Editorial

Video double-lumen tubes: how much room for improvement can they provide?

David Lopez-Lopez[1]^, Patricia Neira-Somoza[2], Rocio Mato-Bua[1], Oscar Pato-Lopez[1]

[1]The Department of Anesthesiology, Perioperative Care and Pain Medicine, Complexo Hospitalario Universitario de A Coruña, A Coruña, Spain; [2]The Surgical and Perianesthesia Nursery Department, Complexo Hospitalario Universitario de A Coruña, A Coruña, Spain

Correspondence to: David Lopez-Lopez, MD. Department of Anesthesiology, Perioperative Care and Pain Medicine, Complexo Hospitalario Universitario de A Coruña, As Xubias, 84. 15006, A Coruña, Spain. Email: david.lopez.lopez@sergas.es.

Comment on: Palaczynski P, Misiolek H, Bialka S, *et al.* A randomized comparison between the VivaSight double-lumen tube and standard double-lumen tube intubation in thoracic surgery patients. J Thorac Dis 2022;14:3903-14.

Keywords: Double-lumen tube (DLT); thoracic anesthesia; unipulmonar ventilation; video double-lumen tube (VDLT); VivaSight double-lumen tube (VivaSight DLT)

Submitted Jan 14, 2023. Accepted for publication Feb 15, 2023. Published online Feb 20, 2023.
doi: 10.21037/jtd-23-70
View this article at: https://dx.doi.org/10.21037/jtd-23-70

It's been a long way since the success of intrathoracic surgery lied in how quickly the rib cage was closed (1). The iatrogenic pneumothorax was the main restriction to the evolution of this field, and anesthesiology practitioners had a lot to do with how this issue was overcome (2).

Back at the turn of the previous century, Brauer was not entirely wrong when he tried to solve this with a positive pressure chamber around the patient's head (in fact, helmet interfaces for non-invasive ventilation are not that far off), but further changes in airway instrumentation were necessary instead. Rudolph Matas managed to join up several advances that led to a revolution (3): he used the O'Dwyer laryngeal tube (4) together with an intermittent positive pressure ventilation system, which he later improved by introducing a chloroform administration channel to the airway. For sure this basic scheme sounds familiar to any anesthesiologist. However, the placement of these devices had to be done blindly. Although Jackson described the first intubating laryngoscope, the Magill, Flagg, and Macintosh (5) devices were described during the first half of the 20th century.

Last, but not least, the first endotracheal tubes were designed around 1900. After the addition of the tracheal cuff by Guedel in 1928 (6), only the problem of lung isolation remained. Gale *et al.* described the technique of endobronchial intubation with a standard rubber tube, advancing it up to the bronchus of the ventilated lung (7). Along with many surgical advances, this allowed for numerous previously unthinkable procedures, such as pneumonectomies or esophagectomies in the 1930s.

Many further improvements in pulmonary isolation arose quickly from then on: bronchial selective block was first described in 1936 by Archibald (8), and Rovenstine designed a single-lumen double-cuffed tube that allowed for alternative bipulmonar and selective ventilation in the healthy lung (9). It was in 1949 when Carlens published the use of double-lumen tubes (DLTs), although these were first used for anesthesia purposes by Bjork in 1950 (10). Subsequently, the most notable evolutions occurred in the development of devices with less risk of airway injury and less tendency to collapse, with the change from rubber to plastic, which reduced the kinking effect and improved expiratory flow. The Robertshaw tube meets these characteristics and remains the prototype of the modern DLT. It was first introduced in 1962 (11). Pharmacological advances have also allowed deeper anesthetic planes, muscle relaxation, and intraoperative apnea.

However, the innovations in airway management for

^ ORCID: 0000-0003-4258-4510.

© Journal of Thoracic Disease. All rights reserved.

thoracic surgery in recent years have been limited to the improvement of pre-existing devices, whether bronchial blockers (BB) or DLTs. At least it does not seem to be the only field where this phenomenon occurs (12). In fact, the most paradigmatic change in this field in recent years might be the performance of intrathoracic interventions in spontaneous ventilation without orotracheal intubation: a comeback to the roots (13).

The arrival of video double-lumen tubes (VDLTs) with an embedded camera was one of the most original proposals. The VivaSight (VivaSight 2DL, Ambu, Vallerup, Denmark) VDLT allows for continuous visualization of the carina once the tube is inserted into the trachea, which eases the management of lung separation through early detection and correction of its malposition during surgery (14). Does it achieve it? It seems so. The data obtained by Palaczynski *et al.* (15) point to an easier intubation, a faster procedure, and a less frequent need for FiberOptic Bronchoscopy (FOB), among others.

In addition, VDLTs are manufactured keeping internal diameters and cross-sectional areas nearly similar to conventional DLTs (16,17), unlike single-lumen Vivasight tubes, in which the lumen becomes narrower due to the optics system and the placement of BB might lead to clinically relevant flow limitation.

Although the use of BB is considered non-inferior to that of DLTs for lung isolation or separation (18), and the use of airway exchangers is well-defined in the literature as a valid strategy for placement of a DLT through it after intubation of a single tube in cases of difficult airway (19), the reality of clinical practice still points out to a clear preference for DLTs and a greater than expected difficulty with the use of exchangers for this purpose (20) (although not for switching to a single tube after thoracic surgery).

It is not a straightforward task to assess the real clinical relevance of the finding of a reduction in intubation time from 125 to 44 seconds in a standard context, figures that are practically comparable to those reported in previous studies studies (14,21). In a scheduled surgery scenario, the safe time in apnea after a standard preoxygenation should be greater than this interval in most cases, and a difference of 81 seconds within the entire perioperative time is minimal from an economic or operation theatre occupation point of view. But time-sensitive scenarios should not be lost sight of, since the relevance of these seconds can be key in emergent surgery, or a physiologic or anatomic difficult airway setting as well. Furthermore, the VivaSight camera itself might be an extra cognitive aid in order to check the correct advance of the tube alongside the airway and even the direction to the glottis during laryngoscopy, although it cannot replace the capnogram, the visual inspection of the thorax or the auscultation in any case. However, it is such a difficult task to obtain high-quality prospective evidence in this area, such as dispelling the doubt as to whether this benefit in seconds can be extrapolated to an emergency setting since there are many other factors that can hinder clinical management and decision-making. The distal camera of the Vivasight single tubes, despite its limitations, or videolaryngoscopes can also be useful tools in this regard (22).

Nevertheless, the most remarkable difference to previous evidence is the percentage of FOB usage both for intubation and for repositioning of the DLT. Palaczynski *et al.* report a much lower need than previous studies since it was not necessary in any case of the VDLT group and only in 20.5% of the conventional DLT group (15). This again raises the issue of the real need for systematic FOB to verify the location of the DLTs, and even to reposition them, provided that airway management is performed by experienced professionals (as seems to be the case). Once again, the reality of clinical practice clashes with the "classic recommendations" that recommend the systematic use of FOBs to verify the correct placement of the DLTs (23).

According to the clinical experience of the authors of this editorial, the presence of secretions or blood remains is a cumbersome problem that sometimes requires the use of FOB for its management. In any case, except in specific situations, VDLTs could virtually eliminate the need for FOB, particularly in cases of complicated anatomy or previous thoracic surgery, provided that a DLT is a right device for airway management. Other high-priority lung separation or isolation situations, or those where dislodgement of the DLT could be detrimental, like during parenchymal lung stapling or high-output air-leak repairs, could be other clear cases of superiority of VDLTs. Left bronchoalveolar lavage, especially in the case of alveolar proteinosis, could be the clearest example. Perhaps the speed for adequately repositioning the tube, especially without the need to introduce a FOB with the consequent loss of PEEP and functional residual capacity, is more decisive in an intraoperative urgent situation than during a scheduled peri-intubation period.

Despite this, the latest asseverations should lead the reader to the conclusion that the clinical and economic superiority of VDLTs might be restricted to several specific situations, such as those mentioned. The difference in

© Journal of Thoracic Disease. All rights reserved.

FOB usage reported by the authors is still higher than the limit of 6.6% proposed by Larsen *et al.* (24), but the more experienced operator, the lesser the need for FOB verification and the lesser the economic superiority. Moreover, the rate of tube repositioning in the study by Palaczynski *et al.* is higher in the VDLT group, pretty close to statistical significance (15).

The authors' approach to the safety problem is also interesting, as the risk of airway injury secondary to the melting of the plastic material of the tube was reported (25). Although the manufacturer's actions seem to have been satisfactory in this regard, it remains to be elucidated whether most recent reports regarding the high risk of cuff rupture may pose a further limitation to a widespread use of these devices.

Thus, it seems that VDLTs provide some room for improvement in airway management in thoracic surgery. Anesthesia practitioners must be critical and cautious when interpreting the clinical relevance of the findings in their favor, as well as when applying their advantages in situations not directly considered in clinical studies. However, it is in these time-sensitive situations that the potential benefits may be the greatest.

Acknowledgments

Funding: None.

Footnote

Provenance and Peer Review: This article was commissioned by the editorial office, *Journal of Thoracic Disease*. The article did not undergo external peer review.

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at https://jtd.amegroups.com/article/view/10.21037/jtd-23-70/coif). The authors have no conflicts of interest to declare.

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

Open Access Statement: This is an Open Access article distributed in accordance with the Creative Commons Attribution-NonCommercial-NoDerivs 4.0 International License (CC BY-NC-ND 4.0), which permits the non-commercial replication and distribution of the article with the strict proviso that no changes or edits are made and the original work is properly cited (including links to both the formal publication through the relevant DOI and the license). See: https://creativecommons.org/licenses/by-nc-nd/4.0/.

References

1. Matas R. Intralaryngeal insufflation. JAMA 1900;34:1371-75.
2. Brodsky JB, Lemmens HJ. The history of anesthesia for thoracic surgery. Minerva Anestesiol 2007;73:513-24.
3. Hutson LR Jr, Vachon CA. Dr. Rudolph Matas: innovator and pioneer in anesthesiology. Anesthesiology 2005;103:885-9.
4. O'Dwyer J. Intubation of the larynx. N Y Med J 1885;42:145-7.
5. Macintosh RR. A new laryngoscope. Lancet 1943;241:205.
6. Guedel AE, Waters RM. A new intratracheal catheter. Anesth Analgesia 1928;7:238-9.
7. Gale JW, Waters RM. Closed endobronchial anesthesia in thoracic surgery*: (Preliminary Report). J Thorac Surg 1932;1:432-7.
8. Archibald E. A consideration of the dangers of lobectomy. J Thorac Surg 1935;4:335-51.
9. Rovenstine EA. Anaesthesia for intrathoracic surgery: the endotracheal and endobronchial techniques. Surg Gynecol Obstet 1936;63:325-30.
10. BJORK VO, CARLENS E. The prevention of spread during pulmonary resection by the use of a double-lumen catheter. J Thorac Surg 1950;20:151-7.
11. Robertshaw FL. Low resistance double-lumen endobronchial tubes. Br J Anaesth 1962;34:576-9.
12. Park M, Leahey E, Funk RJ. Papers and patents are becoming less disruptive over time. Nature 2023;613:138-44.
13. Gonzalez-Rivas D, Aymerich H, Bonome C, et al. From Open Operations to Nonintubated Uniportal Video-Assisted Thoracoscopic Lobectomy: Minimizing the Trauma to the Patient. Ann Thorac Surg 2015;100:2003-5.
14. Onifade A, Lemon-Riggs D, Smith A, et al. Comparing the rate of fiberoptic bronchoscopy use with a video double lumen tube versus a conventional double lumen tube-a randomized controlled trial. J Thorac Dis 2020;12:6533-41.
15. Palaczynski P, Misiolek H, Bialka S, et al. A randomized comparison between the VivaSight double-lumen tube and

standard double-lumen tube intubation in thoracic surgery patients. J Thorac Dis 2022;14:3903-14.
16. Ambu.es. Ambu® VivaSight™ 2 DLT. Hoja técnica. [accessed 11 January 2023]. Available online: https://www.ambu.es/manejo-de-la-via-aerea-y-anestesia/tubos-de-doble-luz/producto/ambu-vivasight-2-dlt
17. Campos J. Lung isolation. In: Slinger P, editor. Principles and Practice of Anesthesia for Thoracic Surgery. Switzerland: Springer Nature; 2019:283-309.
18. Clayton-Smith A, Bennett K, Alston RP, et al. A Comparison of the Efficacy and Adverse Effects of Double-Lumen Endobronchial Tubes and Bronchial Blockers in Thoracic Surgery: A Systematic Review and Meta-analysis of Randomized Controlled Trials. J Cardiothorac Vasc Anesth 2015;29:955-66.
19. Granell M, Parra MJ, Jiménez MJ, et al. Review of difficult airway management in thoracic surgery. Revisión del manejo de la vía aérea díficil en cirugía torácica. Rev Esp Anestesiol Reanim (Engl Ed) 2018;65:31-40.
20. Langiano N, Fiorelli S, Deana C, et al. Airway management in anesthesia for thoracic surgery: a "real life" observational study. J Thorac Dis 2019;11:3257-69.
21. Levy-Faber D, Malyanker Y, Nir RR, et al. Comparison of VivaSight double-lumen tube with a conventional double-lumen tube in adult patients undergoing video-assisted thoracoscopic surgery. Anaesthesia 2015;70:1259-263.
22. Lopez-Lopez D, Mato-Bua R, Garcia-Perez A, et al. Response to 'Cuff inflation technique: A saviour in the double lumen tube placement'. J Clin Anesth 2022;77:110643.
23. de Bellis M, Accardo R, Di Maio M, et al. Is flexible bronchoscopy necessary to confirm the position of double-lumen tubes before thoracic surgery? Eur J Cardiothorac Surg 2011;40:912-6.
24. Larsen S, Holm JH, Sauer TN, et al. A Cost-Effectiveness Analysis Comparing the VivaSight Double-Lumen Tube and a Conventional Double-Lumen Tube in Adult Patients Undergoing Thoracic Surgery Involving One-Lung Ventilation. Pharmacoecon Open 2020;4:159-69.
25. Massot J, Dumand-Nizard V, Fischler M, et al. Evaluation of the Double-Lumen Tube Vivasight-DL (DLT-ETView): A Prospective Single-Center Study. J Cardiothorac Vasc Anesth 2015;29:1544-9.

Cite this article as: Lopez-Lopez D, Neira-Somoza P, Mato-Bua R, Pato-Lopez O. Video double-lumen tubes: how much room for improvement can they provide? J Thorac Dis 2023;15(3):960-963. doi: 10.21037/jtd-23-70

© Journal of Thoracic Disease. All rights reserved.