Authors have nothing to disclose with regard to commercial support.

DOES PATIENT-SPECIFIC 3-Dimensionally Engineered Silicone Y Stent Really Have Perfect Alignment

WITH THE MUCOSA?

To the Editor:

We read with great interest the important article of Schweiger and colleagues,¹ who did a great job to design and produce a 3-dimensionally engineered silicone Y stent individually tailored to their patients with tracheobronchomalacia. This kind of stent could effectively overcome unusual branching angles and airway distortion. Does it really, however, have perfect alignment with the mucosa as they highlight?

The diameter of the trachea and bronchi change with respiration. During expiration, the airway shortens and narrows, and during inspiration, it lengthens and dilates.² Malacia of trachea accentuates these changes and causes deformation. Usually, the computed tomographic data are collected when patient in deep inspiration, and these data reflect the shape of trachea only at that moment. The diameter of this kind of tracheal stent could align with the mucosa during normal respiration if we ignore slight longitudinal shape change. In patient 1, the largest diameter of the trachea was 32 mm, and the maximum outer diameter of the tracheal part of the stent was 27 mm. This gap presents a great chance for biofilm to form and for mucus to emerge between the airway and the stent when patient has tracheal deformation from severe coughing. If the diameter of the stent is designed larger than the trachea, as self-expandable metallic stents are, this kind of complication may be reduced.

There is no doubt that a custom-made stent could effectively match unusual branching angles and airway distortion. As for perfect alignment with the mucosa, further investigation is needed.

The Editor welcomes submissions for possible publication in the Letters to the Editor section that consist of commentary on an article published in the Journal or other relevant issues. Authors should: • Include no more than 500 words of text, three authors, and five references. • Type with double-spacing. • See <http://jtcvs.ctsnetjournals.org/misc/fora.shtml> for detailed submission instructions. • Submit the letter electronically via jtcvs.editorialmanager.com. Letters commenting on an article published in the JTCVS will be considered if they are received within 6 weeks of the time the article was published. Authors of the article being commented on will be given an opportunity to offer a timely response (2 weeks) to the letter. Authors of letters will be notified that the letter has been received. Unpublished letters cannot be returned.

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<https://doi.org/10.1016/j.jtcvs.2019.01.034>

GETTING IN SHAPE: CURRENT HURDLES IN 3-Dimensionally Engineered Printed Airway Stents

Reply to the Editor:

We highly appreciate the interesting comment of Li and Han on our article “Patient-Specific, 3-Dimensionally Engineered Silicone Y-Stents in Tracheobronchomalacia: Clinical Experience with a Novel Type of Airway Stent.”¹ Currently, we are witnessing a strong growth of 3-dimensional printing in medical applications, and this novel technique enables us to provide tailored implants in an easy and time-efficient manner.

We agree with our colleagues that the dimensions of the trachea should not be considered as static. The semirigid characteristics of the tracheobronchial tree allow dynamic changes during inspiration and expiration. Especially in patients with tracheobronchomalacia, these dynamic changes are essential if we are to understand the pathophysiology of the disease and to provide adequate treatment.² Sizing of a stent is generally based on a “best estimation” between inspiratory and expiratory diameters. Oversizing results in difficulties in clearing the airway; undersizing leads to mucus retention, granulation, and chronic cough. Stents thus always represent a compromise, and a perfect fit is rarely achieved. Such a perfect fit is even more difficult in tracheobronchomalacia, in which the shape of the trachea is characterized by a decreased anteroposterior diameter and an increased transverse diameter.

The custom-made Y-stents described in our study were designed with a circular cross section, with all the previously mentioned problems. It seems reasonable, that a horseshoe-shaped cross section, as suggested by Li and Han, would better reflect the tracheobronchial anatomy. To the best of our knowledge, however, 3-dimensionally manufactured tracheal stents with noncircular cross

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sections have not yet been approved by the regulatory authorities.

Beyond the shape of customized stents, recent research focuses on intelligent materials and novel surfaces that may prevent the formation of biofilms; for example, silver coatings possess antimicrobial activity, and nonadhesive surfaces prevent the attachment of bacteria and fungi.³ These customized nanosurfaces could lead to an improved mucus clearance and a decrease in stent-related side effects.

Additive manufacturing is a fast-growing field, with a wide range of potential clinical applications. Now it is

our turn to deliver the benefits of this technology to our patients!

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