

Scoping Review

Sympathetic and Parasympathetic Ganglion Blocks for Treatment of Long COVID-19 Symptoms: A Scoping Review

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Background: Long COVID-19 affects approximately 10–30% of individuals who are infected with SARS-CoV-2 and is associated with persistent functional impairment and reduced quality of life. The heterogeneous, multisystemic nature and nonspecific symptomatology of long COVID-19 makes its treatment challenging. This scoping review evaluates existing evidence on sympathetic and parasympathetic ganglion blocks as potential interventions for patients suffering from long COVID-19.

Objective: Our primary objective was to assess the effectiveness of sympathetic and parasympathetic ganglion blocks in treating patients with long COVID-19 by identifying the most commonly reported symptoms, symptom response to different block regimens, and any adverse effects associated with these interventions.

Study Design: A scoping review.

Setting: Outpatient clinics where patients received sympathetic blocks or parasympathetic blocks.

Methods: A comprehensive search was conducted across PubMed, Embase, Cochrane CENTRAL, Web of Science, Google Scholar, and ClinicalTrials.gov using MeSH and free-text terms related to “long COVID-19,” “post-COVID-19 syndrome,” and “sympathetic ganglion blocks” and “parasympathetic blocks.” Only English-language articles were included. Pre-print repositories and reference lists were also manually screened.

Results: A total of 22 articles covering 505 patients were included in this review. The most frequently studied symptoms were olfactory dysfunction, fatigue, headache, and cognitive disturbances. The most commonly utilized intervention was the stellate ganglion block. The available evidence suggests that the stellate ganglion block could be an effective treatment for dysautonomia symptoms and cognitive dysfunction related to long COVID-19. Sphenopalatine ganglion block may be an effective option to treat headaches in long COVID-19 patients who are refractory to other treatments.

Limitations: The significant existing variations in treatment regimens precluded our ability to do a quantitative analysis. Reporting bias from case reports and small observational studies should also be considered.

Conclusions: Stellate ganglion blocks may offer therapeutic benefit for the dysautonomia and cognitive dysfunction associated with long COVID-19. Sphenopalatine ganglion blocks have shown promise in managing refractory headache symptoms in this population. Further well-designed, placebo-controlled randomized studies that employ validated outcome measures are required to establish the efficacy of sympathetic ganglion blocks in the treatment of long COVID-19.

Key words: Long COVID-19, sympathetic ganglion blocks, stellate ganglion block, sphenopalatine ganglion block

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Long COVID-19, also referred to as post-acute sequelae of SARS-CoV-2 infection (PASC) or post-COVID-19 condition (PCC), is characterized by a constellation of symptoms that persist or emerge after the acute phase of COVID-19 has resolved, typically lasting more than 4 weeks, and formally defined when symptoms persist beyond 12 weeks in absence of alternative diagnosis (1-3). Clinical manifestations are heterogeneous, affecting multiple organ systems, and often include fatigue, dyspnea, cognitive dysfunction, chest pain, and post-exertional symptom exacerbation. These symptoms may be continuous or relapsing, and their severity can range from mild to disabling and last from weeks to months. As recognized by the World Health Organization and national public health agencies, long COVID-19 represents a substantial public health concern, with current estimates suggesting 10–30% of individuals infected with SARS-CoV-2 experience some form of long-term sequelae (4-6). The associated burden includes reduced quality of life, prolonged functional impairment, increased health care utilization, and economic consequences at both individual and societal levels (4,7).

The pathophysiology of long COVID-19 remains incompletely understood but is increasingly being recognized as multifactorial, involving persistent immune dysregulation, neurovascular inflammation, and autonomic nervous system dysfunction. Recent studies have proposed that long COVID-19 results from sustained activation of the innate and adaptive immune systems, with elevated levels of pro-inflammatory cytokines (e.g., IL-6, TNF- α) and immune cell exhaustion contributing to a chronic inflammatory state (8-10). Moreover, evidence suggests that viral antigen persistence in tissues such as the gut, nervous system, and vasculature may drive ongoing immune activation (11). Concurrently, dysfunction of the autonomic nervous system, including sympathetic overactivity and impaired vagal tone, may cause symptoms such as fatigue, orthostatic intolerance, and cognitive impairment (12,13). These mechanisms are also seen in related disorders such as myalgic encephalomyelitis/chronic fatigue syndrome (ME/CFS) and postural orthostatic tachycardia syndrome (POTS), underscoring the role of maladaptive neuroimmune and neurovascular signaling in the perpetuation of these symptoms (12).

Treatment strategies for long COVID-19 are largely supportive and multidisciplinary, focusing on symptom-targeted rehabilitation, autonomic reconditioning, and management of comorbidities. These treatments, how-

ever, are still exploratory and associated with variable responses, largely due to the disease's heterogeneous, multisystemic nature and the nonspecific, fluctuating profile of symptoms (12). Among emerging therapies, the stellate ganglion block (SGB) has garnered attention for its potential role in autonomic reconditioning, particularly in patients with pronounced dysautonomia, fatigue, and post-exertional symptom exacerbation (13). While the SGB has traditionally been used for regional pain syndromes, its application has broadened considerably. A recent scoping review highlighted the use of SGBs across diverse non-pain conditions—including obtunding cardiovascular sympathetic stress response, menopausal hot flashes, posttraumatic stress disorder (PTSD), and sensorineural hearing loss—in which sympathetic overdrive plays a mechanistic role (14). Correspondingly, a surge of interest in the SGB for managing persistent symptoms of long COVID-19 has emerged, with multiple studies reporting success in treating wide spectrum of symptoms associated with the condition. Furthermore, reports of successful uses of the sphenopalatine ganglion block (SpGB) for the treatment of long COVID-19-related headache have also been published.

To date, no attempt has been made to collect and synthesize the evidence on the role of these ganglion blocks in the treatment of long COVID-19 symptoms. We undertook this scoping review to identify the current evidence for the role of these blocks in treating symptoms of long COVID-19. In the sections below, we summarize the characteristics of patients and their symptoms, the techniques of applying sympathetic ganglion blocks, the symptom responses to these treatments, and the duration of relief reported by the patients surveyed in the included studies.

METHODS

This study was performed according to the Joanna Briggs Institute guidelines for scoping reviews (15) and followed the framework for scoping reviews set by Arksey and O'Malley (16).

Identifying the Research Question

We framed the following research question: Are sympathetic ganglion blocks effective in reducing the symptoms of long COVID-19 syndrome?

Identifying Relevant Studies

To identify relevant studies, we built a comprehensive literature search using keywords and controlled

terms, based on the concepts of “long COVID-19,” “post COVID-19 syndrome,” “post-COVID-19 condition,” “sympathetic ganglion block,” “parasympathetic ganglion block,” “stellate ganglion block,” “sphenopalatine ganglion block,” and “pterygopalatine ganglion block.” Terms were searched in PubMed, Embase, Web of Science, Google Scholar, ClinicalTrials.gov, and the Cochrane Central Register of Controlled Trials from January 1st, 2020 to May 27th, 2025, with a repeat search performed on November 23rd, 2025, using medical subject headings (MeSH) and free-text terms. Only those articles that were either originally in English or translated to English were included. We also searched for gray literature by additional hand searching. After the electronic search was conducted, references of the identified studies were searched manually to identify further studies.

Study Selection Criteria

Abstracts were screened in duplicate by independent reviewers (AT and KS) using predefined criteria to assess eligibility to proceed to full-text screening. Full-text reports were reviewed in a similar manner to determine their final inclusion or exclusion. Discrepancies were resolved through discussion, with the senior author (PMS) making final decisions.

Inclusion criteria were as follows: the patients in the study (1) suffered symptoms consistent with long COVID-19 and (2) received SGB or SpGB or any other autonomic ganglion blocks as an intervention. We included full-text conference abstracts, case reports, case series, retrospective and prospective cohorts, and randomized controlled trials (RCTs). We excluded studies in which those blocks were used for any indications other than long COVID-19 symptoms. Registry protocols without data were also excluded, as were incomplete studies.

Data Extraction, Summarizing, and Collating

Data were extracted using a prespecified case report form that captured bibliographical information (author, year, country of origin, and journal name), study design, number of patients, symptoms studied (anosmia, parosmia, dysgeusia, brain fog, fatigue, headaches, sleep disturbances, dysautonomia), outcomes (descriptive or survey-based, validation methods), and block characteristics (unilateral or bilateral, single or multiple, local anesthetic volume and concentration; local anesthetic adjunct; block complications).

We performed a descriptive analysis in which we

summarized the results of the included studies under different categories of symptoms related to long COVID-19. We did not pool the results for quantitative analysis of the data because of the heterogeneity in block regimens, assessment of outcomes, and timelines.

RESULTS

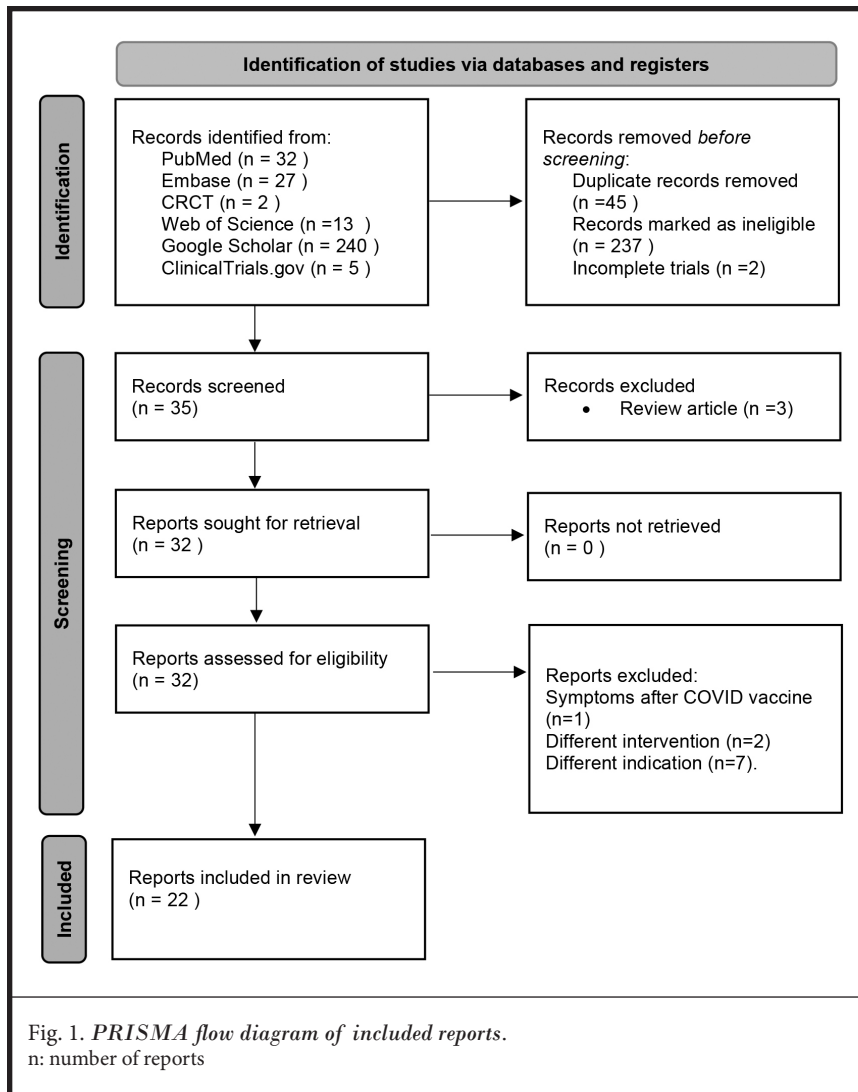
The 6 databases yielded 319 articles. After deduplication, 274 articles were left for screening. Once more studies were excluded based on title and abstract screening, the remaining studies were subjected to full-text screening, and 22 of those articles were found eligible and included in the review. The flowchart of the selection process is shown in Fig. 1.

A total of 22 articles covering 505 patients was included in this review. The mean age of the patients was 45 years, ranging from 18 to 83 years, and 74% of the patients were female. The included manuscripts comprised 8 case reports, 5 case series, 6 retrospective cohort studies, 2 prospective cohort studies, and one randomized clinical trial. The most frequently studied symptoms were olfactory dysfunction, fatigue, headache, and cognitive disturbances. The most commonly utilized intervention was the stellate ganglion block (SGB), which was employed in 19 articles. Of the articles that involved an SGB, 13 of them reported using ultrasound guidance for block placement, whereas 2 studies used fluoroscopy guidance instead. SpGBs were used in 2 reports, and 2 case reports incorporated both SGBs and SpGBs in combination with additional neural therapy techniques. While most reports used a unilateral or bilateral SGB as the primary intervention, procedural techniques, local anesthetic agents, and follow-up durations varied substantially across reports. Table 1 summarizes the designs, number of patients, block method and characteristics, and follow-up intervals of the included studies, in addition to the authors' conclusions.

COVID 19–Related Olfactory Dysfunction

A total of 12 reports covering 365 patients described the effects of sympathetic ganglion blocks on anosmia, parosmia, or dysgeusia in patients with long COVID-19 syndrome. The study designs included 4 case reports (17-20), 3 case series (21-23), 3 retrospective cohort studies (24-26), one prospective single-arm study (27), and one randomized clinical trial (28). All of these reports used SGBs for treating olfactory disorders, the details of which are given in Table 1.

Two case series with 2 patients each and one single



patient case report reported immediate recovery of smell and taste after one to 2 SGB injections, an effect that was sustained at the one-to-3-month follow-up (19,21,22). One case report described partial return of smell within 24 hours of a right SGB and complete recovery after a left SGB was performed 72 hours later (17). In a 6-patient case series, partial olfactory improvement was noted in 3 of the patients, while 5 of the 6 patients experienced improvements in their ability to taste with follow-up ranging from several days to 3 months (23).

In a retrospective review of 195 patients with post-COVID-19 parosmia and dysgeusia, 147 (75.4%) reported improvement in smell and 145 (74.4%) in taste within 7 days of receiving an SGB. Among those with

an improved sense of smell, 132 patients (89.8%) reported higher satisfaction with their symptom resolution, and 127 (87.6%) of those with an improved sense of taste reported higher satisfaction, which were found to be statistically significant ($P < 0.001$) (25). Another retrospective cohort study evaluated parosmia in 47 patients who had received bilateral SGBs and found a statistically significant reduction in the severity and number of the patients' olfactory triggers over a mean follow-up of 7 months, though no objective improvement was seen on the Brief Smell Identification Test (BSIT) (24). In another retrospective review of 41 patients, only 56% of patients who had anosmia or ageusia responded favourably to SGBs and required additional trigeminal nerve blocks (26).

In a prospective pilot study of 20 patients with COVID-19-associated olfactory dysfunction, 11 (55%) achieved a clinically meaningful improvement (≥ 4 points) on the University of Pennsylvania Smell Identification Test (UPSIT), and 7 (35%) met the threshold for clinical improvement (≥ 15 points) on

the Olfactory Dysfunction Outcomes Rating (ODOR) at the one-month follow-up after a bilateral SGB. Subjective improvement in the sense of smell was reported by 10 (50%) patients on the Clinical Global Impression-Improvement (CGI-I) scale (27).

In a recent double-blind, placebo-controlled randomized clinical trial, 48 patients with COVID-19 associated parosmia were randomized to receive a single SGB or saline injection. The patients were assessed on the Parosmia/Distortion Olfactory Dysfunction Outcomes Rating (DisODOR) scale and CGI-I scale at the one-month and 3-month follow-up periods. No significant difference was noted in the median reduction in DisODOR scale scores or the responder rate (> 15 -point reduction in DisODOR scale) between the 2 groups

Table 1. Characteristics of included studies.

First Author, Year, Country	Study Design	Sample Size	Intervention (Technique and Frequency)	Block Medication and Adjuvants	Target Symptoms	Follow-Up Interval	Authors' Conclusion
Abd-Elasved, 2024, USA (18)	Case report	One	Bilateral SGB each side done 3 weeks apart, fluoroscopy-guided	0.375% bupivacaine with epinephrine, 10 mL mixed with 10 mg dexamethasone	Anosmia, dysgeusia	6 months	SGBs should be considered an option in treating loss of smell and taste in long COVID-19 patients.
Alnattour 2023, USA (22)	Case series	2	Bilateral SGB each side done one week apart, fluoroscopy-guided; RF ablation in one case	0.25% bupivacaine, 9 mL mixed with one mL of dexamethasone	Fatigue, dyspnea, myalgia, cough, headache, anosmia, dysgeusia, dysautonomia, sleep	One week, one month, 3 months	Sustained and near-complete relief of multiple long COVID-19 symptoms during a 3-month follow-up period.
Chen, 2024, China (32)	Retrospective cohort	39	Bilateral SGB alternating side daily for one week, US-guided	1% lidocaine, 4 mL	Sleep disturbance	One and 3 months	US-guided SGB demonstrated a significant improvement in the sleep quality of patients recovering from COVID-19, with a high level of safety.
Chauhan, 2022, USA (17)	Case report	One	Bilateral SGB, US-guided; 72 hours apart	0.25% bupivacaine, 4 mL	Anosmia, dysgeusia	One week	SGB may be an effective treatment option for patients with olfactory and taste issues associated with PASC.
Chiang, 2025, USA (34)	Retrospective cohort	52	One or more SGB on alternating sides at different visits, US-guided	Variable, 0.25% bupivacaine, 4 mL with or without 10 mg dexamethasone	Headache, fatigue, brain fog, dizziness, sleep disturbances, anosmia, GI disturbances, multiple symptoms	Not specified	Majority of patients with most commonly reported symptoms (headache, fatigue, dizziness, brain fog) showed substantial improvements. High level of variability in reported duration of improvement.
Duricka, 2022, USA (21)	Case series	2	SGB, alternating 2 days apart	No information	Fatigue, brain fog, anosmia, dysgeusia	One day, one week, 60 days	The lack of effective treatments for long COVID-19/ PASC makes the SGB an attractive therapeutic modality that deserves further investigation.
Farrell, 2025, USA (28)	Randomized clinical trial	48	Single unilateral SGB, US-guided	1% mepivacaine, 6-8 mL or saline (placebo)	Parosmia	One and 3 months	SGB nonsuperior to saline injection placebo for the treatment of COVID-19-induced parosmia.
Galvin, 2023, USA (25)	Retrospective review	195	SGB right or left, US-guided	1% lidocaine, 6 mL mixed with dexamethasone 4 mg	Parosmia, dysgeusia, fatigue	One week	Most of the patients (87.4%) reported improvement in olfaction after SGB injection. The effectiveness of this novel treatment for post-COVID-19 symptoms is promising and warrants further investigation.
Kalava, 2023, USA (23)	Case series	6	SGB, US-guided, one-2 sessions	0.5% of bupivacaine or ropivacaine; 7 mL	Anosmia, dysgeusia	Several days to 4 months	SGB may be a promising therapeutic intervention for patients with olfactory and gustatory dysfunction related to long-term COVID-19 symptoms.
Khan, 2022, USA (29)	Case report	One	SGB, right then left, 12 days apart, US-guided	0.25% bupivacaine, 4 mL mixed with 10mg dexamethasone	Fatigue, malaise, dysautonomia, GI symptoms	12 days	SGB is efficacious in a previously healthy patient for the management of long COVID-19 symptoms including fatigue, post-exertional malaise, shortness of breath, and gastrointestinal symptoms.
Kim, 2023, Korea (36)	Case report	One	Right SGB, single session, fluoroscopy-guided	0.25% bupivacaine, 5 mL	Headache	Immediate, 6 weeks, 4 months	SGB is effective for treating refractory headaches related to long COVID-19, suggesting that the SGB may relieve related dysautonomia.

Table 1 cont. *Characteristics of included studies.*

First Author, Year, Country	Study Design	Sample Size	Intervention (Technique and Frequency)	Block Medication and Adjuvants	Target Symptoms	Follow-Up Interval	Authors' Conclusion
Levey, 2024, USA (33)	Retrospective cohort	17	SGB, unilateral, single session, US- or CT-guided	0.25% bupivacaine, 4-10 mL with or without steroids	Fatigue, PTSD, dysautonomia	One week, one, 2, 3 months	SGB is a safe, low-risk, minimally invasive, and effective procedure in the treatment of symptoms for long COVID-19.
Levin, 2022, USA (37)	Case report	One	SpGB, single session	SpGB; 4% lidocaine on applicators;	Headache	One month	Refractory headache resolved completely; anosmia unchanged.
Machado, 2021, Brazil (38)	Case series	6	SpGB, one-2 sessions, one occipital nerve block	SpGB; 4% lidocaine on cotton-tipped applicator	Headache	2-3 days	SpGB can be an effective anal-gesic technique to treat refractory headache in COVID-19 patients.
Naimi, 2024, USA (24)	Retrospective cohort	47	SGB, one-2 injections on alternate side one month apart, CT-guided	3 mL solution containing one mL of 40 mg of methylprednisone, one mL of 1% lidocaine, and one mL of 0.25% bupivacaine	Parosmia, quality of life	3-7 months	SGB may improve subjective parosmia and QoL for patients with post-COVID-19 OD; however, the block may not affect odor identification.
Pearson, 2023, USA (26)	Retrospective cohort	41	SGB unilateral or bilateral, US-guided	5 mL solution containing 2 mL 2% chloroprocaine, 2 mL 1% lidocaine, and 1 mL 0.2% ropivacaine	Fatigue, brain fog, sleep, anosmia, dysgeusia, multiple symptoms	Not specified	SGB is a promising treatment option for patients suffering from long COVID-19 syndrome.
Peterson, 2023, USA (27)	Prospective single-arm	20	SGB, US-guided, bilateral, one week apart	Mepivacaine	Olfactory dysfunction	One week, one month	Sequential SGBs for COVID-19-associated OD were safe and associated with modest improvements in subjective olfaction, odor identification, and olfactory-specific QoL.
Shim, 2024, Korea (31)	Case series	5	SGB; fluoroscopic guidance	Unilateral SGB; 0.25% bupivacaine, 5 mL	Fatigue, brain fog, headache	Up to 12 months	Use of the SGB may help alleviate symptoms of long COVID-19 and improve many patients' quality of life.
Stogicza, 2022, USA (19)	Case report	One	SGB, single session	Right SGB; 0.5% bupivacaine, 3 mL with clonidine 30 mcg	Anosmia, parosmia, loss of appetite	One month	SGB should be considered in certain long COVID-19 cases. Future research may result in its broad acceptance as a valid treatment.
Vinyes, 2022, Spain (30)	Case report	One	SGB, SpGB, infraorbital and mental nerve block with myofascial TPIs	SGB: 0.5% procaine; 2.5 mL SpGB: 0.5% procaine; 2.5 mL	Fatigue, diarrhea, dyspnea, muscle pain	3 months	Targeted LA injections may have therapeutic benefits in PC-19S and in other chronic diseases linked to stress and inflammation.
Vu, 2023, USA (20)	Case report	One	SGB bilateral followed by SpGB bilateral; 2 weeks apart	SGB: no information; bilateral SpGB: 0.5% bupivacaine one mL with dexamethasone 10 mg	Anosmia, aguesia, headache	Within days	SpGB can treat PASC headaches and improve a patient's quality of life.
Wang, 2025, USA (35)	Prospective pilot	17	SGB and superior cervical ganglion block; alternate side, one week apart	SGB: 0.5% bupivacaine, 7 mL; superior cervical: 0.5% bupivacaine, 3 mL	Dysautonomia, pain, sleep, fatigue	One and 4 weeks	Dual sympathetic blocks appear to be a promising intervention for PASC-related dysautonomia and pain.

SGB, stellate ganglion block; SpGB, sphenopalatine ganglion block; RFA, radiofrequency ablation, US, ultrasound; PASC, post-acute sequelae of COVID-19

at the one- and 3-month periods. Similarly, the smell-distortion scores on the CGI-I did not show clinically important differences at the one- or 3-month follow-up periods in either of the 2 groups. It is noteworthy that the one-month and 3-month nonresponders in both groups had higher scores on the Olfaction Catastrophizing Scale (OCS) and Hospital Anxiety and Depression Scale (HADS) than did the responders (28).

COVID-19-Related Cognitive Disturbances, Fatigue, and Sleep Disturbances

A total of 13 reports covering a combined 425 patients reported outcomes related to cognitive dysfunction, fatigue, or sleep disturbances in patients with long COVID-19 syndrome after they received SGBs. These studies included 3 case reports (20,29,30) 3 case series (21,22,31), 5 retrospective cohorts (25,26,32-34), and one prospective pilot study (35). Follow-up intervals ranged from immediate post-procedure assessments to 3 months after intervention. Three studies employed validated scoring systems (FSS, GAD-7, COMPASS-31, PROMIS-29, PSQI) to quantify their outcomes.

Cognitive disturbances were described variably as brain fog, difficulty concentrating, impaired memory, slowed cognition in various studies. In a 2-patient case series (21), both patients reported marked improvement in mental clarity, focus, and memory within 3 days following a bilateral SGB, with sustained effects at the 60-day follow-up. Another 2-patient case series (22) documented improvement in concentration and cognitive endurance within one day of a right SGB and further enhancement after a left SGB, with effects maintained for 3 months. In a retrospective study (26) of 41 long COVID-19 patients with multiple symptoms, 79% of patients with impaired cognition reported subjective improvement after receiving an SGB; the time interval for assessment was not specified. Similarly, in a retrospective study (34) of 52 patients with multiple symptoms who received one or more SGB injections at variable intervals, 65.8% reported improvements in symptoms related to brain fog. In a prospective open-label pilot study (35) recruiting 17 patients who received bilateral SGBs and superior cervical ganglion blocks on one side per week, qualitative improvements in concentration and mental clarity were noted as secondary outcomes at 4 weeks after dual sympathetic blocks.

Fatigue was evaluated in 9 studies. Three case series (21,22,31) reported marked improvements in fatigue following bilateral stellate ganglion blocks,

with symptom relief observed within 24 hours to 7 days and sustained benefit documented at follow-up intervals ranging from 60 days to 12 months. In another case report (29), a patient reported a 50% reduction in fatigue severity on the 10-point numeric rating scale after sequential right and left SGBs administered 12 days apart. In 2 retrospective cohorts, one covering 41 patients (26) and the other covering 52 patients (34) with multiple symptoms, 77% and 58% of patients with fatigue reported improvements following SGBs; the exact timing of follow-up was not specified. Another retrospective cohort of 17 long COVID-19 patients (33) measured fatigue using the Fatigue Severity Scale (FSS) and reported a statistically significant decrease ($P = 0.002$) after the administration of bilateral SGBs within a week with sustained response up to 3 months in some patients. In a prospective pilot study of 20 patients (35) with long COVID-19, a 30.7% reduction in the PROMIS-29 Fatigue scores were noted at 4 weeks ($P = 0.049$).

For sleep disturbances, a retrospective cohort of 41 patients (26) reported that 71% of patients with sleep-related complaints experienced improvements following SGBs; the timing of this assessment was not specified. Similarly, a retrospective cohort of 39 patients (31) was assessed for sleep quality using the Pittsburgh Sleep Quality Index (PSQI) and found statistically significant improvements at one month and 3 months after 7 sessions of alternating right- and left-sided SGB (total PSQI score reduced from 15.3 to 8.8, $P < 0.001$). Another prospective pilot of 17 patients (33) used the PROMIS-29 scoring and observed a 29.9% reduction in sleep disturbance scores at 4 weeks ($P = 0.016$).

COVID-19-Related Dysautonomia

A total of 5 reports covering a total of 38 patients described dysautonomia as a clinical feature responsive to SGB in patients with long COVID-19. Dysautonomia-related symptoms mostly included orthostatic intolerance, tachycardia, temperature sensitivity, and lightheadedness.

A case series (22) described 2 patients with multiple dysautonomic symptoms, including tachycardia, orthostatic hypotension, temperature dysregulation, and pseudoseizures. Following sequential right and left SGBs, both patients experienced immediate improvements in dysautonomia-related symptoms. One patient underwent radiofrequency ablation of the stellate ganglion after partial symptom recurrence at one month and subsequently achieved complete symptom

resolution, which sustained through 3 months. Another case report (29) described dysautonomic symptoms including resting tachycardia and exertional dyspnea in a single patient. Following 2 SGBs spaced 12 days apart, the patient reported substantial symptom relief, including normalization of heart rate. Similarly, in a third case report (30), a patient with dysautonomic symptoms including fatigue, orthostatic intolerance, gastrointestinal dysmotility, and emotional lability underwent a series of SGB and SpGB injections with 0.5% procaine. Symptoms improved progressively over 3 sessions, with full resolution reported at the 3-month follow-up.

In a retrospective study (33) of 17 patients, baseline symptoms were measured on validated scales, including the Composite Autonomic Symptom Score-31 (COMPASS-31), Fatigue Severity Scale (FSS), General Anxiety Disorder-7 (GAD-7) and PTSD Checklist for DSM-5 (PCL-5). Notably, pre-procedure COMPASS-31 scores indicated moderate and severe autonomic dysfunction in 94% and 81% of patients, respectively. After the procedure, there were significant reductions in FSS ($P = 0.002$) and heart rate ($P = 0.008$), while PCL-5 scores showed a clinically meaningful 5-point decrease despite lacking statistical significance ($P = 0.159$). No significant change was observed in GAD-7 scores ($P = 0.101$).

In a prospective pilot of 17 patients (35), autonomic dysfunction was quantified using the Composite Autonomic Symptom Score-31 (COMPASS-31), a validated self-assessment questionnaire. At 4 weeks after the intervention, COMPASS-31 total scores improved by 38.4%, and the orthostatic intolerance sub-score improved by 44.7%. Both results were statistically significant ($P = 0.0016$ and $P = 0.012$, respectively). Most of the patients reported subjective improvements in symptoms such as lightheadedness, heat intolerance, and postural symptoms.

COVID-19-Related Headache

A total of 7 reports covering a combined 58 patients evaluated headache as a target symptom in patients who had long COVID-19 and were treated with SGBs or SpGBs. These studies included 4 case reports (20,29,36,37), 3 case series (22,30,36), and one retrospective cohort study (26). Follow-up intervals ranged from immediately after the procedure to 12 months. Three studies (22,29,31) used numerical rating scales to quantify changes, while others relied on qualitative or survey-based reports.

In a 2-patient case series, both patients reported marked improvement in headache severity after se-

quential right and left SGBs (22). In a separate case series, all 5 patients reported at least 30% reduction in headache severity, with a mean reduction of 68% and complete resolution in one patient at 9 months after the procedure (31).

Among the case reports, one patient reported reduction in headache severity from a Likert scale score of 7 to 2 following a right SGB and further resolution after a left SGB over a 12-day period (29). Another case reported complete resolution of a persistent, nightly COVID-19-related headache following a single transnasal SpGB, with durable response at the one-month follow-up (37). A series of 6 cases with COVID-19-related headaches refractory to multiple first- and second-line agents reported partial or complete pain relief in all 6 patients after they received intranasal SpGBs, with no recurrence over an observation period of 2 to 3 days (38). Another patient with long COVID-19 also reported relief from multiple symptoms, including headache, after receiving a bilateral SGB followed 2 weeks later by a bilateral SpGB, although timing and symptom-specific scales were not detailed (20).

Furthermore, in 2 retrospective cohorts of 41 patients (26) and 57 patients (34) respectively, 81% of patients in both the studies reported subjective improvements in their headaches after SGBs, although no time interval or quantitative severity scale was provided (26,34).

Adverse Effects of Blocks Reported in Included Studies

For SGBs, most of the included studies reported minor side effects such as Horner's syndrome (most common), hoarseness, globus sensation, facial numbness, mild shortness of breath, and arm heaviness or weakness. All these side effects were transient and self-limiting in nature. One study reported that 3 of the patients experienced transient vagal responses after receiving left-sided blocks and that those responses resolved promptly with reverse Trendelenburg positioning (26).

None of the included studies reported that patients experienced major adverse effects after receiving SpGBs. One case series covering 6 patients reported transient anosmia and hypoesthesia of the nose root, pharynx, and palate in all of the patients, but those effects reversed in a few hours (38).

DISCUSSION

Our scoping review summarizes and consolidates

the current literature evaluating the role of sympathetic and parasympathetic ganglion blocks for treatment of long COVID-19 symptoms. The patients in the included studies had a mean age of 45, ranging from 18 to 83 years, and were predominantly women (74%), which corresponded well with the findings of previous demographic studies (9,39). Also, the majority of the patients in those studies had symptoms that persisted for more than 3 months, which was consistent with the recent NHANES definition of long COVID-19 (3).

Most of the studies employed one or 2 sessions of SGB, using unilateral, bilateral, or alternating techniques. With the advent of ultrasound (US) guidance, clinicians can perform SGBs more safely and accurately by visualizing major anatomical structures and confirming local anesthetic spread above the longus colli muscle. Nearly all included studies used US guidance, with a few utilizing fluoroscopy or computed tomography. Pharmacological regimens varied, ranging from short-acting agents like procaine and mepivacaine to long-acting ones like bupivacaine, with volumes between 2 and 10 mL. Adjuvants such as dexamethasone or clonidine were added, potentially to prolonged block duration or immunomodulation, although these mechanisms remain to be fully elucidated. Symptom response varied among patients. Some experienced immediate relief (e.g., anosmia, headache), while others required days or weeks to see improvement (e.g., fatigue, brain fog, dysautonomia). Similarly, treatment efficacy varied across patients, with some responding to a single session and others requiring multiple sessions. The SpGB, a technique for blocking a predominantly parasympathetic ganglion that also serves as conduit for some post-ganglionic sympathetic outflow, was also used, although less frequently, primarily to treat refractory headaches. While these studies reported symptom relief, they did not demonstrate improvements in olfactory or other systemic symptoms. Additional trials are needed to determine the SpGB's efficacy in treating broader manifestations of long COVID-19. Given the SpGB's success in managing post-dural puncture headaches (40), migraines, and cluster headaches (41), this type of block may serve as an adjunct rather than a primary treatment. The use of SpGB, as shown in case series by Machado et al (38) and Levin et al (37), appeared safe and effective for select symptoms but lacked broader impact, necessitating further controlled investigations.

The rationale for using SGBs to treat long COVID-19 patients is underpinned by increasing recogni-

tion of autonomic dysfunction, neuroinflammation, and sympathetic overactivity as central features of this condition. The stellate ganglion plays a pivotal role in regulating sympathetic tone in the head, neck, and upper body. Blocking this structure may attenuate sympathetic overdrive, reduce circulating catecholamines, improve regional blood flow, and interrupt maladaptive feedback between peripheral and central neural pathways. These effects likely explain the rapid symptom improvement observed in some cases. Moreover, some studies suggest SGBs may exert immunomodulatory effects by modulating cytokine levels, though this idea remains speculative. Future translational studies measuring inflammatory biomarkers before and after the block are warranted to clarify these mechanisms.

Notably, certain symptoms related to cognitive dysfunction, headache, and dysautonomia appeared particularly responsive to sympathetic blockade that were also concordant with significant improvements noted in disease-specific validated measures (COMPASS 31, FSS), suggesting the existence of sub-phenotypes within long COVID-19 populations characterized by sympathetically mediated pathophysiology. Baseline autonomic assessments that use tools like COMPASS-31 or tilt-table testing may help identify the patients who would be most likely to benefit from these interventions. Furthermore, it is worth noting that in non-pain indications for SGBs—such as management of electrical storm, menopausal hot flashes, and PTSD in patients whose sympathetic overactivity seems to be an underlying cause—SGBs have shown promising results (14), reinforcing the concept that the application of SGBs may be a logical extension for indications seen in long COVID-19 for which modulation of sympathetic system hyperactivity can prove beneficial, such as dysautonomia and cognitive disturbances. While current evidence is mostly limited to studies that have a low level thereof, the favorable symptom resolution in many patients supports further investigation.

Limitations

There are limitations inherent to this scoping review. Most of the included studies lacked important patient information such as vaccination status, viral variant, prior comorbidities, or severity of acute SARS-CoV-2 infection—factors known to influence long COVID-19 risk (1,9). Additionally, the reliance on case reports and small observational studies introduced a considerable risk of publication bias, and significant heterogeneity across study designs, outcome measures,

and follow-up durations precluded any pooled quantitative analysis. As such, the intent of this review was to map the landscape of current evidence rather than establish definitive efficacy.

Future research should focus on prospective, randomized controlled trials incorporating laboratory-confirmed COVID-19 diagnoses, stratification by viral variants and vaccination status, standardized symptom assessments, and inclusion of comorbid populations. Furthermore, examining changes in inflammatory biomarkers that follow the administration of SGBs could provide important mechanistic insights and validate the hypothesized role of neurovascular inflammation in long COVID-19. Additionally, trials should compare autonomic ganglion blocks with other emerging therapies, including pharmacologic agents, cognitive rehabilitation, graded exercise therapy, and vagus nerve stimulation to determine relative efficacy and patient-centered outcomes.

CONCLUSION

Long COVID-19 remains an evolving research domain with ongoing refinement in diagnostic criteria, symptom characterization, and treatment strategies. As our understanding of long COVID-19's underlying mechanisms deepens, therapeutic approaches such as autonomic ganglion blocks may play an increasingly defined role in multidisciplinary care. In conclusion, the SGB appears to offer meaningful symptom relief for a subset of long COVID-19 patients, but further high-quality evidence is needed. As for the SpGB, the current data are too limited for definitive recommendations to be made.

Authors' Contributions

All authors contributed data extraction and manuscript preparation to this work. AT and KS designed the concept.

REFERENCES

- Nalbandian A, Sehgal K, Gupta A, et al. Post-acute COVID-19 syndrome. *Nat Med* 2021; 27:601-615.
- Davis HE, Assaf GS, McCorkell L, et al. Characterizing long COVID in an international cohort: 7 months of symptoms and their impact. *EClinicalMedicine* 2021; 38:101019.
- National Academies of Sciences, Engineering, and Medicine; Health and Medicine Division; Board on Global Health; Board on Health Sciences Policy; Committee on Examining the Working Definition for Long COVID. A Long COVID Definition: A Chronic, Systemic Disease State with Profound Consequences. Goldowitz I, Worku T, Brown L, Fineberg HV (eds). *National Academies Press*. Accessed 06/01/2025. www.nationalacademies.org/publications/27768
- Fang Z, Ahnrsbrak R, Rekito A. Evidence mounts that about 7% of US adults have had long COVID. *JAMA* 2024; 332:5-6.
- Soriano JB, Murthy S, Marshall JC, Relan P, Diaz JV; WHO Clinical Case Definition Working Group on Post-COVID-19 Condition. A clinical case definition of post-COVID-19 condition by a Delphi consensus. *Lancet Infect Dis* 2022; 22:e102-e107.
- Long COVID basics. U.S. Centers for Disease Control and Prevention. 07/24/2024. Accessed 06/01/2025. www.cdc.gov/covid/long-term-effects/index.html.
- Cutler DM. The costs of long COVID. *JAMA Health Forum* 2022; 3:e221809.
- Fekete R, Simats A, Bíró E, et al. Microglia dysfunction, neurovascular inflammation and focal neuropathologies are linked to IL-1- and IL-6-related systemic inflammation in COVID-19. *Nat Neurosci* 2025; 28:558-576.
- Su Y, Yuan D, Chen DG, et al. Multiple early factors anticipate post-acute COVID-19 sequelae. *Cell* 2022; 185:881-895.e20.
- Phetsouphanh C, Darley DR, Wilson DB, et al. Immunological dysfunction persists for 8 months following initial mild-to-moderate SARS-CoV-2 infection. *Nat Immunol* 2022; 23:210-216.
- Stein SR, Ramelli SC, Grazioli A, et al. SARS-CoV-2 infection and persistence in the human body and brain at autopsy. *Nature* 2022; 612:758-763.
- Fischer L, Barop H, Ludin SM, Schaible HG. Regulation of acute reflexory hyperinflammation in viral and other diseases by means of stellate ganglion block. A conceptual view with a focus on Covid-19. *Auton Neurosci* 2022; 237:102903.
- Yong SJ. Long COVID or post-COVID-19 syndrome: Putative pathophysiology, risk factors, and treatments. *Infect Dis (Lond)* 2021; 53:737-754.
- Feigin G, Velasco Figueroa S, Englesakis MF, D'Souza R, Hoydonckx Y, Bhatia A. Stellate ganglion block for non-pain indications: A scoping review. *Pain Med* 2023; 24:775-781.
- Peters MDJ, Godfrey C, McInerney P, et al. Best practice guidance and reporting items for the development of scoping review protocols. *JBI Evid Synth* 2022; 20:953-968.
- Arksey H, O'Malley L. Scoping studies: Towards a methodological framework. *Int J Soc Res Methodol* 2005; 8:19-32.
- Chauhan G, Upadhyay A, Khanduja S, Emerick T. Stellate ganglion block for anosmia and dysgeusia due to long COVID. *Cureus* 2022; 14:e27779.
- Abd-Elseyed A. Stellate ganglion block for treating post-COVID impairment of taste and smell. *Pain Med Case Rep*; 8:261-263.
- Stogicza A, Racz E, Bartos B, Racz K. Successful treatment of post COVID anosmia and dysgeusia with stellate ganglion block. *Pain Pract* 2022; 22:6-104. Abstract presented at: 11th World Congress of the World Institute of Pain; 2022 Aug 25-27; Budapest, Hungary.
- Vu PD, Bansal V, Lin MJ, Bruel B. Sphenopalatine ganglion block for postacute sequelae SARS-CoV-2 infection headaches: A case report and review of the literature. *Pain Med Case Rep* 2023; 7:157-161.
- Liu LD, Duricka DL. Stellate ganglion

- block reduces symptoms of Long COVID: A case series. *J Neuroimmunol* 2022; 362:577784.
22. Alnatour O. The utilization of stellate ganglion block in the treatment of long-COVID: A case series. *Pain Med Case Rep* 2023; 7:63-68.
23. Kalava A, Benyahia SA, Tico Calzada R, Staat CM. Efficacy of stellate ganglion block in treating long-term COVID-19-related olfactory and gustatory dysfunction: A case series. *Cureus* 2023; 15:e40929.
24. Naimi BR, Garvey E, Chandna M, et al. Stellate ganglion block for treating post-COVID-19 parosmia. *Int Forum Allergy Rhinol* 2024; 14:1088-1096.
25. Galvin V, Cheek DJ, Zhang Y, Collins G, Gaskin D. Short communication: Stellate ganglion blockade for persistent olfactory and gustatory symptoms post-COVID-19. *Local Reg Anesth* 2023; 16:25-30.
26. Pearson L, Maina A, Compratt T, et al. Stellate ganglion block relieves long COVID-19 symptoms in 86% of patients: A retrospective cohort study. *Cureus* 2023; 15:e45161.
27. Peterson AM, Miller BJ, Kallogjeri D, et al. Stellate ganglion block for the treatment of COVID-19-induced olfactory dysfunction: A prospective pilot study. *Otolaryngol Neck Surg* 2024; 170:272-276.
28. Farrell NF, Crock LW, Islam A, et al. Stellate ganglion block for the treatment of COVID-19-induced parosmia: A randomized clinical trial. *JAMA Otolaryngol Neck Surg* 2025; 151:741-749.
29. Khan MH, Kirkpatrick KP, Deng Y, Shah KB. Stellate ganglion block for long COVID symptom management: A case report. *Cureus* 2022; 14:e32295.
30. Vinyes D, Muñoz-Sellart M, Caballero TG. Local anesthetics as a therapeutic tool for post COVID-19 patients: A case report. *Medicine (Baltimore)* 2022; 101:e29358.
31. Shim WJ, Remick S, Kim C. Stellate ganglion blocks for post-COVID-19 headaches: Case report. *Pain Med Case Rep* 2024; 8:41-43.
32. Chen P, Hu Y, Zhang N. Observation of the therapeutic effect of ultrasound-guided stellate ganglion block on sleep disorders in patients recovered from COVID-19. *OALib* 2024; 11:1-7.
33. Levey AO, Chen GH, Ngyuen A, et al. The effectiveness and safety of stellate ganglion block in the treatment of symptoms from long COVID-19: A pilot study. *Psychopharmacol Bull* 2024; 54:8-17.
34. Chiang MC, Satko KM, Shin C, et al. Stellate ganglion block for the management of long COVID symptoms: A retrospective cohort study. *Cureus* 2025; 17:e88680.
35. Wang S, Salway RJ, Nicklay M, Kuo J. Effectiveness of dual sympathetic blocks for sympathetically mediated symptoms in post-acute sequelae of SARS-CoV-2 (PASC): An open-label, non-randomized pilot study. *Cureus* 2025; 17:e81530.
36. Kim S, Hillery T, Suric V, Kim C. Stellate ganglion block for refractory post-COVID headache: Case report. *Pain Med Case Rep* 2023; 7:73-76.
37. Levin D, Acquadro M, Cerasuolo J, Gerges FJ. Persistent coronavirus disease 2019 headache relieved with sphenopalatine ganglion block. *Turk J Anaesthesiol Reanim* 2022; 50:S68-S70.
38. Machado FC, Carone Neto G, Carone RSD. Sphenopalatine ganglion block for refractory COVID-19 headache: A descriptive case series. *Braz J Anesthesiol* 2021; 71:667-669.
39. Geng LN, Erlandson KM, Hornig M, et al; RECOVER Consortium. 2024 update of the RECOVER-Adult long COVID research index. *JAMA* 2025; 333:694-700.
40. Dwivedi P, Singh P, Patel TK, et al. Trans-nasal sphenopalatine ganglion block for post-dural puncture headache management: A meta-analysis of randomized trials. *Braz J Anesthesiol Elsevier* 2023; 73:782-793.
41. Mojica J, Mo B, Ng A. Sphenopalatine ganglion block in the management of chronic headaches. *Curr Pain Headache Rep* 2017; 21:27.

