

Using a Novel Digital Pleural Drainage Device: A Proof of Concept

Rationale

In the majority of patients with indwelling pleural catheters, pleural drainage currently consists of using a vacuum bottle. The initial pressure in these one liter bottles can be as high as -995 cmH₂O. Although the design of the vacuum bottle is such that the negative pressure decreases with increased drainage, many patients report significant pain or coughing at the end of drainage. We tested a digital device that allows controlled pleural drainage with concurrent quantitative assessment of pleural fluid removed and manometry of the system.

Methods

As a proof of concept study to evaluate the efficacy and functionality of a digital pleural drainage device we enrolled 5 patients, who presented to clinic for evaluation of their indwelling pleural catheters. The indwelling catheters were attached to the device which gave a quantitative read out of the volume of fluid being drained and simultaneously provided a continuous measurement of the pressure of the system (pleural space and vacuum generated by the device). The device was primed and the draining speed (4 possible speeds) was then increased or decreased during the drainage depending on the patients' symptoms. The draining was concluded when the patient reported discomfort.

Results

Of the 5 patients, 1 patient was unable to be drained using the device due to their non-functioning indwelling pleural catheter related to loss of integrity of the catheter. The remainder of the 4 patients reported improved symptoms of discomfort after drainage when they were drained using the device as compared to a vacuum bottle. The highest negative pressures noted were during priming of the system, on average -82.5 cmH₂O (-69 to -117 cmH₂O). The pressures at the end of the drainage were on average -45.5 cmH₂O (-20 to -69 cmH₂O). Overall patients still reported some level of chest discomfort but noted that it improved faster compared to vacuum bottle drainage at home, despite pleural elastance being >14.5 cmH₂O/L (normal).

Conclusion

This proof of concept study of using a digital proof of concept study of using a digital device to more precisely drain pleural fluid showed that the device could safely be used in patients with indwelling pleural catheters. Overall the results were encouraging and showed that the device applied significantly less negative pressure compared to standard vacuum bottles. There was more fine-tuned control of the drainage rate and real time quantitative measurement of relative fluid drained, which could have real world implications in the management of recurrent pleural effusions.

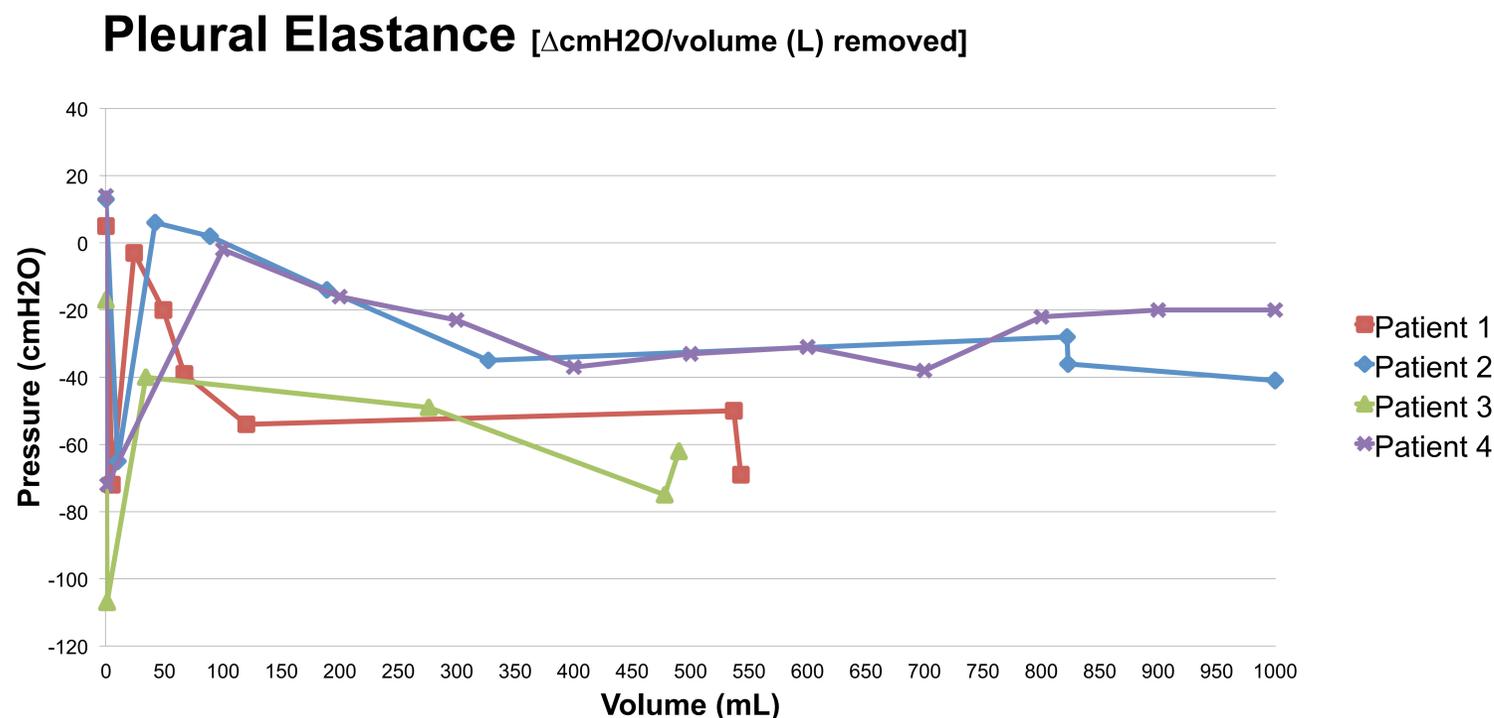


Figure 1. Pleural Elastance Curves