Editorial

Objective analysis of postoperative air leaks can aid in decision-making, but does the use of digital drains really impact patient outcomes?

Vijay Joshi[1], **Ioannis Dimarakis**[1,2]

[1]Department of Cardiothoracic Surgery, Wythenshawe Hospital, Manchester, UK; [2]Division of Cardiovascular Sciences, University of Manchester, Manchester, UK

Correspondence to: Ioannis Dimarakis, MD, PhD, MEBCTS, FRCS(CTh). Department of Cardiothoracic Surgery, Wythenshawe Hospital, Southmoor Road, Manchester M23 9LT, UK. Email: jdimarakis@nhs.uk.

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

Comment on: Jacobsen K, Talbert S, Boyer JH. The benefits of digital drainage system versus traditional drainage system after robotic-assisted pulmonary lobectomy. J Thorac Dis 2019;11:5328-35.

Submitted Feb 24, 2020. Accepted for publication Apr 01, 2020.
doi: 10.21037/jtd.2020.04.22
View this article at: http://dx.doi.org/10.21037/jtd.2020.04.22

Jacobsen *et al*., present a retrospective study evaluating digital drainage systems applied to patients undergoing pulmonary lobectomy with robotic-assisted thoracoscopic surgical (RATS) approach (1). Digital and traditional chest tube drainage systems were compared, with all operations carried out by the same surgeon to control for variance. Assessed outcome measures included postoperative chest tube days, hospital length of stay, chest tube reinsertion during hospitalization, and 30-day readmission for pneumothorax. There were clear criteria for chest drain removal in each group. The authors demonstrated that chest tube duration and length of stay were significantly reduced with the use of a digital system versus traditional method (2.07 *vs.* 2.73 days, P=0.03 and 4.02 *vs.* 5.06 days, P=0.010, respectively). Chest tube reinsertion was four-times more likely with traditional system use, however, this was not statistically significant.

Post-operative air leak continues to be a burden for the thoracic surgeon, with historical data quoting approximately 50% of patients having an air leak immediately after surgery of which 15% exceed postoperative day 5 (2). The clinical need for objective classification systems of air leaks with relevant management algorithms was recognized early (3). Digital drainage systems were shown to further improve user variability in air leak quantification compared to traditional chest tube methods (4,5). The presence of an air leak need not hinder discharge as portable flutter valves can safely facilitate this (6). Preference, however, should be given to discharge a patient without a chest tube, as it is a foreign body. Enhanced recovery is now a priority in many thoracic units and early discharge can be facilitated with protocol driven decision pathways (7). The output recorded from digital drainage systems can therefore be easily adopted into an algorithm leading towards early chest tube removal.

Beyond the undeniably more objective assessment of air leaks compared to traditional systems, digital drainage systems also allow for early mobilization without interruption of continuous suction. Early mobilization is paramount to reduce length of stay and prevent complications associated with poor mobility, such as pneumonia or pulmonary embolism. Not being confined to wall suction provides this advantage and allows the patient more independence early on in their postoperative course. The use of suction can help expand a partially collapsed lung and allows for proper control of the pleural space (8). In a recent open-label randomized controlled trial comparing low suction of –2 compared to –10 cmH_2O, using a digital drainage device, low suction level was shown to significantly shorten drainage duration, time to air leak cessation and total fluid production, without increasing morbidity (9).

© Journal of Thoracic Disease. All rights reserved.

The mainstay of this study remains quality improvement in terms of outcomes and patient satisfaction. RATS has been criticized as not being cost-effective compared to other minimally invasive approaches. Being able to reduce length of stay, and thus the cost of care and a hospital bed, can tip the cost-benefit ratio in favor of the 'robot'. As cost analysis was not an outcome measure of this study no definite conclusions can be made. Although surgeons may have individual preferences regarding choice of minimally invasive approach, overall costs, surgical productivity, and the benefit to the patient need to be taken into consideration (10). Of note, in a retrospective study of a multihospital database including over 15,000 patients by Swanson *et al.*, RATS was associated with increased costs and operating times in comparison to conventional video-assisted thoracic surgery (VATS), with no differences in length of stay and adverse events (11). The advantages of robotic surgery have been well documented and its use is evolving as it is being employed in more complex thoracic procedures (12). Benefits of superior vision, access to all areas of the thoracic cavity, better lymphadenectomy, and wristed robotic instruments allow for more ergonomic and efficient surgery. On the other hand, the steep learning curve required to develop and maintain a successful robotic program is a well-recognized challenge in general thoracic surgery. Encouragingly, the learning curve can be surpassed after approximately 20 RATS procedures, provided an intense training programme together with appropriate proctoring and case observations is adhered to (13). Perioperative outcomes during the learning period have been shown to be similar to VATS, with the robotic approach offering more operative safety with fewer conversions for uncontrolled bleeding (14).

In a multicenter international randomized trial of digital versus traditional drainage systems after pulmonary resection, digital drainage systems were associated with shorter duration of chest tube placement, shorter hospital stays, and higher satisfaction scores compared with those managed with traditional devices (15). Despite some inconsistency in the literature, a number of meta-analyses appear to favor their use (16,17).

The combination of a minimally invasive approach, protocoled patient pathways, including digital drainage systems can collectively reduce the length of stay for patients undergoing pulmonary lobectomy whilst improving patient satisfaction metrics. It is therefore within such a light we should interpret the findings of this study. One can presume that any digital drainage system is solely one of many parameters that jointly contribute to improved quality of care. In addition, as newer robotic technology becomes available, competition will drive purchasing and operating costs down, perhaps to a point where costs no longer become an issue (18). However, further studies, focused specifically at these metrics, would help future minimally invasive surgeons decide which platform is best suited for the task.

Acknowledgments

Funding: None.

Footnote

Conflicts of Interest: Both authors have completed the ICMJE uniform disclosure form (available at http://dx.doi.org/10.21037/jtd.2020.04.22). ID serves as an unpaid editorial board member of *Journal of Thoracic Disease* from Oct 2018 to Sep 2020. The other author has 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. Jacobsen K, Talbert S, Boyer JH. The benefits of digital drainage system versus traditional drainage system after robotic-assisted pulmonary lobectomy. J Thorac Dis 2019;11:5328-35.
2. Brunelli A, Monteverde M, Borri A, et al. Predictors of prolonged air leak after pulmonary lobectomy. Ann Thorac Surg 2004;77:1205-10; discussion 1210.
3. Cerfolio RJ. Advances in thoracostomy tube management. Surg Clin North Am 2002;82:833-48, vii.

© Journal of Thoracic Disease. All rights reserved.

4. Varela G, Jiménez MF, Novoa NM, et al. Postoperative chest tube management: measuring air leak using an electronic device decreases variability in the clinical practice. Eur J Cardiothorac Surg 2009;35:28-31.
5. McGuire AL, Petrcich W, Maziak DE, et al. Digital versus analogue pleural drainage phase 1: prospective evaluation of interobserver reliability in the assessment of pulmonary air leaks. Interact Cardiovasc Thorac Surg 2015;21:403-7.
6. Mueller MR, Marzluf BA. The anticipation and management of air leaks and residual spaces post lung resection. J Thorac Dis 2014;6:271-84.
7. Batchelor TJP, Rasburn NJ, Abdelnour-Berchtold E, et al. Guidelines for enhanced recovery after lung surgery: recommendations of the Enhanced Recovery After Surgery (ERAS®) Society and the European Society of Thoracic Surgeons (ESTS). Eur J Cardiothorac Surg 2019;55:91-115.
8. Cerfolio RJ, Varela G, Brunelli A. Digital and smart chest drainage systems to monitor air leaks: the birth of a new era? Thorac Surg Clin 2010;20:413-20.
9. Holbek BL, Christensen M, Hansen HJ, et al. The effects of low suction on digital drainage devices after lobectomy using video-assisted thoracoscopic surgery: a randomized controlled trial†. Eur J Cardiothorac Surg 2019;55:673-81.
10. Schmid T, Augustin F. From RATS to VATS: why we did choose this way. J Vis Surg 2018;4:23.
11. Swanson SJ, Miller DL, McKenna RJ Jr, et al. Comparing robot-assisted thoracic surgical lobectomy with conventional video-assisted thoracic surgical lobectomy and wedge resection: results from a multihospital database (Premier). J Thorac Cardiovasc Surg 2014;147:929-37.
12. Ricciardi S, Zirafa CC, Davini F, et al. How to get the best from robotic thoracic surgery. J Thorac Dis 2018;10:S947-50.
13. Cheufou DH, Mardanzai K, Ploenes T, et al. Effectiveness of robotic lobectomy-outcome and learning curve in a high volume center. Thorac Cardiovasc Surg 2019;67:573-7.
14. Mahieu J, Rinieri P, Bubenheim M, et al. Robot-assisted thoracoscopic surgery versus video-assisted thoracoscopic surgery for lung lobectomy: can a robotic approach improve short-term outcomes and operative safety? Thorac Cardiovasc Surg 2016;64:354-62.
15. Pompili C, Detterbeck F, Papagiannopoulos K, et al. Multicenter international randomized comparison of objective and subjective outcomes between electronic and traditional chest drainage systems. Ann Thorac Surg 2014;98:490-6; discussion 496-7.
16. Zhou J, Lyu M, Chen N, et al. Digital chest drainage is better than traditional chest drainage following pulmonary surgery: a meta-analysis. Eur J Cardiothorac Surg 2018;54:635-43.
17. Wang H, Hu W, Ma L, et al. Digital chest drainage system versus traditional chest drainage system after pulmonary resection: a systematic review and meta-analysis. J Cardiothorac Surg 2019;14:13.
18. Solinas M, Novellis P, Veronesi G. Robotic is better than VATS? Ten good reasons to prefer robotic versus manual VATS surgery in lung cancer patients. Video-assist Thorac Surg 2017;2:60.

Cite this article as: Joshi V, Dimarakis I. Objective analysis of postoperative air leaks can aid in decision-making, but does the use of digital drains really impact patient outcomes? J Thorac Dis 2020;12(8):3927-3929. doi: 10.21037/jtd.2020.04.22

© Journal of Thoracic Disease. All rights reserved.