

1 **Effectiveness of Stellate Ganglion Block for the Treatment of Patulous Eustachian**

2 **Tube: A Case Report**

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21 **Abstract**

22 A 56-year-old woman presented with a 2-month history of patulous eustachian tube. She
23 had sudden weight loss after developing a cold, after which she had been experiencing
24 disabling autophony and a sensation of blockage in the ear. She underwent stellate
25 ganglion block in eight months; her symptoms resolved subsequently.

26 **Keywords:**

27 patulous eustachian tube, stellate ganglion block, autophony, breathing awareness

28 **Key clinical message:**

29 We concluded that successful management of PET can be obtained with SGB; this
30 treatment was not previously used for this disorder.

31 **1. INTRODUCTION**

32 The eustachian tube (ET) allows pressure equalization between the mesotympanum
33 and the nasopharynx and maintains the health of the middle ear cavity. A patulous
34 eustachian tube (PET) is abnormally patent, with a reported incidence of 0.3–6.6%.¹
35 PET symptoms occur due to the ET remaining open for an extended time; they include
36 enhanced awareness of one's own voice and breathing, a phenomenon known as

37 autophony, and a continuous sensation of ear blockage. In severe cases, these symptoms
38 can lead to depression and suicidal tendencies. Thus, PET is a benign disease that can
39 nevertheless seriously affect the quality of life.

40 The ET is typically closed at rest and maintains middle ear ventilation to facilitate
41 sound transmission from the tympanic membrane to the cochlea. Various risk factors are
42 associated with PET, including rapid weight loss (the most common cause), pregnancy,
43 aging, and hypotension. Anatomical causes of PET include the loss of subcutaneous
44 peritubal tissue (Ostman's fat pad), abnormal contractile activity of the peritubal
45 muscles (soft palate tensor and levator muscles and salpingopharyngeus muscle), or an
46 inability of the pterygoid venous plexus to effectively close the ET.²

47 At present, no treatment for PET has been established. Common therapeutic
48 measures include lifestyle modifications, such as avoiding rapid weight loss,
49 coffee/caffeine, stress, and anxiety; noninvasive treatments (nasal instillation of
50 physiological saline³ and infusion of an absorbable gelatin sponge solution into the
51 pharyngeal ET orifice⁴); and medical management with adenosine triphosphate (ATP)
52 infusion and oriental medicine.⁵ ATP increases the auditory tube closing pressure by
53 stimulating the vascular flow. In addition, several surgical or interventional treatment
54 options are available for patients with persistent symptoms. Surgical options include the

55 insertion of a tympanostomy tube, heavy tympanic membrane loading, a tympanic
56 passage plug, or nasal injection of a soft tissue bulking agent into the tubular torus.⁶ The
57 mechanism underlying these surgical options involves the physical narrowing of the
58 auditory tube opening. Thus, these treatments improve PET symptoms by facilitating
59 ET closure.

60 The stellate ganglion block (SGB) has been used to treat several clinical sympathetic
61 pain and vascular insufficiency syndromes. The stellate ganglion is formed by the fusion
62 of the inferior cervical and superior thoracic sympathetic ganglions. SGB improves the
63 blood supply to the head and neck. Therefore, we believe that SGB can also alleviate
64 PET symptoms by increasing the blood supply.

65 Here, we report a successful case of PET treatment using SGB. This treatment has
66 not been previously attempted in PET cases to the best of our knowledge.

67

68 **2. CASE REPORT**

69 A 56-year-old woman diagnosed with PET visited our hospital. Two months prior to
70 the visit, she had developed a cold and experienced rapid weight loss. Since then, she
71 had been experiencing disabling autophony and a sensation of ear blockage. These

72 symptoms were reduced in the supine and lordotic positions. Soon after, she was
73 diagnosed with PET through otoscopy by an otolaryngologist and was treated with the
74 oriental medicine “Kamikihito,” a popular Japanese herbal medicine used for PET.
75 However, her symptoms continued to persist, and she consulted our hospital, where she
76 had been previously treated for lumbago for two years.

77 Her symptoms were severe, reaching a score of 10 on the numerical rating scale
78 (NRS). We offered SGB as treatment and, after explaining the procedure, obtained
79 informed consent from the patient. Ultrasound-guided SGB was performed by injecting
80 3 mL of 1% mepivacaine. We chose this drug for SGB because mepivacaine is
81 relatively safe and commonly used at our outpatient pain clinic. The treatment was
82 performed on alternate sides in each session, and the NRS score for symptoms in the
83 right ear decreased to 1 after the first procedure. We continued to perform SGB twice a
84 week for a month, and the NRS score for the left side decreased to 3. Subsequently, the
85 frequency of SGB was reduced to once per month. After eight months, the NRS score
86 for the left side had decreased to 1, and the treatment reached its completion after 18
87 sessions. Complications like inadvertent epidural injection, subarachnoid hemorrhage,
88 accidental intravascular injection, hematoma formation and esophageal injury, were not
89 observed.

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91 **3. DISCUSSION**

92 This report describes the first successful treatment of PET with SGB, an intervention
93 typically used to treat various pain conditions in the head and neck, such as postherpetic
94 neuralgia and complex regional pain syndrome. In particular, SGB is used to treat
95 vascular insufficiency. Several studies have reported that SGB reduces vascular
96 resistance, increases blood flow in the homolateral common carotid and vertebral
97 arteries, and decreases the contralateral blood flow.^{7,8} Ultrasound-guided SGB has been
98 reported to allow an effective and precise sympathetic block while requiring only a low
99 injectate volume, thereby minimizing the risk of vascular and soft-tissue injuries.⁹ PET
100 symptoms often diminish in the supine and lordotic positions; this effect is mainly
101 related to the enlargement of the pterygoid venous plexus (PVP).¹⁰ These positions
102 cause venous pooling in the PVP, swelling the tensor veli palatini and medial pterygoid
103 muscles. PET treatments aim to increase blood flow in the areas surrounding the ET,
104 hence, increasing the volume of the nasopharyngeal ET. SGB has similar effects on
105 blood flow in the head and neck. In this case, the PVP blood flow was likely increased
106 by the SGB, reducing the auditory tube lumen. This mechanism may have reduced the
107 patient's PET symptoms.

108 This case report had some limitations; the main one was the lack of an auditory tube
109 function test. PET diagnostic criteria have not yet been definitively established;
110 however, the Japan Otological Society's Eustachian Tube Committee proposed a few
111 criteria in 2016 (Table 1).¹¹ These criteria include 1) subjective symptoms, 2)
112 improvement by tubal obstruction procedures, and 3) objective findings. If all three
113 criteria are met, PET can be a definite diagnosis; if only two criteria are met (1 and
114 either 2 or 3), PET is a possible diagnosis. In this case, all three criteria were present:
115 the patient presented with voice autophony and aural fullness; the symptoms were
116 reduced in the supine or lordotic position, and respiratory fluctuation of the tympanic
117 membrane was noted. However, an evaluation with tubo-tympano-aerodynamic-graphy
118 (TTAG) and sonotubometry is essential for the assessment of the treatment progress.
119 Although our evaluations were sufficient to diagnose PET, an auditory tube function test
120 would have allowed an objective PET evaluation to determine its response to treatment
121 and follow-up.

122 In conclusion, this report describes the first successful management of PET with
123 SGB. This procedure may be an effective treatment for PET, and ultrasound-guided
124 SGB is safer than the conventional technique. However, additional research is required
125 to verify the validity of this technique.

126 **ACKNOWLEDGMENTS**

127 None.

128 **CONFLICT OF INTEREST:**

129 The authors certify that there is no conflict of interest with any financial organization
130 regarding the material discussed in the manuscript. The patient has consented to the
131 submission of the case report for submission to the journal.

132 **AUTHOR CONTRIBUTIONS:**

133 KY was responsible for obtaining consent, discussions with the ethics committee,
134 acquiring the data, and drafting the manuscript. MI and JA established the clinical
135 diagnosis with KY and assisted in the drafting and critical revision of the manuscript.
136 MI critically revised the manuscript. All the authors approved the final version of the
137 manuscript.

138 **ETHICAL APPROVAL**

139 As a single case report with the patient's signed consent, no other ethical review was
140 required.

141 **FUNDING**

142 The authors declare that they have no funding.

143 **CONSENT**

144 Written informed consent was obtained from the patient for publication of this case
145 report.

146 **DATA AVAILABILITY STATEMENT**

147 Data are available on reasonable request.

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219 **Table 1. Diagnostic criteria for patulous eustachian tube proposed by the Japan Otological**
220 **Society**

<p>1. Subjective symptoms</p> <p>One or more of the following symptoms: voice autophony, a sense of aural fullness, and breathing autophony</p> <p>2. Tubal obstruction procedures (A or B) clearly improve the symptoms</p> <p>A. Posture change in the lying / lordotic position</p> <p>B. Pharyngeal orifice obstruction treatment (swab, gel, etc.)</p> <p>3. At least one of the following objective findings for a patent E-tube:</p> <p>A. Respiratory fluctuation of the tympanic membrane</p> <p>B. Variations of external auditory meatus pressure synchronized with the nasopharyngeal pressure</p> <p>C. Sonotubometry showing (1) test tone sound pressure level less than 100 dB or (2) an open plateau pattern.</p>
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221 If all three criteria are met, the diagnosis is “Definite PET;” if only two criteria are met
222 (1 and either 2 or 3), the diagnosis is “Possible PET.” PET: Patulous Eustachian tube
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