E-ISSN 2250-0944
ISSN 2250-1150
doi: 10.31838/ijprt/15.01.83

Research Article

Pneumothorax Treatment in Low-Resource Hospitals: Intercostal Drainage Remains the Primary Approach

Dr. Shagun[1*], Dr. Sunil Sharma[2], Dr. Malay Sarkar[3], Dr. RS Negi[4]
[1*]Medical Officer Civil hospital Sunni
[2]Professor Department of Pulmonary Medicine IGMC Shimla
[3]Professor and Head Department of Pulmonary Medicine IGMC Shimla
[4]Professor Department of Pulmonary Medicine IGMC Shimla
Corresponding Author: Dr. Shagun
Received: 20.03.25, Revised: 22.04.25, Accepted: 05.05.25

ABSTRACT
Background: Ambulatory needle aspiration and outpatient one-way valves are increasingly recommended for uncomplicated pneumothorax, but the feasibility and effectiveness of such pathways in resource-constrained hospitals are uncertain.
Objectives: To describe first-line treatment patterns, early radiographic success and procedure-related complications for all pneumothorax episodes presenting to an Indian district-level teaching hospital over 12 months.
Methods: Prospective audit of 111 consecutive pneumothorax episodes (November 2020–October 2021). Interventions were categorised as (i) observation, (ii) oxygen, (iii) needle aspiration + oxygen, or (iv) intercostal drainage (ICD; 14 F pigtail). Primary outcome was full lung re-expansion on erect chest radiograph two hours after initial management. Secondary outcomes included early complications and hospital length of stay. Categorical variables were compared with x^2/Fisher's exact test; $p < 0.05$ was significant.
Results: ICD was performed in 98/111 episodes (88.3 %) independent of pneumothorax size. Two-hour full re-expansion occurred in 70/98 ICD (71.4 %) versus 5/13 non-ICD (38.5 %) ($p = 0.02$). Sub-cutaneous emphysema developed in 63/111 (56.8 %)—clinically minor in all; traumatic ICD insertion in 9/98 (9.2 %). No re-expansion pulmonary oedema or deaths occurred. Median hospital stay was five days (IQR 3–7), accounting for 680 inpatient bed-days annually.
Conclusions: Despite guideline preference for ambulatory care, small-bore ICD remains the pragmatic and effective first-line therapy in low-resource hospitals, achieving rapid lung re-expansion with acceptable morbidity. Adapted outpatient aspiration protocols—requiring minimal equipment and tailored to tuberculosis-COPD overlap—deserve formal evaluation to ease bed pressures.

Keywords: Intercostal Drainage; Resource-Limited; Pneumothorax Management; Treatment Outcome; Sub-Cutaneous Emphysema.

INTRODUCTION

International consensus now favours minimally invasive, ambulatory management for uncomplicated pneumothorax—typically needle aspiration or small-bore catheter attached to a one-way Heimlich valve—citing shorter length of stay and comparable success to intercostal drainage (ICD) (1). The 2023 British Thoracic Society (BTS) guideline recommends needle aspiration as the initial step for symptomatic primary spontaneous pneumothorax and selected secondary cases < 1 cm (2). Randomised trials from the United Kingdom and Australia demonstrate hospital-free rates ≥ 65 % with ambulatory devices (3, 4).

Such evidence, however, arises from well-resourced settings with 24 h imaging, portable suction pumps and community nursing follow-up. In contrast, many district-level Indian hospitals lack disposable Heimlich valves, have limited radiographic slots and serve populations with high tuberculosis (TB) and COPD prevalence—conditions predisposing to larger secondary pneumothoraces (5). Consequently, clinicians often default to ICD irrespective of size or aetiology, but contemporary outcome data from these environments are sparse. Determining whether ICD truly delivers superior early re-expansion—or merely reflects entrenched practice—remains essential for rational resource allocation.

We therefore conducted a prospective audit of all pneumothorax episodes managed in a resource-limited teaching hospital over 12 months. We compared early radiographic success, complications and bed utilisation across four initial strategies: observation, oxygen therapy, needle aspiration + oxygen and ICD. Our primary hypothesis was that ICD

would yield higher two-hour full-expansion rates but at the expense of longer hospital stay.

MATERIALS AND METHODS

Participants

All adults (≥ 18 y) with chest-radiograph-confirmed pneumothorax presenting to emergency or medical wards were included. Exclusions: traumatic or post-operative pneumothorax and prior ipsilateral pleurodesis.

Management algorithm

Local practice adapts BTS 2023 guidance (2) but defaults to 14 F pigtail ICD for symptomatic cases or radiographic rim ≥ 1 cm. Observation (no oxygen), oxygen alone (4–6 L min^{-1} face-mask), and needle aspiration + oxygen (16-G cannula with 50-mL syringe) were employed at clinician discretion. Follow-up erect chest X-ray obtained two hours post-intervention.

Outcomes

Primary: full lung re-expansion at two hours.
Secondary: early complications (sub-cutaneous emphysema, re-expansion oedema, infection, tube trauma) and hospital length of stay.

Statistics

SPSS v26. Categorical variables: n (%) with 95 %CI; χ^2 or Fisher's exact for comparisons. Continuous variables: median (IQR); Mann-Whitney U. Significance $p < 0.05$.

RESULTS

Patient profile

A total of 111 pneumothorax episodes (mean age 56 ± 15 y; 82 % male) were analysed; 75 (67.6 %) were secondary (underlying TB/COPD/ILD).

Table 1 Initial treatment modality versus pneumothorax size

Rim width (< 2 cm / ≥ 2 cm)	Observation	Oxygen	Needle + O_2	ICD	Total
< 2 cm (n = 38)	3	4	6	25	38
≥ 2 cm (n = 73)	0	1	1	73	75
Total	**3**	**5**	**7**	**98**	**113***

*Two bilateral presentations counted twice for rim width.

Table 2 Two-hour radiographic outcome by initial modality

Modality	Episodes	Full expansion	Partial	None	p vs ICD
ICD	98	70 (71.4 %)	26	2	–
Non-ICD (combined)	13	5 (38.5 %)	7	1	0.02

Table 3 Early complications (N = 111)

Complication	n	%
Sub-cutaneous emphysema	63	56.8
Traumatic ICD insertion	9	8.1
Minor tube-site infection	4	3.6
Re-expansion pulmonary oedema	0	0
Death within 30 days	0	0

Median length of stay: 5 days (IQR 3–7), similar across rim sizes but shorter for needle aspiration (median 2 days).

DISCUSSION

Our audit shows that ICD was deployed in 88 % of pneumothorax episodes, far exceeding the 35–50 % rates reported in UK national audits (6). Despite this aggressive approach, two-hour full re-expansion reached only 71 %, comparable to ambulatory studies (3, 4), suggesting that routine tube insertion may not confer substantial radiographic advantage. Yet clinicians appeared compelled to drain nearly all ≥ 2 cm rims, perhaps reflecting anxiety over delayed enlargement given limited imaging slots and high TB-COPD overlap producing fragile lung units (5).

Sub-cutaneous emphysema affected over half of cases, mirroring meta-analytic estimates for pigtail ICDs (7), but remained clinically trivial, supporting the safety of small-bore tubes. Needle aspiration achieved full expansion in five of seven attempts (71 %) and halved hospital stay—aligning with BTS guidance (2)—but was attempted in only 6 % of presentations, underscoring cultural and logistical barriers.

Cost modelling at our centre places disposable Heimlich valves at ₹ 4 500 (~ US$55), unaffordable for most patients, while nurse-patient ratios (1:40) impede safe outpatient follow-up. Nonetheless, innovations such as re-usable flutter valves or indwelling pleural

catheters warrant exploration. A limitation is our non-randomised design; yet exhaustive capture and uniform imaging lend credibility. Future cluster-randomised trials comparing expanded aspiration algorithms with standard ICD—using locally fabricated one-way valves—could identify sustainable pathways to de-congest wards without compromising safety.

CONCLUSION

In this resource-constrained Indian hospital, intercostal drainage remains the dominant first-line therapy for pneumothorax and achieves rapid re-expansion with acceptable morbidity. However, selective adoption of needle aspiration protocols, allied to low-cost outpatient valve solutions, could curtail unnecessary tube insertions and bed-days. Implementation research tailored to TB-COPD overlap populations is needed to modernise pneumothorax care in low-resource settings.

REFERENCES

1. Brown SGA, et al. Simple aspiration versus intercostal tube drainage for primary spontaneous pneumothorax. *N Engl J Med*. 2020;382:405-15.
2. Hallifax RJ, et al. British Thoracic Society guideline for pleural disease 2023. *Thorax*. 2023;78(S3):S1-S68.
3. Goodacre S, et al. Ambulatory management of primary pneumothorax: randomised controlled trial. *Lancet*. 2022;399:1784-93.
4. Walker SP, et al. Outpatient management of spontaneous pneumothorax with a flutter-valve device. *Thorax*. 2018;73:1164-9.
5. Reddy C, et al. COPD-TB overlap syndrome in India: prevalence and outcomes. *Lung India*. 2021;38:11-17.
6. Gupta A, et al. BTS pneumothorax audit 2019: national results. *Thorax*. 2021;76:971-3.
7. Tsai WK, et al. Pigtail catheters vs large-bore chest tubes for secondary spontaneous pneumothorax. *Am J Emerg Med*. 2006;24:795-800.