Perspectives and horizons of non-intubated robotic-assisted tracheal surgery

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Tracheal surgery remains a field of complex interdisciplinary collaboration given proximity of surgical site and anesthetic working space. Multitude medical advances aimed to reduce hurdles in ventilation during resection resulting in established intubation and ventilation techniques reaching from general anesthesia with small-sized endotracheal tube with or without lung separation, jet-ventilation or apneic oxygenation, over spontaneous ventilation under mild sedation even to extracorporeal life support (1). In a similar way, surgical management experienced relevant paradigm shift: while lower parts of trachea were traditionally reached via sternotomy or thoracotomy, current endeavors established video-assisted thoracic surgery (VATS) or even robotic-assisted thoracic surgery (RATS) as suitable techniques for resection.

Recently published article combines both progresses made in anesthetic and surgical management by presenting a case series of tracheal resections under spontaneous ventilation via RATS (2). The authors have made groundbreaking work by proving this combination as feasible in tracheal surgery.

Generally, maximum extent of tracheal resection is recognized as 4 or 6 cm when applying mobilization strategies such as bilateral hilar or suprahyoid laryngeal release, opening of the pleural spaces, and division of the inferior pulmonary ligaments (3,4). This may be a drawback of minimally invasive approaches allowing for unilateral maneuvers only (5). Li *et al.* described cases of 1.2 cm resections in average with a maximum length of 4.3 cm (2). In consequence, copious release was not necessary. Other case reports of tracheal resections via RATS as well describe resection lengths of less than 3 cm (6,7). The need for extensive bilateral mobilizations strategies may be a limitation criterion for RATS in tracheal surgery. However, compared to VATS techniques, the 3D visualization as well as the facilitation of 7 degrees of freedom, RATS opens up for increased accuracy and handleability of minimal-invasive tracheal surgery (8).

Previous work of the authors has described multiple benefits from spontaneous ventilation regarding easier surgical practicability of tracheal resection and anastomosis as well as more stable hemodynamic status and blood oxygen saturation (9-11). However, hypercapnia is one of the most relevant risks of spontaneous ventilation for thoracic surgery (1). End-tidal CO_2 was reported in one publication only, ranging from 40 and 48 mmHg without respiratory acidosis (9). Yet, information on measurement method and end-tidal CO_2 might be relevant in the current publication as well, since values might be distorted for various reasons such as suction and pneumothorax. Duration of resection might have a significant influence on acid-base balance as well. Hence, information on accurate resection time and whether or how end-tidal CO_2 changed during this period would be interesting as well.

Though Li *et al.* presented a novel and impressive series of cases one must acknowledge that it cannot serve as robust data basis for widespread use and may only be practicable

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in high-volume centers of this seldom disease. Surgical experience based on solitary cases or small series only does not meet modern standards of evidence-based medicine and should not be appropriate anymore. Fundamental and comprehensive upheaval of operative techniques must be built upon solid scientific data from prospective randomized multicenter clinical trials.

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