



About a new pleural digital drainage system, the Thoraguard device

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Pleural postoperative drainage following thoracic procedure has been implemented for a century, historically using valved tubes with air-tight seal management and then water-sealed drains. In current practice, chest tubes' management remains a critical aspect in the postoperative period, especially after pulmonary resection with an important impact on patient recovery and hospital length. Despite being necessary after the majority of cases, drains can induce pain, immobility and reduced pulmonary function. Over the last two decades, things changed, as historical water-sealed drains with analog qualitative assessment of air leaks evolved toward digital drainage systems with quantitative assessment of air leaks, helping surgeons to optimize chest tube management.

Several digital drainage systems are actually available, including Thopaz™ (Medela AG, Switzerland), DrenTech™ (Redax, Italy), DigiVent™ (Millicore, Sweden) or Atmos™ (MedizinTechnik, Germany). Almost all of them use digital sensors to monitor air flow and pleural pressure continuously and display it on digital screens.

The efficiency and convenience for patients of digital drainage system were well studied in 2014 by Pompili *et al.* (1). In this prospective multicenter randomized trial, they evaluated on the one hand objective parameters like air leak duration, chest tube duration and length of stay and the other hand eight subjective parameters. They showed significantly shorter air leak and chest tube duration just as shorter postoperative length of stay. Regarding subjective parameters, the ability to arise from bed, system

convenience for patient and personnel and the potential for being comfortable when discharged home with the device were significant.

Since this trial, more studies have been published and recently, Chang *et al.* released a meta-analysis (2), in which they observed a 1.4 days diminution for length of hospital stay and a reduced chest tube duration of 0,68 days with digital drainage system use.

Indeed, digital drainage systems are more accurate with continuous air leak measurement compared with analog systems which give information on air leak only at the moment when the medical teams assess it. Moreover, analog systems give qualitative information about air leak but there is no way to have quantitative information in this way. The quantitative information brought by digital systems permits to homogenize the drain management and subsequently to reduce chest tube duration with a more precise air flow measurement. These are probably the reasons why digital drainage system permits a reduction of chest tube drainage and postoperative length of stay. Moreover, the portability, comfort and convenience of digital devices facilitate patients' mobilisation, and potentially improve post-operative pulmonary function and decrease infectious complications linked to restriction of pulmonary function. Thereby, 2019 Enhanced Recovery After Surgery (ERAS) guidelines, recommend the use of digital drainage system after lung surgery (3).

Geraci and colleagues conducted a three-part study, firstly assessing the feasibility/safety of a novel digital

drainage system (THORAGUARD) on 50 patients treated with robotic-assisted thoracic surgery (RATS) lobectomy, secondly comparing the results with a retrospective cohort of 200 patients also treated with RATS lobectomy but with an analog drainage system, and thirdly with a clinician feedback survey (4).

In this feasibility study, they found that the Thoraguard system detected a higher number of air leaks than the analog system (36/50 versus 45/200, $P < 0.001$) and was associated with decreased chest tube duration (1 versus 2 days, $P = 0.042$) and shorter hospital length of stay (2 versus 3 days, $P = 0.007$). Concerning the clinician feedback survey, the user-reported ability to detect air leaks (17/23, 74%), the ease of patient ambulation (14/23, 61%) and the display of clinically relevant information (22/23, 96%) are better with Thoraguard system than the analog one. It is important to note that no adverse events were reported using this device.

Although this study is well conducted, its retrospective design could potentially lead to measurement bias as air leaks may have been underreported in the medical report. Thus, the difference in air leak detection reported could be heightened. As reported previously, there are several digital drainage systems available. In the survey user experience, surgeons and nurses reported better performance with Thoraguard system compared to other digital system items. However, this report is only subjective (surgeons' and nurses' feedback) without any underlying clinical evidence in this study. Moreover, the compared digital system is not mentioned.

Does it mean analog systems are not useful anymore? Probably not, but evidence suggests that digital system drainage is more efficient. At time of mini-invasive surgery and ERAS, digital drainage systems are a tool to enhance chest tube management and provide shorter chest tube duration and shorter post-operative length of stay favor to better precision. Even if the use of digital drainage for pneumothoraces is not totally clear, a recent study by Yagi *et al.* seems to show that digital systems provide better outcomes, in particular with the length of stay (5). Still, there will always be a place for analog systems, in patients with high flow of air leaks, multiple chest tubes, or in emergency situations.

Finally, we congratulate the authors for their study on the use of a novel digital drainage device but we emphasize that we need more studies and particularly randomized

research, to assess the clinical benefits of this new system.

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