CASE REPORT

Clinical Case Study on Functional Communication Program with Biomechanical and Rehabilitative Approach for Person with Guillain-Barre Syndrome

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ABSTRACT

Backgrounds: Acute Inflammatory Demyelinating Polyradiculopathy (AIDP), also known as Guillain-Barre syndrome (GBS), is a condition that can affect anyone, causing muscle weakness, discomfort, and paralysis. Occupational therapy intervention aims to enhance communication abilities and overall quality of life for GBS patients.

Objective: This study aims to enhance functional communication in Guillain-Barre Syndrome patients through occupational therapy interventions

Methods: The participant in the study is a 45-year-old man with GBS who struggles with functional communication activities using tablets. Instruments used to measure progress include the Canadian Occupational Performance Measure (COPM), Range of Motion (ROM), and Manual Muscle Testing (MMT), as well as analysing Occupational Performances Area (OPA) and Occupational Performances Component (OPC) abilities.

Result: Occupational therapists developed interventions based on assessment results, which led to significant improvements in range of motion and muscle strength in the upper extremities. The participants' performance in using tablets also improved after the intervention, with an increase in both performance and satisfaction scores. The study showed a clear link between the importance of tablet use, patient performance, and satisfaction levels, with significant improvements seen after the occupational therapy intervention

Conclusion: The biomechanical frame of reference was effective in improving range of motion and muscle strength in GBS patients. This resulted in significant increases in ROM and muscle strength in both upper extremities. Additionally, the COPM examination showed improvements in patient performance and satisfaction, indicating the potential for increased independence in daily activities with the help of the rehabilitative frame of reference.

Keywords: Occupational Therapy, Frame of References, Guillain Barre Syndrome, Communication, Case Report

ABSTRAK

Latar Belakang: Acute Inflammatory Demyelinating Polyradiculopathy (AIDP), atau sindrom Guillain-Barre (GBS), adalah suatu kondisi yang dapat menyerang siapa saja, menyebabkan kelemahan otot, ketidaknyamanan, dan kelumpuhan. Intervensi terapi okupasi bertujuan untuk meningkatkan kemampuan komunikasi dan kualitas hidup secara keseluruhan bagi pasien GBS.

Tujuan: Penelitian ini bertujuan untuk meningkatkan komunikasi fungsional pada pasien Sindrom Guillain-Barre melalui intervensi terapi okupasi

Metode: Partisipan dalam penelitian ini adalah pria berusia 45 tahun dengan GBS yang berjuang dengan aktivitas komunikasi fungsional menggunakan tablet. Instrumen yang digunakan untuk mengukur kemajuan meliputi Canadian Occupational Performance Measure (COPM), Range of Motion (ROM), dan Manual Muscle Testing (MMT), serta menganalisis kemampuan Occupational Performances Area (OPA) dan Occupational Performances Component (OPC).

Hasil: Terapis okupasi mengembangkan intervensi berdasarkan hasil penilaian, yang menghasilkan peningkatan signifikan dalam rentang gerak dan kekuatan otot pada ekstremitas atas. Performa partisipan dalam menggunakan tablet juga meningkat setelah intervensi, dengan peningkatan skor performa dan kepuasan. Studi menunjukkan hubungan yang jelas antara pentingnya penggunaan tablet, performa pasien, dan tingkat kepuasan, dengan peningkatan signifikan terlihat setelah intervensi terapi okupasi

Kesimpulan: Kerangka acuan biomekanik efektif dalam meningkatkan rentang gerak dan kekuatan otot pada pasien GBS. Hal ini menghasilkan peningkatan signifikan dalam ROM dan kekuatan otot di kedua ekstremitas atas. Selain itu, pemeriksaan COPM menunjukkan peningkatan performa dan kepuasan pasien, yang menunjukkan potensi peningkatan kemandirian dalam aktivitas sehari-hari dengan bantuan kerangka acuan rehabilitatif.

Kata Kunci: Terapi Okupasi, Kerangka Acuan, Sindrom Guillain Barre, Komunikasi, Laporan Kasus

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INTRODUCTION

Acute Inflammatory Demyelinating Polyradiculopathy (AIDP), commonly known as Guillain-Barre syndrome (GBS), can affect anyone at any moment in life, whether they are male or female, young or elderly (American Association of Neuromuscular & Electrodiagnostic Medicine, Access on February 26, 2023). Signal transmission is made more complicated by nerve injury. Because of this, it is challenging for the muscles to react to impulses from the brain (Singh et al., 2016). GBS affects the myelin sheath that protects nerve axons, resulting in widespread muscular weakness, discomfort, and paralysis (Machiko R. Tomita; Kathryn Buckner; Sumandeep Saharan; Kimberley Persons; Sheng Hui

Liao, 2016). GBS occurs more frequently as people age, with an estimated 4 cases per 100,000 people over the age of 75 (Pithadia & Kakadia, 2010). There is no specific information available regarding the number of GBS patients in Indonesia, although research from Cipto Mangunkusumo Hospital (RSCM) in Jakarta has shown that at the end of 2010–2011, there were 48 incidences of GBS in a calendar year, with varying numbers of cases by month. At RSCM, GBS cases increased by about 10% in 2012 (Kompas.com, Access on February 26, 2023,.). Within a year, 50% of GBS patients resume their normal health. Yet, a third of those who have GBS continue to have muscle weakness even after three years (American Association of Neuromuscular & Electrodiagnostic Medicine, Access on February 26, 2023).

Many GBS patients can recover after receiving therapy, even to the point of being able to walk on their own. Yet even 3 to 6 years after the onset of GBS symptoms, some individuals continue to have poor effects on activities of daily living (ADL) and have anomalies in muscle function. To improve their chances of becoming independent, GBS sufferers must receive rehabilitation care. the improvement of muscle power, range of motion, and endurance in the domain of activity of daily living (ADL)(Kim et al., 2011). In cases with GBS, occupational therapy contributes to the rehabilitation process. The activity of Daily Living (ADL), which includes Instrumental Activity of Daily Living (IADL), Productivity, and Relaxation, are three areas of Occupational Performance Area (OPA) that occupational therapy targets to help patients regain their highest level of independence.

With their unique frame of reference, such as biomechanics and rehabilitative, occupational therapy can enhance the performance of GBS patients. To improve muscular strength, joint range of motion, and patient endurance during activity, a biomechanics frame of reference is used. The Rehabilitative Frame of Reference, on the other hand, is utilized to assist GBS patients in regaining their prior capacities—physically, psychologically, socially, professionally, and financially—that is appropriate for a person with their resources (Cole M & Tufano, 2008). Communication activities are one of the IADL challenges that GBS patients encounter. The process of understanding and sharing meaning is defined as communication (Pearson, 2000). People now communicate using communication tools or gadgets such as cell phones, computers, and tablets that are internet-enabled, allowing them to use e-mail, chatrooms, or video calls for faster communication (Drago, 2015). People with physical disabilities frequently are unable to use mobile phones because the devices lack the necessary accessibility features. More than one billion people, or 15% of the global population, have physical disabilities that limit their ability to use modern communication devices such as cell phones, computers, laptops, or tablets (Itu, 2012). Communication with family members can boost a patient's motivation to recover (Abascal & Civit, Access on February 26, 2023.). The use of accessible communication tools for GBS patients can enable patients to communicate independently with friends, family, relatives, or caregivers (Kane et al., 2009). The purpose of this study is to see an improvement in the ability of patients with Guillain-Barre Syndrome in functional communication activities with occupational therapy interventions using the Biomechanical and Rehabilitative reference framework.

CASE DESCRIPTION

This study investigates the improvement of the ability of patients with Guillain-Barre Syndrome in functional communication activities with occupational therapy interventions using Biomechanical and Rehabilitative frames of reference.

Occupational therapists carry out several assessments to determine the participants' functional abilities. The assessment was completed during the first meeting with the occupational therapist and was reassessed using the same measuring instrument so that the changes could be seen or evaluated. We conducted occupational therapy interventions for participants, what we did was provide physical exercise and made modifications tools so that participants could easily carry out functional communication activities using tablets. The intervention we carried out aims to be able to carry out functional communication activities in the form of using tablets independently. We divide the stages to make it easier to achieve these goals. First, we aim for participants to be able to position their hands on the base of the modification tool independently. Second, participants were able to position their palms in front of the tablet screen independently. Third, participants were able to press the tablet button and type on the tablet screen independently. Fourth, participants can use modification tools independently. We also apply the principles of energy conservation and ergonomics. We do passive stretching for participants at each meeting to increase muscle strength, range of motion, and endurance. In addition, we offer training in the form of positioning and simulation to enable participant to use tablets.

PARTICIPANTS

The participant in this study was a 45-year-old man who worked as an employee. Because of Guillain-Barre Syndrome (GBS) for seven months, he was unable to move all four of his extremities and was referred to the Occupational Therapy division in Pertamina Central Hospital, Jakarta.

Participants were diagnosed with GBS in July 2018, currently, participants have difficulty in functional communication activities by using gadgets (tablets) to communicate with family, relatives, and co-workers. Patients need the help of others for functional communication activities. The patient feels that his muscle strength is weak, so the patient has difficulty communicating, namely when using gadgets (tablets). Currently, the participant is still working via e-mail, the participant's family does not live in the same city where the participant is being cared for, therefore the participant needs to use communication tools to stay connected with his family and be able to do his work online using tablets.

INSTRUMENTS

We used several instruments to comprehensively assess the participant's occupational performance and identify areas of intervention, the following standardized instruments and theoretical frameworks were utilized:

1. Canadian Occupational Performance Measure (COPM)

The COPM is a client-centered outcome measure designed to identify and evaluate self-perceived performance and satisfaction in occupational tasks across the domains of self-care, productivity, and leisure (Law et al., 1990). The participant identified functional communication using a tablet as a primary goal. During the initial COPM assessment, the participant reported a performance score of 18 and a satisfaction score of 27, indicating notable dissatisfaction and limited perceived competence in completing the task independently. The COPM facilitated the identification of meaningful goals and provided a baseline for measuring outcomes of the intervention.

2. Manual Muscle Testing (MMT)

MMT is a standardized method for evaluating muscle strength using a grading scale ranging from 0 (no muscle activation) to 5 (normal strength) (Kendall et al., 2005). This assessment focused on the

upper extremities, particularly muscle groups responsible for fine motor control and device manipulation, such as wrist extensors, finger flexors, and shoulder stabilizers. The results confirmed the participant's reported weakness and provided objective data to guide therapeutic exercises.

3. Range of Motion (ROM) Assessment

ROM measurement evaluates the functional mobility of joints either actively or passively. This assessment was conducted to determine any limitations in joint flexibility that might impede the participant's ability to position and use a tablet effectively. Preserving or improving ROM was essential to ensure accessibility to communication tools and to reduce the risk of secondary complications such as joint contractures.

4. Occupational Performance Area (OPA) and Occupational Performance Component (OPC) Model

The OPA-OPC model offers a structured approach to analyze and address occupational performance by delineating areas of occupational engagement (e.g., self-care, productivity, leisure) and their underlying performance components (e.g., physical, cognitive, psychosocial, environmental). In this case, the target OPA was productivity, specifically work and communication via digital devices, while the relevant OPCs included motor performance (muscle strength and range of motion) and cognitive abilities (attention, task planning, and sequencing). The integration of this model enabled the therapist to formulate a targeted, client-centered intervention plan by addressing both the activity demands and the contributing components.

In summary, a multidimensional assessment strategy integrating COPM, MMT, ROM, and the OPA-OPC framework facilitated a comprehensive understanding of the participant's functional limitations, priorities, and therapeutic needs. We conducted an initial examination on the participants, the examinations carried out included: Canadian Occupational Performance Measure (COPM) for the main activity to be carried out in the form of functional communication, namely using gadgets (tablets) with a performance score of 18 and a satisfaction score of 27 (Table 3), Manual Muscle Test (Table 2) and Range of Motion (Table 1)

RESULT

The participant is still dependent on others in most Activity Daily Living (ADL) subcomponents, like grooming, hygiene oral, bathing, dressing, eating, drinking, functional mobility, functional communication, and transportation. Because social interaction activities do not require ROM or muscle strength, participants can be independent. Participant can communicate effectively face to face with others in social interactions. Using tablets, patients can communicate with their families who are in different cities while receiving treatment. The video call feature allows them to connect with their loved ones, helping to ease their feelings of longing and providing motivation to continue with their treatment. Patients, on the other hand, have difficulties with functional communication activities, such as using gadgets (tablets), because these gadgets require ROM and muscle strength to operate (tablets). Patients rely on caregivers for functional communication activities during this time. Participants need functional communication activities, namely the use of gadgets (tablets) to communicate with family, relatives and co-workers who live far from them. Occupational therapists create interventions for participants after having assessment results.

Based on the occupational therapy assessment, the participant remained dependent on others for the majority of Activities of Daily Living (ADL) subcomponents, including grooming, oral hygiene, bathing, dressing, eating, drinking, functional mobility, functional communication, and transportation. The evaluation of these functional domains utilized the Activity Daily Living (ADL) trait-based measurement, which systematically examines performance in essential self-care activities, highlighting the participant's current level of independence and areas requiring assistance.

Despite severe limitations in physical function due to reduced Range of Motion (ROM) and muscle strength, the participant was capable of engaging independently in social interaction when conducted face-to-face, as such interactions primarily rely on verbal and cognitive abilities rather than physical movement. However, when social interaction required the use of assistive technology—specifically tablets—the participant faced significant challenges. These challenges stemmed from the motor demands of operating such devices, which include precise finger and wrist movements that require adequate ROM and muscular control. Consequently, the participant relied heavily on caregivers for assistance with functional communication tasks involving the use of tablets. In the context of prolonged hospitalization and separation from family members living in other cities, digital devices such as tablets have emerged as critical communication media. These devices support audio-visual communication through platforms that allow video calls, enabling patients to maintain emotional connections with their families and social networks. For the participant, the ability to see and speak with loved ones not only alleviated feelings of isolation and longing but also served as a source of psychological support and motivation during the rehabilitation process.

Thus, although the physical operation of the device was impaired, the functional value of the tablet as a communication medium remained high. It became the focal point of occupational therapy goals, with interventions designed to restore partial independence in its use.

The occupational therapist formulated intervention strategies based on the ADL assessment results and prioritized improving functional communication through graded therapeutic activities. These interventions were aimed at enhancing fine motor control and endurance to support independent gadget use and ultimately increase the participant's autonomy and quality of life.

According to table 1, there was a significant change in the range of motion of the right upper extremity joints after OT intervention, with a maximum change of 140°. Similarly, the range of motion of the left upper limb joint changed significantly, with a maximum change of 130°. Table 2 shows the results of MMT assessments from the first one on February 8, 2019, to the last one on May 15, 2019.

Table 1. Degree of Change Range of Motion in Upper Extremities

Upper Extremities	*Pre – Active Range of Motion*		*Post – Active Range of Motion*		Degree of Change *(Post – Pre)*	
	Dextra	*Sinistra*	*Dextra*	*Sinistra*	*Dextra*	*Sinistra*
Shoulder Flexion	50°	50°	130°	130°	80°	80°
Extension	10°	10°	40°	40°	30°	30°
Adduction	10°	10°	40°	40°	30°	30°
Abduction	50°	50°	130°	130°	80°	80°
Elbow Flexion	10°	10°	150°	140°	140°	130°
Forearm Pronation	20°	20°	80°	70°	60°	50°
Supination	20°	20°	80°	80°	60°	60°
Wrist Flexion	10°	10°	50°	40°	40°	30°
Extension	10°	10°	60°	50°	50°	40°
Thumb Flexion	10°	0°	60°	50°	50°	50°
Extension	10°	0°	60°	50°	50°	50°
Abduction	10°	0°	60°	50°	50°	50°
Finger 2 Flexion	10°	0°	50°	40°	40°	40°
Extension	0°	0°	30°	30°	30°	30°
Abduction	0°	0°	30°	20°	30°	20°

ROM assessment that was carried out for the first time on February 8, 2019, until the last assessment on May 15, 2019

Table 2. Score **of Change Manual Muscle Testing in Upper Extremities**

Upper Extremities	*Pre – Active Range of Motion*		*Post – Active Range of Motion*		Score of Change *(Post – Pre)*	
	Dextra	*Sinistra*	*Dextra*	*Sinistra*	*Dextra*	*Sinistra*
Shoulder Flexion	2+	2+	4-	4-	+4	+4
Extension	2+	2+	4-	4-	+4	+4
Adduction	2+	2+	4-	4-	+4	+4
Abduction	2+	2+	4-	4-	+4	+4
Elbow Flexion	1	1	4-	4-	+8	+8
Extension	1	1	4-	4-	+8	+8
Forearm Pronation	1	1	4-	4-	+8	+8
Supination	1	1	4-	4-	+8	+8
Wrist Flexion	1	1	4-	4-	+8	+8
Extension	1	1	4-	4-	+8	+8
Thumb Flexion	2-	2-	4-	4-	+6	+6
Extension	2-	2-	4-	4-	+6	+6
Adduction	2-	2-	4-	4-	+6	+6
Finger 2 Flexion	2-	2-	4-	4-	+6	+6
Extension	2-	2-	4-	4-	+6	+6
Adduction	2-	2-	4-	4-	+6	+6

According to table 2, there was a significant change in muscle strength of the right upper extremity, with a maximum score change of +8. Similarly, the muscle strength of the left upper extremity changed significantly, with a maximum score change of +8. In the assessment using COPM, we found an increase in performance scale and satisfaction in functional communication activities using gadgets (tablets) as shown in table 3. In table 4, it is possible to conclude that there is a relation between the importance of tablet use and patient performance. The initial examination resulted in a score of 54 points. There was a change in the results to 72 points after the OT intervention. Similarly, there is a relation between the importance of tablet use and patient satisfaction. The initial examination yielded a satisfaction level of 54 points. The patient satisfaction level increased to 81 points after the OT intervention. The increase in these points indicates a significant improvement in tablet performance and patient satisfaction.

Table 3: Result of Assessment and Reassessment of COPM

		First Assessment: February 8, 2019		Re Assessment: May 9, 2019	
Problem *Occupational Performance* (A)	Importance (B)	Performance (C)	Satisfaction (D)	Performance (E)	Satisfaction (F)
Using tablet	9	6	6	8	9

Tabel 4. Evaluation Results with the COPM Instrument

No.	Problem (A)	Importance (B)	*Pre – Intervention*		*Post – Intervention*	
1.	Using tablet	9	Performance(C) 6	Satisfaction (D) 6	Performance(E) 8	Satisfaction(F) 9
			B x C (G) 54	B x D (H) 54	B x E (I) 72	B x F (J) 81
	Score Performance				Scire Satisfaction	
Pre – Intervention (K)		GA = 54		*Pre – Intervention* (M)		HA = 54
Post – Intervention (L)		IA = 72		*Post – Intervention* (N)		JA = 81
Change of Performance (L – K)		18		Change of Satisfaction (N – M)		27

DISCUSSION

After OT intervention using a biomechanical frame of reference, patients with GBS of the Acute Inflammatory Demyelinating Polyradiculoneuropathy (AIDP) type had significant changes in range of motion and muscle strength. Patients with GBS of the Acute Motor type experienced an increase in joint range of

motion and muscle strength after OT intervention using a Biomechanical frame of reference (Khanzada & Zameer, 2016). However, in the authors study, the changes in range of motion and muscle strength were greater than the results of the intervention performed by Khazanda and Zameer. This is because the patients who were intervention by Khazanda and Zameer had sensory issues. Addressing sensory issues creates a more stable and predictable internal and external environment for the individual.

This foundation of sensory comfort and clarity allows them to process information more effectively, regulate their emotions, engage more fully with their surroundings, and ultimately, communicate more clearly and confidently. Improvement in sensory processing plays a crucial role in supporting effective communication, particularly among individuals with neurological conditions such as Guillain-Barré Syndrome (GBS). Sensory integration refers to the brain's ability to organize and interpret sensory input from the body and the environment in a meaningful way. Individuals with sensory processing challenges may experience either hypersensitivity or hyposensitivity, which can lead to difficulties in attention, emotional regulation, and motor planning—all of which are foundational to successful communication.

Addressing sensory issues contributes to creating a more stable and predictable internal and external environment for the individual. When sensory input is modulated effectively, it allows for greater sensory comfort and clarity, which reduces distractibility and anxiety. This stability supports cognitive functioning by facilitating more accurate information processing, which in turn enhances the individual's capacity to organize thoughts and articulate them effectively. Furthermore, improved sensory regulation contributes to better emotional self-regulation, enabling individuals to participate in communication exchanges with greater composure and social reciprocity.

In individuals recovering from GBS—particularly those with overlapping sensory impairments—interventions that address sensory challenges can lead to noticeable improvements in the clarity, confidence, and frequency of communication. For instance, tactile or proprioceptive sensory deficits may impair the ability to manipulate communication tools such as tablets or keyboards, thereby limiting functional communication. By integrating sensory-based occupational therapy interventions, individuals become more tolerant of stimuli, more engaged in their surroundings, and more capable of using assistive technologies to communicate with others. This enhanced capacity ultimately promotes functional independence and social participation, which are central goals in occupational therapy.

This study demonstrates that the combined application of the Biomechanical and Rehabilitative frames of reference in occupational therapy interventions significantly enhances the ability of individuals with Guillain-Barré Syndrome to participate in functional communication activities. Improvements in muscle strength, joint range of motion, and postural control—achieved through biomechanical interventions—enabled patients to physically engage with communication tools such as tablets and keyboards. Concurrently, the rehabilitative approach, which focuses on compensatory strategies and the use of adaptive devices, allowed patients to overcome residual motor limitations and utilize assistive technologies effectively.

This dual-framework intervention facilitated independence in communication by improving both physical function and environmental accessibility. As a result,

participants in this study were able to communicate more clearly, confidently, and frequently with others, including family members and caregivers, thereby promoting not only functional independence but also enhancing quality of life and social participation. These findings underscore the importance of integrating restorative and adaptive approaches in OT practice for individuals recovering from GBS, particularly in domains requiring fine motor coordination and sustained engagement, such as communication.

The findings of this study also showed that patients could carry out functional communication activities, such as the use of gadgets (tablets), independently after OT interventions were done using the Rehabilitative frame of reference. Although the activities are not similar, OT interventions using a rehabilitative frame of reference can enable patients with GBS to carry out daily activities such as eating and brushing their teeth independently using modified tools such as modified spoons and universal toothbrush cuffs (Khanzada FJ & Zameer S, 2016). As a result, it can be concluded that the use of rehabilitative frames of reference such as modification aids or tool adaptation can assist GBS patients in carrying out daily activities independently.

A clinically meaningful change in the COPM examination is a difference in score of 2 points between the initial intervention and the final intervention (Peny-Dahlstrand et al., 2020). Changes in participant performance scores changed by 2 points, while changes in participant satisfaction scores changed by 3 points in this study. As a result, it is concluded that participants in this study experienced significant changes in performance and satisfaction in functional communication activities, specifically the use of gadgets (tablets). Based on this, OT interventions based on the Biomechanical and Rehabilitative frame of reference are appropriate for GBS patients. These OT interventions can assist patients in achieving the functional ability to carry out daily activities independently.

Study Limitations

There are several limitations to this study. First, the patient's internal resistance occurred during the intervention process when he did not come for therapy several times in mid-February because his body was not fit due to the flu and fever he was experiencing. After the patient's condition has improved, the patient returns to therapy; however, the training load given cannot be as planned because the patient's condition is not completely fit and the patient easily becomes tired. Second, external obstacles encountered during the intervention process included patients returning to their hometown earlier than expected. Previously, the patient stated that he would return to his hometown near the day of Eid. However, it turned out that the patient had to go back to his hometown more quickly than anticipated.

CONCLUSION

The biomechanical frame of reference can help GBS patients in increasing their range of motion and muscle strength. ROM increased to a maximum of 140° in the right upper extremity and 130° in the left upper extremity. Maximal muscle strength values increased by +8 points in the right upper limb and +8 points in the left upper limb. The COPM examination resulted in a +2-point increase in patient performance and a 3-point increase in patient satisfaction. The Rehabilitative frame of reference can then help GBS patients in carrying out their daily activities independently.

Declaration of Conflicting Interests:

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Ethical Approval: Due to student internship activities between the Occupational Therapy Study Program, Vocational Program of the University Indonesia, and the Pertamina Central Hospital in Jakarta, ethical approval was waived for this study.

Author Contributions: GW researched the literature and conceived the study, and RSNA designed the treatment program. Both RSNA and CAT were involved in protocol development, gaining ethical approval. RSNA and CAT conducted patient recruitment and interventions. RSNA was involved in the data analysis. GW wrote the first draft of the manuscript, and MHS further improved the draft for submission. All authors reviewed and edited the manuscript and approved the final version of the manuscript.

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INFORMED CONSENT

All subjects were informed of the study's risks and benefits, and written informed consent was obtained; the participation of subjects was voluntary, and their identity would not be disclosed. The research data was only accessible and handled by the authors, who followed guidelines for keeping data confidential, encrypted, and secured.

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