Ambulatory management of secondary spontaneous pneumothorax: a mirage, or a solution on the horizon?

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Ambulatory management of selected patients with secondary spontaneous pneumothorax using small-bore chest catheters (12F) with an attached one-way flutter valve device seems feasible and safe
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Secondary spontaneous pneumothorax (SSP) exemplifies the idea of a "wicked problem" [1]: the type of challenge with complicated solutions that must be examined carefully, in order to avoid compounding the problem itself. In this case, the problem, SSP, is characterised by an equally problematic immediate solution, namely prolonged hospitalisation. As extended hospital stays are costly to SSP patients and healthcare systems alike, ambulatory management might appear to be an appealing alternative. Recent randomised trials and prior observational studies have demonstrated the efficacy of ambulatory management in primary spontaneous pneumothorax (PSP) [2–7] and iatrogenic pneumothorax [8]. While PSP and SSP are thought of as distinct clinical syndromes, recent radiological and pathological data [9, 10] challenge this assumption. PSP and SSP are likely at different ends of the spontaneous pneumothorax spectrum.

In this issue of the *European Respiratory Journal*, Walker *et al.* [11] conducted a randomised trial to study whether ambulatory management (n=21) with one-way valves reduces hospitalisation length in adult SSP patients. The standard of care group (n=20) was hospitalised and drained with a 12F tube connected to an underwater seal. The intervention group was initially drained with an all-in-one 8F Rocket Pleural Vent (n=13/21, chest tube and Heimlich valve in one device with no need for an additional attachment). 22 months into the study, the use of this device was abandoned due to an unacceptable failure rate (n=6/13, 46%). As a substitute, a stand-alone Heimlich valve device (Atrium Pneumostat) was attached to a 12F chest tube to aid outpatient management (n=8/21).

Despite the study's limitations of being underpowered and also changing the pre-defined intervention strategy, its importance cannot be ignored. Results show that the length of hospitalisation, including 30-day readmissions, was similar between the outpatient and inpatient groups. The results were likely confounded by high short-term failure rates of the 8F pleural vent, mandating readmissions and emergency department visits. The substitute intervention strategy, *i.e.* 12F chest tube attached to a stand-alone Heimlich valve, did not report any adverse events. Clinically relevant secondary outcomes (failure within the first week, 6-month recurrence rate, and the need for thoracic surgery) did not differ between the two groups.

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These findings challenge existing beliefs that admission and a large chest tube (⩾14F) are obligatory for initial management of SSP patients. However, routine ambulatory management of SSP using a stand-alone one-way valve is not yet ready for widespread adoption for various reasons: lack of data regarding comorbidities during the presentation (*e.g.* frequency of acute exacerbations of COPD), minimal data about use and outcomes in non-COPD patients, and limited experience (n=8) with the stand-alone Heimlich valve. These devices are susceptible to errors during attachment, often with serious consequences [12, 13]. The lack of serious adverse events in this study with the stand-alone Heimlich valve might be owing to a combination of various factors, including a unique design and a small sample size.

It is clear from this study that the 8F device is prone to failure in SSP. This raises the question of whether there is a tipping point between 8F and 12F diameters. It is plausible that a 12F device offers the "Goldilocks" size for ambulatory management of SSP, by providing additional resiliency against external compressive forces (ribs) and internal challenges (blockages due to pleural fluid, blood) in comparison to an 8F tube. Additionally, while the differences between the diameters seem negligible upon examination (2.7 mm for 8F *versus* 4 mm for 12F) [14, 15], they could be significant as the resistance to flow for liquids is inversely proportional to the 4th power of radius in tubes. Chest tubes rarely conduct air alone, especially in prolonged use as in SSP, and resistance to pleural fluid flow [16] could hamper a chest tube's intended functionality in pneumothorax.

A 12F device with an inbuilt Heimlich valve has the potential of combining the best of both worlds, by reducing iatrogenic errors due to Heimlich valve misorientation and providing an adequate chest tube size. It has potential advantages of reduced length, and therefore possibly reduced resistance, in comparison to the traditional 14F pigtail catheters. Such a device should be considered for formal studies in the SSP population.

Facets of the natural history of SSP are also evident thanks to this effort. A significant proportion of participants across both groups needed a repeat procedure within 3 months (n=14/41, 66.6%), and ultimately needed thoracic surgery intervention (n=12/41, 29%). Recent studies using administrative data have shown the importance of prophylactic surgical procedures in transforming this recurrent and costly disease's natural history [17]. Initial management strategies should be aimed at being effective, safe, efficient and patient-centred. The initial intervention should be complemented by meticulous follow-up (as done in this study) and, potentially, elective surgical intervention. Formal clinical pathways (*e.g.* "pleural pathways") [18–20] are needed to implement the evidence generated by this and many recent landmark studies in real world practice [2, 3].

The slow and incomplete recruitment that hampered this study should catalyse global collaboration in pleural medicine research. Our patients need timely delivery of evidence that guides effective shared decision-making. Despite the study's significant limitations, Walker *et al.* [11] must be congratulated on their attempt to examine the role of ambulatory management in the immediate approach to SSP. The solution to SSP must not become a problem in itself.

Starting with the efforts of Stradling and Poole [21] in 1966, various researchers have described the role of minimally invasive [7, 22–25] and ambulatory [26] management in SSP subgroups in their studies. A 2019 systematic review restricted to randomised studies and studying the most efficacious and safe intervention in spontaneous pneumothorax reported only a 15% prevalence of SSP in their pooled sample [27]. This suggests potential under-recruitment in trials that did not exclude SSP subjects. Therefore, it is no mean feat for Walker *et al.* [11] to have focused solely on SSP. This, along with the study's randomised design, sets it apart from prior studies. This investigation has generated intriguing hypotheses about initial management choices and raised awareness about safety issues with "minimally invasive" devices: a concern noted in previous studies [27]. Continuous efforts using the principles of mistake proofing [28] to improve pleural device safety, including stand-alone Heimlich valves and narrow bore chest tubes [29], should complement these efforts. Ambulatory management of SSP is no longer a mirage on the horizon, but we do have some distance to cover.

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