

Clinical Practice Guideline



Clinical Practice Guideline for Stroke Rehabilitation in Korea—Part 1: Rehabilitation for Motor Function (2022)

Doo Young Kim, Byungju Ryu, Byung-Mo Oh, Dae Yul Kim, Da-Sol Kim, Deog Young Kim, Don-Kyu Kim, Eun Joo Kim, Hoo Young Lee, Hyoseon Choi, Hyoung Seop Kim, Hyun Haeng Lee, Hyun Jung Kim, Hyun Mi Oh, Hyun Seok, Jihye Park, Jihyun Park, Jin Gee Park, Jong Moon Kim, Jongmin Lee, Joon-Ho Shin, Ju Kang Lee, Ju Sun Oh, Ki Deok Park, Kyoung Tae Kim, Min Cheol Chang, Min Ho Chun, Min Wook Kim, Min-Gu Kang, Min-Keun Song, Miyoung Choi, Myoung-Hwan Ko, Na Young Kim, Nam-Jong Paik, Se Hee Jung, Seo Yeon Yoon, Seong Hoon Lim, Seong Jae Lee, Seung Don Yoo, Seung Hak Lee, Seung Nam Yang, Si-Woon Park, So Young Lee, Soo Jeong Han, Sook Joung Lee, Soo-Kyung Bok, Suk Hoon Ohn, Sun Im, Sung-Bom Pyun, Sung Eun Hyun, Sung Hoon Kim, Sung-Hwa Ko, Sungju Jee, SuYeon Kwon, Tae-Woo Kim, Won Hyuk Chang, Won Kee Chang, Woo-Kyoung Yoo, Yeo Hyung Kim, Yeun Jie Yoo, Yong Wook Kim, Yong-Il Shin, Yoon Ghil Park, Yoon-Hee Choi, Youngkook Kim, KSNR Stroke CPG Writing Group

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Correspondence to

Min Wook Kim

Department of Rehabilitation Medicine,
Incheon St. Mary's Hospital, College of
Medicine, The Catholic University of Korea,
56 Dongsu-ro, Bupyeong-gu, Incheon 21431,
Korea.

Email: msdykim@catholic.ac.kr

HIGHLIGHTS

- This clinical practice guideline is the fourth edition of the Korean guideline for stroke rehabilitation, which was last updated in 2016.
- The development approach has been changed from a consensus-based approach to an evidence-based approach using the Grading of Recommendations Assessment Development and Evaluation method.

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Korea.

Email: msdykim@catholic.ac.kr

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cited.

ORCID iDs

Doo Young Kim <https://orcid.org/0000-0003-1327-5348>
Byungju Ryu <https://orcid.org/0000-0003-0109-9885>
Byung-Mo Oh <https://orcid.org/0000-0001-9353-7541>
Dae Yul Kim <https://orcid.org/0000-0003-1275-1736>
Da-Sol Kim <https://orcid.org/0000-0002-7745-978X>
Deog Young Kim <https://orcid.org/0000-0001-7622-6311>
Don-Kyu Kim <https://orcid.org/0000-0001-8619-830X>

Clinical Practice Guideline for Stroke Rehabilitation in Korea—Part 1: Rehabilitation for Motor Function (2022)

Doo Young Kim ¹, Byungju Ryu ², Byung-Mo Oh ^{3,4,5}, Dae Yul Kim ^{6,7},
Da-Sol Kim ⁸, Deog Young Kim ⁹, Don-Kyu Kim ¹⁰, Eun Joo Kim ¹¹,
Hoo Young Lee ^{3,4}, Hyoseon Choi ¹², Hyoung Seop Kim ¹³, Hyun Haeng Lee ¹⁴,
Hyun Jung Kim ¹², Hyun Mi Oh ^{3,4}, Hyun Seok ¹⁵, Jihye Park ¹⁶,
Jihyun Park ¹⁷, Jin Gee Park ¹⁸, Jong Moon Kim ¹⁹, Jongmin Lee ¹⁴,
Joon-Ho Shin ¹¹, Ju Kang Lee ²⁰, Ju Sun Oh ²¹, Ki Deok Park ²⁰,
Kyoung Tae Kim ²², Min Cheol Chang ²³, Min Ho Chun ^{6,7}, Min Wook Kim ¹⁶,
Min-Gu Kang ²⁴, Min-Keun Song ²⁵, Miyoung Choi ²⁶, Myoung-Hwan Ko ⁸,
Na Young Kim ⁹, Nam-Jong Paik ^{3,27}, Se Hee Jung ^{3,28}, Seo Yeon Yoon ⁹,
Seong Hoon Lim ¹⁶, Seong Jae Lee ²⁹, Seung Don Yoo ³⁰, Seung Hak Lee ^{6,7},
Seung Nam Yang ³¹, Si-Woon Park ¹, So Young Lee ³², Soo Jeong Han ³³,
Sook Jung Lee ¹⁶, Soo-Kyung Bok ³⁴, Suk Hoon Ohn ¹⁷, Sun Im ¹⁶,
Sung-Bom Pyun ³¹, Sung Eun Hyun ^{3,5}, Sung Hoon Kim ³⁵, Sung-Hwa Ko ³⁶,
Sungju Jee ³⁴, SuYeon Kwon ³³, Tae-Woo Kim ^{3,4}, Won Hyuk Chang ³⁷,
Won Kee Chang ^{3,27}, Woo-Kyoung Yoo ¹⁷, Yeo Hyung Kim ¹⁶, Yeun Jie Yoo ¹⁶,
Yong Wook Kim ⁹, Yong-Il Shin ³⁶, Yoon Ghil Park ⁹, Yoon-Hee Choi ¹⁵,
Youngkook Kim ¹⁶, KSNR Stroke CPG Writing Group

¹Department of Rehabilitation Medicine, International St. Mary's Hospital, Catholic Kwandong University College of Medicine, Incheon, Korea

²Department of Physical Medicine and Rehabilitation, Sahmyook Medical Center, Seoul, Korea

³Department of Rehabilitation Medicine, Seoul National University College of Medicine, Seoul, Korea

⁴Department of Rehabilitation Medicine, National Traffic Injury Rehabilitation Hospital, Yangpyeong, Korea

⁵Department of Rehabilitation Medicine, Seoul National University Hospital, Seoul, Korea

⁶Department of Rehabilitation Medicine, University of Ulsan College of Medicine, Ulsan, Korea

⁷Department of Rehabilitation Medicine, Asan Medical Center, Seoul, Korea

⁸Department of Physical Medicine and Rehabilitation, Jeonbuk National University Medical School, Jeonju, Korea

⁹Department of Rehabilitation Medicine, Yonsei University College of Medicine, Seoul, Korea

¹⁰Department of Physical and Rehabilitation Medicine, College of Medicine, Chung-Ang University, Seoul, Korea

¹¹Department of Rehabilitation Medicine, National Rehabilitation Center, Seoul, Korea

¹²Department of Rehabilitation Medicine, Nowon Eulji Medical Center, Eulji University School of Medicine, Seoul, Korea

¹³Department of Physical medicine and Rehabilitation, National Health Insurance Service Ilsan Hospital, Goyang, Korea

¹⁴Department of Rehabilitation Medicine, Konkuk University School of Medicine, Seoul, Korea

¹⁵Department of Physical Medicine and Rehabilitation, Soonchunhyang University College of Medicine, Asan, Korea

¹⁶Department of Rehabilitation Medicine, College of Medicine, The Catholic University of Korea, Seoul, Korea

¹⁷Department of Physical Medicine and Rehabilitation, Hallym University College of Medicine, Chuncheon, Korea

¹⁸Department of Physical Medicine and Rehabilitation, Samsung Changwon Hospital, Sungkyunkwan University School of Medicine, Changwon, Korea

¹⁹Department of Rehabilitation Medicine, CHA Bundang Medical Center, CHA University, Seongnam, Korea

²⁰Department of Rehabilitation Medicine, Gachon University, Gil Medical Center, Incheon, Korea

²¹Department of Physical medicine and Rehabilitation, Seoul Medical Center, Seoul, Korea

²²Department of Rehabilitation Medicine, Keimyung University School of Medicine, Keimyung University Dongsan Hospital, Daegu, Korea





























²³Department of Rehabilitation Medicine, College of Medicine, Yeungnam University, Daegu, Korea

²⁴Department of Rehabilitation Medicine, Daegu Workers' Compensation Hospital, Daegu, Korea

²⁵Department of Rehabilitation Medicine, Chonnam National University Medical School, Gwangju, Korea

²⁶National Evidence-based Healthcare Collaborating Agency, Seoul, Korea

²⁷Department of Rehabilitation Medicine, Seoul National University Bundang Hospital, Seongnam, Korea

Eun Joo Kim 
<https://orcid.org/0000-0001-6166-7886>
 Hoo Young Lee 
<https://orcid.org/0000-0003-3846-943X>
 Hyoseon Choi 
<https://orcid.org/0000-0002-2781-2557>
 Hyoung Seop Kim 
<https://orcid.org/0000-0002-5310-4802>
 Hyun Haeng Lee 
<https://orcid.org/0000-0001-6666-6284>
 Hyun Jung Kim 
<https://orcid.org/0000-0002-2198-5668>
 Hyun Mi Oh 
<https://orcid.org/0000-0001-5493-4691>
 Hyun Seok 
<https://orcid.org/0000-0001-7266-6045>
 Jihye Park 
<https://orcid.org/0000-0002-9764-128X>
 Jihyun Park 
<https://orcid.org/0000-0002-2172-1072>
 Jin Gee Park 
<https://orcid.org/0000-0003-2672-1618>
 Jong Moon Kim 
<https://orcid.org/0000-0002-8684-8736>
 Jongmin Lee 
<https://orcid.org/0000-0001-8718-0099>
 Joon-Ho Shin 
<https://orcid.org/0000-0001-6447-8829>
 Ju Kang Lee 
<https://orcid.org/0000-0002-8335-9785>
 Ju Sun Oh 
<https://orcid.org/0000-0002-0994-3051>
 Ki Deok Park 
<https://orcid.org/0000-0003-1684-4737>
 Kyoung Tae Kim 
<https://orcid.org/0000-0001-9355-8326>
 Min Cheol Chang 
<https://orcid.org/0000-0002-7629-7213>
 Min Ho Chun 
<https://orcid.org/0000-0001-8666-7225>
 Min Wook Kim 
<https://orcid.org/0000-0003-4505-809X>
 Min-Gu Kang 
<https://orcid.org/0000-0002-0680-9607>
 Min-Keun Song 
<https://orcid.org/0000-0001-8186-5345>
 Miyoung Choi 
<https://orcid.org/0000-0002-2424-9965>
 Myoung-Hwan Ko 
<https://orcid.org/0000-0002-0566-3677>
 Na Young Kim 
<https://orcid.org/0000-0001-9888-3953>
 Nam-Jong Paik 
<https://orcid.org/0000-0002-5193-8678>
 Se Hee Jung 
<https://orcid.org/0000-0002-0623-8752>

²⁸Department of Rehabilitation Medicine, Seoul National University Boramae Medical Center, Seoul, Korea
²⁹Department of Rehabilitation Medicine, Dankook University College of Medicine, Seoul, Korea
³⁰Department of Rehabilitation Medicine, Kyung Hee University School of Medicine, Seoul, Korea
³¹Department of Physical Medicine and Rehabilitation, Korea University College of Medicine, Seoul, Korea
³²Department of Rehabilitation Medicine, Jeju National University Hospital, Jeju National University College of Medicine, Jeju, Korea
³³Department of Rehabilitation Medicine, Ewha Womans University College of Medicine, Seoul, Korea
³⁴Department of Rehabilitation Medicine, College of Medicine, Chungnam National University, Daejeon, Korea
³⁵Department of Rehabilitation Medicine, Yonsei University Wonju College of Medicine, Wonju, Korea
³⁶Department of Rehabilitation Medicine, Pusan National University School of Medicine, Busan, Korea
³⁷Department of Physical and Rehabilitation Medicine, Samsung Medical Center, Sungkyunkwan University School of Medicine, Seoul, Korea




ABSTRACT

This clinical practice guideline (CPG) is the fourth edition of the Korean guideline for stroke rehabilitation, which was last updated in 2016. The development approach has been changed from a consensus-based approach to an evidence-based approach using the Grading of Recommendations Assessment Development and Evaluation (GRADE) method. This change ensures that the guidelines are based on the latest and strongest evidence available. The aim is to provide the most accurate and effective guidance to stroke rehabilitation teams, and to improve the outcomes for stroke patients in Korea. Fifty-five specialists in stroke rehabilitation and one CPG development methodology expert participated in this development. The scope of the previous clinical guidelines was very extensive, making it difficult to revise at once. Therefore, it was decided that the scope of this revised CPG would be limited to Part 1: Rehabilitation for Motor Function. The key questions were selected by considering the preferences of the target population and referring to foreign guidelines for stroke rehabilitation, and the recommendations were completed through systematic literature review and the GRADE method. The draft recommendations, which were agreed upon through an official consensus process, were refined after evaluation by a public hearing and external expert evaluation.

Keywords: GRADE Approach; Korea; Practice Guideline; Rehabilitation; Stroke

INTRODUCTION

Stroke is one of the leading causes of death in South Korea as well as around the world. Globally, in 2019, the incidence of stroke was 12.2 million, the prevalence was 110 million, the disability-adjusted life-years lost due to stroke was 143 million, and the number of deaths were 6.55 million [1]. According to the Korean Statistical Information Services, the number of stroke patients in South Korea has been over 110,000 per year for the past five years [2]. Comprehensive and specialized rehabilitation treatment starting from the acute phase of stroke can improve functional recovery and minimize disability [3-5]. Many countries have recognized the need for stroke rehabilitation and developed clinical practice guidelines (CPG) for stroke rehabilitation tailored to their individual circumstances [6-9]. Korean Society for NeuroRehabilitation (KSNR) has also published and revised CPGs for stroke rehabilitation, most recently the third edition in 2016. Since the publication of the third edition, a number of important studies in stroke rehabilitation have been published, and it has become clear that the CPG need to be revised to reflect these recent findings.

Seo Yeon Yoon 
<https://orcid.org/0000-0002-0365-2923>
 Seong Hoon Lim 
<https://orcid.org/0000-0002-5475-4153>
 Seong Jae Lee 
<https://orcid.org/0000-0001-7867-4695>
 Seung Don Yoo 
<https://orcid.org/0000-0003-4513-2560>
 Seung Hak Lee 
<https://orcid.org/0000-0002-3017-8497>
 Seung Nam Yang 
<https://orcid.org/0000-0003-2850-0341>
 Si-Woon Park 
<https://orcid.org/0000-0002-1787-4914>
 So Young Lee 
<https://orcid.org/0000-0002-2832-6083>
 Soo Jeong Han 
<https://orcid.org/0000-0002-5685-0384>
 Sook Joung Lee 
<https://orcid.org/0000-0002-6894-445X>
 Soo-Kyung Bok 
<https://orcid.org/0000-0002-8957-2827>
 Suk Hoon Ohn 
<https://orcid.org/0000-0002-1139-1946>
 Sun Im 
<https://orcid.org/0000-0001-8400-4911>
 Sung-Bom Pyun 
<https://orcid.org/0000-0002-1933-038X>
 Sung Eun Hyun 
<https://orcid.org/0000-0003-3114-5504>
 Sung Hoon Kim 
<https://orcid.org/0000-0001-6043-7640>
 Sung-Hwa Ko 
<https://orcid.org/0000-0003-4900-5972>
 Sungju Jee 
<https://orcid.org/0000-0002-9400-9609>
 SuYeon Kwon 
<https://orcid.org/0000-0003-2840-4982>
 Tae-Woo Kim 
<https://orcid.org/0000-0003-4017-549X>
 Won Hyuk Chang 
<https://orcid.org/0000-0002-4969-7895>
 Won Kee Chang 
<https://orcid.org/0000-0001-9756-6817>
 Woo-Kyoung Yoo 
<https://orcid.org/0000-0002-1273-0647>
 Yeo Hyung Kim 
<https://orcid.org/0000-0002-3951-7205>
 Yeun Jie Yoo 
<https://orcid.org/0000-0003-1323-4503>
 Yong Wook Kim 
<https://orcid.org/0000-0002-5234-2454>
 Yong-Il Shin 
<https://orcid.org/0000-0001-7894-0930>
 Yoon Ghil Park 
<https://orcid.org/0000-0001-9054-5300>

AIM OF CPG

The aim of this CPG is to provide medical professionals with the necessary information for the rehabilitation process of stroke patients, from acute to chronic stages, based on scientific and objective evidence. The CPG also seeks to reduce variability in the quality of care received by stroke patients in different medical settings. This CPG aims to help the patient recover their function, prevent complications, and facilitate their return to society.

TARGET POPULATION AND SCOPE

The “Clinical Practice Guideline for Stroke Rehabilitation in Korea. Part 1: Rehabilitation for Motor Function (2022)” is the 4th edition of CPG for stroke rehabilitation in Korea, which updates the 3rd edition published in 2016 [10], and it deals with the rehabilitation of adult male and female stroke patients with motor dysfunction caused by stroke. Pediatric stroke is not covered in this guideline, and both ischemic and hemorrhagic strokes are included.

END-USERS AND SETTINGS

The primary target users of this CPG are physicians and therapists who provide care for patients with disabilities in activities of daily living, including motor dysfunction due to stroke, at primary, secondary, and tertiary medical facilities.

METHOD OF CPG DEVELOPMENT

Building of CPG development group

The development team for clinical guidelines was composed of the operational committee, the practical committee, and the advisory committee. The head of the development team for clinical guidelines was appointed based on the consensus of the KSNR after considering the expertise and representativeness, and 11 operational committee members, including the head of the committee, secretary, and one methodologist expert, were selected to form the operational committee. The practical committee for the development of clinical guidelines was composed of 54 specialists from 26 universities and 5 hospitals nationwide. The advisory committee provided advice and reviewed the recommendations during the development process for the substantive content covered by the clinical guidelines. The advisory committee included the chairperson, vice chairperson, and eight members of the KSNR who have expertise and representativeness in the related field.

Decision of CPG development method

Although this clinical guideline is an updated version of “Clinical Practice Guideline for Stroke Rehabilitation in Korea,” the development approach has been changed from an expert-opinion based to an evidence-based clinical guideline development method (Grading of Recommendations Assessment Development and Evaluation, GRADE) [11]. This clinical guideline is partially updated from the previous clinical guideline, but systematic search and analysis of reference literature is being conducted for the first time, so it was decided to develop it as a *de novo* (new development). The selection of key questions was based on the previous clinical guideline, but it was decided to consider the latest foreign clinical

Yoon-Hee Choi 
<https://orcid.org/0000-0001-6651-7908>
Youngkook Kim 
<https://orcid.org/0000-0003-3964-026X>

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Conflict of Interests

All researchers involved in the development of this clinical guideline were instructed to indicate any conflicting interests related to the study (involvement in similar clinical guideline development, employment, financial understanding, and other potential conflicts). All researchers except for six declared that they have no conflicting interests. Researchers with personal interests in the content of this clinical guideline have excluded themselves from making recommendations regarding specific items (botulinum toxin, virtual reality, robot rehabilitation, medication).

guidelines, the perspectives and preferences of the target population, and the results of the survey when selecting key questions.

Decision of CPG scope

The revision of this CPG has been transformed into an evidence-based clinical guideline development method through systematic evidence search and analysis, GRADE, while the extensive previous clinical guidelines have been divided into three parts and will be sequentially updated in phases. With the advice of the operations committee and the advisory committee, the scope of this clinical guideline has finally been determined as Part 1: Rehabilitation for Motor Function.

Evaluation of foreign stroke clinical guidelines

To select the key questions, references were made to foreign guidelines for stroke rehabilitation. The stroke rehabilitation guidelines published in Canada (2019) [7,9], the United States (2019) [8], and Australia (Living updated CPG) [6] were evaluated using the Korean appraisal of guidelines for research and evaluation II (K-AGREE II). Each guideline was evaluated by two researchers, and all three foreign guidelines were referred to by the guideline operating committee and the practical committee in selecting the key questions.

Perspectives and preferences of the target population

The operating committee summarized 39 key questions that were relevant to the scope of this study, based on the key questions of the previous CPG and the latest foreign guidelines for rehabilitation after stroke. They surveyed the perspectives and preferences of the target population regarding these key questions. A survey was conducted on 11 stroke patients and their caregivers who were hospitalized in the hospital where the operating committee members belong. The preferences of the target population regarding each key question were surveyed using an 11-point Likert scale, with the perspective of the target population on the importance or desired coverage in the treatment guidelines.

Selection of key questions

The operating committee organized 39 key questions that are relevant to the scope of the study from the key questions of the existing clinical guidelines and the latest foreign guidelines for stroke rehabilitation and surveyed the perspectives and preferences of the target population and the members of practical committee. The results of the survey were discussed by the operating committee, and based on this, 24 final key questions were selected from the 39 candidate key questions.

Searching and selecting evidence-based literature

The literature search was conducted by entrusting it to 6 information search experts, using three overseas databases, PubMed (<https://pubmed.ncbi.nlm.nih.gov/>), EMBASE (<http://embase.com>), and Cochrane Library (<http://cochranelibrary.com>). The search range for a comprehensive literature search was not specified for the starting point and was until February 28, 2022. The results of the search were finally selected by at least 2 clinical experts in charge of each key question, according to the PRISMA flow diagram.

Evaluation of risk of bias

The final selected literature was individually evaluated by a minimum of two clinical specialists for each key question, using a literature screening evaluation tool. A systematic review was conducted using AMSTAR (A Measurement Tool for Assessment of multiple

systematic Reviews) 1.0, and for randomized controlled trial (RCT) studies, Cochrane's Risk of Bias (RoB 1.0) was used, while for non-RCT studies, the Risk of Bias Assessment tool for Non-randomized Study 2.0 (RoBANS 2.0) was used. The evaluations were then reviewed through a consensus process.

Analysis of evidence

The clinical experts responsible for each key question summarized the results of the final selected studies and, if a meta-analysis was feasible, performed a meta-analysis. If a meta-analysis was possible, the data heterogeneity was assessed. For data with high heterogeneity, a random-effects model was applied, and subgroup analyses was conducted. Publication bias was assessed using Egger's test and the trim-and-fill method if the number of studies included in the synthesis was over 10. Review Manager (RevMan) Version 5.4 (Copenhagen: The Nordic Cochrane Center) was used for meta-analysis.

Assessment of certainty of the evidence and level of recommendation

The level of certainty of evidence and recommendation grades were carried out using the GRADE method [12], based on the results of the blinding evaluation and the evaluation and analysis of evidence. The process was carried out by at least two clinical experts who evaluated individually and reached a consensus. We presented certainty of evidence as summary of findings table.

Formal consensus and conflict of interests

Among the development members, if there was even a slight interest in the result of the declaration of interest, it was excluded from the development process of individual clinical questions with interest and the official agreement process. Prior to reaching a formal consensus, a preliminary consensus was reached through a review meeting for each team, and an additional preliminary consensus meeting was held at the operating committee. The recommendations revised and supplemented through informal consensus were subsequently followed by a formal consensus-building process using the RAND-UCLA Appropriateness Method (RAM) method.

Opinion of the persons concerned/appraisal from outside expert

After drafting, a public hearing was held by inviting stakeholders to improve the quality of the guideline, the developed CPG was evaluated by experts (include representatives of related academic societies) who were not involved in the guideline development process. The completed CPG will be entrusted to the Clinical Practice Guideline Expert Committee of the Korean Medical Association for external evaluation, and the pointed-out points will be referred to in the next revision.

Distribution and implement

This CPG will be released free of charge on the website of the KSNR and will be distributed through publicity.

Plan of revision/update

The revision/update of the CPG will be based on the contents of the previous 3rd CPG but will be conducted with GRADE method. The scope of the previous clinical guidelines was very extensive, making it difficult to revise at once. Therefore, the previous version of the CPG was divided into three parts and updated sequentially: 1) motor/sensory function, 2) non-motor function, 3) other (general, complications, chronic rehabilitation, etc.).

RESULTS

As a result of the above development process, evidence-based CPG was developed including recommendations for a total of 24 key questions (Table 1) A Korean version of the recommendation summary is available as **Supplementary Data 1**, and the detailed development process and rationale for the recommendation is available as **Supplementary Data 2**.

DISCUSSION

In Korea, research on guidelines for rehabilitation treatment for stroke started in 2006 and the first edition of “Clinical Practice Guideline for Stroke Rehabilitation in Korea.” was published in 2009 [13]. The 2009 guidelines were based on guidelines for stroke treatment in the United States (2005) [14], Europe (2003) [15], UK (2004) [16], Scotland (2002) [17],

Table 1. Summary of recommendations (See **Supplementary Data 1** for a summary in Korean)

KQ	Division	Recommendation	LoE	LoR
KQ 1. Early mobilization	Update	1-1. Early mobilization is recommended within 24–48 hours of stroke onset as it improves functional independence and walking ability in stroke patients, unless contraindicated.	Low	A
		1-2. Selective consideration is given to very early mobilization within 24 hours of stroke onset. *Early mobilization: Out-of-bed activities such as sitting, standing, and walking performed during the acute phase of stroke	High	B
KQ 2. Total amount	Update	2. It is recommended to increase the total amount of exercise therapy, considering the patient's neurological and medical status, to improve activities of daily living and motor function in stroke patients.	Low	B
KQ 3. Exercise therapy method	Update	3. As there is no superior exercise therapy method among various methods that have the effect of improving motor function, such as exercise relearning, neurophysiological approach, and biomechanical approach, it is recommended to apply them individually in combination according to the patient's condition.	Moderate	A
KQ 4. Task-specific training	Update	4-1. Task-specific training is recommended for the improvement of upper limb function.	Low	A
		4-2. Task-specific training is recommended for the improvement of lower limb function.	Moderate	A
KQ 5. Progressive resistance training	Update	5-1. For stroke patients with upper limb weakness, progressive resistance training of the upper limb is recommended for improving upper limb strength, motor function, and activities of daily living, compared to not receiving rehabilitation therapy.	Very low	A
		5-2. For stroke patients with upper limb weakness, there is no significant difference in improving upper limb strength, motor function, and activities of daily living between progressive resistance training of the upper limb and other rehabilitation methods. Therefore, it is considered to apply depending on the patient's condition.	Low	B
		5-3. For stroke patients with lower limb weakness, progressive resistance training of the lower limb is recommended for improving lower limb strength and motor function, compared to not receiving rehabilitation therapy.	Moderate	A
		5-4. For stroke patients with lower limb weakness, there is no significant difference in improving lower limb strength and motor function between progressive resistance training of the lower limb and other rehabilitation methods, so it is recommended depending on the patient's condition.	Low	B
KQ 6. Aerobic exercise	Update	6-1. Regular aerobic exercise, considering appropriate medical evaluation and functional limitations due to concurrent diseases, is recommended for stroke patients as it has a positive effect on cardiorespiratory function, motor function, disability improvement, and quality of life.	Moderate	A
		6-2. High intensity interval training (HIIT) in chronic stroke patients can have positive effects on the recovery of cardiovascular and motor function, so it is recommended with appropriate medical evaluation and consideration of coexisting conditions and functional limitations.	Moderate	B
		6-3. Educating home-returning stroke patients on aerobic exercise, considering comorbidities and functional limitations as well as accessibility, and providing community-based long-term intervention may help improve their exercise capacity, so it is recommended depending on the patient's condition.	Moderate	B
KQ 7. Treadmill exercise	Update	7-1. In stroke patients, gait training in a treadmill is recommended over no intervention, as it is more effective in improving walking function.	High	A
		7-2. Compared to conventional therapy, it cannot be said that gait training in a treadmill is superior in improving walking function, so it should be applied selectively.	High	B
KQ 8. Functional electrical stimulation	Update	8-1. Functional electrical stimulation therapy is recommended for improving upper limb function and performing daily activities in stroke patients.	High	A
		8-2. Functional electrical stimulation therapy is recommended for improving lower limb function.	High	A
		8-3. Functional electrical stimulation therapy is recommended for improving shoulder joint subluxation.	High	A

(continued to the next page)

Table 1. (Continued) Summary of recommendations (See **Supplementary Data 1** for a summary in Korean)

KQ	Division	Recommendation	LoE	LoR
KQ 9. Ankle-foot orthosis	Update	9-1. In stroke patients with foot drop, considering the use of an ankle-foot orthosis is recommended, as it improves walking.	Moderate	B
		9-2. Regarding whether ankle-foot orthosis or functional electrical stimulation therapy is more effective in improving walking in stroke patients with foot drop, no method can be said to be superior, so they should be applied selectively according to the patient's condition.	Moderate	B
		In this statement, functional electrical stimulation therapy, compared to ankle-foot orthosis, is limited to a treatment method that uses electrical stimulation to prevent foot drop in accordance with the walking cycle.		
KQ 10. Repetitive transcranial magnetic stimulation	Update	10-1. Adding repetitive transcranial magnetic stimulation to rehabilitation therapy in stroke patients has a positive effect on improving upper limb motor function, grip strength, and hand function, so it is recommended depending on the patient's condition.	Low	B
		10-2. The evidence for repetitive transcranial magnetic stimulation to improve lower limb function in stroke patients is insufficient, so a recommendation level cannot be determined.	I	
		10-3. Adding repetitive transcranial magnetic stimulation to rehabilitation therapy in stroke patients has a positive effect on improving upper limb spasticity, so it is recommended depending on the patient's condition.	Low	B
		10-4. The evidence for repetitive transcranial magnetic stimulation to improve lower limb spasticity in stroke patients is insufficient, so a recommendation level cannot be determined.	I	
KQ 11. Robot	Update	11-1. In stroke patients, when applying machine-assisted training, including upper limb robots, there is an improvement in upper limb function and daily living ability compared to conventional rehabilitation therapy, so it is recommended depending on the patient's condition and the medical institution's circumstances.	High	B
		11-2. In stroke patients, when applying machine-assisted training, including lower limb robots, there is an improvement in balance ability compared to conventional rehabilitation therapy, so it is recommended depending on the patient's condition and the medical institution's circumstances.	High	B
KQ 12. Virtual reality	Update	12-1. Virtual reality therapy for stroke patients is more effective in improving upper limb motor function compared to conventional rehabilitation therapy, but it can have side effects, so it is recommended depending on the patient's condition.	Low	B
		12-2. Virtual reality therapy for stroke patients is effective in improving balance compared to conventional rehabilitation therapy, but it can have side effects.	Low	B
KQ 13. Transcranial direct current stimulation	Update	13-1. Transcranial direct current stimulation can have a positive effect on improving upper limb motor/function in stroke patients, and it is recommended in conjunction with rehabilitation therapy considering the patient's condition.	High	B
		13-2. Transcranial direct current stimulation can have a positive effect on improving the ability to perform daily life activities in stroke patients, and it is recommended in conjunction with rehabilitation therapy considering the patient's condition.	Moderate	B
KQ 14. Individualized exercise and functional task training	Update	14-1. Individualized exercise and functional task training are recommended to improve upper limb motor function in stroke patients.	Moderate	A
		14-2. Individualized exercise and functional task training are recommended to improve the ability to perform daily life activities in stroke patients.	Low	B
KQ 15. Constraint induced movement therapy	Update	15-1. In stroke patients with hemiparesis, if constraint-induced movement therapy (CIMT) is deemed feasible given the affected upper extremity strength, CIMT is recommended to improve upper limb motor function and daily life activity performance.	Moderate	A
KQ 16. Mirror therapy	Update	16-1. Mirror therapy can have a positive effect on the recovery of upper limb motor function and the ability to perform daily life activities in stroke patients, and it is recommended in conjunction with other rehabilitation therapies depending on the patient's condition.	Low	B
		16-2. Mirror therapy can have a positive effect on the recovery of lower limb function in stroke patients, it is recommended in conjunction with other rehabilitation therapies depending on the patient's condition.	Moderate	B
KQ 17. Motor imagery training	Update	17-1. To enhance the recovery of upper limb motor function after a stroke, motor imagery training is recommended in addition to rehabilitation using actual movements, but it can be selectively applied depending on the patient's condition.	Moderate	B
		17-2. To enhance the recovery of upper limb function after a stroke, motor imagery training is recommended in addition to rehabilitation using actual movements, but it can be selectively applied depending on the patient's condition.	Moderate	B
		17-3. To improve the ability to perform daily life activities after stroke, motor imagery training is recommended in addition to rehabilitation using actual movements, but it can be selectively applied depending on the patient's condition.	Moderate	B
KQ 18. Balance training	Update	18. Balance training is recommended for stroke patients with impaired balance, as it can improve balance, gait, and reduce the risk of falls.	Moderate	A
KQ 19. Balance training method	Update	19. Recommended effective balance training methods include trunk training/sitting balance training, task-specific training, and biofeedback using force plates.	Moderate	B
KQ 20. Medication for motor recovery	Update	20-1. Serotonergic agents and Cerebrolysin is recommended for improving motor function in stroke patients, depending on the patient's condition and risk of side effects.	Very low	B
		20-2. Additional research is needed to establish the efficacy of dopamine agonists in improving motor function in stroke patients.	I	

(continued to the next page)

Table 1. (Continued) Summary of recommendations (See **Supplementary Data 1** for a summary in Korean)

KQ	Division	Recommendation	LoE	LoR
KQ 21. Spasticity prevention	Update	21-1. Proper posture, joint exercises, and stretching are recommended for preventing and treating stiffness in stroke patients.	Expert Consensus	
		21-2. Foot braces are recommended when lying down or standing to prevent foot contracture in stroke patients.	Expert Consensus	
KQ 22. Botulinum toxin	Update	22-1. Botulinum toxin injections are recommended for reducing spasticity in stroke patients.	High	A
		22-2. It is recommended to perform splinting or casting in conjunction with botulinum toxin injection therapy for the treatment of contracture in stroke patients, as there are reports that this helps improve contracture due to spasticity.	Very low	B
KQ 23. Medication for spasticity	Update	23-1. Oral administration of tizanidine (LoE: Low), baclofen (LoE: Very low), and dantrolene (LoE: Low) are recommended because they improve clinical muscle tone with a low risk of serious adverse events (LoE: Low).	Low Very low Low	B
		23-2. Benzodiazepines such as diazepam should not be orally administered for controlling spasticity in stroke patients during the recovery phase, except when specifically needed, due to their negative impact on functional recovery.	Low	C
KQ 24. Intrathecal baclofen	New	24. Intrathecal baclofen infusion is recommended for the treatment of severe spasticity that does not respond to conventional spasticity therapy.	Moderate	B

KQ, key question; LoE, level of evidence; LoR, level of recommendation.

*LoR A: strong for recommend; LoR B: conditional for recommend; LoR C: conditional against recommend; LoR D: strong against recommend; LoR I: inconclusive.

Italy (2002) [18], and New Zealand (2003) [19] and on articles published from January 1, 2004 to June 30, 2007. After the distribution of the first edition of the guideline, the need for supplementation was raised as the guideline was used in clinical practice. With the publication of new foreign guidelines for rehabilitation treatment for stroke and related research, the need for periodic revision of the guidelines has become more recognized. Based on five foreign CPGs from Scotland (2010) [20], Australia (2010) [21], Canada (2010) [22], and the United States (2010) [23,24] and on articles published from July 1, 2007 to June 30, 2012, the first edition of “Clinical Practice Guideline for Stroke Rehabilitation in Korea.” was revised and the second edition was published in 2012 [25]. The 3rd “Clinical Practice Guideline for Stroke Rehabilitation in Korea 2016.” was published based on foreign CPGs from Canada (2015) [26] and the United States (2016) [27], as well as research published between July 1st 2012 and June 30th 2016.

After the release of the 3rd edition of the clinical guidelines, the need for a revision of the clinical guidelines from an expert-opinion-based to an evidence-based approach (GRADE) was emphasized. The discussion on this revision took place among the clinical guidelines committee in the planned year of revision, 2020. Subsequently, in this 4th edition, the development approach has been changed from a consensus-based approach to an evidence-based approach using the GRADE method. This change in development method ensures that the guidelines are based on the latest and strongest evidence available, rather than just the opinions of experts. The scope of the previous clinical guidelines was very extensive, making it difficult to revise at once. Therefore, the previous version of the CPG was divided into three parts and updated sequentially: 1) motor/sensory function, 2) non-motor function, 3) other (general, complications, chronic rehabilitation, etc.).

This clinical guideline is a partial (Part 1. Motor Function Rehabilitation) update of the clinical guideline published in 2016, and there are still non-updated recommendations in the previous version of CPG. Regular updates/revisions will be made in the future. As a limitation of this CPG, although the development committee consists only of specialists in rehabilitation medicine, but it is judged that the validity of the recommendation will not be biased because the opinions of experts in other occupations in related fields with interests are collected and reflected. The re-establishment of some key question will be required in a future update, details of which can be found in Other Considerations of that Advisory.

The CPGs systematically summarize the scientific evidence for stroke rehabilitation and provide guidance for medical decision-making. However, while CPGs are developed to help medical decisions based on scientific evidence, they should not be applied uniformly to all patients. The physician must consider the medical condition of the patient and other circumstances before making a final decision. The physicians' medical practices should not be limited or judged based on CPGs.

CONCLUSION

“Clinical Practice Guideline for Stroke Rehabilitation in Korea. Part 1: Rehabilitation for Motor Function (2022)” is the updated 4th edition of the CPG for stroke rehabilitation in Korea. The development approach has been changed from a consensus-based approach to an evidence-based approach using the GRADE method. The change in development method ensures that the guidelines are based on the latest and strongest evidence, rather than just expert opinions, to provide accurate and effective guidance to stroke rehabilitation teams and improve outcomes for stroke patients in Korea.

SUPPLEMENTARY MATERIALS

Supplementary Data 1

Korean version of Clinical Practice Guideline for Stroke Rehabilitation in Korea - Part 1: Rehabilitation for Motor Function (2022) - Summary of recommendations

[Click here to view](#)

Supplementary Data 2

Korean version of Clinical Practice Guideline for Stroke Rehabilitation in Korea. Part 1: Rehabilitation for Motor Function (2022)

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