

A Box is Not Just a Box

Alberto Antonicelli, MD¹, Carlo Capra, MD², Bryan M. Burt, MD³

¹*Independent Scientist*; ²*Department of Anesthesia Intensive Care, Tragate Hospital, Italy*; ³*Baylor College of Medicine, Houston, Texas, USA*

Objective: Chest drainage units regulate intrapleural pressure and thus are therapeutic against postlung resection airleak. While a variety of models exist, the scientific investigation of their working principles is underdeveloped. We set out to compare important “safety” metrics of some of those that are clinically available.

Methods: Eight chest drainage units were tested using a Black-box to simulate a postoperative bronchopleural fistula of 3L/min, and coughing. Five units were fully digital (low-flow/lowvacuum pumps), 2 were hybrids (a combination of a water-seal and a low-flow/low vacuum pump), and 1 was a traditional three-chamber plastic disposable (water-seal wet-suction).

Results: Five units were highly restrictive to flow (peak-pressures > 50cmH₂O - **image A**), 5 allowed the normally negative-pressure intrapleural space to instead remain positive at length (5 to 81s - **image B**) and 7 showed no capability to handle a 10L/min leak.

Conclusions: The traditional chest drainage unit outperformed each of the digital ones, which were too restrictive to flow and slow to react. These data highlight the need for clinical testing of new models against traditional ones, as new technology emerges.

AATS Patient Safety Meeting

Image

All measurements were made at the patient's end of the chest drainage tubing.

Yellow curves = traditional three-chamber plastic disposable (water-seal wet-suction)

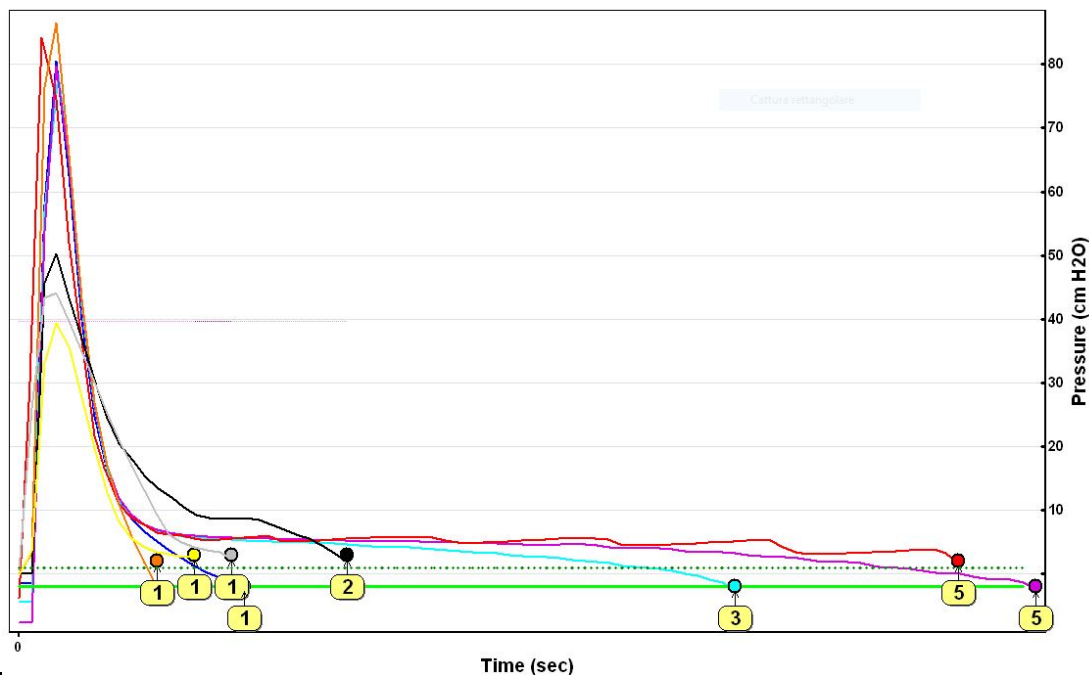
Grey and black curves = hybrids (a combination of a water-seal and a low-flow/low vacuum pump)

All other curves = fully digital (low-flow/low-vacuum pumps)

Green horizontal solid line = vacuum set on the tested chest drainage unit

A) "Positive-pressure protection" against cough

(Peak-pressure measured in each unit when an air-pocket of 0.4L pressurized at +300cmH₂O is released)



B) "Overflow protection" against a medium-sized air leak of 3L/min

(Times needed by each unit to handle the flow demand while bringing the intrapleural pressure back to more physiologic values)

