Interview

EMJ had the pleasure of interviewing Luca Bertolaccini, who shared insights into lung cancer surgery, exploring minimally invasive techniques, role of the multi-disciplinary team in lung cancer treatment, and the potential for artificial intelligence in the field. Bertolaccini also shared advice for younger clinicians hoping to specialise in thoracic surgery in the future.

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Citation: EMJ Respir. 2023; DOI/10.33590/emjrespir/10302711. https://doi.org/10.33590/emjrespir/10302711.

Q1 What led you to specialise in lung cancer surgery after completing your medical training?

The decision to perform lung cancer surgery was influenced by various factors. I have a strong interest in surgical procedures and a passion for treating lung-related diseases, and lung cancer surgery can significantly impact patients' lives and improve their wellbeing. Furthermore, lung cancer is one of the leading causes of cancer-related deaths globally. Surgeons specialising in lung cancer can work with diverse patients, and address critical healthcare needs.

There are constant advancements in surgical techniques, technologies, and treatment options for lung cancer, which also attracted me, and I am excited about staying at the forefront of medical innovation. I am also interested in clinical research.

Lung cancer treatment often involves a multidisciplinary approach, involving medical oncologists, radiologists, pulmonologists, and other specialists. Since I enjoy collaborative patient care, I found lung cancer surgery appealing. And, finally, challenging cases can be intellectually stimulating and rewarding for surgeons who enjoy solving intricate medical puzzles.

Q2 In May of this year, you co-authored a paper, entitled 'Next-Generation Lung Cancer Surgery: A Brief Trip into the Future of the Research'. Could you summarise the main advances discussed in the paper and your hopes for the future of lung cancer surgery?

In this paper, we discussed several key advances and considerations in lung cancer surgery with Lorenzo Spaggiari, Professor and Director of the Lung Program and Division of Thoracic Surgery at the Istituto Europeo di Oncologia

(IEO), European Institute of Oncology IRCCS Milan, Italy, such as the prevalence and need for advancement. Lung cancer is a significant global health issue with high mortality rates. Non-small cell lung cancer (NSCLC) constitutes a large portion of lung cancer cases, and, due to the lack of effective screening and low survival rates, it remains a significant focus of scientific research.

Another point that we discussed is minimally invasive surgery. The standard treatment for early-stage NSCLC is anatomic lobectomy and lymph node dissection. Minimally invasive techniques, such as video-assisted thoracoscopic surgery and robotic-assisted thoracoscopic surgery (RATS), have become the norm due to better outcomes than traditional open surgery. These techniques offer benefits like shorter recovery times and reduced invasiveness.

The role of sub-lobar resection (segmentectomy and wedge resections) is debated. There are studies evaluating the feasibility and safety of these approaches. Current evidence suggests that lobectomy may be preferable for early-stage NSCLC in specific patient groups, but ongoing trials aim to provide more clarity on this matter.

We also discussed adequate lymphadenectomy, which is crucial for proper staging and treatment outcomes. Studies emphasise the importance of dissecting sufficient lymph nodes to ensure accurate staging and better patient prognoses. However, patients with ipsilateral and/or subcarinal mediastinal lymphatic spread (N2) Stage III NSCLC face poor prognoses. Studies suggest that post-operative radiotherapy alone, or combined with chemotherapy, can extend survival, especially in more extensive nodal disease cases. Extra-nodal extension, where cancer cells extend beyond lymph nodes, strongly predicts poor outcomes in NSCLC. Recent research highlights its significance and association with recurrence and mortality.

In terms of hopes for the future of lung cancer surgery, this paper underscores the ongoing need for advancements and research due to the persistent challenges of lung cancer. We anticipate further refinements in surgical techniques, including minimally invasive approaches like RATS. We hope for an improved understanding of patient selection criteria for sub-lobar resections, and more evidence from ongoing trials to guide treatment decisions. Advances in imaging and staging techniques like PET/CT are expected to continue, aiding in accurate diagnosis and treatment planning. Ultimately, the goal is to enhance patient outcomes and survival rates through improved surgical methods, precision in lymph node dissection, and comprehensive treatment strategies for various stages of lung cancer.

Q3 The surgical options for NSCLC include segmentectomy and lobectomy. What are the pros and cons of these, and does the current evidence indicate that one is more favourable than the other?

Segmentectomy and lobectomy are surgical options for treating NSCLC, and the choice between them depends on various factors, such as the tumour's size, location, and the patient's overall health. Each approach has pros and cons, and deciding which is more favourable can vary based on individual circumstances.

Segmentectomy can preserve lung function as it removes only a portion of the lung, preserving more healthy lung tissue than lobectomy. This can be advantageous for patients with compromised lung function. It can also lower morbidity. A smaller resection may lead to a shorter hospital stay and quicker recovery time, reducing the risk of complications, especially in patients with limited cardiopulmonary reserve. Finally, segmentectomy might be more suitable for older patients, or those with medical conditions that make a complete lobectomy riskier. However, segmentectomy can increase the risk of local recurrence. In some instances, removing a smaller portion of the lung may leave residual cancer cells behind, leading to a potentially higher risk of local recurrence. It also has limited applicability, as segmentectomy is typically suitable for smaller tumours that are located in a way that allows for the safe removal of a specific lung segment. Larger or more centrally located tumours might not be suitable for this approach. Finally, segmentectomy might not involve a thorough lymph node evaluation, potentially affecting staging accuracy in some cases.

Lobectomy, on the other hand, has higher oncological radicality. Lobectomy removes the entire lung lobe containing the tumour,

minimising the risk of local recurrence due to residual cancer cells. Lobectomy also allows for more thorough lymph node evaluation, aiding in accurate staging and treatment planning. Finally, it has a wide applicability, and can be used for a broader range of tumour sizes and locations, providing a potentially curative option for many patients. However, there is a more significant loss of lung function when removing an entire lobe, which might be a concern for patients with limited lung capacity. There is generally a longer recovery time with lobectomy, and there may be a higher risk of complications. Moreover, lobectomy might not be suitable for older patients, or those at high-risk with underlying health issues that could complicate recovery.

As for the question of whether one approach is more favourable than the other, it is essential to note that the choice between segmentectomy and lobectomy is highly individualised. Current evidence suggests that segmentectomy can yield comparable survival outcomes for smaller tumours in specific locations, while preserving more lung function. However, lobectomy might be more appropriate for larger tumours, or in cases where a more aggressive approach is required.

Ultimately, the decision should carefully consider the patient's overall health and tumour characteristics, and there should be a thorough discussion between the patient and the medical team. A multidisciplinary collaboration involving surgeons, oncologists, and other specialists is crucial to determining the best treatment strategy for individuals with NSCLC.

Q4 Since starting your career, what do you think has been the most significant change in the field of lung cancer surgery?

One of the most significant changes in the field of lung cancer surgery over the years has been the adoption and advancement of minimally invasive surgical techniques. These techniques, such as video-assisted thoracoscopic surgery and RATS, have revolutionised lung cancer surgeries. Adopting these minimally invasive techniques has significantly improved lung cancer surgery, improving patient outcomes, quality of life, and overall treatment experience. It is important to note that deciding to use a specific surgical approach depends on factors such as the patient's medical condition, tumour characteristics, and the surgeon's expertise.

> **"Adopting these minimally invasive techniques has significantly improved lung cancer surgery."**

Other notable advancements in lung cancer surgery include the integration of precision medicine, improvements in imaging technologies, better perioperative care protocols, and the ongoing refinement of surgical techniques to enhance patient outcomes, and minimise the impact of surgery on the patient's life.

Q5 You have an interest in minimally invasive thoracic surgery. Are there any innovations on the horizon that you are excited for or any aspects that require further attention to improve outcomes?

There are some notable advancements and areas of ongoing research, as well as some innovations on the horizon, including single-incision surgery. Advanced and enhanced imaging technologies, such as real-time 3D imaging and augmented reality, could provide surgeons with improved visualisation and navigation during minimally invasive procedures, leading to even more precise surgeries, The continued development of robotic surgical systems could lead to more sophisticated and precise movements during minimally invasive thoracic surgeries. These systems might become more widely accessible, enhancing surgeons' capabilities.

Artificial intelligence (AI)-powered tools could assist surgeons in planning procedures, analysing imaging data, and even providing real-time guidance during surgery, leading to better decision-making and outcomes.

However, there are areas that require further attention. For example, there should be a focus on training and skill development. Ensuring that surgeons are adequately trained to perform these complex procedures is crucial as minimally invasive techniques evolve. Training programmes and simulation tools can help surgeons develop the skills needed for optimal outcomes. There should also be a standardisation of techniques.

The field benefits from guidelines and best practices that ensure consistency and quality across different surgical teams and institutions.

Identifying the most suitable patients for minimally invasive approaches remains essential. Tailoring the approach to individual patient characteristics can lead to better outcomes and avoid potential complications. Patients should be well-informed about the benefits, risks, and potential outcomes of minimally invasive surgery to make informed decisions about their treatment.

While minimally invasive surgery has shown promising short-term outcomes, ongoing research is needed to assess its impact on long-term cancer recurrence rates and overall survival. Minimally invasive thoracic surgery is often just one aspect of a patient's treatment journey. However, seamless collaboration among surgeons, medical oncologists, radiation oncologists, and other specialists is essential for comprehensive patient care. Furthermore, minimally invasive surgery can be cost-effective, due to shorter hospital stays and faster recovery times, but economic factors should be considered to ensure equitable access to these advanced procedures.

In conclusion, the minimally invasive thoracic surgery field continues to evolve with innovations that can further improve patient outcomes and experiences. Addressing challenges, and focusing on areas requiring attention will be vital to realising the full benefits of these advancements.

Q6 Do you think there is a role for artificial intelligence in lung cancer surgery and where do you feel this would be most beneficial in clinical practice?

Yes, there is a significant role for AI in lung cancer surgery, and its potential benefits span various aspects of clinical practice. AI can augment healthcare professionals' skills, enhance decision-making, and improve patient outcomes. Here are some areas where AI can be particularly beneficial in lung cancer surgery.

AI can provide diagnostic assistance by analysing medical images, such as CT and PET scans, and aid in detecting and characterising lung tumours. It can identify subtle patterns and anomalies that might be missed by human observers, helping in early and accurate diagnosis. AI-powered image analysis can assist pathologists in accurately assessing tissue samples. It can identify and classify cancer cells, determine tumour margins, and provide insights into the tumour's aggressiveness.

AI-powered tools can also provide patients with personalised educational materials, explaining their condition, treatment options, and potential outcomes in an understandable manner. It can also support telemedicine consultations by providing real-time data analysis, and assist remote specialists in making decisions about treatment plans and surgical approaches.

AI algorithms can also assist surgeons and oncologists in creating personalised treatment plans. By considering patient data, tumour characteristics, and medical literature, AI can recommend optimal treatment approaches, including surgery, radiation therapy, chemotherapy, or targeted therapies. It can also analyse patient data to predict outcomes based on patient characteristics, tumour characteristics, and treatment plans. This can help clinicians make informed decisions and manage patient expectations.

During surgery, AI can provide real-time guidance to surgeons, helping them navigate complex anatomical structures. This can be particularly valuable in minimally invasive procedures where precise instrument placement is essential. AI can integrate with surgical imaging systems to provide augmented reality overlays, highlighting important structures, and aiding surgeons in identifying tumour boundaries, blood vessels, and critical anatomical landmarks. AI can assist in post-operative monitoring by analysing patient data, such as vital signs and laboratory results, to detect early signs of complications or recurrence. This could lead to prompt interventions and improved patient care.

> **"AI can assist in post-operative monitoring by analysing patient data."**

As AI can process and analyse vast amounts of patient data, it can contribute to research efforts and clinical trials. It can identify trends, patterns, and potential new treatment strategies based on large datasets.

AI can improve efficiency, accuracy, and patient care in lung cancer surgery in all these areas. However, it is essential to recognise that AI is not meant to replace healthcare professionals, but instead complement their expertise. Collaboration between AI systems and skilled medical professionals can lead to more informed decisions, and better patient outcomes.

Q7 In 2018, you were awarded the Grillo Prize for the best innovative/experimental abstract by the European Society of Thoracic Surgeons (ESTS). Can you explain the key points from the abstract, and highlight any advances made on this work since 2018?

The abstract describes a systematic review and meta-analysis of randomised controlled trials that investigated the effectiveness of endoscopic lung volume reduction (LVR) using endobronchial valves for patients with severe chronic obstructive pulmonary disease and emphysema. The study evaluated whether endoscopic LVR had a significant clinical impact compared with untreated control groups. The abstract summarises the methodology, results, and conclusions of the study. The meta-analysis concluded that, in terms of forced expiratory volume in 1-second improvement, exercise performance, and complication rate, there was no clear clinical impact of endoscopic LVR. The study recommended a more extended follow-up to assess the durability of clinical benefits and effects on survival associated with endoscopic LVR.

Since 2018, there have been ongoing research and developments in endoscopic lung volume reduction for severe chronic obstructive pulmonary disease and emphysema using endobronchial valves. Some potential advances and developments might have occurred since then. For example, researchers may have conducted longer-term follow-up studies to assess the durability of clinical benefits, and effects on survival after endoscopic LVR. These studies could provide insights into the longer-term impact of the procedure on patient outcomes.

Advances in procedural techniques and device design may have improved patient selection, procedural success rates, and patient outcomes. Also, researchers might have explored combination therapies involving endoscopic LVR and other interventions, such as bronchodilators, pulmonary rehabilitation, or medical management, to enhance overall treatment efficacy.

Refinement of patient selection criteria based on individual patient characteristics, lung function, and disease severity could have improved the identification of candidates most likely to benefit from endoscopic LVR. Meanwhile, new randomised controlled trials and clinical trials might have been conducted to evaluate the effectiveness and safety of endoscopic LVR, potentially providing additional insights and data beyond those available in the original meta-analysis.

Q8 Finally, what advice would you give to young clinicians starting their career in thoracic surgery?

Medicine and surgery are ever-evolving fields, which require continuous learning. Stay committed to lifelong learning by attending conferences and workshops, and stay updated with the latest research. Continuous education will keep you at the forefront of advancements in thoracic surgery. Develop and refine your surgical skills with dedication and diligence. Focus on achieving technical excellence, as this will be the foundation of your surgical practice. Medicine evolves rapidly. Be adaptable and willing to embrace new technologies, techniques, and treatment modalities to ensure the best care for your patients.

Seek experienced mentors who can guide you through the challenges and decisions you will face. A mentor can provide invaluable insights, advice, and support as you develop your skills and career. Also, establish a solid professional network by engaging with colleagues, attending conferences, and participating in surgical societies. Networking can lead to collaboration, mentorship, and career opportunities. Thoracic surgery often involves collaboration with various healthcare professionals. Build strong relationships with pulmonologists, oncologists, radiologists, anaesthesiologists, and other specialists, to ensure comprehensive patient care.

Always prioritise your patients' wellbeing and preferences. Effective communication and

empathy are essential in building trust, and providing patient-centred care. Uphold the highest standards of ethics and professionalism. Your patients' trust depends on your integrity and ethical decision-making. Work with patients from diverse backgrounds. Cultural sensitivity and effective communication are crucial to personalised care that respects patients' values and beliefs.

Acknowledge your achievements and milestones. Celebrating successes, whether big or small, can provide motivation and satisfaction. However, medicine is a humbling profession. Recognise that you will encounter cases that challenge your knowledge and skills. Embrace a growth mindset and be open to learning from every experience.

Thoracic surgery can be demanding, but do not neglect your wellbeing. Strive for a healthy work-life balance to prevent burnout, and to maintain physical and mental health.

Surgery can be challenging and emotionally taxing. Develop resilience to cope with the pressures of the profession. Seek support from colleagues, mentors, and resources when needed.

Contribute to the field through research and innovation. Investigate clinical questions, participate in studies, and explore ways to improve patient outcomes. Surgery is a field of continuous discovery. Stay curious, ask questions, and explore intellectually to deepen your understanding of thoracic surgery, and related disciplines.

Remember, the journey in thoracic surgery is a marathon, not a sprint. Embrace the growth opportunities, learning, and impact this career offers. The dedication to patient care and the advancement of the field will leave a lasting mark on the lives you touch, and the future of thoracic surgery.

"Strive for a healthy work-life balance to prevent burnout, and to maintain physical and mental health."