

Case Report

Is Laser Surgery with Balloon Dilatation Treatment Effective in Subglottic Stenosis Developing After Covid-19 Infection?

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ABSTRACT

COVID-19 pneumonia has increased tracheal complications because it increases the need for mechanical ventilation and causes mucosal damage in the airway mucosa. One of these complications is subglottic stenosis. Four patients who developed subglottic stenosis following the COVID-19 infection were examined and referred to the ear, nose, and throat clinic between June 2020 and June 2022. All the patients included in our study were male and 57,75± 14.38 years old on average. The median intubation time was 15.75±7.8 days. All patients received laser surgery with balloon dilatation treatment. The median number of laser surgery with balloon dilatation treatments was 2.25±0.95. We used laser surgery and balloon dilatation as an effective and safe treatment method in our patients to treat subglottic stenosis resulting from the damage caused by COVID-19 pneumonia in the airway mucosa.

Keywords: Covid-19, Subglottic Stenosis, Balloon Dilatation, Laser.

ÖZ

Covid-19 Enfeksiyonu Sonrası Gelişen Subglottik Stenozda Lazer+Balon Dilatasyon Tedavisi Yeterli midir?

COVID-19 pnömonisi, mekanik ventilasyon ihtiyacını arttırması ve solunum yolu mukozasında yapmış olduğu mukozal hasar nedeniyle trakeal komplikasyonları arttırmıştır. Bu komplikasyonlardan birisi subglottik stenozdur. Firat Üniversitesi Hastanesi Kulak Burun ve Boğaz Hastalıkları Kliniğine Haziran 2020 ve Haziran 2022 tarihleri arasında COVID-19 enfeksiyonu sonrası subglottik stenoz gelişerek başvuran dört hasta incelendi. Çalışmamıza dahil edilen hastaların hepsi erkek cinsiyette, ortalama yaşı 57,75± 14.38 yıldır. Ortalama entübasyon süresi 15.75±7.8 gündür. Tüm hastalara balon dilatasyon+lazer tedavisi uygulanmıştır. Ortalama balon dilatasyon+lazer sayısı 2.25±0.95 idi. Covid-19 pnömonisinin solunum yolu mukozasında hasar oluşturması sonucunda oluşan subglottik stenoz tedavisinde lazer cerrahisi ve balon dilatasyon yöntemini, hastalarımızda etkin ve güvenilir bir tedavi yöntemi olarak kullandık.

Anahtar Sözcükler: Covid-19, Subglottik Stenoz, Balon Dilatasyon, Lazer.

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Coronavirus disease 2019 (COVID-19) was declared by the World Health Organization as a pandemic in March 2020 (1). Nineteen percent of the COVID-19 patients who progress with symptoms similar to those of viral pneumonia are classified as severe-critical. The ratio of patients with respiratory distress enough to require invasive mechanical ventilation was 10-15% (2-4).

COVID-19, which increases upper airway inflammation, combined with airway management factors, led to the onset of challenging subglottic stenosis in patients, which requires multiple interventions (5). For subglottic stenosis, endoscopic treatment techniques such as laser surgery (carbon dioxide laser (CO₂ laser), Neodymium-doped Yttrium Aluminum Garnet laser (Nd:

YAG laser)), balloon dilatation, or cold knife are used. In general, a combination of these endoscopic techniques is used together. Open-technique treatment options associated with high morbidity and are more invasive, are not preferred as an initial method. The purpose of all these methods is to ensure airway patency to eliminate shortness of breath. However, most of the patients develop repetitive stenosis and require multiple interventions (6).

This study examines, in conjunction with the existing literature, individuals who were followed up in intensive care after COVID-19 infection, were intubated and given ventilator support due to respiratory distress, and were then treated for subglottic stenosis.

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CASE REPORT

The demographic data of the patients with a history of COVID-19 pneumonia and follow-up in intensive care as intubated is presented in Table 1.

Table 1. Demographic data of patients.

	Patient 1	Patient 2	Patient 3	Patient 4
Age	75	48	44	64
Gender	Male	Male	Male	Male
Intubation Time (days)	25	17	6	15
Comorbidity	HT,CAD	-	-	HT, CAD
Pre-treatment Stenosis Grading	Stage 3	Stage 3	Stage 2	Stage 3
Post-treatment Stenosis Grading	Stage 1	Stage 1	Stage 1	Stage 1
Number of Operations (Laser Surgery with Balloon Dilatation)	1	3	2	3
Time Since the Last Operation (Months)	12	13	7	11

HT: Hypertension, CAD: Coronary artery disease.

All the patients included in our study were male and $57,75 \pm 14.38$ years old on average. The median intubation time was 15.75 ± 7.8 days. All patients were treated by laser surgery (Blue Shine Diode Laser, Italy) with balloon dilatation (TRACOE Aeris, Germany). Our study found the median number of laser surgery + balloon dilatation treatments to be 2.25 ± 0.95 . No open surgery was required in any of the patients (Figure 1).

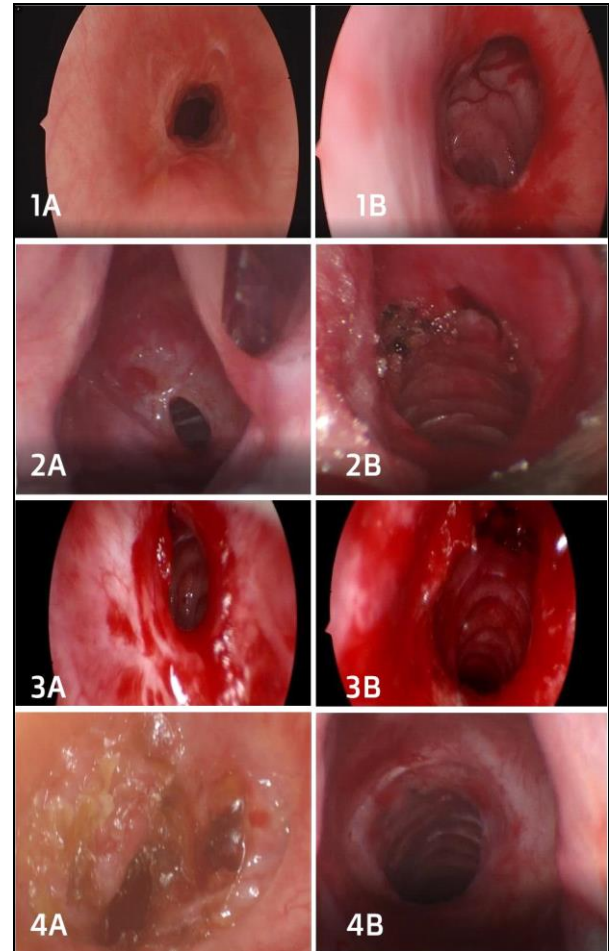


Figure 1. Patients' preoperative (A) and last postoperative (B) views.

The intubation period of one of our patients appeared to take longer, so a tracheotomy was performed on the 25th day.

Subglottic stenosis grading of the patients was done according to the Cotton-Myer classification and evaluated pre-operatively and post-operatively (Table 1) (7). When we looked at the preoperative stenosis grading of the patients, three were Stage 3, and one was Stage 2. The last postoperative stenosis grading of the patients was Stage 1 for all patients (Figure 1). Also, the time that passed since the patients' last laser surgery with balloon dilatation operation was 10.75 ± 2.62 months (Table 1).

DISCUSSION

Patients with COVID-19 pneumonia have been found to require increased mechanical ventilation (4). Also, the need for extended periods of positive end-expiratory pressure (PEEP) in patients with COVID-19 pneumonia led to extended periods of intubation (8).

It was considered to delay performing tracheotomy to mitigate the infection risk to physicians and allied healthcare personnel during the COVID-19 pandemic, and compared to the pre-pandemic period, the intubation time of patients without tracheotomy was reported

to have increased by 10 days on average (9). Allgood et al. (4) have reported the median ventilation time of COVID-19 patients as 17 days, while Scholfield et al. (5) have reported it as 28 days. In our study, all of our patients were followed up as intubated, and the median number of intubation days was 15.75 ± 7.8 .

The significance of damage depth was found to be an important factor in developing subglottic stenosis (10.). The damage on a mucosal and submucosal level usually appears to heal in a normal way. However, the damage in lamina propria, perichondrium, and cartilage heals in the form of stenosis in the subglottic region (11, 12). The traumas on the deep level stimulate the fibroblasts in lamina propria (13). Fibroblasts in the lamina propria produce inflammatory cytokines such as collagen and TGF-beta. This stimulates mucosal fibrosis (14). Mucosal damage is observed as a result of the subglottic region's traumatization due to the intubation tube's movement during the intubation. One of the factors that cause mucosal damage is cuff pressure. Increased cuff pressure causes mucosal damage due to its mucosal contact (15, 16). The rate of tracheal complications in coronavirus patients, such as postintubation subglottic stenosis, has been reported to increase as a result of different combinations of increased proinflammatory cytokines, microvascular damage caused by increased thrombosis, increased viral load in the airway mucosa, mucosal atrophy caused by steroids used in the treatment (17).

Subglottic stenosis treatment algorithm is questionable, and criteria that define the inefficacy of endoscopic laser surgery with balloon dilatation method and the

requirement of surgical intervention have yet to be defined conclusively. Christopher et al. (18) have reported the median number of pre-resection endoscopic laser surgery with balloon dilatation treatments as 2.2. in patients where laser surgery with balloon dilatation intervention is not effective and tracheal resection is required. Scholfield et al. (5) have reported that one of the three patients who developed subglottic stenosis during COVID-19 responded to laser surgery with balloon dilatation treatment; the other two patients did not benefit from the laser surgery with balloon dilatation treatment and performed the resection of the stenotic segment and end-to-end anastomosis operation. Our study found the median number of laser surgery with balloon dilatation treatments to be 2.25 ± 0.95 . No open surgery was required in any of the patients. The preoperative stenosis grading was Stage 3 in three of the patients and Stage 2 in one of them, while the postoperative stenosis grading was Stage 1 in all of them. The median time since the last laser surgery with balloon dilatation operation was 10.75 ± 2.62 months, and the patients continued to live normally without any shortness of breath.

COVID-19 infection can cause various complications following the damage it causes in the tissues. Patients intubated due to pneumonia developing in the lungs can develop subglottic stenosis. Despite our limited number of patients, we think that laser surgery and balloon dilatation are effective and safe methods to treat subglottic stenosis that develops after the COVID-19 infection.

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