“Effect of pranayama and meditation as an add-on therapy in rehabilitation of patients with Guillain-Barré syndrome—a randomized control pilot study”

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Objective: To study the add-on effects of pranayama and meditation in rehabilitation of patients with Guillain-Barré syndrome (GBS). Patients and Method: This randomized control pilot study was conducted in neurological rehabilitation unit of university tertiary research hospital. Twenty-two GBS patients, who consented for the study and satisfied selection criteria, were randomly assigned to yoga and control groups. Ten patients in each group completed the study. The yoga group received 15 sessions in total over a period of 3 weeks (1 h/session), one session per day on 5 days per week that consisted of relaxation, Pranayama (breathing practices) and Guided meditation in addition to conventional rehabilitation therapeutics. The control group received usual rehabilitation care. All the patients were assessed using Pittsburgh Sleep Quality Index, Numeric pain rating scale, Hospital anxiety and Depression scale and Barthel index score. Mann–Whitney U test and Wilcoxon’s signed rank test were used for statistical analysis.

Results: Quality of sleep improved significantly with reduction of PSQI score in the yoga group (p = 0.04). There was reduction of pain scores, anxiety and depression in both the groups without statistical significance between groups (pain p > 0.05, anxiety p > 0.05 and depression p > 0.05). Overall functional status improved in both groups without significant difference (p > 0.05).

Conclusions: Significant improvement was observed in quality of sleep with yogic relaxation, pranayama, and meditation in GBS patients.

Keywords: Guillain-Barré syndrome, yoga

Implications for Rehabilitation

- GBS is an inflammatory demyelinating polynervous radiculopathy with multiple complications requiring long term care.
- Yoga and other rehabilitation measures contribute in improving functional abilities, pain and sleep quality in GBS patients.
- This randomized control trial showed that short term yoga practice can improve the quality of sleep as compared to other rehabilitation measures in GBS patients.

Background

Guillain-Barré Syndrome (GBS) is an inflammatory, demyelinating disease affecting multiple peripheral nerves. The disease onset is acute or sub acute in nature. The clinical features include flaccid ascending symmetrical limb weakness/paralysis, absence of deep tendon reflexes, cranial nerve palsies, autonomic nervous system disturbances, pain and paraesthesia [1,2]. It has an annual incidence varying from 0.16 to 4 cases per 100 000 populations [3–5]. There are four clearly defined subtypes of GBS: AIDP (acute inflammatory demyelinating polyradiculoneuropathy), AMAN (acute motor axonal neuropathy), AMSAN (acute motor and sensory axonal neuropathy) and Miller–Fisher syndrome [6]. In general the disease outcome is expected to be good. Wide variations are observed during the long term.
follow up with persistent sensory and motor impairments as common sequelae [7,8].

Multiple complications occur during the course of the disease with several long term sequelae. Apart from physical disability persistent pain, fatigue, paraesthesia, mood changes, anxiety, depression [2,7,9] and sleep disturbances are common during rehabilitation [10,11]. A multidisciplinary approach is required for the rehabilitation of the GBS patients which includes pharmacotherapy, nutrition management, carefully modified exercises using gentle range of motion, assisted range of motion, manual resistance, positioning and orthotic management [12,13]. Therapeutic methods like cognitive behavior therapy in the management of pain [14], and psychological education programs designed specifically for patients and the family members have been found to be beneficial in managing pain and psychological sequelae of GBS [15,16].

Integrated yoga that includes postures, pranayama, relaxation and meditation have been found to be effective in the long term rehabilitation of diseases like rheumatoid arthritis [17], bronchial asthma [18] and major depression [19]. Yoga as an add-on to physiotherapy has shown benefits in patients with chronic neck pain [20]. Addition of yogic prana energization technique hastens the callus formation in fracture of long bones [21]. Many other studies have shown demonstrable benefits of yoga after short duration of intensive integrated programs either as inpatient [22] or out patient [23] with better quality of sleep in the elderly [24] and in cancer patients [25] have been documented. There are no studies in the literature that have tried to observe the effect of yogic relaxation techniques during rehabilitation of GBS patients. The aim of the present pilot study was to examine the effect of yoga as an add-on therapy in patients with GBS undergoing in-patient rehabilitation.

Patients and methods

In this randomized control trial, 44 GBS patients who were admitted in the neurological rehabilitation unit in the university hospital after their initial treatment with either plasmapheresis or intravenous immunoglobulin therapy in the acute care neurological ward or in the ICU, from April 2010 to March 2011 were screened for our study. The inclusion criteria were: (a) age group of 15–60 year of both gender, (b) patients with stage 3 (able to walk 5 feet with assistance) and 4 (bed bound) of Hughes scale, (c) weaned off from ventilator, (d) medically stable, (e) those with fair to good trunk balance and (f) admitted in the unit for inpatient rehabilitation. The exclusion criteria were: (a) GBS with Hughes grade 1 (able to run) and 2 (able to walk independently), (b) those with severe respiratory distress, (c) with poor trunk control, (d) Miller–Fisher variant of GBS and (e) chronic inflammatory demyelinating polyneuropathy (CIDP) patients. Patients with grade 5 and 6 according to Hughes scale would not be able to perform yoga whereas patients with grade 1 and 2 on Hughes scale would not agree for 3 weeks inpatient rehabilitation program as they would be independent for most of the ADL including locomotion. This was the reason for including patients’ only with Hughes grade 3 and 4 in the study. Twenty-five (10 AIDP, 12 AMAN, 3 AMSAN) patients met with the eligibility criteria. The sample size calculation for the trial not done as it was a pilot study only. Eleven patients were recruited in each group. The study protocol was approved by the institutes’ ethical committee. Informed consent was obtained from all patients. Out of the total 25 patients, 22 patients who consented to participate were recruited for the study (Figure 1). The patients from rehabilitation consultant were sent to therapy section using serially numbered referral forms, then they were randomly allocated to yoga or control group using a computer generated random table. The random table was created using software from www.Randomizer.org. It was single blind study with blinding of outcome assessor who would assess all patients (both the groups) at the beginning and after end of therapy sessions (after 3 weeks) without knowing the group of the patient (Yoga vs. conservative therapy).

Rehabilitation program

All patients in both the groups (yoga and control) received regular rehabilitation care which included pharmacotherapy, physiotherapy, occupational therapy and orthotic management as per the need of individual patients. Physiotherapy included active assisted range of motion, passive range of motion, stretching of tight muscles, strengthening exercises using weight cuffs, breathing exercises and gait training with or without assistive devices. Functional ability training was provided in the occupational therapy section which included hand function training, trunk stability training and care giver’s education about transfer techniques etc.

Yoga intervention

Patients in yoga group received 15 sessions of yoga (1 hour/day) in addition to the regular rehabilitation therapeutics by a qualified post graduate yoga therapist. Five sessions per week were conducted with no sessions on Saturdays and Sundays. Patients completed sessions over a period of 3 weeks. The yoga intervention was carried out in a place near the in-patient neurological rehabilitation unit between 5 to 6 PM daily. There was no scientific reason behind this particular time of the day for conducting session. This time schedule was convenient for the participant to attend after their routine regular therapy sessions like physiotherapy and occupational therapy etc. During this time, the patients in the control group were allowed to relax with their friends or relatives in the adjacent open lawn.

The specific yoga module developed for GBS patients included Quick relaxation technique (QRT), pranayama and guided meditation (Mind Sound Resonance Technique-MSRT) that could be practiced in supine posture in bed (Table I). Quick relaxation technique (QRT) could be practiced in three phases in a comfortable supine position with eyes closed that involves synchronization of breathing with abdominal movement and energization of the whole body as they chant ‘aaa’ slowly during exhalation.

Pranayama, as defined by sage patanjali([swasa praswayok gatir vicchedah pranayamah] [26]), is aimed at calming down the mind by reducing the rate of breathing voluntarily while
maintaining the mindful awareness of the touch of the air flowing in and out of the air passages.

MSRT is an eight stepped guided meditation technique where the participants are guided to experience the soothing sound resonance in the whole body during repeated slow chanting of the Vedic syllables (a, u, m and om, etc) in a low pitch.

**Measurements**

Assessment for sleep, anxiety, depression and pain was done before and after the period of intervention using Pittsburg Sleep Quality Index (PSQI [27]), Hospital Anxiety and Depression Scale (HADS [28]) and Numeric pain rating scale (NPRS [29]), respectively. Functional status was recorded using Barthel Index (BI [30]) at admission and at discharge.

Pittsburg Sleep Quality Index [27] assesses the quality of sleep in the previous 2 weeks through seven areas: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction. The client self-rates each of these seven areas of sleep. Scoring of answers is based on a 0–3 scale, whereby 3 reflect the negative extreme on the Likert Scale. The responses are added to give composite global PSQI [27], score. A global sum of “5” or greater indicates a “poor” sleeper.

Hospital Anxiety and Depression Scale [28], is used as a screening scale to assess anxiety and depression level of the patients. It contains a total of 14 questions related to anxiety and depression, 7 questions each for anxiety and depression. Each question is scored using 0–3 response, 0 being lowest.
level of response and 3 being the highest level response. Scores are added to get total anxiety score and depression scores separately. A score between 0 and 7 is normal, 8–10 is borderline abnormal and 11–21 is abnormal for both anxiety and depression.

Numeric pain rating scale [29] evaluates the level of pain marked by the patients in a scale containing numbers from 0 to 10, 0 being ‘No’ pain and 10 being the worst maximum pain.

BI [30] consists of 10 items (bladder and bowel in the preceding week, grooming, in preceding 24–48 h, toilet use, feeding, transfers, mobility, dressing, stairs and bathing) with scores ranging from 0 to 100.

Data analysis
Analysis was done using SPSS version 15.0 (SPSS Inc., Chicago, IL). Descriptive statistics was made for the variables showing the demographic details and Shapiro–Wilk’s test was done for all the outcome measures for both groups to find out normality of distribution. Assessment of effect of additional yoga therapy was done by comparing the scores PSQI, HADS, and Numeric pain rating scale at the time of starting therapy and after the completion of 15 sessions between both the groups using Mann–Whitney U test. Effect of therapy within group was analyzed using Wilcoxon signed rank test.

Results
There were 11 subjects in each group with two drop outs, as these two patients took discharge before the study completed at their will due to their personal reasons. Age ranged from 20 to 55 years (32.30 ± 9.911) in yoga group. In the control group age ranged from 15 to 58 years (31.30 ± 14.317). There were eight (80%) male patients and two (20%) female patients in the yoga group whereas five (50%) male and five (50%) female patients in control group. Three patients (30%) had typical AIDP, four patients (40%) had AMAN variant and three patients (30%) had AMSAN variant in yoga group. In the control group four (40%) had typical AIDP and six (60%) patients had AMAN variant. The mean length of stay in the rehabilitation unit in yoga group was 43 ± 3.8 days and in control group was 40.70 ± 3.2 day. The baseline data did not differ significantly between groups (p > 0.05, Shapiro–Wilk test) although there were more males in the yoga group as compare to control group (8 vs. 5).

Yoga schedule of the patients has been shown in Table I. Results after 15 sessions of intervention are shown in Table II.

There was significant difference between groups (p = 0.048, Mann–Whitney U test) in the quality of sleep. The global PSQI [27] score in yoga group improved from 8.70 ± 4.24 to 4.00 ± 3.36 (p < 0.05, Wilcoxon’s test) with no significant change (p = 0.21) in control group from 9.30 ± 4.37 to 7.20 ± 3.49.

The anxiety score of HADS [28] showed a reduction in yoga group from 2.90 ± 2.18 to 1.60 ± 1.64 (p < 0.05) and in control group from 6.60 ± 4.50 to 4.20 ± 4.51 (p < 0.05). No significant difference observed between both group (p > 0.05).

The depression score of HADS [28] also showed a reduction in yoga group from 4.70 ± 3.59 to 1.20 ± 1.22 (p < 0.05) and in control group from 4.90 ± 2.84 to 3.20 ± 2.70 (p < 0.05). No significant change between the groups existed (p > 0.05).

There was a reduction in the level of pain in Numeric pain rating scale [29] in yoga group with a shift from 3.5 ± 2.42 to 2.20 ± 1.47 (p < 0.05) and in control group from 5.90 ± 2.28 to 3.50 ± 2.46 (p < 0.05). There was no significant difference observed between the groups (p > 0.05).

Functional status improved in BI from 33.50 ± 15.64 to 57.50 ± 26.82 (p < 0.05) in yoga group and from 32 ± 8.88 to 69 ± 21.42 (p < 0.05) in control group. No significant difference observed between the groups (p > 0.05). Sub group analysis based on gender was not done because of the unequal number of male and female patients in yoga group.

Discussion
To our knowledge, this is the first randomized control study using yoga techniques (QRT, pranayama and MSRT meditation) as adjuvant therapy for rehabilitation of GBS patients. The results showed that the patients in the yoga

Table II. Results of intervention.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Yoga (Wilcoxon signed rank test)</th>
<th>Control (Wilcoxon signed rank test)</th>
<th>Between groups (Mann–Whitney U test)</th>
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<tbody>
<tr>
<td>PSQI</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Pre</td>
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<td>10.00</td>
<td>0.210</td>
</tr>
<tr>
<td>Post</td>
<td>3.00</td>
<td>8.00</td>
<td>0.048*</td>
</tr>
<tr>
<td>NPRS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre</td>
<td>4.00</td>
<td>6.50</td>
<td>0.026</td>
</tr>
<tr>
<td>Post</td>
<td>2.50</td>
<td>3.50</td>
<td>0.017</td>
</tr>
<tr>
<td>HADS (anx)</td>
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<td></td>
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<tr>
<td>Pre</td>
<td>2.50</td>
<td>6.50</td>
<td>0.026</td>
</tr>
<tr>
<td>Post</td>
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<td>3.00</td>
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<tr>
<td>HADS (dep)</td>
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<td>4.00</td>
<td>0.036</td>
</tr>
<tr>
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<tr>
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<td></td>
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<td>Admission</td>
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</tr>
<tr>
<td>Discharge</td>
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<td>75.00</td>
<td>0.402</td>
</tr>
</tbody>
</table>

**PSQI**, Pittsburg Sleep Quality Index; **NPRS**, Numeric pain rating scale; **HADS (anx)**, Hospital Anxiety Depression Scale-anxiety domain; **HADS (dep)**, Hospital Anxiety Depression Scale-depression domain; **BI**, Barthel index.

*Mann–Whitney U test; significance with p < 0.05.*

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group had significantly better (p < 0.05, between groups on Mann–Whitney) improvement in quality of sleep than the control group, while there were significant improvements in functional status, pain, anxiety and depression in both groups with statistically insignificant differences between groups. However, the results should be interpreted with caution because it's a pilot study only with relatively small sample size.

In one of the studies continuous sleep monitoring among the GBS patients admitted in ICU revealed some sleep abnormalities in the form of reduced REM sleep latency, REM sleep without atonia and NREM sleep with rapid eye movements. These changes were observed even in patients staying out of ICU [10]. Disordered breathing pattern leading to hypoxia and hypercarbia and fragmented sleep pattern have also been observed among GBS patients [11]. High (Global PSQI > 5) baseline scores on PSQI [27], (Yoga = 8.70 ± 4.24, control = 9.30 ± 4.37) observed in our study reflects these observations. The improvement in the median scores after yoga reached a value of 4.00 ± 3.36 indicating that these patients slept normally, while the patients in control group also showed some improvement in their scores (7.20 ± 3.49) that did not reach normalcy. Studies using meditation and chanting similar to the techniques used in this study showed improved quality of sleep in the form of appearance of theta rhythm during slow wave sleep along with low EMG and enhanced REM duration following Transcendental Meditation(TM) among healthy volunteers [31,32] and enhanced slow wave sleep and REM sleep state among different age groups of healthy Vipassana meditation practitioners [33,34]. This improved quality of sleep may be due to the improved REM sleep and slow wave sleep by meditation practice and regularization of breathing through pranayama practices.

Pain control through pranayama and meditation (MSRT) techniques in chronic pain conditions like low back pain and neck pain was found to be significant in some studies [20,22]. In this present study, the pain in GBS patients showed improvement in both the groups and add on yoga techniques did not have additional benefits. This may be due to the difficult nature of GBS pain which includes both nociceptive and neuropathic components. In one of the earlier studies in neurological rehabilitation unit, it was reported that about 80% admitted GBS patients had neuropathic pain and 34.3% of these patients required more than one medications and the pain persisted for longer duration [13]. As the neuropathic pain is more difficult to treat, 15 yoga sessions might not have been sufficient and the results could have been different with more yoga therapy sessions.

The baseline median anxiety and depression scores in both the group, showed that the anxiety and depression level were in normal range. This can be attributed to natural history of illness, nature of the disease progression and prognosis being explained routinely to all patients including GBS patients in rehabilitation unit and this might have contributed in improving relaxation and allaying mood disorders in this population. Similar observation has been reported in a qualitative analysis of the patients’ experiences during the acute stage of GBS [35]. Though there was a significant improvement in the post session scores in both anxiety and depression (less score) there was no statistical significance existed between the groups. When comparing the depression scores according to HADS in our trial between yoga group and control group, we observed a trend suggestive of better improvement in depression in yoga group as compare to control group, although it did not reach significant levels (p = 0.07). A future trial comprising of healthier sample size using the same scale might come up with some interesting findings.

Some positive findings have been reported in the management of anxiety and depression levels with the use hyperventilation type of pranayama like kapalabathi and Basthrika or combination of Aasanas (physical postures)and pranayama [36]. Hyperventilation techniques are difficult to practice by the GBS patients because of the intercostals and abdominal muscles weakness. Similarly some physical postures also cannot be practiced because of the motor paralysis of both trunk and limb muscles.

Significant functional recovery found in both groups at discharge time without statistical significance on comparison. In one of the earlier study similar improvement in the functional status has been reported [13].

Although study has a small sample size, it highlights the importance of yoga in managing a number of co-morbidities (complications) occurring as a result of GBS. Training para-medical staff to carry out these practices or hiring trained yoga instructors to take care of such patient group could prove be a cost-effective method of rehabilitation. Further, although patients showed trend for improvement across all the domains (functional ability, sleep quality, anxiety and depression) in both the groups, a longer duration of yoga program should be worth exploring in future studies.

**Conclusions**

Significant improvement in quality of sleep was observed in GBS patients in yoga group as compare to control group with yogic relaxation, pranayama, and meditation. There was reduction of pain scores, anxiety and depression in both the groups without statistical significance between groups. Similarly overall functional status improved in both groups without significant difference between the groups.

Pranayama and meditation practices are simple and effective techniques, which do not require any special equipment or space, can be used in GBS patients to improve their quality of sleep, anxiety, depression and level of pain during their stay in the hospital for rehabilitation. Yoga practices can also be incorporated as home-based programs with recorded materials with little direct contact training for the GBS patients. This would also benefit many such patients, who are not able to avail in-patient rehabilitation for various reasons.

There were some limitations of this study like it was a single blind study. The number of yoga therapy sessions was confined to 15 only. More sessions would have provided better insight on the role of yoga in improving other problem areas and issues in GBS patients during in-patient rehabilitation. Sleep recordings and pulmonary function test can be added in future study with healthier sample size, increased frequency and duration of yoga practice and adequate follow up to see the lasting effects.
Declarations of Interest: The authors declare no conflict of interest. The authors alone are responsible for the content and writing of the paper. No funding was received from any source for this project.

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