



Recent advances in perioperative care in thoracic surgery and anesthesia

Lung surgery has a long, vast, and thrilling history. After the tuberculosis pandemic in the 19th and first half of the 20th century, thoracic surgery gradually came of age. Lung resections for cancer began around 1950 and evolved tremendously from non-selective pneumonectomy, to selective hilar dissection pneumonectomy, anatomic lobectomy, and segmentectomy via open thoracotomy. During that time [1980–2000] anesthesiologists acquired extensive expertise which allowed their surgical colleagues to safely perform a wide spectrum of thoracic procedures. The development of selective lung ventilation using double-lumen endotracheal tubes, fiberoptic bronchoscopy, modern bronchial blockers, and peridural analgesia were the subject of a large number of treatises and textbooks; these were the “golden years” of thoracic surgery and anesthesia.

At the turn of the millennium, minimally invasive thoracic surgery (MITS) rapidly expanded its territory from simple lung resections to advanced lung resections and many other complex intra-thoracic procedures, eventually going on to replace thoracotomy in most cases. The development and continuing progress of minimally invasive (MI) approaches was and remains eminently relevant both in surgical and anesthetic care. Improvements in the quality of intraoperative video-imaging technology, the development of dedicated surgical instruments, the evolution of stapling technology towards automated, “intelligent” devices, sophisticated buttress materials, sealants for staple lines, and digital chest drainage technology paved the way for a new era. This progress has allowed surgery to become ever more precise while improving postoperative breathing mechanics and decreasing the physiologic impact of lung resection, length of hospital stay, pain, and overall morbidity.

MI approaches have required anesthesiologists to correspondingly adapt their way of working with thoracic surgery patients. In fact, improvements in surgical technique evolved hand in hand with improvements in anesthetic care, which were a key factor in allowing MITS to reach its full potential. Because of limited surgical access and a limited field of vision, MITS cannot proceed without excellent and reliable lung deflation to allow optimal surgical exposure and visualization. Protective ventilation strategies have become routine and are now successfully applied during single lung ventilation to maximize oxygenation and minimize lung barotrauma, volutrauma and postoperative atelectasis (which is a precursor of acute lung injury), thus further decreasing the risk of pulmonary complications. An important but often overlooked aspect of anesthetic care is the intraoperative management of pulmonary hemodynamics, with particular attention to anatomic and physiologic considerations related to hemodynamic evaluation of the right ventricle–pulmonary artery unit as well as the impact of one-lung ventilation and lung resection on right ventricular function.

Other than MITS, recent years have also seen a major evolution in postoperative analgesia. Multimodal analgesia has become a standard part of the anesthesiologist’s arsenal. While epidural analgesia was the mainstay of postoperative pain control in the era of thoracotomy, the era of MITS has given way to sophisticated nerve block techniques: these include intercostal and paravertebral blocks and modern inter fascial blocks often used in combination with intravenous (IV) patient-controlled analgesia.

Although the initial hopes that MI surgery would eliminate post-thoracotomy pain syndromes have not necessarily materialized, MITS is indeed associated with a significant decrease in early postoperative pain. Original video-assisted techniques have evolved into totally thoracoscopic, uniportal, and robotic techniques. While the overall merits of these techniques continue to be debated, their relative benefits in terms of pain control remain unresolved. However, theoretically, there is certainly a rationale to limiting the size and number of incisions as well as mitigating the extent of fulcrum effects of surgical instruments at the intercostal space.

On the other hand, persistent air leaks require maintenance of chest tube drainage which probably accounts for a significant proportion of postoperative pain in the MITS patient. Although technical improvements and the use of digital drainage systems have decreased the incidence and duration of air leaks, they can be considered the thoracic surgeon’s unrelenting Achilles’s heel, a vexing problem still in search of a definitive solution.

Perhaps even more importantly than all of the above, the development of MITS has fostered a change in the mindset with which contemporary thoracic surgical teams approach their patients. Prehabilitation and enhanced recovery after surgery (ERAS)[®] approaches are predicated on standardized perioperative management strategies, starting with optimal preoperative

preparation. They are of particular interest in the management of lung cancer patients who typically suffer from some degree of chronic obstructive pulmonary disease (COPD), and are more and more often aged, frail and affected by multiple other co-morbidities. This allows patients to attain an optimal perioperative condition while streamlining care and promoting an efficient use of resources within an invariably cost-conscious healthcare environment. ERAS[®] management is not limited to the intraoperative and immediate postoperative periods, but extends into the outpatient setting as well and reaches all the way into the patient's home. This is a radically new philosophy of care that has resulted in increased patient safety and an overall improvement in the patient experience.

It is important to recognize that MITS does not exist in a bubble. Non-invasive treatments for early lung cancer have been gaining influence, including stereotactic radiotherapy, percutaneous ablation, and interventional bronchoscopic techniques. Although these should be viewed as complementary rather than “competing” approaches, there is no doubt that they reflect an ongoing quest to reach an optimal risk-benefit profile for individual lung cancer procedures. This provides further incentive for the exploration of new frontiers and ongoing quality improvement in pulmonary surgery. As innovation in surgical technique and perioperative care continues, novel approaches such as non-intubated spontaneous ventilation lung resections and lung resections as day surgery procedures are increasingly being described.

All these developments make it timely to review key aspects of perioperative management in thoracic surgery, with a particular emphasis on standardized care pathways, key intraoperative issues related to single lung ventilation, advancements in pain control, and contemporary air leak management. We hope this special series will provide thoracic surgery teams with up-to-date information and perspective on these issues from leading experts while inspiring ongoing innovation. We wish you pleasant and informative reading!

Acknowledgments

We dedicate this series of articles to the late Dr. Jean Deslauriers (Department of Surgery, Institut Universitaire de Cardiologie et de Pneumologie de Québec, Université Laval, Québec, QC, Canada) who co-authored the “*Evolution of Thoracic Surgery in Canada*” in 2014. In this book, Dr. Deslauriers describes the significant legacy of Canadian thoracic surgeons, who carry on the heritage of late Dr. F. Griffith Pearson (Division of Thoracic Surgery, Department of Surgery, University Health Network-Toronto, General Hospital, University of Toronto, Toronto, ON, Canada). That is why we voice to Canadian authors who continually strive towards excellence in thoracic surgery patient care, research and medical education.

Funding: None.

Footnote

Provenance and Peer Review: This article was commissioned by the editorial office, *Current Challenges in Thoracic Surgery* for the series “Recent Advances in Perioperative Care in Thoracic Surgery and Anesthesia”. The article did not undergo external peer review.

Conflicts of Interest: Both authors have completed the ICMJE uniform disclosure form (available at <https://cts.amegroups.com/article/view/10.21037/cts-23-4/coif>). The series “Recent Advances in Perioperative Care in Thoracic Surgery and Anesthesia” was commissioned by the editorial office without any funding or sponsorship. GR serves as an unpaid editorial board member of *Current Challenges in Thoracic Surgery* from October 2019 to September 2023 and served as the unpaid Guest Editor of the series. He reports TransmedTEch grant for Lung Biomechanics Research Program from Ecole Polytechnique Montreal, Canada and Concordia University (Montreal) grant for Surgical Imaging Research Program from Concordia University, Montreal, Canada. JSB served as the unpaid Guest Editor of the series. The authors have no other conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects for the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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Keywords: Perioperative care; thoracic surgery; thoracic anesthesia

Received: 25 May 2023; Accepted: 07 July 2023; Published online: 20 July 2023.

doi: 10.21037/ccts-23-4

View this article at: <https://dx.doi.org/10.21037/ccts-23-4>

doi: 10.21037/ccts-23-4

Cite this article as: Rakovich G, Bussi eres JS. Recent advances in perioperative care in thoracic surgery and anesthesia. *Curr Chall Thorac Surg* 2023;5:33.