# Hyperbaric oxygen treatment in a patient with Guillain-Barré syndrome receiving mechanical ventilation

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**Abstract**

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The mortality rate of patients with Guillain-Barré syndrome (GBS) who develop respiratory muscle paralysis and need mechanical ventilation is increased. Though an unestablished indication, hyperbaric oxygen treatment (HBOT) has been used to treat patients with mild GBS who do not have respiratory muscle paralysis. The use of HBOT in severe cases has not been reported. We present a patient with severe GBS who received HBOT while ventilated in a multiplace hyperbaric chamber. Three courses of HBOT (one session per day, 10 sessions per course) were administered with a 2-day rest period between each course. The HBOT protocol was 40 minutes at 220 kPa with 25 minutes of compression and decompression. Following weeks of gradual deterioration, motor function improved after the first HBOT session. After eight HBOT sessions, the patient was successfully discontinued from mechanical ventilation and after 10 sessions the patient's muscle strength was significantly improved. After 30 HBOT sessions, the patient had normal breathing and speech, and did not cough when eating. Upper limb muscle strength was graded as 4 on the Medical Research Council (MRC) scale, lower limb muscle strength was graded as MRC 3. The patient was successfully discharged. Mechanically ventilated GBS patients may benefit from HBOT but studies are required to separate spontaneous recovery rates from treatment benefit.

## Introduction

Guillain-Barré syndrome (GBS) is a monophasic, autoimmune polyneuropathy causing demyelination of the spinal nerve roots and peripheral nerves. It is characterised by progressive symmetrical muscle weakness of acute or subacute onset; commonly precipitated by an infection.[1,2] Patients with severe GBS may develop cranial nerve palsies, respiratory muscle paralysis, dysphagia, dysphonia and respiratory failure. There is no definitive therapy for GBS; while most patients have a favourable prognosis after active treatment, severe cases may die from respiratory muscle paralysis complicated by pneumonia. The use of hyperbaric oxygen treatment (HBOT) in patients with severe GBS with respiratory muscle paralysis requiring mechanical ventilation has not been reported. We report a woman with severe ventilator-dependent GBS who received HBOT with contemporaneous improvement of her symptoms such that mechanical ventilation could be discontinued, and she could be discharged.

## Case report

A 24-year-old female was hospitalised because of limb weakness and numbness for two months and difficulty breathing for one month. The patient visited several hospitals without a diagnosis being made. Her symptoms had worsened, with muscle strength progressively decreasing, her voice becoming weak, onset of dysphagia and difficulty walking.

She initially presented to another local hospital where cerebrospinal fluid examination showed a protein of 0.59 $g \cdot L^{-1}$ (normal range 0.15–0.45 $g \cdot L^{-1}$), glucose of 3.85 $mmol \cdot L^{-1}$ (normal range 2.8–4.5 $mmol \cdot L^{-1}$), positive Pandy's reaction, white blood cell count of $2 \times 10^{6} \cdot L^{-1}$, and no red blood cells. After excluding other diseases, the patient was diagnosed with GBS and pneumonia, receiving a tracheotomy, mechanical ventilation and continuous intravenous infusion of gamma globulin for five days. She was also treated with hormone pulse therapy and administrated neurotrophic, anti-inflammatory and anti-tuberculosis medications. However, the patient's condition failed to improve, requiring continued mechanical ventilation from which she was unable to be weaned. After one month of treatment in the neurology department of the local hospital she was transferred to the Department of Neurology, the First Hospital of Jilin University, Peoples' Republic of China for further treatment.

On admission, the patient's temperature was 36.8°C, heart rate112 beats·min$^{-1}$, and blood pressure 80/60 mmHg. The patient was alert but with no spontaneous breathing, and had received a tracheostomy. Scattered moist rales were heard in both lungs. Neurological examination showed that the patient was conscious, her tongue was midline when extended, bilateral pain and temperature sensation were normal and there were no signs of meningeal irritation. Her limb muscle strength was graded as zero on the Medical Research Council (MRC) scale, and tendon reflexes were absent. A lung CT scan revealed tuberculosis of the right upper lobe and both lower lobes, several calcified mediastinal lymph nodes and multiple enlarged lymph nodes in both axillae. Her admission diagnosis included GBS and pneumonia, with shock. After admission, the patient received continuous mechanical ventilation, and neurotrophic, anti-inflammatory, low-dose hormone and immunosuppressive medication. However, there was no significant improvement in limb muscle strength and she could not be weaned from mechanical ventilation.

On the tenth day of admission, the patient underwent HBOT with mechanical ventilation, accompanied by a hyperbaric physician. Three courses of HBOT were performed (one session per day, 10 HBOT sessions per course) with a two-day rest period between each course. Each session lasted 90 minutes with a treatment pressure of 220 kPa with 25 minutes of compression and decompression and inhalation of 100% oxygen for 40 minutes. After the first HBOT session, the patient was improved, with muscle strength in her upper limbs graded as one, and in the lower limbs graded as two. After five sessions, the patient was able to move her fingers and slightly move her neck and shoulder muscles; proximal lower limb muscle strength was graded as three, distal muscle strength was graded as two, and tendon reflexes were restored. After eight HBOT sessions, the patient was successfully discontinued from mechanical ventilation and after 10 sessions, the patient's muscle strength was significantly improved. As the patient's condition was significantly improved, she was able to be discharged. After discharge she had two further courses of HBOT as an outpatient. After the third course of HBOT, the patient had spontaneous normal breathing, normal voice, and did not cough when eating. Upper limb muscle strength was graded as four and lower limb muscle strength was graded as three. At one-month follow-up, the patient was able to take care of herself.

## Discussion

Plasma exchange and immunoglobulin therapy are the proven effective treatments for GBS, no other treatments have been shown to be effective.[3,4] In our case, the patient had received treatment with plasma exchange, hormone pulse therapy, intravenous infusion of high-dose gamma globulin and administration of neurotrophic, anti-inflammatory drugs without improvement after one month of treatment, and mechanical ventilation could not be discontinued. The patient then received HBOT whilst ventilated with immediate signs of improvement; her respiratory and limb muscle strength began to recover gradually, enabling the patient to be discontinued from ventilatory support and eventually to be able to take care of herself.

HBOT increases blood oxygen concentration, produces vasoconstriction and inhibits neuro-oedema.[5] HBOT increases the diffusion distance of oxygen through the tissues, increasing tissue oxygen supply, improving the hypoxic state of nerves which may create a healing environment to improve the repair of injured nerves. Studies have shown that HBOT can promote axonal regeneration and facilitate nerve repair.[6–8] HBOT combined with methylprednisolone can promote facial nerve regeneration.[9]

This report shows that patients with severe GBS can receive HBOT while ventilated. There was a precise temporal relationship between commencement of HBOT and improvement in her clinical condition after one month of no improvement with other therapies. However, GBS has not been recognised as a proven indication for HBOT[10] and can only be considered an experimental indication as previously defined.[11] Many patients with GBS may recover spontaneously, so whether the improvement in patients with GBS is attributable to HBOT requires further investigation.

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