Tracheomalacia

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Tracheomalacia

Management

- Observation (PM)
- Managing associated conditions (PM)
- PAP (PM)
- Stenting and posterior wall –plasty (OR)
- Splinting (EP)
- Tracheotomy (EP)
- Aortopexy/tracheopexy (DB)
• Tracheotomy
  – Elongated tracheostomy tubes
    • Issues:
      – Bronchospasm, tracheal injury

[Page BA, Klein EFJ. Tracheal stent as an aid weaning from mechanical ventilation in tracheomalacia]
• External Splinting
  – Materials
    • Autologous grafting, silastic membrane-reinforced crystalline polypropylene, high-density polyethylene, aluminum oxide ceramic rings
  – Pros: Decreased contamination/fistula formation
  – Cons: Effect on growth of trachea, approach, limitations
Tracheal ring-graft reinforcement in lieu of tracheostomy for tracheomalacia

Fig. 1 Tracheal reinforcement with four autologous costal-cartilage ring grafts of 0.25 cm width applied at approximately 0.5–1 cm intervals. Inset shows three-quarter costal-cartilage ring graft with multiple partial release incisions along convex border to allow for flexibility and moulding to the anterior trachea.
Tracheal Ceramic Rings for Tracheomalacia: A Review After 17 Years

Gyula Göbel, MD; Niki Karaiskaki, MD; Imre Gerlinger, MD, PhD; Wolf J. Mann, MD, PhD, FACS

Fig. 1. Aluminum-oxide ceramic rings (180 degree and 220 degree, inner diameters: 18 and 24 mm).

Fig. 2. Ceramic ring sutured to the trachea.
Bioresorbable Airway Splint Created with a Three-Dimensional Printer

TO THE EDITOR: Tracheobronchomalacia in newborns, which manifests with dynamic airway collapse and respiratory insufficiency, is difficult to treat. In an infant with tracheobronchomalacia, we implanted a customized, bioresorbable tracheal splint, created with a computer-aided design based on a computed tomographic image of the patient’s airway and fabricated with the use of laser-based three-dimensional printing, to treat this life-threatening condition.

At birth at 35 weeks’ gestation, the patient did not have respiratory distress and otherwise appeared to be in normal health. At 6 weeks of age, he had chest-wall retractions and difficulty in breathing. A computerized tomographic image revealed a bulging trachea with severe tracheal wall thinning, which was consistent with tracheobronchomalacia. Furthermore, the patient had left mainstem bronchus compression and mild dilatation of the left upper lobe bronchus. A bioresorbable tracheal splint was designed with computer-aided design and fabricated with the use of computer-assisted three-dimensional printing, and this device was placed in the patient’s trachea, thus minimizing the effect of upper airway compression (Fig. 1A). The splint was manufactured from polycaprolactone with the use of a three-dimensional printer (Fig. 1B).

The institutional review board of the University of Michigan consulted with the Food and Drug Administration and approved the use of the device under the emergency-use exemption, and written informed consent was provided by the patient’s parents. After transposition of the}

Figure 1. Placement of the Printed Airway Splint in the Patient.
Panel A shows the airway in expiration before placement of the splint; the image was reformatted with minimum-intensity projection. Panel B shows the patient-specific computed tomography-based design of the splint in red. Panel C shows an image-based three-dimensional printed cast of the patient’s airway without the splint in place, and Panel D shows the cast with the splint in place. Panel E shows intraoperative placement of the splint (green arrow) overlaying the malacic left mainstem bronchial segment. SVC denotes superior vena cava. Panel F shows the bronchoscopic view, from the carina, of the left mainstem bronchus after placement of the splint. Panel G shows the airway in expiration 1 year after placement of the splint; the image was reformatted with minimum-intensity projection.