Journal of Science Innovare
https://journal.unpak.ac.id/index.php/jsi

Volume 06, Number 01, February 2023, Page 05-09
e-ISSN: 2615-3750 ; p-ISSN: 2615-3769

TELEREHABILITATION APPLICATION IN POST STROKE PATIENTS AFTER HOSPITALIZATION

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***Article history**: received 15 September 2022; revised 20 December 2022; accepted 10 January 2023* *DOI: https://doi.org/10.33751/jsi.v6i1.7733*

Abstrak. Nursing services include promotive, preventive and rehabilitative. Rehabilitation for post-inpatient post-stroke patients is developing rapidly along with developments in internet use and advances in information technology. Telerehabilitation is an innovation to make it easier for patients to receive rehabilitation services as a continuation after treatment in hospital to improve motor, speech and psychosocial abilities as a result of stroke. Telerehabilitation increases client comfort in carrying out exercises during rehabilitation either at home, in the community or in easily accessible health facilities to help restore the patient's ability to be independent. In several countries, telerehabilitation has been developed to provide post-stroke telerehabilitation services after hospitalization, considering that there are so many benefits to be gained, it is necessary to consider implementing a telerehabilitation system in Indonesia with various adjustments so that it can be implemented optimally.

Keywords: telerehabilitation; post-hospitalization; stroke

I. INTRODUCTION

Stroke is the leading cause of disability in adults and is the highest prevalence of cardiovascular disease in Asia (Kamiya et al., 2015). Health research or Riskesdas in 2013 showed that the number of stroke patients in Indonesia based on the diagnosis of health workers (Nakes) was estimated at 1,236,825 people or 7 per mile. Riskesdas results in 2018 increased by 10.9 per mile. From these data, it can be concluded that there is a significant increase in the number of stroke patients. Some literature states that patients who suffer neurological damage up to stroke require long-term care and rehabilitation, to improve or restore to function before illness. In Hou et al. (2013) in Linder et al. (2015) it is said that early rehabilitation of stroke reduces the risk of depression at the beginning of stroke by an average of 43%. Language impairment is second only to motor impairment and often cognitive decline due to lesions in the brain (Agostini et al., 2014). Physical disability in stroke survivors often leads to a profound decline in cognitive function as well as mental health disorders with adverse consequences on the patient, family and society at large. In stroke patients, neurocognitive function impairment is multi-domain (Sarfo et al., 2017). So it requires a series of treatments that must be undergone by patients after hospitalization. Rehabilitation in posthospitalized or post-acute stroke patients plays a key role in stroke patient care based on the path way, to improve quality of life development, decrease dependence, reduce risk of recurrence and overall cardiovascular risk management (Gabet et al., 2016). Stroke is a leading cause of long-term disability, requiring a multi-rehabilitation approach to repair motor impairment and function (Go et al., 2014 in Linder et al., 2015). So important is the rehabilitation program for stroke patients that patient compliance and family support are needed in undergoing it so that rehabilitation goals can be achieved. In fact, there are many obstacles encountered related to the level of compliance of patients undergoing rehabilitation programs, including geographical constraints, namely the distance of rehabilitation services, costs that must be incurred, lack of motivation or ability and time that must be provided to follow the series of programs. Some acute stroke patients with disabilities or disabilities do not accept recommendations for rehabilitation after completion of treatment, impaired functioning and social barriers as reasons often used for non-compliance with post-treatment rehabilitation (Koh et al., 2015).

Along with the rapid development of internet use and the use of information technology in Indonesia, it is necessary to think ahead to develop a technology innovation based on rehabilitation services for post-stroke patients that integrates both called telerehabilitation programs. Other considerations that can be raised, among others, telerehabilitation programs are likely to have an indirect effect on cutting costs that must be budgeted by the government to support rehabilitation programs, especially for stroke patients.

Telerehabilitation is a rehabilitation service provided using information technology using remote services including assessment, intervention, monitoring, prevention and counseling (American Telemedicine Association, 2010 in Reeder, Chung, Lapsley, 2016). Telerehabilitation has increased rapidly in recent years along with technological developments, the rapid rise of telecommunications and the decreasing cost of computer hardware and software. Telerehabilitation coverage includes direct therapy,

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e-ISSN: 2615-3750 ; p-ISSN: 2615-3769

intervention, disease monitoring, service coordination, training and patient education, patient networks with multidisciplinary professional consultation (Levy, Silverman, Jia, Geiss, Omura, 2015). There are 3 types in telerehabilitation technology, namely image-based, sensor-based and virtual reality (Russel, 2007 in Reeder, 2016). In the literature review on telerehabilitation, the author used 8 articles, including 5 articles on the use of telerehabilitation to improve motor skills, speech, and psychological effects that are often encountered in post-stroke patients, namely depression, 1 article on the use of telerehabilitation in the elderly and 2 articles on the development of telerehabilitation systems using the help of therapeutic robots. The purpose of making this manuscrip is to review literature on innovations in the use of information technology, namely telerehabilitation in nursing services in general and in stroke patients in particular that can be applied in Indonesia.

II. RESEARCH METHODS

The design of this research is a Literature Review or literature review. Library research or literature review (literature review, literature research) is research that examines or critically reviews knowledge, ideas, or findings contained in the body of academic-oriented literature, as well as formulating theoretical and methodological contributions to certain topics, Cooper (2010). The nature of this research is descriptive analysis, namely the regular analysis of the data that has been obtained, then understanding and explanation is provided so that it can be understood well by the reader. This Literature Review was synthesized using a narrative method by grouping similar extracted data according to the results measured to answer the objectives. Research journals that match the inclusion criteria are then collected and a summary of the journal is made including the name of the researcher, year of publication of the journal, research title, method and summary of results or findings. The research journal summary is entered into the table according to the format above. To further clarify the analysis of the abstract and full text of the journal, read and pay close attention. The journal summary is then analyzed regarding the content contained in the research objectives and research results/findings. Analyze the contents of the journal, then code the contents of the journal being reviewed based on the outline or essence of the research which is done by describing it in a sentence, then when it has been collected, then look for similarities and differences in each study and then discuss it to draw conclusions.

III. RESULTS AND DISCUSSION

Telerehabilitation is a discussion that attracts the attention of researchers, among others, in 2014 Agostini et al conducted a clinical study entitled "Telerehabilitation in poststroke Anomia". Researchers are interested in conducting research because damage to language function is the second most common occurrence after motor disorders. In addition, geographical factors such as rural areas, travel barriers that cause limited access to specialist services affect the quality and quantity of rehabilitation interventions for speech disorders. The study aimed to explore the possibilities of telerehabilitation compared to conventional therapies that called face to face treatment. Participants were selected for 5 consecutive post-stroke patients between 32 years of age, assessed by speech and language pathologists at IRCCS San Camilo, Venice and at Grosseto Hospital from January to August 2013. The results obtained by all patients completed the study. Difficulties using the computer at home or reception from teletreatment do not arise.

Pre-treatment separately in both groups was held on different days. In each session, participants were asked the name of 1 set consisting of 255 images. The image is displayed on the computer for 10 seconds of use adjusted to the presentation of the software. If the participant mispronounces the name within the allotted time, the therapist proceeds to another item and marks the wrong item. Incorrect items in both pre-treatment sessions were used to determine management individually and as a control list for each participant. There are two management lists, namely face to face and telerehabilitation and two control lists, namely the list of face to face controls and telerehabilitation for each participant. Images are presented on a computer screen using adjustment software. The software runs Window 7 or XP and follows remote communication between therapist and patient using the embedded Skype platform. The app display has two different screens: the therapist display and the participant display. The therapist's display controls and registers all information including participant information, exercise sessions and image displays. The display of participants in telerehabilitation is conditioned by 2 windows: interactive window with therapist and window with target image. Software adapted to be installed on 2 basic Intel 17" laptops connected to the internet and complete with internal video camera and external headphones. Skype program only at the time of telerehabilitation. The results of the study found significant improvements in management in both telerehabilitation groups and face-to-face conditions but no difference in the correct presentation of items in both. It can be underlined that between telerehabilitation and conventional post-stroke management face-to-face has the same effectiveness. Future developments of telerehabilitation are further developed in complex applications given to stroke patients, faster return home, with a complete telerehabilitation program (motor, speech and cognitive) as obtained during hospitalization.

The second literature study of the journal Cuervo et al in 2014 entitled "Integration of emerging motion capture technologies and videogames for human upper-limb telerehabilitation: A systematic review". Specific analysis that telerehabilitation can be followed by patients from places far from the rehabilitation center but can complete the rehabilitation program.

The systematic review aimed to explore telerehabilitation systems using motion screenshots and video games to benefit upper extremity rehabilitation. Motion screenshots focus on combining information from inertial

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e-ISSN: 2615-3750 ; p-ISSN: 2615-3769

sensors and other technologies. Systematic review taken from 2010 to 2013 obtained a sample of 57 articles in the end obtained 3 articles with a study subject approach. It can be concluded that the combination of inertial sensor information and motion capture technology shows a new trend in remote monitoring of motor rehabilitation processes. However, the combination with video game activity in physical therapy programs raises promising areas of research. Tele-rehabilitation keeps patients in a pleasant environment towards full recovery and other important things, technology at a low cost and allows it to be installed at home or in an easily accessible place. Future orientation to the implementation of motion capture and platform analysis based on inertial sensors and unindicator motion capture vision. The platform includes basic low-cost programs such as video games, easily installed in the patient's home or at the place where therapy is administered. The journal above is very interesting because the innovation of merging video games in telerehabilitation is starting to be thought of. This journal also provides a cheaper and more enjoyable alternative to telerehabilitation systems by utilizing video games, as well as ease of access to rehabilitation exercises.

The third journal of Linder et al's research in 2015 entitled "Improving Quality of Life and Depression After Stroke Trough Telerehabilitation". The study was conducted because it was felt that there were still few studies on post-stroke depression. The research method used is a prospective, multiside, single-blind, randomized controlled, clinical trial designed to access the effectiveness of two basic interventions on motor and nonmotor outcomes after stroke. Participants were recruited from Cleveland, OH and Atlanta, GA, geographic areas.

Robot assistant applied in this study, robot assistant therapy is an evolving technology design to add exercise during stroke recovery (Kwakkel, Kollen, &Krebs, 2008 in Linder, 2015). Robot therapy assistants can improve repeatedly, task-specific activities can be increased so that users can be encouraged motor exercise without any negligence from the therapist. In this study, telerehabilitation monitoring was carried out by calling participants once a week by a therapist. Participants sent daily exercise skills from exercise notes to the therapist and ability constraints were discussed. The therapist enhances the participants' HEP (Home Exercise Program), UE (Upper Extremity) is developed to be modified, altered or added to exercises, activities and education. Merger of EU (Upper Extremity) development towards activity functions and ADLs (Activities of Daily Living). Data from the robot therapy assistant is transmitted to the mentor's web site, the therapist modifies settings and activity levels. The therapist provides objective data from the tool, including additional module procurement time and complete repetition rates and compares with participants' subjective reports.

Both activities were effective for improving QOL Quality of Life and depression in participants less than 6 months after stroke. The implications of the study contribute to the occupational field of therapy i.e. robot therapy assistant combined with HEP design and HEP improves QOL and depression measurement, at 8 weeks the program provides enough time to observe QOL and depression measurement in patients, the use of robot therapy assistant tools increases objectivity. Research is interesting because it is useful to help prevent depression in post-stroke patients. Given the rate of post-stroke depression is quite high, 1-3 patients after stroke suffer from depression (Hackett et al., 2005 in Linder, 2015).

Another study that discusses the relationship between telerehabilitation and quality of life was conducted by Levy, Silverman, Jia, Geiss and Omura (2015) namely "Effects of Physical therapy delivery via home video telerehabilitation on functional and health-related quality of life outcomes". The study was conducted on a group of veterans receiving physical therapy that can be done at home through a video telerehabilitation program the Rural Veteran TeleRehabilitation Initiative (RVTI). A restrospective, pre-post study was designed using measurements from 26 veterans who received physical therapy in the RVTRI program between February 22, 2010 and April 1, 2011 then analyzed with FIM (Functional Independent Measure), MoCA (Montreal Cognitive Assessment) and 2MWT (2-minute walk test), HRQol (health-related quality of life). Telerehabilitation refers to clinical applications including consultation, prevention, diagnostics and therapy services using 2 avenues of communication interaction with telecommunication technology. Telerehabilitation is an alternative commonly used in post-hospitalization patients who require continuous rehabilitation. As an alternative service is "home care" by requiring a therapist to the patient's home. By lowering or removing time barriers to travel and travel costs, telerehabilitation can be developed as an access to rehabilitation care for stroke patients. Improving access to rehabilitation also lowers the imbalance of stroke patients with the challenge of transportation costs.

The results showed significant improvement of physical function, cognitive function, independence function and HRQol through telerehabilitation. Satisfaction measurement of RTVRI obtained very high results. Patient satisfaction is an important measurement to ensure the quality of telerehabilitation itself. Satisfaction measurement is also related to patient motivation and ability to the prescribed therapy. The results also indicate that video-home telerehabilitation is a promising potential alternative compared to in-person rehabilitation services.

In a review study conducted by Reeder, Chung and Lapsley in 2016 entitled "Current Rehabilitation Research with Older Adults At Home" it was found that future studies on technology for home can use sensing technology to monitor health on mobile devices such as computer tablets. The analysis was conducted on 9 articles related to telerehabilitation from 4 countries, namely Australia, Canada, the Netherlands and the USA. 6 studies focused on the delivery of telerehabilitation services by remote therapists using real-time video where 3 studies were based on text or web messages and electronic surveys. 6 out of 9 Internet studies were from landline telephone services while 3 studies used extensive internet networks for real-time video. 3 out of

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e-ISSN: 2615-3750 ; p-ISSN: 2615-3769

6 studies in monitoring safety during telerehabilitation involved a family member or friend.

In 2015 a clinical trial was held in Singapore on using telerehabilitation in stroke patients known as Singapore Tele-Technology Aided Rehabilitation in Stroke (STARS). The method used was single blind, parallel, two-arms randomized control involving 100 patients with inclusion criteria aged more than or equal to 40 years, having service provider support and was a new stroke that was diagnosed with stroke in 4 weeks proposed by Koh et al in a journal entitled "Singapore Tele-technology Aided Rehabilitation in Stroke (STARS) trial: protocol of Randomized clinical tial on tele-rehabilitation for stroke patients." Telerehabilitation is considered a possible solution to perform remote supervision and remove access barriers to post-treatment rehabilitation, because therapeutic supervision is an important factor in determining post-stroke recovery. This trial to determine the expected telerehabilitation intervention of improved recovery of function after stroke compared to conventional treatments. Basic assessment is carried out within 4 weeks of stroke onset followed by follow-up assessment of 3 to 6 months. The 3-month rehabilitation intervention includes exercise 5 days a week using the I-Pad based system. Daily workout recording with video and data sensor once every 1 week. Video conferencing with a tele-therapist is done after the data is reviewed. For group control received conventional treatment. The technology used for the telerehabilitation study, the team built a lightweight wireless that patients can use to follow real-time feedback and collect data from sensors for subsequent delivery. The data sensor automatically creates summaries on forms for the therapist to quickly review. The therapist monitors the patient as well as prescribes remote rehabilitation exercises. The rehabilitation team uses wireless with internet on patients. The data sensor automatically follows the patient to save his own video of the treatment which is always sent to the therapist for review if needed. Patients and therapists can communicate with others using video conferencing. Trials have several contributions to the practice of rehabilitation interventional assistance tele-technology including: testing the practicality of rehabilitation intervention tele-assisted technology, testing the results of telerehabilitation for speed walking sessions, time contracts with therapists, balance, self-reports related to quality of life, health care benefits, burden of service providers compared to conventional care, assessing improved function in Intervention group compliance with supervision or independence from compliance supervise exercises, tele-testing technology economic evaluation helps determine the cost-effectiveness of telerehabilitation. In this study there is a privilege that the workload of service providers is also included in the research, researchers are very concerned in service providers where in previous literature reviews have not been found. Telerehabilitation is expected to increase comfort in patients by involving families in encouraging patients during exercise sessions. This is also in accordance with the culture of the Indonesian nation whose family system is still thick, where the support of other family members is needed. But in this research journal the results of the study are not explained in detail.

Lin et al in 2014 in their research in Taiwan on telerehabilitation described in a journal entitled "Bidirectional and Multi user telerehabilitation system: Clinical Effect on Balance, Fungtional Activity and Satisfaction in Patients with Chronic Stroke Living in Long Term Care Facilities". The pilot study used a multi-side, blocked randomization design. Participants were taken from 3 LTCFS (Long-Term Care Facilities) as many as 24 participants. Participants were randomized and prescribed for telerehabilitation and conventional therapy (tele group and conv group). In each pilot project study was conducted in Taipei, Taiwan and Taichung Taiwan. Tele group receives telerehabilitation while conv group receives conventional therapy by 2 people. The intervention was carried out for 4 weeks with 3 sessions each week. Final results are measured by BBS (Berg Balance Scale) and BI (Barthel Index) and telerehabilitation satisfaction. The results obtained were that the exercise program held in tele and conv groups showed a significant effect on each group. BBS in participants was as good as self-care independence from BI. Participant satisfaction between the 2 tele groups and conv groups did not show a significant difference. The use of bidirectional and multi-user telerehabilitation systems improved balance and activity function in patients with chronic hemiplegion on LFCTs, although there was no significant difference in balance and activity in the tele- and conv-therapy groups.

The following journal is a development of telerehabilitation by developing robotic therapy assistance in upper extremity exercises entitled "A Modular Telerehabilitation Architecture for Upper Limb Robotic Therapy", a study conducted by Simonetti et al in 2017.

The journal contains modules on general architecture for telerehabilitation systems by improving flexible models that can be used in several rehabilitation scenarios in specific areas. Applications include remote control robotic systems that can be delivered to rehabilitation homes and continuously optimize rehabilitation outcomes. The article includes the presentation for the first time modular for upper extremities assisted by robotic telerehabilitation, then applied to the case study architectural submission on the described Motus CBM (case study of the end planar effector machine) for upper limb rehabilitation, experimental validation on health subjects and discussed. Telerehabilitation developed more modernly by using the help of telerehabilitation robots can be a discourse on the development of telerehabilitation in general. Telerehabilitation in general has the same success compared to conventional rehabilitation in achieving rehabilitation goals, namely improving motor and non-motor skills and improving quality of life which includes preventing post-stroke depression.

IV. CONCLUSION

From the journal above, the author concludes that the use of telerehabilitation, especially in post-stroke patient rehabilitation programs, can have a positive impact, namely increasing the effectiveness and efficiency of rehabilitation

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e-ISSN: 2615-3750 ; p-ISSN: 2615-3769

service delivery in stroke patients. Given the rapid use of the internet and advances in information technology, actually it would be a shame if it was not tried to be applied in Indonesia. There are complex problems regarding patient non-compliance ranging from cost, transportation and geographical constraints affecting the success rate of the rehabilitation function itself to improve or restore body functions that have been disabled due to stroke. This is in accordance with what was stated by Levy et al., (2015) that there are several factors that influence patients to access health services including: distance, expensive transportation costs, small number of service providers in rural areas, transportation constraints, burden on service providers, patient knowledge, service providers and family support, cultural differences. Decreased access to health care facilities contributes to increased morbidity and mortality, increased cost of care and underappreciated use of emergency care facilities. Some things that can hinder the implementation of telerehabilitation in Indonesia include limited human resources (health workers who understand information technology or programmers who understand nursing, especially rehabilitative nursing). From the results of the discussion above, it can be concluded that the existence of this telerehabilitation innovation program is possible to be applied in Indonesia with notes: 1. Human resources who are able and skilled to apply this system. 2. There are operational costs that support the implementation of this application. 3. There are facilities and facilities that support the implementation of this application. 4. Availability of support from the government as a policy maker. 5. Trials were carried out first and adjustments were made to the characteristics of the people in Indonesia so that they were suitable for implementation.

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