

Hyperbaric oxygen therapy for the treatment of anastomotic complications after tracheal resection and reconstruction

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Objective: Failure of anastomotic healing is a rare but serious complication of laryngotracheal resection. Treatment options include reoperation, tracheostomy, or T-tube placement. Hyperbaric oxygen therapy (HBOT) is the delivery of 100% O₂ at pressures greater than 1 atm, and has been shown to enhance wound healing after tracheal resection in animal models. To date, there have been no reports describing its usefulness in humans after tracheal resection.

Methods: Five consecutive patients with varying degrees of failed anastomotic healing, from necrotic cartilage to partial separation identified by bronchoscopy were treated with HBOT. HBOT was administered for 90 minutes via a hyperbaric chamber pressurized to 2 atm with 100% oxygen. Patients were treated with daily or twice daily HBOT. Four of 5 patients had buttressing of the anastomosis by strap muscle at the initial surgery.

Results: All patients had evidence of anastomotic healing on bronchoscopy. None of the patients in this series required tracheostomy, T-tube, or reoperation after initiation of HBOT. On average it took 9.6 days for healing to occur (5-14 days). The size of the anastomotic defect ranged between 3 and 13 mm. One patient required bilateral tympanostomy tubes for inner ear discomfort and experienced blurry vision as complications of HBOT. One patient developed tracheal stenosis from granulation tissue that required bronchoscopic debridement.

Conclusions: In select patients with anastomotic complications after tracheal resection, HBOT may aid in healing and avoid tracheostomy. Future investigations are necessary to further define the benefits of HBOT in the management of airway anastomotic complications. (*J Thorac Cardiovasc Surg* 2014;147:1030-5)

Anastomotic separation after tracheal resection and reconstruction (TRR) is rare, occurring in only 4% of procedures.¹ However, anastomotic separation carries significant morbidity and a 0.6% chance of mortality.¹ Risk factors for anastomotic complications include diabetes, resection length greater than 4 cm, reoperation, laryngotracheal resections, age less than 17 years, and preoperative tracheostomy.¹ We have previously described our experience with anastomotic complications after TRR. Treatment of anastomotic complications included reoperation, revision of the anastomosis, and T-tube or tracheostomy placement.¹

Hyperbaric oxygen therapy (HBOT) is the administration of 100% oxygen at pressures greater than 1 atm. It is currently used to increase healing of diabetic lower extremity wounds and radiation injuries. HBOT is believed to promote wound healing by increasing angiogenesis and collagen

synthesis.² Recent experimental evidence in animals has shown that it may stimulate increased healing of the trachea after resection and reconstruction.^{3,4} We used HBOT in 5 consecutive patients with anastomotic complications after tracheal resection and followed their clinical outcomes.

METHODS

This is a retrospective review of 5 consecutive patients treated at a single institution from 2009 to 2012. Approval for this study was obtained from the Institutional Review Board. Each patient previously underwent a tracheal resection and anastomosis and was found to have evidence of failed anastomotic healing on bronchoscopic examination between postoperative days 5 and 7. Our technique for tracheal and laryngotracheal resection has been described in previous publications.⁵⁻⁸ Bronchoscopic findings ranged from necrotic cartilage to partial separation of the tracheal anastomosis. All patients were treated as inpatients and HBOT was administered for 90 minutes via a hyperbaric chamber pressurized to 2 atm with 100% oxygen. The goal number of HBOT treatments was 20. Initially in our series, patients were treated with daily HBOT, however later patients received twice daily HBOT. Four of 5 patients in this series had careful buttressing of the primary anastomosis with sternohyoid and sternothyroid strap muscles. One patient with anastomotic separation did not undergo buttressing of the anastomosis with muscle and underwent reexploration, revision of the anastomosis, and tracheostomy placement. In this patient, HBOT was started after the reoperation procedure. All patients received intravenous broad-spectrum antibiotics and 3 of 5 patients also received treatment with tobramycin nebulizers administered twice daily. Heliox was used in patients as clinically indicated.

RESULTS

The characteristics of the patients in this series were as follows: the mean age was 46 years (range, 20-63 years),

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