



Post-intubation tracheal stenosis in COVID-19 patients

Francesco Mattioli¹ · Alessandro Marchioni² · Alessandro Andreani² · Gaia Cappiello² · Matteo Fermi¹ · Livio Presutti¹

Received: 18 May 2020 / Accepted: 23 September 2020 / Published online: 3 October 2020
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Benign subglottic/tracheal stenosis (SG/TS) is a debilitating and potentially life-threatening condition that is commonly caused by iatrogenic events as a result of endotracheal intubation or tracheostomy. It has long been known that ischemia caused by prolonged intubation is a source of initial injury leading to scar formation, especially in obese patients [1]. In December 2019, a novel coronavirus causing severe acute respiratory disease occurred in China. The World Health Organization (WHO) considered it a public health emergency of international concern on January 31, 2020. The most common and severe complication in patients with COVID-19 is an acute respiratory distress syndrome (ARDS), requiring oxygen and ventilation therapies. Current evidence from China suggests that between 9.8 and 15.2% of patients required invasive mechanical ventilation (IMV) [2]. It has been demonstrated that COVID-19 patients had a median duration of ventilation of 17 days and high frequency of re-intubation [3, 4]. In addition, over-cuffed intubation and prone position ventilation might contribute to the mechanism underlying the stenosis. Lastly, several authors have demonstrated the correlation between COVID-19 patients requiring IMV and obesity, which is a proven risk factor also for SG/TSs [5]. It can be postulated that a certain amount of these patients will develop a SG/T cicatricial concentric stenosis after extubation. A respiratory distress syndrome in these patients might be misdiagnosed, thus we believe that HRCT plays a significant role in differential diagnosis of SG/TS with other tracheobronchial or pulmonary diseases. The management of SG/TS is still controversial and there is no consensus about the best treatment strategy. At present, there

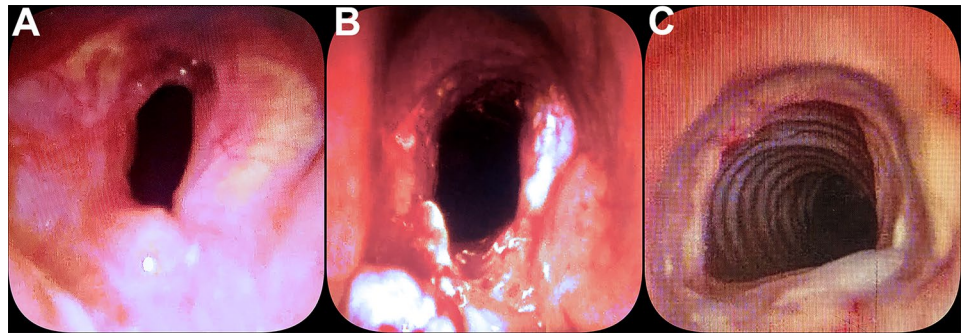
are no experiences reported about this topic in COVID-19 scenario. The primary aim of the treatment consists in maintaining the patency of the patient's airway, preserving voice and swallowing. Open surgical approaches, such as tracheal resection-anastomosis, should be avoided as primary choice treatment in COVID-19 population. This strategy is more common in the setting of previous prolonged intubation or tracheostomy, since external or internal trauma to the airway is associated with cartilage injury and the potential loss of structural support. However, these approaches should be selected for patients with no comorbidities, which is not the case of the vast majority of the critically ill COVID-19 patients that required prolonged IMV [6]. Another important issue is the postoperative management, since patients undergoing open airway surgery require close observation and serial endoscopic evaluations to intervene promptly in case of complications. These issues might expose health-care workers (HCW) to a higher risk of cross-infection. For such reasons we suggest, based on our experience [6], to manage this complication endoscopically with balloon dilation procedure with eventual intralesional corticosteroid injection, even in case of circumferential and complex stenosis (Fig. 1a). This minimally invasive procedure might guarantee a significant improvement of the airway patency (Fig. 1b), preventing the need for tracheostomy. Moreover, procedure is fast and does not require ventilation, thus limiting the risk of cross-infection for the HCWs involved in the intervention. This technique might play a significant role during COVID-19 epidemic, since it is minimally invasive, safe and might definitively solve some of the post-intubation SG/TS, avoiding the need for tracheostomy or more invasive surgeries. However, there is a non-neglectable risk of recurrences with restenosis and thus it is recommended to follow-up the patients treated endoscopically with consecutive endoscopic assessment. Several authors have already demonstrated that balloon dilation can be beneficial in selected patients, especially those with "thin and young" stenosis. Moreover, it can play a temporary and symptomatic role while waiting for definitive open surgery for patients having

✉ Matteo Fermi
matteo.fermi.med@gmail.com

¹ Department of Otorhinolaryngology, Head and Neck Surgery, University Hospital of Modena, Via Largo del Pozzo 71, Modena, Italy

² Bronchoscopy and Respiratory Diseases Department, University Hospital of Modena, Via Largo del Pozzo 71, Modena, Italy

Fig. 1 **a** Tracheoscopy. Circumferential cicatricial tracheal stenosis. Cotton-Meier grade 3; **b** bronchoscopy. Anatomic result immediately after endoscopic balloon dilation. The airway patency is restored. **c** Endoscopic assessment 2 months after surgery



complex laryngotracheal stenosis or comorbidities related to COVID-19 (e.g. obesity, advanced age, post-COVID-19 severe cardiopulmonary conditions or polyneuropathy) [7]. Having this technique in the surgical armamentarium can be of importance during COVID-19 epidemic, since it is likely to manage SG/TS in patients previously treated with IMV, who are not seroconverted or have unknown viral or serologic status. Endoscopic treatments will aid the clinician to solve the airway stenosis, buying time for eventual further treatment and limiting the HCWs cross-infection.

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