

Literature Review

Telemedicine in stroke patients during the COVID-19 pandemic: Literature Review

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Abstract

The effectiveness of stroke therapy depends on speed, accuracy and a multidisciplinary approach. The era of the COVID-19 pandemic has caused a high risk of treatment for stroke patients. The application of telemedicine or telestroke that is good and focuses on quality is a possible alternative for stroke therapy during the COVID-19 pandemic. This study aims to determine the effectiveness of telemedicine in stroke patients during the COVID-19 pandemic. This study used a systematic review research design, namely by searching journal articles on Google Scholar, PubMed, and Research Gate databases, using keywords ("Telemedicine" OR "Tele stroke") AND ("stroke" OR "strokes" OR "cerebrovascular accident" OR "cerebral stroke") AND ("COVID 19" OR "COVID-19 Virus Disease" OR COVID19 OR "Coronavirus disease 2019"). Based on searching and searching for journal articles in 2019 - 2021, 131 journals were obtained from PubMed, 90 journals from ResearchGate, and 1000 journals from Google Scholar. A total of 1221 journals were obtained, and 8 scientific articles fit the inclusion criteria. It can be concluded that the application of telemedicine in stroke patients during the COVID-19 pandemic has been implemented in various countries with evidence that it can reduce comorbidities, improve clinical outcomes, and reduce the recurrence of stroke patients. Telemedicine can be applied to stroke patients with clear diagnosis criteria, a multidisciplinary approach, and a complete infrastructure.

Keywords: COVID-19 pandemic; telemedicine; telestroke; stroke

1. Introduction

Stroke is a focal clinical sign that develops rapidly or globally with impaired brain function and lasts more than 24 hours and can cause death, with no apparent cause of vascular origin. It is associated with significant advances in the nature, timing, and clinical recognition of stroke and can be known through imaging findings (Kuriakose & .

Data obtained from the World Health Organization (WHO) has shown a mortality rate of 7.9% of the total death rate in Indonesia caused by stroke. The incidence rate of stroke in Indonesia based on diagnosis by medical professionals is 7 per 1000 population or with symptoms of 12.1 per 1000 population. Stroke can cause record-keeping and death in middle age and old age (Mutiarasari, 2019), (Ministry of Health Research and Development Agency, 2018).

Acute stroke care is very time-sensitive and requires a rapid, multidisciplinary approach to effective management. Rapid decision-making for thrombolytic therapy or endovascular intervention, and then transfer to a center with a higher level of care. In the era of COVID-19, there is a reduced capacity of care for stroke patients. Avail the service telestroke a good and quality-focused one made stroke care possible during the COVID-19 pandemic. This strategy was chosen to reduce the COVID-19 infection rate, thus avoiding ICU overcapacity (Leira et al., 2020).

Along with the industrial revolution 4.0 technology, telemedicine can be defined as the provision of health services carried out remotely by health professionals using and utilizing information and

communication technology, which includes the exchange of information on diagnosis, treatment, prevention of a disease and injury, research and evaluation, and continuing education of health care providers aimed at improving individual and community health (Indonesia, 2019). Telemedicine in stroke (telestroke) can be used for first examination and decision-making in case of stroke and follow-up examination to identify changes in symptoms through video conferencing at stroke services in some countries (Hubert et al., 2021).

Telemedicine In stroke (telestroke) can be used for first examination and decision-making in case of stroke and follow-up examination to identify changes in symptoms through video conferencing at stroke services in some countries (Hubert et al., 2021). Implementation of telestroke using advanced video telecommunications is a potential solution. The number of stroke patients receiving acute phase stroke therapy is maximum and effective and can be carried out both throughout the country and throughout the world. Telestroke can facilitate remote cerebrovascular specialist consultations from almost any location within minutes of connecting with a specialist doctor (Levine & Gorman, 1999).

Many reports have been published describing a marked decrease in stroke patients in hospitals around the world. This may be partly due to patients' fear of consultation and check-ups in hospitals, but it can also be due to the closure of stroke centers and a shortage of beds to serve stroke patients and doctors. A potential way to optimize health professional resources is to use telemedicine (Hubert et al., 2021). Therefore, it is necessary to conduct an assessment aimed at determining the implementation, benefits and effectiveness of implementing telemedicine services for stroke patients (telestroke) during the COVID-19 pandemic.

2. Research Methods

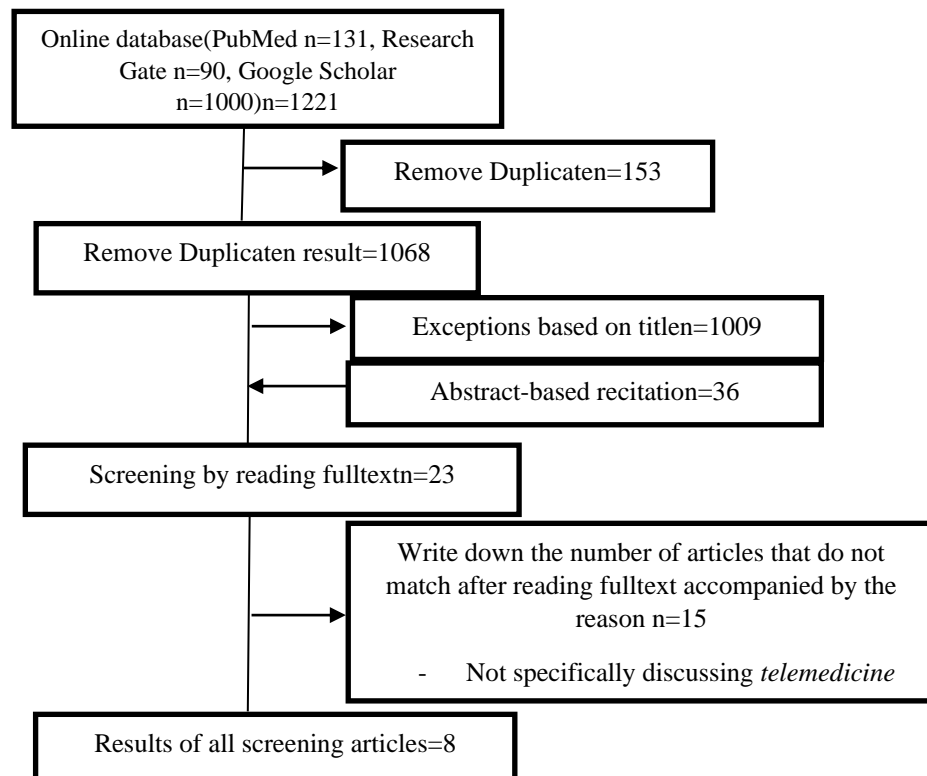


Figure 1. Flowchart PRISMA

The study used a literature review research design, namely by searching scientific articles carried out on online databases, namely: PubMed, Google Scholar, and Research Gate, using keywords ("Telemedicine" OR "Tele stroke") AND ("stroke" OR "strokes" OR "cerebrovascular accident" OR "cerebral stroke") AND ("COVID 19" OR "COVID-19 Virus Disease" OR COVID19 OR

"Coronavirus disease 2019"), and uses article inclusion criteria, namely research journals 2019 - 2021, journals using English and Indonesian, can be accessed in full text, and specifically discuss telemedicine. The exclusion criterion is that the article does not discuss stroke. The data obtained is then extracted using PRISMA flowchart guidelines. This research has been declared to have passed ethics by the Research and Health Ethics Commission (KEPK) team of the Faculty of Medicine, University of Muhammadiyah Surakarta with No.3961/C.1/KEPK-FKUMS/XI/2021.

3. Results and Discussion

Search results were obtained from PubMed, namely 131 journals; from Research Gate, obtained 90 journals; and from Google Scholar, 1000 journals. Thus, the final result was obtained, which was 1221 journals. Thus, the final result was obtained, which was 1221 journals. Then, extraction was carried out into 8 journals by the inclusion criteria. In the search results, several research designs were obtained, namely, 3 studies using retrospective studies, 2 with cohort study designs, 1 journal with cross-sectional, 1 article using observational statistics, and 1 journal using a multicenter study design.

Table 1. Classification of populations, interventions, and outcomes

Writer	Heading	Population	Intervention	Outcome
(Sevilis et al., 2022)	Telestroke: Maintainin g Quality Acute Stroke Care During the COVID-19 Pandemic	n= 171 hospitals 15,226 consultations in the pre-COVID-19 cohort compared to, 11,105 consultations using telemedicine in the COVID-19 group were evaluated.	The survey of acute stroke consultation data seen by Telespecialists, LLC physicians at 171 hospitals in 19 states via telestroke from December 1, 2019, to June 27, 2020, was taken from the telecare database. The consultations were divided into two pre-COVID groups, including consultations seen from December 1, 2019, to March 14, 2020, and the COVID group, including consultations seen from March 15, 2020, to June 27, 2020.	The median median door-to-needle (DTN) and call-to-needle (CTN) time in stroke patients evaluated in the pre-COVID-19 and COVID-19 groups showed no significant difference in the two groups. Thus, telestroke is effective and useful during the COVID-19 pandemic.
(Huang et al., 2020).	Telestroke in the COVID-19: The Mayo Clinic Experience	Review the data collected, n=142 telestroke pre-declaration during a pandemic, n=71 post-declaration period telestroke activation during the pandemic.	Reviewed data collected for ED telestroke activation during the 30 days prior to the pandemic declaration (February 10 to March 10, 2020) and 30 days after declaration (March 11 to April 9, 2020) from the Mayo Clinic telestroke network. The data reviewed included patient age, sex, location of telestroke services, time of	Analyzed population patterns of telestroke adoption in the Americas in the 30 days prior to the WHO declaration on COVID-19 (February 10, 2020 – March 10, 2020) and compared to 30 days after the declaration (March 11, 2020 – April 9, 2020). There was a 50.0% volume reduction in telestroke activation because the

Writer	Heading	Population	Intervention	Outcome
			onset of symptoms or last known normal, time of telestroke activation, diagnosis, and National Institutes of Health Stroke Scale (NIHSS) scores.	volume of stroke reception also decreased.
(D'Anna et al., 2021)	Delivering Telemedicine Consultations for Patients with Transient Ischaemic Attacks during the COVID-19 Pandemic Comprehensive Tertiary Stroke Centre in the United Kingdom	n=180 patients evaluated by face-to-face consultation. n=136 patients treated with telemedicine.	Electronic medical records of eligible patients are taken from Imperial College Healthcare NHS Trust's online medical records system. The extracted patient data includes patient characteristics, including age, vascular risk factors, and relevant medical history. The data was obtained by reviewing the medical records of all patients admitted to the Hyperacute Stroke Unit (HASU) and referred to the rapid outpatient TIA service of Imperial College Healthcare NHS Trust between 23 March 2020 and 30 June 2020, and between 23 March 2019 and 30 June 2019.	This journal is to assess telemedicine in patients with TIA (Transient Ischaemic Attack) during the COVID-19 pandemic in London, England. It was found that the group of TIA patients who were evaluated face-to-face with the group using telemedicine did not find a significant difference and showed no recurrence. So, the results are equally effective and telemedicine is good to apply.
(Siegler et al., 2020)	Falling stroke rates during COVID-19 pandemic at a comprehensive stroke center	Analysis and evaluation of the analysis and evaluation of, n=328 patients overall and n=53 patients presented during the COVID-19 period at Univ.Cooper Hospital	Conducted a retrospective analysis of a prospective observational cohort of adults aged >18 years who were admitted to Cooper University Hospital (CUH) with a final diagnosis of acute ischemic stroke from October 1, 2019 to April 15, 2020. Patients were compared between two treatment periods: pre-COVID-19, which includes patients admitted between October 1, 2019 and February 29, 2020, and COVID-19, which includes patients admitted between March 1, 2020 and April 15, 2020.	The Comprehensive Stroke Center in New Jersey offered telestroke services during the COVID-19 pandemic. There was a decrease in the number of daily stroke admissions during the COVID-19 period (p = <0.01) so that daily telestroke consultations there was a 25% decrease in the average number of daily telestroke consultation requests (p = 0.08).

Writer	Heading	Population	Intervention	Outcome
			2020March 1, 2020 until April 15, 2020.	
(Zachriso n et al., 2021)	National Trends in Telestroke Utilization in a US Commercial Platform Prior to the COVID-19 Pandemic	n= 67,736 telestroke consultations at 132 spoke sites in the United States.	Using data from large commercial telehealth companies that provide software and platforms for telestroke delivery to physician service organizations	Diagnosis using telestroke is mostly found in the percentage of stroke at 53.0% with cases of TIA (Transient Ischaemic Attack) 12.8%, ischemic stroke 38.8%, hemorrhagic stroke 2.4%.
(Kolikonda et al., 2022)	Virtual Rounding in Stroke Care and Neurology Education During the COVID-19 Pandemic – A Residency Program Survey	Evaluating the use of telemedicine in acute stroke in the ER (Emergency Department) with surveys of neurology residents, stroke fellows, stroke practitioner nurses, and stroke physician staff surveyed for 2 months (n=32 out of 42 surveys (73%).	The study was a cross-sectional survey at an academic medical center in the United States. Two major changes in stroke education and care were instituted at our comprehensive stroke center following the declaration of a state emergency in Ohio on March 9, 2020. First, a virtual platform for education and teaching was introduced. Second, the stroke program implements the implementation of telemedicine in the emergency department (ER) by residents, then conducting patient evaluations directly under virtual supervision by supervisors.	The responses obtained by both residents and experienced supervisors included that the implementation of telesroke did not interfere with learning and education about stroke services, virtual services protected health workers from exposure to the virus, less time was spent at the patient's bedside, and experienced supervisors were comfortable with the use of telemedicine in stroke patients. However, 37% of residents still feel uncomfortable with telemedicine activities in the emergency department (ER), this can be due to lack of exposure and previous experience of telemedicine services in stroke patients.

Writer	Heading	Population	Intervention	Outcome
(Pandian et al., 2021).	Stroke Care During the COVID-19 Pandemic: Asian Stroke Advisory Panel Consensus Statement	The Asian Stroke Advisory Panel (ASAP) administered a survey questionnaire addressed to n=13 Asian countries, with 9 completing the questionnaire.	Members completed a standardized survey questionnaire consisting of 19 questions. Members were asked about the impact of COVID-19 on the continuum of stroke care (pre-hospital phase, emergency evaluation, imaging, thrombolysis, mechanical thrombectomy, stroke unit care, discharge, and rehabilitation). Thirteen members, representing 9 countries, responded to the questionnaire.	During the COVID-19 pandemic, emergency consultations using telestroke were used for thrombolysis and thrombectomy decisions to reduce the number of referrals. They were also used to guide the management of stroke patients and were not of significant value.
(Vollmut h et al., 2021)	Impact of the coronavirus disease 2019 pandemic on stroke teleconsultations in Germany in the first half of 2020	The survey of n=38,895 consultation patients was conducted in 14 stroke networks, 31 network centers, and 155 hospitals, and the potential of telemedicine during the COVID-19 pandemic was analyzed.	Analyzed patient characteristics, type/severity of stroke, and treatment of acute stroke. A survey has been conducted focusing on the potential shortage of stroke care in hospitals and (telemedicine) during the pandemic.	There was a decrease in the average rate of daily telemedicine consultations ($p < 0.001$) due to regional restrictions. However, it became normal again after easing during the COVID-19 pandemic, and there was no relevant shortage of telemedicine stroke care in Germany.

Based on the article above, it was found that the application of telemedicine to stroke patients (telestroke) during the Covid 19 pandemic was able to reduce comorbidities, improve clinical outcomes and reduce the recurrence of stroke patients with rapid diagnosis and medical action after connecting with neurology doctors/experts.

Acute stroke care requires a rapid, multidisciplinary approach to effective management to reduce the occurrence of disability and death. Therefore, call-to-needle (CTN) and door-to-needle (DTN) are when the patient shows symptoms until the start of the procedure in the hospital. Lowering the DNT median is an important goal for quality improvement. Sevilis' 2022 study showed that the timing of DTN and CTN performed on stroke patients before the pandemic and during the COVID-19 pandemic was evaluated using telemedicine. The same results were obtained, with no significant difference (Sevilis et al., 2022). Door-to-needle (DTN) is an important time in the management of ischemic stroke, especially for stroke patients who will be thrombosed. The minimum DTN time (maximum 4.5 hours) will increase Outcome stroke patients who have thrombolysis performed (Baraban et al., 2018), (Fonarow et al., 2011), (Kamal et al., 2017). Therefore, Efforts that accelerate assessment And therapy of stroke patients, including rapid evaluation of the feasibility of thrombolysis, is very important in improving patient outcomes (Fonarow et al., 2011), (Kamal et al., 2017). Some factors that affect the timing of DTN include the way the patient arrives, hospital

protocols, the availability of adequate imaging, these are things that must be a priority in thrombolysis therapy (Kamal et al., 2017).

According to Huang 2020, the diagnostic criteria for activation Telestroke (stroke treatment) i.e. the presence of persistent focal neurological deficits appearing within 6 hours after the onset of stroke is last known to be normal, known neurological deficits (Huang et al., 2020). According to research conducted by Pandian et al. 2021 which uses the method of Cohort Study stated that there was a decrease in the number of stroke patients seeking treatment due to fear of COVID-19 infection, especially in mild stroke patients. Furthermore, the decision to perform thrombolysis and thrombectomy can be made through emergency consultation telestroke, which aims to reduce the number of referrals. Therefore, telemedicine is used as a Tele Follow Up Clinic to be able to visit and monitor patients at home by communicating using real-time video calls to provide clinical evaluations, conduct discussions with patients, and prescribe medications (Pandian et al., 2021).

The research mentions that patients use telestroke to perform an acute stroke evaluation that has a low comorbidity score and NIHSS score (National Institute of Health Stroke Scale) higher (Nguyen-Huynh et al., 2020). Research conducted by d'Anna et al. and Zachrison et al. 2021 states that telemedicine is Effectively used to establish the diagnosis. Most diagnoses were obtained in TIA (Transient Ischaemic Attack) and can also be applied to cases of ischemic stroke or hemorrhagic stroke (D'Anna et al., 2021) (Zachrison et al., 2021). Telestroke is a telemedicine approach to improve stroke patient services, facilitation, access, and quality of services and outcomes. The role of telestroke includes administering thrombolysis early, facilitating the transfer of patients to stroke centers, reducing health service costs, training and mentoring teams of medical personnel in the region and the development of artificial intelligence to assist in the assessment and care of stroke patients (Harahsheh et al., 2022), (Levine & Gorman, 1999), (Ali et al., 2020). Telestroke programs also play an important role in rural stroke services, where the number of vascular neurology doctors is still limited (Wechsler et al., 2017). This can reduce healthcare disparities in different geographical areas (Nelson et al., 2011). A systematic review and meta-analysis reported that the application of telestroke in rural areas had better clinical outcomes compared to usual care (Lazarus et al., 2020).

There are service improvements telehealth or telemedicine by 154% during the first quarter of 2020 in the United States and an increase of 2013% on outpatient care through televisit during mid-2020 since the COVID-19 outbreak (Koonin et al., 2020). Kolinda 2022 also mentioned that telestroke can be carried out in the emergency room by residents with supervisory supervision without disrupting the teaching process and is useful for reducing virus exposure to health workers during the COVID-19 pandemic because there is less time next to patients provided that they have received exposure to previous experience for residents who provide telemedicine services for stroke patients in the ER (Kolikonda et al., 2022).

Neurology specialists in teaching hospitals have an important role in the therapy of thrombolysis of stroke patients. A study shows that residents carrying out acute stroke protocols can reduce door-to-needle (Ruff et al., 2017). Full-time residents are in inpatient wards and are directly involved in assessing and managing stroke patients (Pines et al., 2020). The resident has an important role in making decisions for thrombolysis in stroke patients under the supervision of a neurologist. Health professionals involved in the thrombolysis pathway (primary care health workers, ambulance personnel, paramedics, emergency department staff, and radiology staff) require training and consistent guideline adherence (Zaheer et al., 2011). The experience of the health team has a significant impact on the effectiveness of thrombolysis. Experienced healthcare professionals will be more efficient in assessing and treating patients and able to minimize DTN time in thrombolysis therapy (Kijpaisalratana et al., 2020)¹, (Liu et al., 2018). The quality of nursing and the implementation of thrombolysis that is integrated and supported by integrated stroke unit facilities increases the effectiveness of thrombolytic therapy (Zaheer et al., 2011).

4. Conclusion

Based on the review and description above, it can be concluded that the application of telemedicine in stroke patients (telestroke) during the Covid 19 pandemic can reduce comorbidities, improve clinical outcomes and reduce the recurrence of stroke patients by establishing a diagnosis and rapid medical action after connecting with neurology doctors/experts. Telemedicine can be applied to stroke patients with clear diagnosis criteria, a multidisciplinary approach and complete infrastructure.

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