J R Coll Physicians Edinb 2021; 51: 125–8 | doi: 10.4997/JRCPE.2021.205 ORIGINAL RESEARCH PAPER

Ambulatory pneumothorax management in a district general hospital

Avinash Aujayeb[1]

Abstract

Background The pleural vent (PV) is a new drain and valve device enabling ambulatory pneumothorax management. This study analysed the characteristics and outcomes of patients with pneumothorax treated with a PV.

Methods The characteristics and outcomes of 49 patients with pneumothorax treated with a PV between 1 March 2018 and 1 February 2021 were retrospectively analysed.

Results The mean number of days the PV remained in situ for all patients was 5.6 days, range 0-25, IQR 3-7. Forty patients were managed completely in the ambulatory setting. The total number of days with the PVs in situ was 248. Approximate inpatient bed days saved are 240-320 days. Complications requiring a change in management occurred in nine (18.3%) cases.

Conclusion This single-centre study shows that ambulatory pneumothorax management with the PV is feasible and associated with inpatient bed savings. Complication rates are less than previously described.

Keywords: pleural vent, spontaneous pneumatothorax, cardiothoracic, intercostal drain

Financial and Competing Interests: No conflict of interests declared

Correspondence to:
Avinash Aujayeb
Respiratory Consultant
Northumbria Healthcare
NHS Foundation Trust
Northumbria Way
Cramlington
Northumberland NE23 6NZ
UK

Email:
avinash.aujayeb@nhct.nhs.uk

Introduction

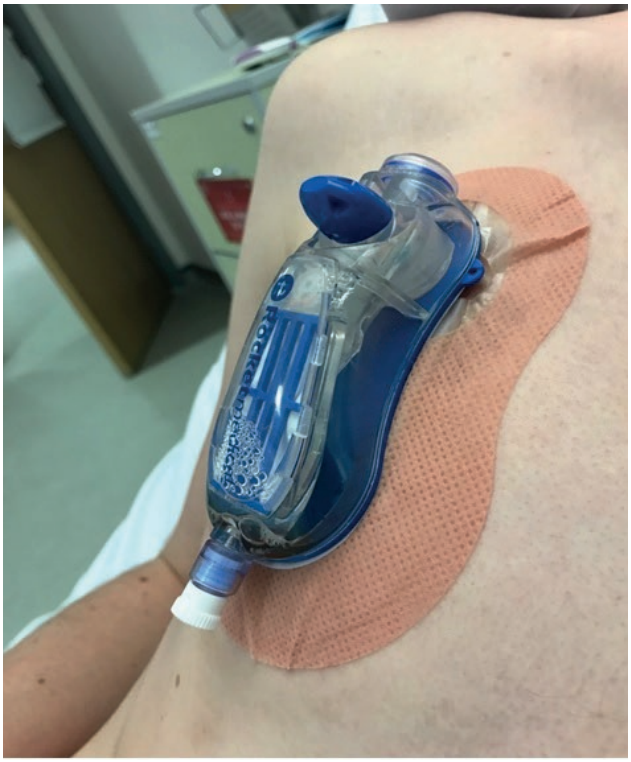
Spontaneous pneumothorax occurs without trauma or iatrogenic injury. British Thoracic Society (BTS) 2010 guidance suggests a subdivision of pneumothorax into primary (without pre-existing lung disease) and secondary (with pre-existing lung disease or in those who are older than 50 with a significant smoking history).[1] However, primary spontaneous pneumothorax (PSP) patients have macroscopic and microscopic structural abnormalities: distal airways inflammation, 'pleural porosity' and emphysema-like changes.[2,3]

Approximate yearly incidence of pneumothorax is 40.7 in men and 15.6 in women per 100,000.[1,4] Conservative management might be an option in those with minimal symptoms.[1] Needle aspiration and intercostal drain (ICD) insertion are established therapeutic interventions. Hospital stay for patients requiring drainage is 6-8 days.[4]

Ambulatory pneumothorax management can be performed with disposable, single-use devices but all require an ICD and subsequent connection. The 8 French Gauge (FG) Rocket® Pleural Vent™ (PV) is a self-contained drain and valve (Figures 1,2).

We hypothesised that ambulatory management of PSP and secondary spontaneous pneumothorax (SSP) is feasible and

Figure 1 Pleural vent in situ in the second intercostal space, mid clavicular line



[1]Respiratory Consultant, Northumbria Healthcare NHS Foundation Trust

Figure 2 Pleural vent in situ in the 5th intercostal space, mid axillary line

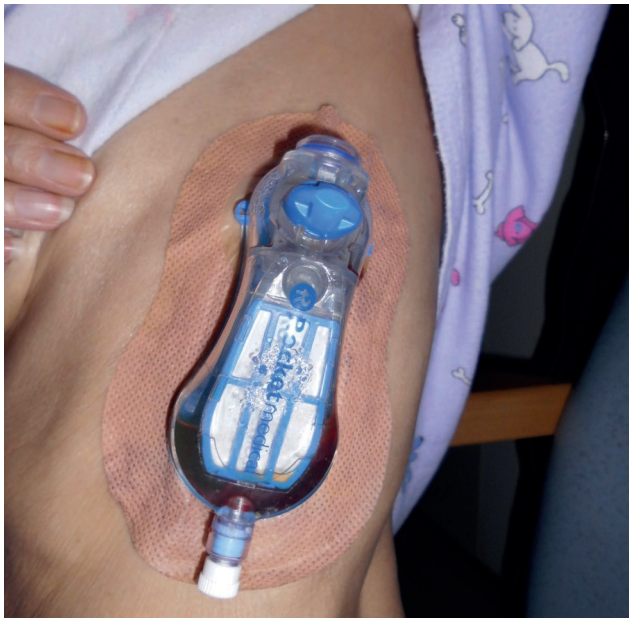
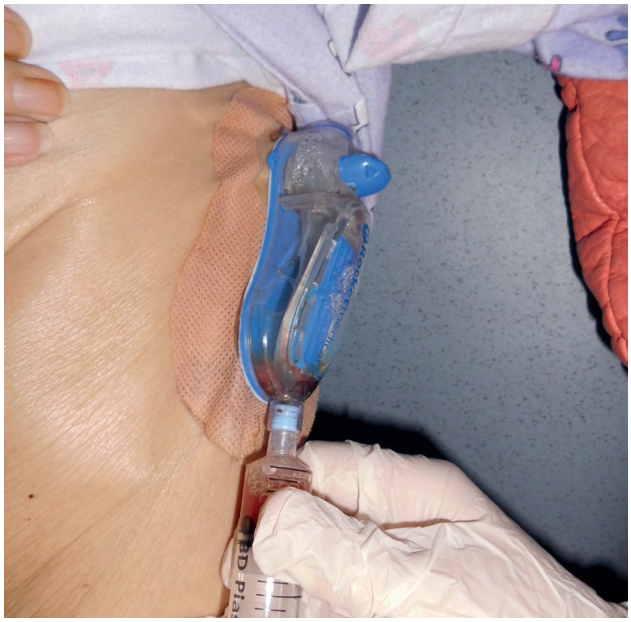


Figure 3 Fluid being drawn out of the pleural vent using a Luer lock syringe



safe in a district general hospital. We describe the local set-up process for generalisable applicability.

Methods

A retrospective observational study of all pneumothoraces managed with a PV was performed (March 2018 to January 2021). Demographics and outcomes were collected. Local Caldicott approval from Northumbria Healthcare NHS Foundation Trust was granted (reference: C3705).

Local pathway development

The PV required authorisation from local safety and new device committees. The manufacturing company facilitated training. Local protocols and patient leaflets were produced. Patients need to be ambulant and have a performance status of 0 to 2. Financial implications were clear: an overnight inpatient stay costs approximately 800 GBP, the PV device 125 GBP, and an ICD 50 GBP (internal cost estimate, not referenced).

The PV can be inserted anywhere where the pneumothorax is easily drained. Consent for pain, bleeding, surgical emphysema, visceral perforation, prolonged air leak and failure to do is taken. An invasive procedure checklist is filled out. Pre-medication with oral opiates can be offered. The selected area is sterilised, draped and shaved if needed. Local anaesthetic is infiltrated with 25G and then 21G needles and air aspirated. A 5mm incision is made over the superior rib border. The PV is inserted through the incision into the pleural space. A click is heard on penetrating the space, and the indicator on the safety needle goes from red to green. The needle is removed. The PV is capped and secured. The indicator diaphragm and the valve should move with respiration, indicating patency. A chest radiograph is obtained two hours later to assess improvement or for any complications.

Results

Between March 2018 and January 2021 49 PVs were inserted. Mean age was 42.8 years (range 18-83); 35 (71.4%) patients were male; two PVs were inserted for pneumothorax post CT guided biopsy and the rest for spontaneous pneumothorax. Table 1 describes patient characteristics according to SSP and PSP categories.

The mean number of days the PV remained in situ for all patients was 5.6 days, range 0-25, IQR 3-7; PSP: mean 5.9 days, median 6 days (0-25) versus SSP: mean 4.5 days, median 3 (0-7). One patient had the PV for 25 days due to regional cardiothoracic COVID-19 guidance requiring patients to self-isolate for 14 days. Forty patients were managed completely in the ambulatory setting. The total number of days with the PVs in situ was 248. Approximate inpatient bed days saved are 240-320 days. Two patients were admitted overnight due to geographical reasons. Twelve patients (nine PSP, three SSP) had fluid accumulation in the chamber. This was drained using a Luer lock syringe (Figure 3). Complications requiring a change in management occurred in nine (18.3%) cases.

Discussion

This single-centre study shows that ambulatory pneumothorax management with the PV is feasible and associated with inpatient bed savings. Complication rates are less than previously described.

Hallifax et al. showed ambulatory pneumothorax management in PSP is feasible, despite a higher rate of complications.[5] Median hospital stay in the ambulatory care arm was 0 days and statistically significant. Adverse events occurred in 47% patients: 64 (55%) ambulatory care patients versus 46 (39%)

Table 1 Patient characteristics according to SSP and PSP categories

	Primary spontaneous pneumothorax (PSP)	Secondary spontaneous pneumothorax (SSP)	
Number	31	16	
Mean age (years)	30.9	61.5	
Mean number of days PV in situ	5.9	4.5	
Current tobacco smokers	17	1	
Current marijuana smokers	11	0	
Ex-smokers	0	15	
Never smokers	14	0	
Number with respiratory comorbidity	2	16	
Description of comorbidity			
Previous pneumo-thorax	2	2	
Chronic obstructive pulmonary disease (COPD)	0	12	
Asbestosis	0	1	
Non-specific fibrotic lung disease	0	1	
Lung cancer	0	1	
Rheumatoid lung disease	0	1	
Adverse events (total)	**PSP (12)**	**SSP (2)**	**Was a change in intervention required?**
Description of adverse events			
Re-expansion pulmonary oedema (REPE)	1		No
Pain	5		One vent was removed, and patient observed
Allergic reaction to dressing	1		Intercostal drain (ICD) inserted
Surgical emphysema (SE) with no kinks or blockage	2	1	Three required ICD
Blockage of PV with fibrin or secretions or kinked on rib, causing SE	3	1	PV in patient with SSP replaced with another. All two PSP patients required an ICD

in the standard care. All 14 serious adverse events occurred in the former, eight (57%) were intervention related (enlarging pneumothorax, asymptomatic pulmonary oedema, and PV malfunctioning).

In a randomised trial of ambulatory management of SSP, the PV was initially used, resulting in 43% of serious adverse events (the PV being of a smaller gauge and thus not enough for the air leaks associated with SSP).[6] This required a change of device, but not of concept, to an atrium pneumostat chest drain valve. There was no difference between total hospitalisation days in the two arms. Initial admission for ambulatory care was one day versus 3.5 days for standard care (p=0.122) but failure of initial treatment in seven days was higher in the former. Thirty-three (56%) of the 59 adverse events were with ambulatory care. The trial did not reach the intended recruitment levels. However, case series profess safety of the PV in SSP.[7,8]

One patient had asymptomatic re-expansion pulmonary oedema. He had a large pneumothorax for a number of days, with rapid lung re-expansion with the PV. There was no

associated morbidity. Five patients had significant pain with lung re-expansion. We have adapted our technique and the PV is capped within a few seconds of insertion. Symptoms due to rapid re-expansion have not re-occurred.

The PV has an 8FG needle: air leaks might exceed the allowed flow with resultant surgical emphysema (SE). We observe all PVs for two to three hours afterwards with a chest radiograph. Movement of the diaphragm, clinical stability or improvement and lack of SE all allow discharge. Early treatment failure might be predicted with digital air leak measurement but this is a highly specialised aspect of care.[9]

Our study has several limitations. It is a single-centre case series with no control arm and carries selection bias. Formal health economic analysis is beyond our scope. We also do not have the numbers of patients whose pneumothorax was conservatively managed. A retrospective analysis of all pneumothoraces over the last decade is currently in set up. Brown et al. have recently published that conservative management might be an option in a select group of PSPs.[10]

We provide a unique insight into the development and review of an ambulatory pneumothorax pathway in a district general hospital. The pathway described is applicable to any hospital. Most PVs are inserted in the Accident and Emergency Department, with follow up care provided by Acute Medicine Department. We encourage centres to share data of patients managed with PV for further characterisation.

References

1 MacDuff A, Arnold A, Harvey J, BTS Pleural Disease Guideline Group. Management of spontaneous pneumothorax: British Thoracic Society Pleural Disease Guideline 2010. *Thorax* 2010; 65: ii18–ii31.

2 Bintcliffe OJ, Edey AJ, Armstrong L, Negus IS, Maskell NA. Lung parenchymal assessment in primary and secondary pneumothorax. *Ann Am Thorac Soc* 2016; 13: 350-5.

3 Thomas R, Rahman NM, Maskell NA, Lee YCG. Pleural effusions and pneumothorax: Beyond simple plumbing: Expert opinions on knowledge gaps and essential next steps. *Respirology* 2020; 25: 963-71.

4 Brims FJ, Maskell NA. Ambulatory treatment in the management of pneumothorax: a systematic review of the literature. *Thorax* 2013; 68: 664-9.

5 Hallifax RJ, McKeown E, Sivakumar P, Fairbairn I, Peter C, Leitch A et al. Ambulatory management of primary spontaneous pneumothorax: an open-label, randomised controlled trial. *Lancet* 2020; 396: 39-49.

6 Walker SP, Keenan E, Bintcliffe O, Stanton AE, Roberts M, Pepperell J et al. Ambulatory management of secondary spontaneous pneumothorax: a randomised controlled trial. *Eur Respir J* 2020; 2003375.

7 Masih I, Vali Y, Naeem M, Reddy RV. Partial ambulatory management of severe secondary spontaneous pneumothorax. *Respir Med Case Rep* 2017; 22: 4-6.

8 Tufail M, Bennett J, Panchal R, Varey R, Martin N. Efficacy and safety of a new pleural device for the ambulatory management of pneumothorax. *Eur Respir J* 2015; 46: PA2492.

9 Hallifax RJ, Laskawiec-Szkonter M, Rahman NM, RAMPP Trial collaborators. Predicting outcomes in primary spontaneous pneumothorax using air leak measurements. Thorax 2019; 74: 410-12.

10 Brown SGA, Ball EL, Perrin K, Asha SE, Braithwaite I, Egerton-Warburton D et al. Conservative versus interventional treatment for spontaneous pneumothorax. *N Engl J Med* 2020; 382: 405-15.