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BRIEF COMMUNICATION

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# A modified technique to simplify external fixation of the subglottic silicone stent

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## Abstract

Several techniques have been previously proposed to fix silicone stents for subglottic tracheal stenosis. However, they require special tools or cumbersome manoeuvres. The proposed modified procedure offers a potential alternative fixing technique using absorbable suture buried subcutaneously and not requiring special devices. This procedure was successfully performed in 27 patients with inoperable complex subglottic stenosis. The mean distance from vocal folds, the mean length and mean diameter of stenosis were 17 ± 2 mm, 20 ± 2.9 mm and 6.9 ± 0.9 mm, respectively. The mean procedural time for fixing the stent was 5 ± 0.3 min. No intraoperative or postoperative complications such as stent damage, dislocation, plugging or vocal folds dysfunction were reported (mean follow-up 20 ± 7.7 months).

**Keywords:** Subglottic stenosis • Rigid bronchoscopic • Fixation stent

## INTRODUCTION

Endoscopic dilation and straight-type silicone stent placement are palliative treatment for inoperable subglottic stenosis [1]. However, respiratory movement, coughing and swallowing may cause stent dislocation [2, 3]. To avoid this complication, several techniques [4–7] have been previously proposed to fix the silicone stent, often requiring special tools or cumbersome manoeuvres. To simplify the stent-securing procedure, a modified fixing technique was proposed, evaluating its feasibility.

## TECHNIQUE

The procedure was performed in the operating room under local anaesthesia with 2% xylocaine and intravenous deep sedation with short-acting narcotics and benzodiazepines. The patient was intubated with a 14-mm rigid Efer-Dumon bronchoscope, and the ventilator was connected to it. An adequate airway lumen was obtained with laser radial incisions and mechanical dilation of stenosis, and then a straight-type silicone stent was inserted to maintain the airway patency. The length and diameter of the stent were chosen according to the characteristics of the stenosis. The stent was loaded into a dedicated introducer, manually expulsed into the stenosis and then held in the exact position with forceps. Following antiseptic preparation of the skin, the patient's neck was extended, identifying the cricoid, the first and the second tracheal rings. Under endoscopic view, a 14-gauge intravenous angiocatheter was inserted transcutaneously between the first and the second tracheal rings into the stent lumen. The needle was then removed, and the Teflon catheter sheath was left in place inside the stent lumen. A 0-0 absorbable vycril suture was passed through the sheath, grasped with forceps and withdrawn through the bronchoscope. A knot was tied at the proximal end of the suture, and traction was placed on the free distal end until the knot was secured to the anterior wall of the stent. A second catheter was inserted at the same level alongside few millimetres from the first catheter, and the above-reported procedure was repeated, thus a second knot anchored the stent. Following this, a skin incision was performed at the exit site of the sutures, the 2 free ends were tied to secure the stent on the anterior neck and the knot was buried subcutaneously. Finally, the skin was closed over the knots. Figure 1 and Video 1 summarize the procedure.

## STUDY POPULATION

From January 2015 to December 2017, the proposed technique was performed to anchor straight-type silicone stent in 27 patients (Table 1) with postintubation ($n = 15$) and post-tracheotomy ($n = 12$) complex subglottic stenosis. Tracheal resection was contraindicated due to cardiovascular ($n = 13$), pulmonary ($n = 11$) and cerebrovascular ($n = 3$) comorbidities. The mean distance from vocal folds, the mean length and diameter

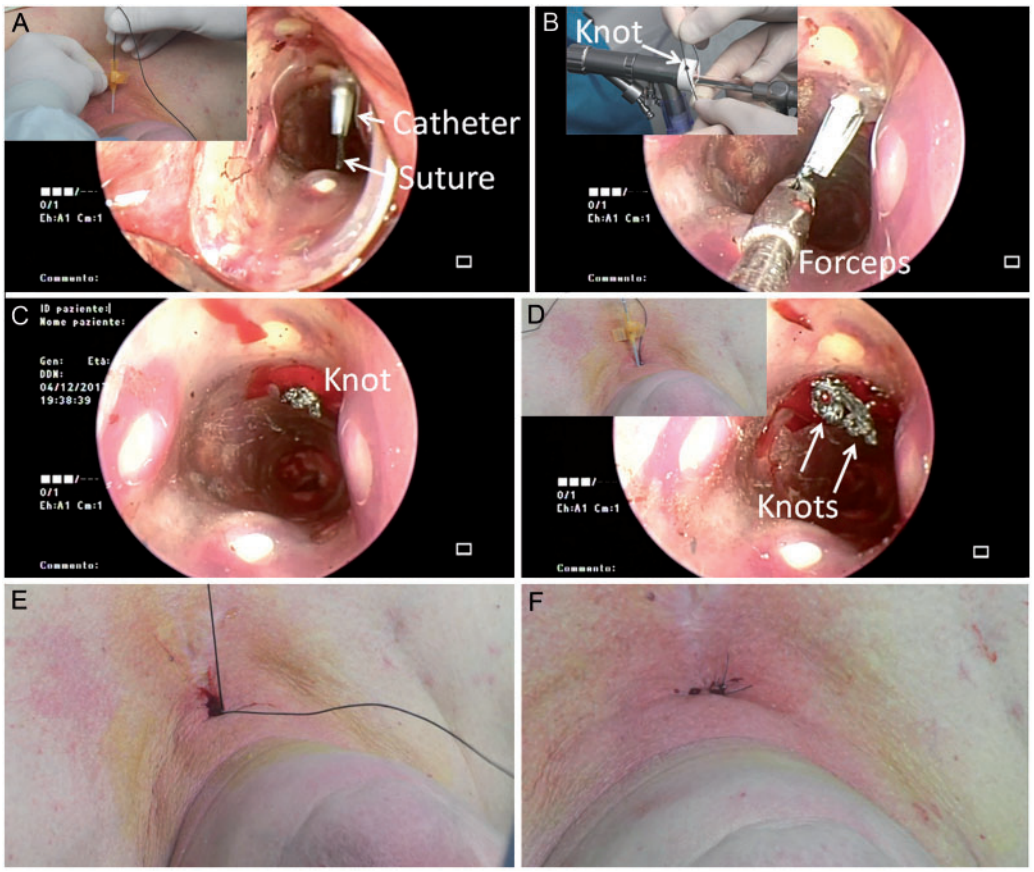
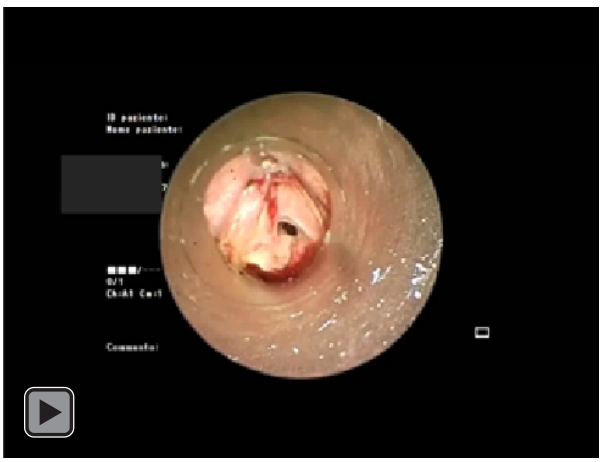



**Figure 1:** A suture is inserted through the Teflon catheter sheath into the stent lumen (**A**), a knot is externally tied at the proximal end (**B**) and the stent is fixed (**C**), another knot is tied to fix the stent (**D**), the sutures are tied (**E**) and the skin is closed over the knot (**F**).



**Video 1:** The main steps of the procedure in a patient with subglottic stenosis are shown. The stent is first placed using a traditional technique, migrated and it was successfully anchored with the proposed technique.

of stenosis were 17 ± 2 mm, 20 ± 2.9 mm and 6.9 ± 0.9 mm, respectively. In 7 patients, the stent, placed first through a traditional technique, migrated, and it was successfully reinserted and then anchored using the proposed technique. The mean procedural time to fix the stent was 5 ± 0.3 min. No intraoperative or postoperative complications such as stent damage, dislocation, plugging or vocal folds dysfunction were observed (mean follow-up 19 ± 9.0 months).

## COMMENT

Migration is a troublesome complication of straight-type silicone stent and has been reported to occur in up to 18% of patients with subglottic stenosis undergoing endoscopic treatment [8]. Over the years, different strategies [4–7] have been proposed to secure the stent placed in the subglottic trachea. However, all reported methods displayed specific advantages and disadvantages, and, thus, there is still not an easy and standardized protocol to ensure good results. Mace *et al.* [4] directly sutured the stent using a needle holder placed outside the body. However, the thickness of the tracheal wall and of the stent could complicate the needle insertion into the stent. Colt *et al.* [5] introduced a suture into the stent lumen through an angiocatheter and then withdraw it through another angiocatheter using a wire threader. On the basis of this principle, other authors [6, 7] used more sophisticated devices to capture the suture and then to extract it from the airway. In all these procedures, the suture was secured to the skin with an external button that could be complicated by a skin infection or unsatisfactory motility during deglutition.

To offer an alternative method, the original Colt's technique [5] was modified by tying a knot at the proximal end of the suture that was then intraluminally secured to the anterior wall of the stent. The main advantages of the proposed procedure over previous techniques are that no special device is required to withdraw the suture from the airway, and the absorbable suture for fixing the stent is buried subcutaneously. The use of absorbable rather than non-absorbable sutures prevented the risk of subcutaneous

**Table 1:** Study population

| Patients | Sex | Age (years) | Stenosis aetiology | Comorbidities | Characteristics of stenosis | | | Characteristics of silicone stent | | Follow-up (months) | Complications |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Distance from vocal folds (mm) | Length (mm) | Diameter (mm) | Length (mm) | Diameter (mm) | | |
| 1 | Male | 55 | Postintubation | Cardiovascular | 18 | 21 | 5 | 40 | 15 | 34 | None |
| 2 | Male | 47 | Post-tracheotomy | Pulmonary | 15 | 23 | 7 | 50 | 15 | 32 | None |
| 3 | Male | 59 | Postintubation | Cardiovascular | 20 | 24 | 8 | 50 | 16 | 32 | None |
| 4 | Male | 68 | Post-tracheotomy | Pulmonary | 13 | 21 | 6 | 40 | 15 | 31 | None |
| 5 | Male | 69 | Postintubation | Cerebrovascular | 18 | 20 | 6 | 40 | 16 | 29 | None |
| 6 | Female | 73 | Post-tracheotomy | Cardiovascular | 20 | 20 | 7 | 40 | 15 | 27 | None |
| 7 | Female | 67 | Postintubation | Cerebrovascular | 20 | 24 | 8 | 50 | 15 | 25 | None |
| 8 | Male | 59 | Post-tracheotomy | Pulmonary | 18 | 25 | 9 | 40 | 16 | 25 | None |
| 9 | Female | 55 | Post-tracheotomy | Cardiovascular | 17 | 26 | 8 | 50 | 15 | 24 | None |
| 10 | Male | 65 | Post-tracheotomy | Pulmonary | 13 | 20 | 7 | 40 | 16 | 24 | None |
| 11 | Female | 63 | Postintubation | Cerebrovascular | 17 | 20 | 6 | 40 | 14 | 23 | None |
| 12 | Male | 68 | Post-tracheotomy | Cardiovascular | 15 | 25 | 7 | 50 | 15 | 21 | None |
| 13 | Female | 69 | Post-tracheotomy | Pulmonary | 14 | 20 | 6 | 40 | 15 | 21 | None |
| 14 | Male | 72 | Postintubation | Pulmonary | 20 | 22 | 7 | 40 | 15 | 20 | None |
| 15 | Female | 71 | Postintubation | Cardiovascular | 20 | 20 | 5 | 40 | 14 | 19 | None |
| 16 | Male | 64 | Post-tracheotomy | Cardiovascular | 16 | 18 | 6 | 40 | 16 | 18 | None |
| 17 | Female | 57 | Postintubation | Pulmonary | 18 | 15 | 7 | 40 | 14 | 17 | None |
| 18 | Male | 59 | Post-tracheotomy | Cardiovascular | 17 | 20 | 8 | 40 | 16 | 16 | None |
| 19 | Female | 64 | Postintubation | Cardiovascular | 20 | 15 | 6 | 40 | 16 | 15 | None |
| 20 | Male | 63 | Postintubation | Pulmonary | 17 | 23 | 7 | 50 | 16 | 14 | None |
| 21 | Male | 69 | Postintubation | Pulmonary | 20 | 21 | 8 | 40 | 16 | 13 | None |
| 22 | Male | 71 | Postintubation | Cardiovascular | 16 | 22 | 7 | 40 | 16 | 12 | None |
| 23 | Male | 63 | Post-tracheotomy | Pulmonary | 15 | 20 | 7 | 40 | 15 | 9 | None |
| 24 | Male | 69 | Postintubation | Cardiovascular | 18 | 15 | 6 | 40 | 14 | 7 | None |
| 25 | Male | 65 | Postintubation | Pulmonary | 18 | 18 | 8 | 40 | 16 | 5 | None |
| 26 | Male | 66 | Postintubation | Cardiovascular | 20 | 20 | 7 | 40 | 16 | 3 | None |
| 27 | Male | 67 | Post-tracheotomy | Cardiovascular | 16 | 17 | 8 | 40 | 15 | 2 | None |
| Mean ± SD | | 64 ± 6 | | | 17 ± 2 | 20 ± 2.9 | 6.9 ± 0.9 | 42 ± 4.2 | 15 ± 0.7 | 19 ± 9.0 | |

SD: standard deviation.

infection. In addition, there was no need to remove the stich later, because the knots dissolve by themselves and were coughed out. The formation of tenacious adhesions safely secured the stent with no dislocation when suture dissolved as well.

The proposed technique is feasible and easy to perform, although it should be accomplished with appropriate cautions. The angiocatheter should be inserted perpendicularly to the trachea and gently advanced into the lumen of the stent to prevent overstepping the posterior wall of the stent and damaging the trachea. During these manoeuvres, the tip of the bronchoscope is wedged against the proximal end of the stent to prevent its displacement. During the anchoring manoeuvre, the 2 suture ends should be gently knotted to prevent the laceration of the anterior wall of the stent. The proposed procedure should be indicated for patients with severe malacia or without extrinsic compression, because they have a higher risk of dislocation. A second potential indication could be a reinsertion of a silicone stent that was previously placed through the traditional technique (with no stent securing) and was then migrated.

## CONCLUSION

In conclusion, the proposed modified fixing technique could be a simple alternative to secure a subglottic silicone stent in selected cases. No special device is required. The absorbable suture, buried subcutaneously, could provide a long-term fixation with good aesthetic results.

**Conflict of interest:** none declared.

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