quite effective).

Secondary preventative measures, which reduce the risk of a stroke from reoccurring and delay the progression of the disease, are commonly directed at controlling risk factors such as smoking, diet (i.e., combating obesity, hyperlipidemia, diabetes), hypertension and even physical inactivity [4]. Encouraging physical activity in stroke patients is commonly overlooked in nursing care. Issues such as complications in feeding, personal care, and incontinence relief take precedence. However, disruptions in the ability to move and perform physical exercise can alter the disease trajectory and health status of a patient. In addition, complications in physical health can limit participation in physical activity [5]. Physical activity is limited in stroke patients with ambulatory stroke patients walking slower, taking significantly fewer steps and sleeping more compared to healthy-

matched controls [6]. This is even more problematic in the severe stroke patient who is affected by paralysis and is wheel-chair bound. The functional limitations that are associated with a reduction in physical activity in hemiplegic stroke patients are exacerbated leading to substantial de-conditioning and further physical deterioration. This is further compounded by conditions of muscle spasticity and/or flaccidity in various muscle groups.

Passive physical exercise can be defined as physical movements that are performed without volitional control [7]. It can be delivered manually by therapists and rehabilitation nurses or by equipment such as a continuous passive motion machines (e.g., a passive cycle or arm ergometer) [8]. A prior small pilot study performed in a long-term care setting involving 13 patients (74-99 years of age) with a variety of co-morbidities (cardio-respiratory, metabolic and musculoskeletal conditions) demonstrated that passive exercise training for as little as 6 weeks had a positive effect on muscle strength, flexibility and endurance as well as improved mood state and body composition [9]. Patients who participated in the passive exercise-training program (using an Ex N' Flex machine) outperformed their sedentary counterparts on measures of the 6-minutewalk test, the chair-stand test and the sit-and reach test. Other researchers have demonstrated additional positive effects of passive exercise training including increased blood flow to the brain [10], improved cognitive function [11], decreased pain [8] and a reduction in circulating levels of pro-inflammatory cytokines [8]. Lastly, it has been demonstrated that passive range of motion exercises can be safely performed by critically ill neurosurgical patients [12].

The purpose of this study was to examine, from a nursing perspective, the post-stroke process of physical rehabilitation using passive exercise training in an elderly patient who had suffered a severe stroke leading to hemiplegia. A descriptive case-report approach is used to describe a unique intervention (passive exercise training) and the real-life phenomenology in which it occurred [13]. This observational report provides useful information for the subsequent design of an intervention to be tested in a future randomized control trial.

CASE PRESENTATION

Client X is a 93-year old Caucasian male who resides with his family at his homelocated within the community. Client X suffered a stroke at the age of 91. Medical history includes an appendectomy, hypothyroidism, a bout of congestive heart failure (CHF) due to a virally induced cardiomyopathy, mild chronic obstructive pulmonary disease (COPD), right osteoarthritis of the knee and a right hip fracture with a replacement hemi-arthroplasty. His use of medications is minimal including 0.137 mg Synthyroid (for hypothyroidism), 2.5 mg Bisoprolol (for CHF) and 81 mg aspirin daily (for anti-coagulation therapy). Prior to sustaining his stroke, Client X was regularly active, walking on the treadmill 30 min per day and attending the local YMCA March of Dimes swimming program twice weekly. In one swim session, Client X began leaning rightwards in the swimming pool and also started to lose balance in the water more frequently than normal. The following morning, Client X experienced a severe left ischemic stroke while at home and was rushed to the local hospital. Despite receiving thrombolytic therapy within the recommended time interval, Client X still sustained a permanent neurologic deficit affecting parts of the parietal lobe, temporal lobe and internal capsule.

The infarct left Client X with a dense right-sided hemiplegia. Minimal function remained in the adductor muscles of the right leg that also exhibited spontaneous periods of spasticity. Movement in the right arm was minimal with some reflexive responses that occurred during yawning and sleeping. Cognitive functioning was slightly effected with Client X exhibiting signs of early dementia and some memory loss. After 1 week of hospitalization, his Barthel Index was 10 out of a possible 100. This precluded Client X from entering into a hospital-based rehabilitation program as he did not qualify for funding for rehabilitation by the Government Health Insurance Plan (OHIP – the Ontario Health Insurance Plan). Little physical therapy was performed with Client X while he was in hospital. After seven weeks of hospitalization, Client X was discharged home in the care of his family. This length of hospitalization was required to allow for patient stabilization, the training of family members to provide basic nursing care and preparation of the home to be wheel-chair accessible.

Client X left the hospital with very limited mobility and minimal speech. He required a total body weight support lift for transfers as he could not sit up on his own nor performs any weight bearing activities, which is required for use of a weight-bearing transfer aid (also referred to as sit-to-stand machine). While at home, Client X initially spent most of his time in bed interspersed with brief periods of sitting in a custom-designed wheel chair. When in bed, Client X was turned by the nurse from side to side in the bed at regular intervals to provide basic nursing care. On a weekly basis, Client X also received minimal physical therapy including range of motion exercises of the normal and weak limbs. At thirteen weeks post-stroke, Client X began physical training using a passive-lower body exercise bike (Theracycle 100, Franklin MA).

The Theracycle is a motorized device that enables the legs to move through a full range of cycling motion without any volitional effort. Any assisted effort by the functional leg is rated between 0-2, depending upon the amount of additional force generated. A score of zero indicates that the functional leg provided no effort and a score of 2 indicates that the functional leg provided substantial assistance to the movement. For Client X, the functional leg contributed slightly (a consistent rating of 1 was noted) to the passive motion of the paralyzed leg.

Passive exercise training began at 5 min per day at a cadence of 3 miles/hour. This was gradually increased in 5 – 10 min intervals/day over two weeks until Client X could perform 30 min of cycling, without any breaks, at 3 miles/hour covering a distance of 1.5 miles over the 30 min. The duration of activity was then gradually increased by 5 min intervals per month leading to daily exercise durations of 45 min, performed at 3 miles per hour covering 2.2 miles. One trial with increased exercise intensity (speed) failed since Client X was limited by pain in the right knee due to osteoarthritis. During training sessions, Client X exhibited some spasticity in the paralyzed leg which periodically caused the foot to come off of the pedal. To prevent this from occurring, each foot was strapped with velcro straps to foot pedal platforms located on the passive cycle ergometer, with additional support

provided by extensions located at the back of the pedal that could hold the calf in place. No additional adverse effects occurred in Client X as a result of participation in the training program.

Notable changes in Client X were observed in response to the training program. One of the first adaptations noted were improvements in cognitive function. Client X became more alert, talkative and responsive to his environment. He also stayed awake for longer periods of time. Client X began to regain the control of his bladder function; feeling the sensation of a full bladder and expressing the need to use a urinal. In addition, bowel movement became more regular. Client X also regained some physical function and substantial reduction in spasticity was observed in the paralyzed leg. Client X became able to turn on his own from side-to-side in his bed and sit up-right without support. Care providers were then able to progress from using a full body transfer lift (i.e., a Hoyer 340, Joerns, Arlngton, Texas) to that of a weight-bearing transfer aid (i.e., a Hoyer Ascend, Joerns, Arlington, Texas). When asked how he liked using the passive exercise bike, Client X's response was that "it is OK" and that he "feels better after moving". Assessment using the Barthel Index (BI) indicated that Client X improved over three and a half months by 15 points (increasing from 10 to 25).

DISCUSSION

Restoring the ability to perform daily activities is one goal for patients who were able to do so prior to their stroke. It is a step towards resuming their "normal" lifestyle. Client X had been physically active during the time leading up to his stroke and was able to carry out all activities of daily living on his own. Client X began to demonstrate improvements in physical function when physical therapy, using passive exercise training, was initiated (i.e., at 13–weeks post-stroke) and continues to do so today. While in hospital, Client X received minimal physical therapy (passive exercise training was performed approximately once weekly, if at all), thus there was minimal improvement in physical function from the time of hospitalization to discharge.

The majority of studies indicate that the recovery of motor control occurs primarily within the first 6 weeks following a stroke, with functional recovery occurring within 12.5 weeks [14]. Although the initial severity of the stroke will determine the time course of recovery; patients with severe strokes may take up to 20 weeks or more to regain some functional ability. It is thought that some of the adaptations that occurred in Client X may simply be the result of the time course of recovery; however, the passive exercise-training intervention may have played a role.

Both physical and cognitive functions improved once Client X began to exercise. Although, the gains were very small and the progressions slow, they were notable from a nursing care perspective. The fact that the patient could now turn side to side on his own made personal care much easier to perform. In addition, the ability to sit up on his own and lean forward when sitting made dressing the patient easier to do as well. Transitioning from a total body-weight supported lift to a weight-bearing transfer lift enabled the patient to be transferred more efficiently and provided the patient with a greater sense of security and dignity. It enabled Client X to regain some balance and lower-leg muscle strength, since it requires some (albeit minimal) weight-bearing activity.

Participation in passive exercise training enabled Client X to use his leg muscles, promoting circulation throughout the body and especially the lower extremities, increasing muscle strength and slowing the progression of muscle atrophy that occurs due to disuse. Besides these physical adaptations, improvements in cognitive function and elimination were also noted. The improvement in cognitive function that occurred in this case study is supported by the research of others who examined the effect of passive exercise training in another clinical population (i.e., patients with Parkinson's disease) [11]. Although research, using sophisticated imaging techniques is needed on this topic, it may be possible that some improvements in cognitive function could be due to an increase in cerebral blood flow and subsequent supply of oxygen [10]. The improvements in the control of elimination that were observed following the exercise training program are thought to be due to an enhancement of autonomic regulation (enhanced parasympathetic activity) in these organs [15] as well as enhanced physical control of the external sphincter muscles.

Brenner and Marsella, 2008 [16] reported that family support and pain management were significant determinants of participation in exercise programs by patients in long-term care. The case report referred to in this paper took place in the home environment with the patient's family being thoroughly supportive in encouraging Client X to participate in physical activity. The passive exercise bike was purchased by the family and brought home to enable Client X to continue participating in some form of physical activity. Due to the presence of osteoarthritis in one knee, Client X reported discomfort when an attempt was made to increase the exercise intensity beyond 3 mile/hour. He was able to report his discomfort and stop the exercise bike using the emergency stop key and the exercise intensity was lowered back to 3 miles/hour (i.e. pedaling speed was decreased) so that Client X could exercise without any discomfort. Subsequent exercise sessions were maintained at 3 mph. At no time did Client X require pain medication prior to exercise as a form of prophylaxis treatment.

The results of this case report indicate that low-intensity passive exercise training (using a cycle ergometer) could be performed with minimal adverse effects and was a useful means of promoting physical rehabilitation in an elderly patient who suffered upper and lower-body hemiplegia following a stroke. The patient regained some function and improved on his stroke score indices (as reflected by the Barthel Index). It also had additional effects of decreasing the time required for hands-on care that was required by the care providers. To date, Client X continues to improve in physical and cognitive function. Client X is now also receiving speech therapy in addition to the physical therapy and there is a notable improvement in speech. Overall, this experience with Client X has demonstrated that improvements in physical and cognitive function are still attainable in elderly patients who have succumbed to a severe stroke. Family and care-giver support play an important role in this process. Future research is warranted on this topic.

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