



Review Article

Analysis of Research Trends in Korean Medicine Treatment for Guillain-Barre Syndrome in Korea

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ABSTRACT

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This review aimed to analyze Korean medicine treatment (KMT) methods used for Guillain-Barre syndrome (GBS) in studies from January 1, 2010, to December 21, 2021. Five online databases (KISS, SCIENCEON, DBpia, RISS, KMBase) were searched for GBS-related studies. A total of 14 case reports were selected. Various treatment methods for GBS such as acupuncture, herbal medicine, moxibustion, and cupping have been reported, and some included Western medication. Herbal medicine and acupuncture were the most frequently used treatment methods. The most common prescription for GBS was Shipjeondaebotang Gami, the most common herb used was Glycyrrhizae radix et rhizome, and the most common acupoints were ST36, LI11, TE5, and LI4. In moxibustion treatment for GBS, CV4 was commonly used, and in cupping treatment the low back and back-shu points and were mostly used. Further studies on Korean medicine treatment of GBS are necessary for standardization of treatment.

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Introduction

Guillain-Barre syndrome (GBS) causes inflammatory demyelination and axonal degeneration, which is an autoimmune peripheral polyneuropathy characterized by elevated protein levels and normal cell counts in the cerebrospinal fluid [1]. The incidence of GBS has been reported to be 0.6–4 per 100,000 people worldwide [2], and the incidence in women is reported to be 1.5 times higher than in men [3]. The GBS is commonly preceded by a viral infection before symptoms begin, and it has been reported that various other factors including surgery, vaccination or bacterial infections precede GBS [4]. Symptoms of GBS occur in one or more limbs and are characterized by upward paralysis and a decrease

in deep tendon reflex (DTR). Most of the paralysis is symmetrical. In addition, there are typically complaints of numbness, abnormal sensation, facial paralysis, difficulty breathing, and autonomic nervous system symptoms such as tachycardia, arrhythmia, high blood pressure, and low blood pressure [4]. Generally, symptoms peak within 2–4 weeks of onset, then recovery begins [4]. Recovery may progress slowly over several months, and most patients fully recover functionally [4]. However, 5–8% of patients with GBS die from complications such as respiratory failure, and 15–25% have sequelae such as the need for assisted walking a year after the first symptoms [1,5]. The typical Western medical treatment for GBS is the administration of intravenous high-dose immune globulins (IVIG) and plasmapheresis, and other treatments are performed

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according to the symptoms [6]. Despite administration of IVIG and plasmapheresis, nearly 20% of patients have sequelae [5], and there are no clear treatment method other than physiotherapy, occupational therapy, and speech and language therapy. In addition, IVIG and plasmapheresis can cause headaches, nausea, and vomiting [7]. Therefore, it is necessary to study treatment methods other than IVIG and plasmapheresis.

In Korea, the incidence of GBS increased by 45.2% from 648 to 941 between 2010 and 2016, and the incidence significantly increased in most age groups with the exception of those under the age of 20 [8]. There have been several reports of Korean medicine treatment (KMT) being administered to patients with GBS in Korea [9], but most are almost limited to case reports. A study on the latest trends in KMT for GBS has not yet been conducted. Therefore, in this study, we report on the efficacy and safety and various KMTs for GBS by analyzing publications from 2010 to 2021.

Materials and Methods

Search strategy

A comprehensive literature search was conducted for studies that applied KMT to treat GBS from January 1, 2010, to December 31, 2021, using five Korean databases [Korean studies Information Service System (KISS), SCIENCEON, Data Base Periodical Information Academic (DBpia), Research Information Sharing Service (RISS), Korean Medical Database (KMBase)]. The search terms used were “Guillain-Barre Syndrome” or “GBS,” and “Acupuncture” or “Korean Medicine.” Similar words, such as “Korean medicine treatment” and “Oriental Medicine” were also searched. Search terms and formulas were modified and combined according to the characteristics of the database.

Search methods

This review included all studies that used KMT for patients with GBS regardless of the patient’s gender / sex, age, or race. Patients

who had been clinically diagnosed with GBS or received treatment for GBS by doctors were selected, and patients suspected of having GBS were excluded. Only randomized controlled clinical studies and studies with case reports were included. Relevant literature published from January 1, 2010, to December 31, 2021 were retrieved. The title and abstract were used to screen the studies that contained information on GBS treatment. There were 116 duplicate studies which were excluded from a total of 332 retrieved articles. Of the 216 remaining studies, 201 were not related to KMT and one did not include information on GBS. Finally, 14 studies were selected for this review. Among the 14 selected studies, treatments performed to treat the patient’s underlying diseases, such as hypertension, or diabetes i.e., symptoms other than those caused by GBS, were excluded from the analysis (Fig. 1).

Data analysis

The year of publication, complaints and symptoms, treatment, and evaluation for each study were summarized.

Results

Publication trends

A total of 14 studies were selected, all of which were case reports [10–23]. The studies were published in the Journal of Korean Oriental Internal Medicine ($n = 7$); Journal of Korean Acupuncture and Moxibustion Society ($n = 1$); Journal of Korean Medicine Rehabilitation ($n = 2$); Journal of Korea CHUNA Manual Medicine for Spine & Nerves ($n = 1$); Research Institute of Korean Medicine, Taejon University ($n = 1$); Journal of the Society of Stroke on Korean Medicine ($n = 1$), and the Journal Sasang Constitutional Medicine ($n = 1$).

Year of publication

Studies on KMT for GBS were reported annually since 2011, except for 2012–2013 (Fig. 2).

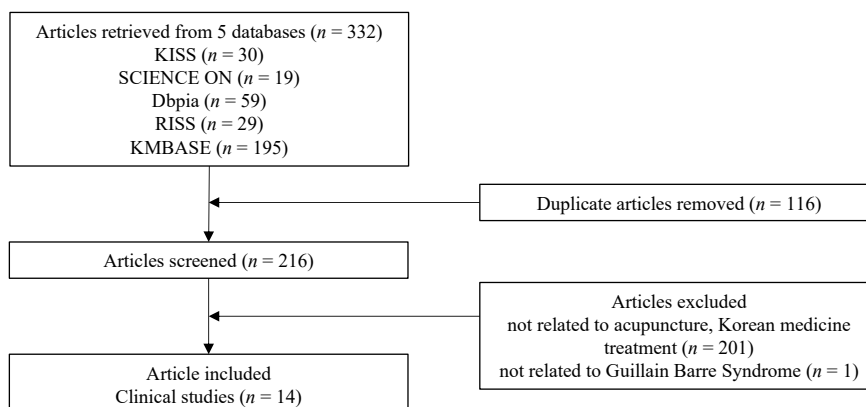


Fig. 1. Flow chart of the study selection process.

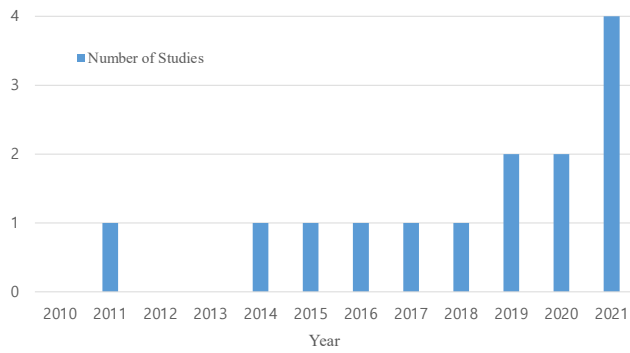


Fig. 2. Analysis of publication year.

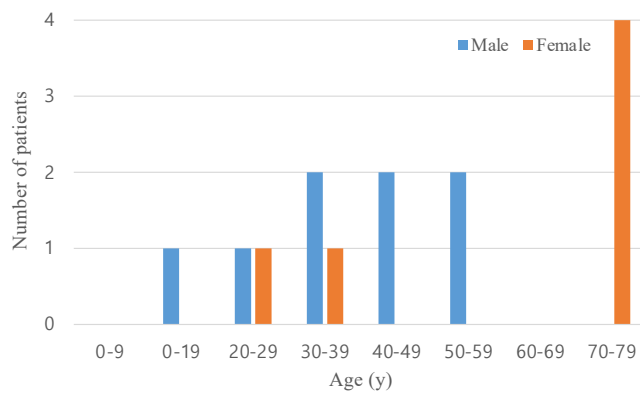


Fig. 3. Age and sex distribution.

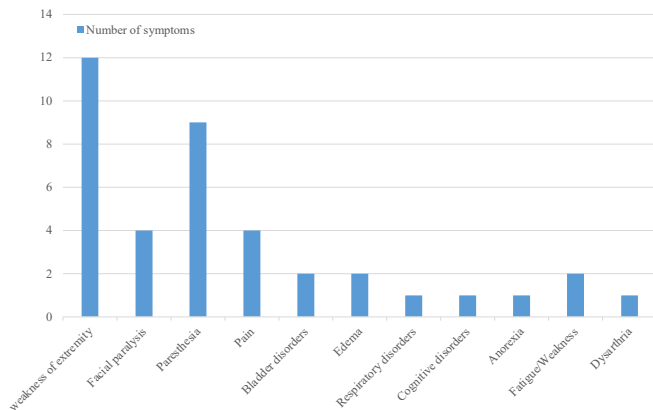


Fig. 4. Analysis of chief complaint.

Analysis of sample data

A total of 14 studies reported one case each: eight males and six females (Fig. 3). Patient complaints were extracted in duplicate based on the chief complaint as described in the study. Symptoms were compiled in the order of weakness of extremities ($n = 12$), numbness or paresthesia ($n = 10$), facial paralysis ($n = 4$), and pain ($n = 4$; Fig. 4; Table 1).

Acupuncture

In the 14 studies reviewed, acupuncture treatment was performed once or twice a day. There were 13 studies using a single size needle, four studies using 0.20×30 mm [12,16,17,22], three studies using 0.25×40 mm [10,18,19], four studies using 0.25×30 mm [13,15,21,23], one study using 0.30×30 mm [14], and one study using 0.30×40 mm [20]. In one study [11], two different sizes of needles, 0.20×30 mm and 0.25×30 mm, were used. Acupuncture treatment time was 15–20 minutes in all studies, except in two studies [15,18], where the treatment time was not specified. The period of acupuncture treatment ranged from a minimum of 14 days to a maximum of 118 days. The most frequently used acupoints were ST36 ($n = 10$), LI11 ($n = 9$), TE5 ($n = 8$), LI4 ($n = 7$). The most frequently used meridian systems were the large intestine meridian ($n = 27$) and stomach meridian ($n = 27$). The frequency of acupuncture treatment was not counted in duplicate in the same case regardless of the type of acupuncture (manual acupuncture, electroacupuncture, or pharmacopuncture). Pharmacopuncture was used in five studies [10,12,15,17,18]. Hominis placenta pharmacopuncture was used in three studies [10,15,16], jungsongouhyul pharmacopuncture was used in two studies [10,12], and Shinbaro pharmacopuncture [18], snake venom toxin pharmacopuncture [17], and sweet bee venom (BV) [12] were used in one study each. The acupoints most frequently used were in areas with complaints of weakness and pain.

Herbal medicine

Complex herbal medicine treatment was used in all 14 studies. Medical decoction was used in 13 studies, and in one study [11], extract product (squeeze-type insurance product) was used. A total of 21 complex herbal medicines were used in the 14 studies. Both decoctions and extract products were administered three times a day. Shipjeondaebotang Gami ($n = 4$) was used in four studies [10,12,16,22] and Bojungikgitang Gami was used in two studies [13,21]. Herbal medicine complex prescriptions and herbal medicines that were used to treat symptoms other than GBS symptoms were excluded. Similarly, when herbal medicines were added based on the same prescription and subsequently administered, the prescription was not calculated as a duplicate.

Herbs used in complex prescription

A total of 85 herbal medicines were used for the prescription: Glycyrrhizae radix et rhizoma ($n = 16$), Angelicae gigantis radix ($n = 14$), Paeoniae radix alba ($n = 12$), Ligustici rhizoma ($n = 11$), and Poria sclerotium ($n = 10$).

Western medicine treatment

All 14 patients were diagnosed and underwent Western medical treatment before receiving KMT, of which 2 studies [14,21] did not describe the types of Western medicine. The most frequently performed Western medical treatment was IVIG ($n = 11$) [10–13,15–20,22]. In four studies [11,18,19,23], steroids were taken

Table 1. Symptoms, Treatment, and Evaluation Summary of the 14 Case Reports Included in this Review.

Author(s) [ref]	Gender/ Sex	Treatment period (d)	Symptoms	Treatment	Treatment site	Evaluation	Result / Score
Heo (2021) [10]	M/52	118	Quadriplegia	Manual acupuncture	GV20, GB20, TE5, GB34, SP9, ST38, GB39, SP6, EX-UE9, EX-LE10, EX-UE11, EC-LE12	MMT	Shoulder (elevation) 4/4 → 4+/4, (abduction, adduction) 3+/3+ → 4/4 Elbow (flexion) 3/3 → 4/4 Wrist (extension) 3/3 → 3+/3+ Hip (flexion) 2/2 → 3+/4, (abduction, adduction) 2-/2- → 3+/3+ Knee (extension) 1/1 → 3-/3 Ankle (dorsiflexion, Plantar flexion) 0/0 → 2-/2- Toe (extension) 0/0 → 1/1
Won (2021) [11]	F/25	20	Quadriplegia, facial numbness of the extremities, headache, paresthesia	Electroacupuncture Pharmacopuncture - banjungsangju pharmacopuncture / 2-4 cc - jungsoongduhyul pharmacopuncture / 2-4 cc Moxibustion (indirect) Rehabilitation bicycle, standing balance training, quadruped walking, strength training, ambulation exercise, manual therapy Herbal Medicine -- GamisShippjontang, GamisSamultang, GamisSamultang + Sosikcheongwoollang	L14, LI11, ST36, LR3 - LI11, LI14, TE5, GB34, ST36, SP9, ST38, GB39, SP6, LR3, EX-B - Back-shu points, hypoc check points CV4, CV1, BL64	Ambulation state Independent walking speed	0.23 m/s (no loading) → 0.51 m/s (with 3kg loading)
Choi (2021) [12]	E/37	51	Facial paralysis, numbness of bilateral limbs, paresthesia of the sphincter	Manual acupuncture Western medicine- prednisolone 5 mg, ibuprofen 400 mg, acetaminophen 650 mg, nortriptyline HCl 1.4 mg, uricosylsulfate 100 mg, dexlansoprazole 30 mg, paracetamol 80 mg, sodium hyaluronate 1 mg Manual acupuncture Pharmacopuncture - banjungsangju (1:10, 000)/1 cc - jungsoongduhyul pharmacopuncture / 0.6 cc Moxibustion (indirect) Cupping (not bleeding) Physical therapy - ICF, MW - ES1	BL2, TE23, ST3, CV24, LI20, GV20, TE5, LI4, HT7, GB39 Neck and lumbar ashi-points Right ST4, ST06, LI10, GB39 Both ST6, ST3, TE5, LI4, LI10, and HT7 Neck and lumbar ashi-point, back-shu points Face - Neck and lumbar ashi-points - Face CV4 Back Back Both sides of the forearms and lower limbs	MMT K-MBI Y-score NRS Y-score NRS NRS EQ-5D-5L	Shoulder, elbow, finger, ankle 4/4 → 4+/4+ Hip, knee 4+/4+ → 4+/4+ 92 → 98 31 → 36 Headache 6 → 2 Neck and back pain 6 → 1 22 → 40 Numbness in fingers 6 → 0 Numbness in toes 7 → 0
Ahn (2020) [13]	E/79	64	Quadriplegia, numbness of upper and lower limbs, cognitive disorder, anorexia	Manual acupuncture Electroacupuncture Moxibustion (indirect) Cupping (not bleeding) Physical therapy- electrotherapy Tilt training, mat training, occupational therapy, ADL therapy Herbal medicine- gambujosungkiptalung	GV20, CV24, LI4, TE5, LI11, GB34, SP9, SP6, HT7 LI10, GB39 CV4 Back-shu points Unknown Herbal medicine- gambujosungkiptalung	MMT K-MMSE MBI FIM Ambulation state EQ-5D-5L	Shoulder, hip, knee, Ankle 2+/2+ → 4+/4+ Elbow, wrist, finger 3/3 → 4+/4+ 11 → unknown 14 → 95 42 → 101 Wheelchair → can walk without assistance 24 → 7
Western medicine- rivastigmine 20 mg, tamsulosin hydrochloride 0.2 mg, cholecalciferol concentrated gr. 56 mg, risedronate sodium 2.5 mg, hydrate 40.162 mg, acetyrophyllyne 100 mg, dimerhydrinate 50 mg, pregabalin 75 mg, mosapride citrate hydrate 5.29 mg							

Table 1. (continued).

Author (y) [ref]	Gender/ Sex	Treatment period (d)	Symptoms	Treatment	Treatment site	Evaluation	Result / Score
Lee (2019) [14]	F/71	51	Quadruplegia, numbness of upper and lower limbs, dysuria, numbness, edema of both hands and feet	Manual acupuncture	GV20, CV24, LI4, TE3, TE5, ST36, LI11, GB34, SP9, SP6, HT7	MMT	Shoulder 3-/3+ → 4/4 Elbow 3/3 → 4/4 Finger 2+/2/4 → 3+/3+ Ankle 1/1 → 4/4 Knee 1/1 → 4/4 Ankle 1/1 → 2/2
				Electroacupuncture	Both sides of LI10, GB39	MBI	11 → 56
				Moxibustion (indirect)	CV4	FIM	37 → 70
				Cupping (not bleeding)	Back-shu points	Ambulation state	Wheelchair → can walk 30 m with a cane
				Physical therapy- electrotherapy	Unknown	NRS	Numbness in upper and lower limbs 8 → 3
				Mat training, occupational therapy			
				Herbal medicine- gamisambitang			
				Western medicine- levothyroxine sodium hydrate 0.1 mg, ascorbic acid calcium triflate 10 mg, cantharidin hydrochloride 0.2 mg, vitis vinifera seed dried ext. 150 mg, acetyrophylline 100 mg, amitriptyline hydrochloride 10 mg, polaprezinc 75 mg, betanecolol chloride 25 mg, acetofenac 100 mg, gabapentin, 300 mg, citrulline malate 1 g			
Roh (2018) [15]	M/43	24	Weakness of right upper limb, numbness of both lower limbs	Manual acupuncture	Lumbar and lower limbs ashi-point, both sides of brachioradialis m., hand extensors	MMT	Rt. elbow 4 → 4 Rt. wrist 3 → 3 Rt. 2nd finger 2 → 2+ Rt. 3rd finger 2+ → 3
				Electroacupuncture	Lumbar and lower limbs ashi-point, both sides of brachioradialis m., hand extensors	GBS disability scale	2 → 1
				Pharmacopuncture- hominis placenta pharmacopuncture / 0.4 cc	Both LI11, ST36	NRS	Numbness in both calf 2 → 1 Numbness in both toes and plantar 8 → 7
				Moxibustion (indirect)	CV4		
				Cupping (not bleeding or bleeding)	BL50		
				Steam bath	Both upper and lower limbs		
				Manual therapy			
				Herbal medicine- gamiyoungseonjaetongteum, gamitgishodogum			
Park (2019) [16]	M/16	26	Quadruplegia	Manual acupuncture	ST34, SP10, LI11, TE5, ST38, LR3, KI3, Ashi-point, peroneus longus m. and extensor digitorum longus m.	MMT	Hip, knee 3-/3 → 5/5 Wrist 5-/5 → 5/5
				Pharmacopuncture- hominis placenta Pharmacopuncture / 0.4 cc	Both LR3, KI3	K-MBI	71 → 86
				China manual therapy	Unknown	Ambulation state	Wheelchair → can walk 5 m without assistance
				Tilt training		DTR	Biceps, triceps, Achilles tendon reflex ++/++ → ++/++ patella tendon +++/++++ → +++/++++
				Herbal medicine- shijipomdeborang			
Lee (2017) [17]	M/39	14	Fatigue, numbness, paresthesia	Manual acupuncture	SI5, ST41, GB41, ST43, LI11, ST36, neck and lumbar ashi-point	FSS	8 → 2
				Pharmacopuncture- snake-venom Toxin pharmacopuncture / 0.5 cc	LI11, ST36	NRS	Numbness 8 → 0 Pain 8 → 3
				Moxibustion (indirect)	CV4, CV12		
				Cupping (not bleeding)	Neck and lumbar ashi-point		
				Physical therapy- ICT, MW	Both sides of upper and lower limbs		
				Manual therapy, simple therapeutic exercise			
				Herbal medicine- gami-hyangsangwintang			
Hwang (2016) [18]	M/22	48	Quadruplegia, low back pain	Manual acupuncture	Back-shu points both sides of brachioradialis m., hand extensors, quadriceps femoris m., tibialis anterior m.	MMT	Elbow (flexion), wrist (extension), finger (flexion) 4/4 → 5/5 Hip (ab, adduction, Flexion, extension) 3-/3 → 4+/4+ Knee (flexion, extension) 3-/3 → 5/5 ankle (flexion, extension), 1st toe (flexion, extension) 3+/3 → 5/5
				Electroacupuncture	Ashi-point of lumbus, both sides of quadriceps femoris m. and tibialis anterior m.	GBS disability scale	3 → 0
				Pharmacopuncture- shinbaro Pharmacopuncture / unknown	Back-shu points, both sides of brachioradialis m., hand extensors, Quadriceps femoris m., tibialis anterior m.	MBI	52 → 100
				Steam bath	Low back	NRS	low back pain 4 → 0
				Physical therapy- TENS	Low back		
				Herbal medicine- subjiyanggeumtang			

Table 1. (continued).

Author (y) [ref]	Gender/ Sex	Treatment period (d)	Symptoms	Treatment	Treatment site	Evaluation	Result / Score
Heo (2015) [19]	F/71	59	Paraplegia, paresthesia of extremities	Manual acupuncture	Both sides of brachioradialis m., hand extensors, quadriceps femoris m., tibialis anterior m.	MMT	Neck (flexion, extension) 3/4 → 5/5, (rotation) 4/4 → 5/5 shoulder (elevation) 4-/4- → 4+/4+ (abduction) 4-/4- → 5/5 (adduction) 3/3 → 5/5 Elbow (flexion) 4-/4- → 5/5 wrist (extension) 4-/4- → 5/5 finger (flexion) 4-/4- → 4+/4+ hip (extension) 4-/4- → 4+/4+ knee (extension) 3-/3- → 3+/3+ ankle (dorsi flexion, planta flexion), toe (extension) 3-/3- → 3/3
				Electroacupuncture	Both sides of brachioradialis m., hand extensors, quadriceps femoris m., tibialis anterior m.	GBS disability scale	4 → 2
				Moxibustion (indirect)	CV4, CV12		
				Physical therapy - FES, SSP - Air massage	- Both sides of tibialis anterior m. both sides of quadriceps femoris m., tibialis anterior m. - Both lower limbs		
				Ambulation exercise, occupational therapy			
				Herbal medicine- chungjiguyupstrang			
Kim (2011) [20]	M/36	35	Weakness of extremities, edema, and pain in both hand and foot	Manual acupuncture	TE10, TE6, SP29, Saam's acupuncture (SIS, LIS, BI66, LI2)	MMT	Hip, knee, ankle 4/4 → 4+/4+ 1st toe 3/3 → 4+/4+
				Electroacupuncture	Both sides of ST36, ST37, SP39, LR3	Ambulation state	Wheelchair → can walk without Assistance
				Physical therapy - TENS - Massage	- Ashi-point - Back-shu points	Satisfaction degree	Poor → good
				Herbal medicine- gunbitang			
Huh (2014) [21]	M/46	147	Weakness of both upper limbs, numbness of both upper limbs, facial paralysis, both shoulder pain, dysarthria, autonomic, residual Urine	Manual acupuncture	LI14, TE14, GB21, LI11, KI3, LR3, ST36	Shoulder joint aROM	Abduction, flexion 0/0 → 180/180 Adduction, extension 0/0 → 45/45 Internal rotation 0/0 → 90/90 External rotation 0/0 → 90/85
				Electroacupuncture	LU9, LI4	MMT	Both legs 4/4 → 5/5 Both arms 2/2 → 5/5
				Moxibustion (indirect)	GB21, LI11, LI4, LU9	MBI	53 → 89
				Physical therapy- EST	Both sides of the shoulder	GBS disability scale	3 → 2
				Herbal medicine- gamjigumjihwangrang, yukwoolrang, bojungjigijoon, palmultang		Grip strength (kg)	Rt. 7.3 → 11.6 Lt. 0 → 5.5
				Western medicine- warfarin sodium 2 mg, warfarin sodium 5 mg			
Jung (2019) [22]	F/75	22	Paresthesia of extremities, quadriplegia, facial paralysis	Manual acupuncture	Both LI10, TE5, ST38, ST7, ST4, ST6, LI20	MMT	Elbow (flexion), wrist (extension) 3+/3+ → 4+/4+ hip (flexion), knee (flexion, extension), ankle (dorsi flexion, plana flexion) 3+/3+ → 4+/4+
				Electroacupuncture	Both LI11, ST36, LI14, LR3	Y-score	36/21 → 40/26
				Moxibustion (indirect)	CV12	NRS	Numbness in hand and foot 5 → 3
				Cupping (not bleeding)	Back-shu points	CBC	WBC (103/μL: 4.5-11) 2.30 → 5.10 ANC (cdls/mm ³ : 2,000) 1,122 → 3,070
				Physical therapy - FES - EST	- Fes - Both sides of tibialis anterior m.	Ambulation state	Walk with assistance → can walk without assistance
				Manual therapy, simple therapeutic exercise			
				Herbal medicine- gamshijpjoedaeborang			
Oh (2021) [23]	M/50	73	Weakness of both lower limbs, sign of itching	Manual acupuncture	GV20, LI4, TE5, ST36, LI11, GB34, LI10, SP9, GB39, HT7, GB41, Saam's acupuncture (KI10, LR8, LU8)	MMT	4/4 → 5/5
				Herbal medicine- ogapjangchukrang	LR4, HT8, LU10, LU5, ST36	GBS disability scale	3 → 0
				Western medicine- prednisolone 5 mg		NRS	Pain of thigh and calf 6 → 2

MMT; manual muscle test; K-MBI, Korean version of modified Barthel index; Y-score, Yangghara grading score; NRS, numeric rating scale; K-MMSE, Korean-mini mental status examination; MBI, modified Barthel index; FIM, functional independence measure; EQ-5D-5L, Euro-quality of life-5 dimension 5-level instrument; GBS disability scale, Guillain-Barre syndrome disability scale; DTR, deep tendon reflex; FSS, fatigue severity scale; Shoulder aROM, shoulder active range of motion; CBC, complete blood count.

orally, and patients in one study each received rehabilitation treatment [10], plasmapheresis [15], and manual treatment [15].

In four studies [11,13,14,21], Western medicine was used to control the symptoms of GBS. In one study [23], Western medicine was stopped prior to KMT. Ibuprofen 400 mg [11], piroxicam 48 mg [11], pregabalin 75 mg [13], aceclofenac 100 mg [14], and gabapentin 300 mg [14] were the most commonly used analgesics. Western medicine to treat underlying diseases such as hypertension, and diabetes were not included in the analysis.

Moxibustion, cupping, and other Korean treatment

Moxibustion treatment was used in 10 studies [10-15,17,19,21,22], all of which used indirect moxibustion. Moxibustion treatment was performed 6-7 times a week. The most frequently used acupoint in moxibustion treatment was CV4 ($n = 8$), followed by CV12 ($n = 3$) and LI4 ($n = 2$). The most frequently used meridian system was the conception vessel ($n = 8$). Cupping was used in seven studies [11-15,17,22]. In all seven studies, dry cupping was performed, and in one study [15], wet cupping was performed when necessary. Cupping was performed 6-7 times a week. The most frequently used acupoint was the back-shu points ($n = 4$), followed by the ashi-point of the neck and waist ($n = 2$). There were 4 studies [11,15,16,18] that performed other KMT; in three studies [11,15,18] a steam bath was used, and in one study Chuna treatment was used [16].

Physical therapy

Physical therapy was used in nine studies [11-14,17-22]: interferential current therapy [11,12,17], electrical stimulation therapy [12,21,22], transdermal electric stimulation therapy (Silver Spike Point) [11,19,22], and transcutaneous electrical nerve stimulation [11,18,20]. Microwave [12,17] and electrotherapy [13,14] were used in 3 studies each. Functional electrical stimulation [19], air massage [19], and massage [20] were each used in one study each. Physical therapy was most frequently performed when there were complaints of paralysis and weakness of the extremities ($n = 5$). In the same case, if another form of physical therapy was received in the same area, it was counted as a duplicate.

Exercise therapy

Exercise therapy was used in nine studies [10,11,13-17,19,22]. Manual therapy was performed in five studies [10,11,15,17,22], and occupational therapy was performed in three studies [13,14,19]. Manual therapy was applied to the whole body including the face.

Assessment tools and analysis of the effect

In 12 studies [10,11,13-16,18-23], weakness due to GBS was evaluated using manual muscle testing (MMT) which identified one case of in the upper extremities [15], two cases in the lower extremities [20,23], and nine cases in the extremities. The MMT showed improvement in all 12 studies. The study that showed the most improvement as measured by MMT was reported Huh et al

[21], which showed that the MMT of the extremities changed from 4/4 or 5/5 to 5/5 (Table 2).

In 11 studies [11-15,17-19,21-23], pain, numbness, and paresthesia were evaluated using the Numeric Rating Scale (NRS). Pain and paresthesia were evaluated in two studies [11,17], pain in two studies [18,23], and paresthesia in four studies [12,14,15,22]. Complaints of numbness were recorded in three studies [13,19,21], but were not included in the evaluation tools. On average, the pain improved by 76.4% and numbness was improved by 69.1%. The most effective treatment was reported in the study by Cha et al [12], where the patient's NRS score of 6 for numbness in both fingers and 7 for numbness in toes before treatment improved to 0 after treatment.

In six studies [10,13,14,16,20,22], the state of ambulation evaluation method was used. There were five studies [10,13,14,16,20] which reported that patients with GBS, initially using a wheelchair, improved allowing walking with a cane [10,14], and improved with self-gait [13,16,20]. In the remaining one study [22], improvement was from a state of being able to walk with help to self-gait.

In five studies [15,18,19,21,23], the GBS disability scale evaluation method was used, and improvement by 3 points was observed in two studies [18,23], improvement by 2 points in one study [19], and improvement by 1 point in two studies [15,21]. In three studies [11,12,22], the Yanagihara grading score evaluation method was used for facial paralysis caused by GBS. All three studies showed improvement, and among them, Cha et al [12] reported that the patient had a complete recovery. In six studies, the Korean version of the Modified Barthel index [11,16] and Modified Barthel index [13,14,18,21] evaluation methods were used. The study that reported the most improvement was by Ahn et al [13], which showed an 81-point improvement, and the study that reported the least improvement was Won et al [11], which showed a 6-point improvement. On average, this was a 38.5-point improvement over the six studies.

In addition, independent walking speed [10], the Korean-Mini-Mental Status Examination (K-MMSE) [13], Functional Independence Measure [13,14], Euro-quality of life-5 dimension 5-level instrument [13], DTR [16], fatigue severity scale [17], degree of satisfaction [20], shoulder joint active range of movement [21], grip strength [21], and complete blood count [22] were the evaluation methods used. Among them, the K-MMSE [13] was used only at the first evaluation and was not used thereafter, so improvement could not be evaluated. The DTR was reported to be maintained, and the remaining evaluation methods showed improvement [16]. Bladder disorders, respiratory disorders, dysarthria, anorexia, and edema were not evaluated. There were no side effects reported in the 14 studies.

Discussion

This study analyzed 14 studies on GBS published in Korea between January 1, 2010, and December 31, 2021 retrieved from five Korean databases. In 14 studies, 14 cases were reported. In 14 studies, acupuncture and herbal medicine were used, and in 10 studies electroacupuncture was used. A review of overseas research

Table 2. Assessment Tool Summary of 14 Patients.

Assessment tool	Author (y) [ref]	Result / score
MMT	Heo (2021) [10]	Shoulder (Elevation) 4/4 → 4+/4, (abduction, adduction) 3+/3+ → 4/4 Elbow (Flexion) 3/3 → 4/4, wrist (extension) 3/3 → 3+/3+, finger (flexion) 3/3 → 3+/4 Hip (Flexion) 2-/2- → 3+/4, (abduction, adduction) 2-/2- → 3+/3+ Knee (Extension) 1/1 → 3-/3, ankle (dorsiflexion, planta flexion) 0/0 → 2-/2-, toe (extension) 0/0 → 1/1
	Won (2021) [11]	Shoulder, elbow, finger, ankle 4/4 → 4+/4+, hip, knee 4+/4+ → 4+/4+
	Ahn (2020) [13]	Shoulder, hip, knee, ankle 2+/2+ → 4+/4+, elbow, wrist, finger 3/3 → 4+/4+
	Lee (2019) [14]	Shoulder 3-/3- → 4/4, elbow 3/3 → 4/4, finger 2+/2+ → 3+/3+ Hip 2/2 → 4/4, knee 1/1 → 4/4, ankle 1/1 → 2/2
	Roh (2018) [15]	Rt. elbow 4 → 4, Rt. wrist 3 → 3, Rt. 2nd finger 2- → 2+, Rt. 3rd finger 2+ → 3
	Park (2019) [16]	Hip, knee 3-/3- → 5/5, wrist 5-/5- → 5/5
	Hwang (2016) [18]	Elbow (flexion), wrist (extension), finger (flexion) 4/4 → 5/5, hip (ab, adduction, flexion, extension) 3-/3- → 4+/4+
	Heo (2015) [19]	Knee (flexion, extension) 3-/3- → 5/5, ankle (flexion, extension), 1 st toe (flexion, extension) 3+/3- → 5/5 Neck (flexion, extension) 3/4 → 5/5, (rotation) 4/4 → 5/5 Shoulder (elevation) 4-/4- → 4+/4+ (abduction) 4-/4- → 5/5 adduction 3/3 → 5/5 Elbow (flexion) 4-/4- → 5/5 Wrist (extension), finger (flexion) 4-/4- → 4+/4+ Hip (flexion) 3-/3- → 4/4 (abduction, adduction) 3/3 → 4/4
	Kim (2011) [20]	Knee (extension) 3-/3- → 3+/3+ Ankle (dorsi flexion, planta flexion), toe (extension) 3-/3- → 3/3
	Huh (2014) [21]	Hip, knee, ankle 4/4 → 4+/4+, 1 st toe 3/3 → 4+/4+
	Jung (1029) [22]	Both legs 4/4 → 5/5, both arms 2/2 → 5/5
	Oh (2021) [23]	Elbow (flexion), wrist (extension) 3+/3+ → 4+/4+ Hip (flexion), knee (flexion, extension), ankle (dorsiflexion, planta flexion) 3+/3 → 4+/4+ 4/4 → 5/5
	NRS	Won (2021) [11]
Cha (2021) [12]		Numbness in fingers 6 → 0, numbness in toes 7 → 0
Lee (2019) [14]		Numbness in upper and lower limbs 8 → 3
Roh (2018) [15]		Numbness in both calf 2 → 1, numbness in both toe and plantar 8 → 7
Lee (2017) [17]		Numbness 8 → 0, pain 8 → 3
Hwang (2016) [18]		Low back pain 4 → 0
Jung (1029) [22]		Numbness in hand and foot 5 → 3
Oh (2021) [23]	Pain of thigh and calf 6 → 2	
Ambulation state	Heo (2021) [10]	Wheelchair → can walk with a cane
	Ahn (2020) [13]	Wheelchair → can walk without assistance
	Lee (2019) [14]	Wheelchair → can walk 30 m with a cane
	Park (2019) [16]	Wheelchair → can walk 5 m without assistance
	Kim (2011) [20]	Wheelchair → can walk without assistance
	Jung (1029) [22]	Walk with assistance → can walk without assistance
GBS disability scale	Roh (2018) [15]	2 → 1
	Hwang (2016) [18]	3 → 0
	Heo (2015) [19]	4 → 2
	Huh (2014) [21]	3 → 2
	Oh (2021) [23]	3 → 0
Y-score	Won (2021) [11]	31 → 36
	Cha (2021) [12]	22 → 40
	Jung (1029) [22]	36/21 → 40/26
K-MBI	Won (2021) [11]	92 → 98
	Park (2019) [16]	71 → 86
	Ahn (2020) [13]	14 → 95
	Lee (2019) [14]	11 → 56
MBI	Hwang (2016) [18]	52 → 100
	Huh (2014) [21]	53 → 89
Independent walking speed	Heo (2021) [10]	0.23 m/s (no loading) → 0.51 m/s (with 3 kg loading)
K-MMSE	Ahn (2020) [13]	11 → unknown

Table 2. (continued).

Assessment tool	Author (y) [ref]	Result / score
FIM	Ahn (2020) [13] Lee (2019) [14]	42 → 101 37 → 70
EQ-5D-5L	Ahn (2020) [13]	24 → 7
DTR	Park (2019) [16]	Biceps, triceps, Achilles tendon reflex ++/++ → ++/++ Patella tendon +++/+++ → +++/+++
FSS	Lee (2017) [17]	8 → 2
Degree of satisfaction	Kim (2011) [20]	Poor → good
Shoulder joint aROM	Huh (2014) [21]	Abduction, flexion 0/0 → 180/180 Adduction, extension 0/0 → 45/45 Internal rotation 0/0 → 90/90 External rotation 0/0 → 90/85
Grip strength (kg)	Huh (2014) [21]	Rt. 7.3 → 11.6 Lt. 0 → 5.5
CBC	Jung (1029) [22]	WBC (103/ μ L; 4.5–11) 2.30 → 5.10 ANC (cells/ mm^3 ; > 2,000) 1,122 → 3,070

MMT, manual muscle test; NRS, numeric rating scale; GBS disability scale, Guillain-Barre Syndrome disability scale; Y-score, Yanagihara grading score; K-MBI, Korean version of modified Barthel index; MBI, modified Barthel index; K-MMSE, Korean-mini mental status examination; FIM, functional independence measure; EQ-5D-5L, Euro-quality of life-5 dimension 5-level instrument; DTR, deep tendon reflex; FSS, fatigue severity scale; Shoulder aROM, shoulder active range of motion; CBC, complete blood count.

trends in the effects of acupuncture treatment to promote nerve regeneration and recovery by Yang et al [24] analyzed 24 studies and reported that acupuncture and electroacupuncture had a positive effect in 23 studies. In a study by Wang et al [25], there were 49 patients with GBS who were randomly divided into an immunotherapy group or acupuncture treatment group, and the patients were observed for 6 months. It was reported that the group receiving acupuncture treatment had less motor function than the group receiving immunotherapy. In this current review, it seems that acupuncture and electroacupuncture had a positive effect on nerve regeneration and motor function recovery in GBS. The most frequently used acupoints for GBS were ST36 ($n = 10$) and LI11 ($n = 9$). The most frequently used meridian systems were the intestine meridian and stomach meridian. These are the acupoints and meridian systems located above the radial brachioradialis, carpal extensor, and tibialis anterior muscles, which are muscles affected by paralysis. Huangjenaegyong considered it important to use intestine meridian and stomach meridian for wi syndrome [26]. Hong et al [27] reported that the acupuncture treatment for GBS was mainly performed on the intestine meridian and stomach meridian, but was modified according to the symptoms. The use of these acupoints and meridian systems are used to treat paralysis, numbness, and paresthesia in the extremities caused by GBS.

In 6 studies, pharmacopuncture was used. In three studies, hominis placenta pharmacopuncture was used, showing the highest frequency of use. Pharmacopuncture is a type of KMT in which various components extracted from herbal medicines are injected into the body. It is a treatment that combines acupuncture and herbal medicine [28]. The study by Kim et al [29] reported that hominis placenta pharmacopuncture restores motor function by reducing neuronocrosis by promoting the expression of NGF. In this current review, Shinbaro pharmacopuncture, snake venom toxin pharmacopuncture, and sweet BV were used in each study.

Shinbaro pharmacopuncture is pharmacopuncture using GCSB-5 (Acanthopanax Cortex, Achyranthis Radix, Saposhnikovia Radix, Cibotii Rhizoma, Glycine Semen Nigra, Eucommiae Cortex) as the main component [30], which has anti-inflammatory effects (lowering iNOS, COX-2, TNF- α , and mRNA expression), and has a pain relieving effect by increasing the pain threshold [31]. Shinbaro pharmacopuncture also has a nerve regeneration effect [32]. Snake venom toxin for pharmacopuncture is made by refining and diluting the venom of a viper. It is a neurotoxin mainly used for its analgesic effect on pain and nervous system conditions/diseases [33]. Melittin and apamin, which are components of sweet BV, have local analgesic and anti-inflammatory effects such as increasing the concentration of cortisol in the blood and inhibiting the biosynthesis of prostaglandin [34]. This may help control the nerve damage and pain caused by GBS.

In the 14 studies in this current review, herbal treatment was used, and among them, the most frequently prescribed was Sipjeondaebotang Gami, which was used in four studies. Sipjeondaebotang participates in T helper 1 and T helper 2 immune response in the bone marrow, spleen, thymus, liver, Peyer's patch, which are immune organs, increases the functions of bone marrow, spleen, and thymus, and also affects T-cell and B-cell immunity through Ig regulation, thereby enhancing immune activity [35]. In a study by Lee et al, Sipjeondaebotang was reported to have the potential to prevent damage to the brain and nerve cells through its antioxidant effect [36]. It appears that Sipjeondaebotang treatment for GBS caused immunomodulation to protect the nerve cells.

A total of 85 herbal medicines were used in the prescription, and the highest frequency of use was for Glycyrrhizae radix et rhizoma ($n = 16$), Angelicae gigantis radix ($n = 14$), Paeoniae radix alba ($n = 12$), Ligustici rhizoma ($n = 11$), and Poria sclerotium ($n = 10$). Glycyrrhizae radix et rhizoma has been reported to inhibit hyaluronidase activity to reduce hypersensitivity [37] and have anti-

inflammatory effects by inhibiting immune signal transduction in phagocytes [38]. *Angelicae gigantis radix* helps to maintain normal blood pressure by inducing vasodilation [39] and acts on the central nervous system to relieve pain [40]. *Angelicae gigantis radix* may be effective in reducing pain and controlling hypertension of the autonomic nervous system symptom. *Paeoniflorin*, a monoterpene glycoside in peony, is a key component of *Paeoniae radix alba* [41]. *Paeoniflorin* has an anti-inflammatory effect by inhibiting inflammatory substances such as nitric oxide, reactive oxygen species, and prostaglandin E2 generated from lipopolysaccharide-activated macrophages [42]. *Paeoniflorin* may be effective in treating GBS.

Moxibustion treatment was used in 10 studies. The most frequently used acupoint was CV4 ($n = 8$). The CV4 was used to treat and prevent conditions/diseases by regulating Qi and the blood, regulating water metabolism, and improving systemic function [43]. Hu et al [44] reported that moxibustion treatment significantly induced, stimulated, and controlled axonal regeneration and myelin formation during the recovery phase of the damaged peripheral nerves. In addition, proliferation of Schwann cells can be promoted when serum from moxibustion-treated mice is injected into damaged nerves *in vitro*. Moxibustion may be helpful in the recovery of patients with GBS.

Cupping was used in 7 studies. The most frequently used acupoint was back-shu points ($n = 4$), followed by the neck and waist ashi-points ($n = 2$). Back-shu points are the acupoints located on the back, and activation of these points stimulates the sympathetic and parasympathetic nervous systems that flow out through the thoracolumbar spine [45]. Whang et al [46] reported that cupping on back-shu points in patients with autonomic nervous system dysfunction had a positive effect (immediately after the cupping treatment) on autonomic nervous system stability through the stabilization of heart rate variability. Cupping treatment for GBS may alleviate autonomic symptoms.

In 12 studies [10,11,13-16,18-23], weakness was evaluated using the MMT. The MMT is a commonly used clinical measure of changes in muscle strength of a patient's body in a way that can be simply measured [47]. In 11 studies [11-15,17-23], pain and paresthesia were evaluated using the NRS. The NRS is a very simple and convenient scale for patients to express their level of pain using numbers from 0 to 10, and the concept of the NRS can be easily understood, so that it can be applied to patients with low educational levels [48,49]. In five studies [15,18,19,21,23], the GBS disability scale was used as a specialized evaluation index for GBS. It is a disability scale developed by the GBS study group, consisting of points from 0 to 6, ranging from "Normal" (0 points), "Able to walk 5 m or more without assistance but unable to run" (2 points) to "Death" (6 points) [50]. However, since the evaluation method is focused on the patient's walking and muscle strength, other symptoms, such as fatigue and edema derived from GBS, may be overlooked. In addition, independent walking speed [10], K-MMSE [13], Euro-quality of life-5 dimension 5-level instrument [13], DTR [16], fatigue severity scale [17], degree of satisfaction [20], and shoulder joint active range of movement used in one study each [21], and grip strength [21], complete blood count [22], and Functional Independence Measure [13,14]

used in two studies each were used as evaluation methods. Thus, standardization of the evaluation method for GBS would be helpful in the future.

This study is significant in that it comprehensively analyzed relatively recent case studies in Korea that applied KMT to GBS. In addition, in the 14 studies analyzed in this review, it was reported that all 14 patients who received KMT showed improvement, suggesting the possibility that KMT could be effective in GBS. KMT may shorten the recovery period for Guillain-Barre syndrome and minimize the sequelae. Various KMT methods were analyzed and presented as a method that can be used in the treatment of GBS in clinical practice. However, this study has some limitations. None of the 14 studies reported adverse reactions or side effects. However, it is unclear whether the researcher overlooked the adverse reactions and side effects of KMT or whether adverse reactions and side effects did not occur. In addition, all 14 studies were reported as cases, and there were no controls. By evaluating the various KMTs combined, the effect of an individual treatment cannot be assessed. Therefore, this study suggests that KMT may be used for GBS, although there is risk of bias in the case studies used in this review.

Since GBS is an intractable condition/disease and it is difficult to conduct large-scale studies due to the small number of patients, case accumulation is required, and thus there is a need to establish a consistent treatment and evaluation method for GBS. In addition, further studies are needed to determine the effectiveness of individual KMTs. It is believed that large-scale clinical studies, and KMT-only randomized controlled studies are needed in the future to ascertain the efficacy of KMT for GBS.

Conclusion

1. There were complaints of weakness of the extremities in 12 cases, and paresthesia and numbness in nine cases in that order.
2. The most frequently used treatments in GBS were acupuncture and herbal medicine.
3. A total of 60 acupoints were used for GBS treatment, the most used acupoints were ST36, and the most used meridian systems were the intestine meridian and the stomach meridian.
4. A prescription for herbal medicine was used in all 14 cases, and *Sipjeondaebotang Gami* was the most used in four cases.
5. A total of 85 herbal medicines were used in 21 prescriptions, followed by *Glycyrrhizae radix et Rhizoma* in 16 cases, *Angelicae gigantis radix* in 14 cases, and *Paeoniae radix alba* in 12 cases.
6. Moxibustion was used in 10 cases, and the most used acupoints were CV4.
7. Cupping was used in 7 cases, and the most used acupoints were back-shu points.
8. Treatment evaluation mainly consisted of MMT and NRS. The MMT was used to evaluate weakness, and NRS was used to evaluate pain and paresthesia.

Author Contributions

Conceptualization: HJJ. Methodology: HJJ. Formal investigation: HJJ. Data analysis: HJJ. Writing original draft: HJJ. Writing – review and editing: HJJ, SJK, MJK, HKC, YRL, HJC, JKJ, JHJ and YIK.

Conflicts of Interest

The authors declare that they have no competing interests.

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Ethical Statement

This research did not involve any human or animal experiment.

Data Availability

All relevant data are included in this manuscript.

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