

The Analysis Study of Comparison of Chest Tube Drainage vs Conservative Management of Pneumothorax: A Comprehensive Systematic Review

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ABSTRACT

Background: The management of pneumothorax significantly across different clinical guidelines, reflecting ongoing uncertainty in the optimal approach to treatment. Recent research has highlighted the potential benefits of conservative management compared to surgical approach. This systematic review aims to compare the outcomes of conservative management and chest tube drainage in the treatment of pneumothorax by analyzing available studies of the last 10 years. **Methods:** The study adhered to PRISMA 2020 standards, examining English literature from 2014 to 2024. It excluded editorials, reviews from the same journal, and submissions without a DOI. PubMed, SagePub, SpringerLink, and Google Scholar were utilized as literature sources. **Result:** Initially retrieving 360 articles from online databases (PubMed, SagePub, SpringerLink and Google Scholar) eight relevant papers were selected after three rounds of screening for full-text analysis. **Conclusion:** Conservative management of pneumothorax, particularly in clinically stable patients, has shown effectiveness comparable to chest tube drainage, with benefits such as shorter hospital stays and fewer complications. However, careful patient selection and further trials are needed to confirm its long-term safety and efficacy.

Keywords: pneumothorax, chest tube, conservative management

INTRODUCTION

Primary spontaneous pneumothorax (PSP), defined as the occurrence of a pneumothorax in otherwise healthy individuals, represents a notable health issue with an annual incidence of approximately 7.4 per 100,000 men and 1.2 per 100,000 women.¹ PSP predominantly affects young individuals, and despite appropriate management, recurrence rates remain high. It is reported that 29% of PSP patients experience recurrence within the first year, and the lifetime recurrence rate is estimated to be 32.1%.² Various factors, including age, body weight, height, smoking status, and radiographic findings such as bullae or pleural thickening, have been suggested as predictors of PSP recurrence. However, consensus on the key factors contributing to recurrence is still lacking.³

PSP patients typically present with pleuritic chest pain, characterized by sharp discomfort that often prompts medical attention. Unlike secondary spontaneous

pneumothorax, which arises from underlying lung disease, PSP is less frequently accompanied by significant dyspnea or respiratory failure. Treatment options for PSP range from conservative measures, such as clinical observation and oxygen inhalation, to more invasive interventions, including needle aspiration, pleural catheter insertion, and chest tube drainage. In some cases, advanced surgical interventions, such as video-assisted thoracoscopic surgery (VATS) or thoracotomy, are required to manage persistent air leaks or to reduce the risk of recurrence.⁴

The management of PSP varies significantly across different clinical guidelines, reflecting ongoing uncertainty in the optimal approach to treatment. For instance, the American College of Chest Physicians (ACCP) recommends chest tube drainage for large PSP to facilitate lung reexpansion. In contrast, the British Thoracic Society (BTS) suggests that asymptomatic patients may be managed conservatively through observation alone, reserving chest

tube drainage for those with physiological instability. This lack of consensus extends to clinical practice, where treatment strategies often differ between centers, particularly for patients who are stable and asymptomatic.⁵⁻⁷

Recent research has highlighted the potential benefits of conservative management in PSP. A randomized controlled trial (RCT) found that recurrence rates were higher among patients treated with chest tube drainage compared to those managed conservatively. This finding challenges the traditional approach of relying on chest tube drainage for PSP and suggests that less invasive management strategies may offer similar, if not better, outcomes in certain patient populations. However, heterogeneity in treatment practices persists, reflecting the need for further research and clearer clinical guidelines.^{8,9}

This systematic review aims to compare the outcomes of conservative management and chest tube drainage in the treatment of pneumothorax by analyzing available studies of the last 10 years.

METHODS

Protocol

The author carefully followed the rules laid out in the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) 2020. This was done to make sure the study met all its standards. The selection of this methodological approach was specifically aimed at ensuring the precision and reliability of the conclusions drawn from the investigation.

Criteria for Eligibility

This systematic review compares the outcomes of conservative management and chest tube drainage in the treatment of pneumothorax based on literatures of the last 10 years. This study meticulously analyzed data on literatures to provide insights and enhance patient treatment strategies. The primary objective of this paper is to highlight the collective significance of the identified key points.

Inclusion criteria for this study entail: 1) Papers must be in

English, and 2) Papers must have been published between 2014 and 2024. Exclusion criteria comprise: 1) Editorials; 2) Submissions without a DOI; 3) Previously published review articles; and 4) Duplicate entries in journals.

Search Strategy

The keywords used for this research are pneumothorax, chest tube, conservative management. The Boolean MeSH keywords inputted on databases for this research are: *((("pneumothorax"[MeSH Terms] OR "pneumothorax"[All Fields] OR "pneumothoraxes"[All Fields]) AND ("chest tubes"[MeSH Terms] OR ("chest"[All Fields] AND "tubes"[All Fields]) OR "chest tubes"[All Fields] OR ("chest"[All Fields] AND "tube"[All Fields]) OR "chest tube"[All Fields])) OR ("conservative treatment"[MeSH Terms] OR ("conservative"[All Fields] AND "treatment"[All Fields]) OR "conservative treatment"[All Fields] OR ("conservative"[All Fields] AND "management"[All Fields]) OR "conservative management"[All*

Fields])) AND ((y_10[Filter]) AND (clinicaltrial[Filter]))).

Data retrieval

The authors assessed the studies by reviewing their abstracts and titles to determine their eligibility, selecting relevant ones based on their adherence to the inclusion criteria, which aligned with the article's objectives. A consistent trend observed across multiple studies led to a conclusive result. The chosen submissions had to meet the eligibility criteria of being in English and a full-text.

This systematic review exclusively incorporated literature that met all predefined inclusion criteria and directly pertained to the investigated topic. Studies failing to meet these criteria were systematically excluded, and their findings were not considered. Subsequent analysis examined various details uncovered during the research process, including titles, authors, publication dates, locations, study methodologies, and parameters.

Quality Assessment and Data Synthesis

Each author independently evaluated the research presented in the title and abstract of the publication to determine which ones merited further exploration. The subsequent

stage involved assessing all articles that met the predefined criteria for inclusion in the review. Decisions on including articles in the review were based on the findings uncovered during this evaluation process.

Table 1. Article Search Strategy

Database	Strategi Pencarian	Hits
Pubmed	<i>((("pneumothorax"[MeSH Terms] OR "pneumothorax"[All Fields] OR "pneumothoraxes"[All Fields]) AND ("chest tubes"[MeSH Terms] OR ("chest"[All Fields] AND "tubes"[All Fields]) OR "chest tubes"[All Fields] OR ("chest"[All Fields] AND "tube"[All Fields]) OR "chest tube"[All Fields])) OR ("conservative treatment"[MeSH Terms] OR ("conservative"[All Fields] AND "treatment"[All Fields]) OR "conservative treatment"[All Fields] OR ("conservative"[All Fields] AND "management"[All Fields]) OR "conservative management"[All Fields])) AND ((y_10[Filter]) AND (clinicaltrial[Filter]))</i>	100
Science Direct	<i>((pneumothorax) AND (chest tube)) OR (conservative management)</i>	150
Sagepub	<i>((pneumothorax) AND (chest tube)) OR (conservative management)</i>	50
Google Scholar	<i>((pneumothorax) AND (chest tube)) OR (conservative management)</i>	160

Table 2. JBI *Critical appraisal of Study*

Parameters	Walker (2018)	Chew (2014)	Brown (2020)	Balta (2020)	Ollesen (2018)	Bayo (2016)	Gerhardy (2021)	Batihan (2023)
1. Bias related to temporal precedence Is it clear in the study what is the “cause” and what is the “effect” (ie, there is no confusion about which variable comes first)?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2. Bias related to selection and allocation Was there a control group?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
3. Bias related to confounding factors Were participants included in any comparisons similar?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
4. Bias related to administration of intervention/exposure Were the participants included in any comparisons receiving similar treatment/care, other than the exposure or intervention of interest?	No.	No.	No.	No.	No.	No.	No.	No.
5. Bias related to assessment, detection, and measurement of the outcome Were there multiple measurements of the outcome, both pre and post the	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

intervention/exposure?

Were the outcomes of participants included in any comparisons measured in the same way?

No. No. No. No. No. No. No. No.

Were outcomes measured in a reliable way?

Yes Yes Yes Yes Yes Yes Yes Yes

6. Bias related to participant retention

Was follow-up complete and, if not, were differences between groups in terms of their follow-up adequately described and analyzed?

Yes Yes Yes Yes Yes Yes Yes Yes

7. Statistical conclusion validity

Was appropriate statistical analysis used?

Yes Yes Yes Yes Yes Yes Yes Yes

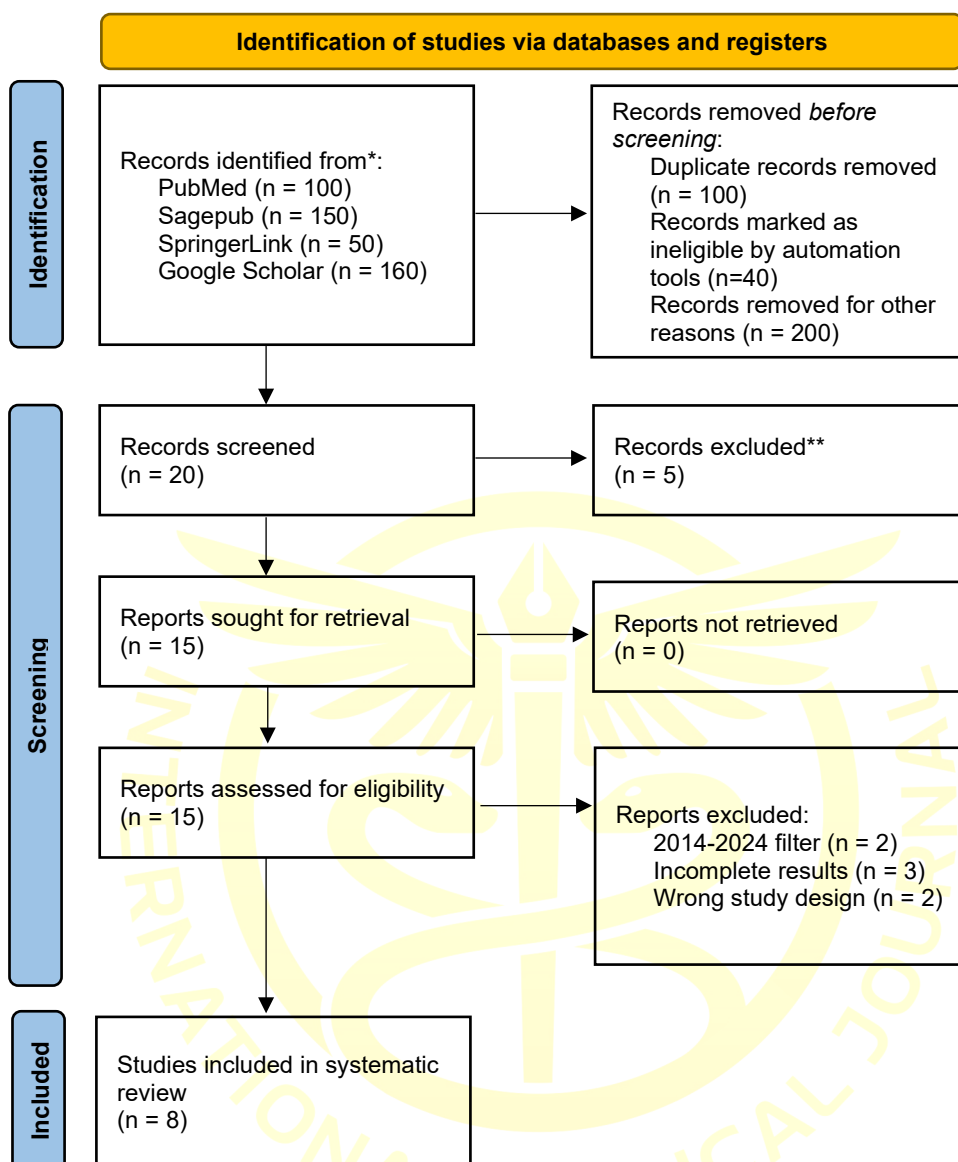


Figure 1. Article search flowchar

RESULT

The initial number of articles retrieved from online databases (PubMed, SagePub, SpringerLink, and Google Scholar) is 360 articles. After conducting three levels of screening, eight articles that directly relate to the current systematic review have been chosen for further assessment through full-text reading and analysis. Table 3 presents the selected literature included in this analysis.

Table 3. The literature included in this study

No.	Author	Origin	Method	Sample	Result
1.	Walker, et al. ¹⁰ (2018)	UK	Prospective cohort study	602 patients	The study included 602 patients with traumatic pneumothoraces, with a mean age of 48 years, of which 73% were men. The mean Injury Severity Score (ISS) was 26, and the inpatient mortality rate was 9%. Of these patients, 46% (277/602) were initially treated conservatively without chest tube insertion. Remarkably, 90% of these conservatively managed patients (252/277) did not require later chest tube insertion, including those receiving positive pressure ventilation (PPV) on admission. The hazard ratio (HR) for failure of conservative treatment showed no significant difference between ventilated and non-ventilated patients (HR, 1.1; P = .84). However, the presence of a large hemothorax increased the likelihood of conservative management failure.
2.	Chew, et al. ¹¹ (2014)	Australia	Retrospective cohort study	127 patients	The study analyzed 127 episodes of primary spontaneous pneumothorax in 116 patients, with 75% of the patients being male and a median age of 37 years. The majority (82%) were ever-smokers. Among the episodes with available pre-treatment radiographs,

					53 were treated conservatively and 58 invasively with tube thoracostomy, with all patients being clinically stable. The outcome of pneumothorax was unaffected by factors such as size, age, sex, ethnicity, or smoking status. Compared to invasive treatment, conservative management showed no complications, an equal recurrence rate, and a significantly shorter hospital stay.
3.	Brown, et al. ¹² (2020)	Australia	Retrospective cohort study	316 patients	The study randomized 316 patients with primary spontaneous pneumothorax, assigning 154 to the intervention group and 162 to the conservative-management group. In the conservative group, 15.4% (25/162) required interventions, while 84.6% (137/162) did not. In a complete-case analysis, lung reexpansion within 8 weeks occurred in 98.5% (129/131) of the intervention group and 94.4% (118/125) of the conservative group, with a risk difference of -4.1 percentage points (95% CI, -8.6 to 0.5; P = 0.02 for noninferiority), meeting the noninferiority margin of -9 percentage points. However, a sensitivity analysis imputing missing data as treatment failure

					showed a risk difference of -11.0 percentage points (95% CI, -18.4 to -3.5), which exceeded the noninferiority margin.
4.	Balta, et al. ¹³ (2020)	Turkey	Retrospective cohort study	80 patients	The study included 80 patients with spontaneous pneumothorax, with a mean age of 28.8 ± 9.47 years, 95% of whom were male. Conservative treatment was used in 30% of patients (24/80), while 70% (56/80) underwent drainage using an 8 F thorax catheter. Two patients initially treated conservatively later required catheter drainage due to lack of response, and one patient underwent videothoracoscopic bulla excision and partial pleurectomy for a non-expandable lung. The average hospital stay was 3.55 ± 1.41 days.
5.	Olesen, et al. ¹⁴ (2018)	Denmark	Retrospective cohort study	181 patients	The study identified 88 patients with blebs <1 cm, randomly assigned to either chest tube treatment (50 patients) or video-assisted thoracoscopic surgery (VATS) (38 patients). Additionally, 93 patients with bullae ≥ 1 cm were randomly assigned to chest tube treatment (43 patients) or VATS (50 patients). During the follow-up period, 23.8% (43/181) of patients experienced recurrence. Overall, recurrence rates were

					significantly lower after VATS compared to chest tube treatment ($P = 0.0012$), especially for bullae ≥ 1 cm ($P = 0.014$). There was also a size-response relationship, with larger bullae associated with an increased risk of recurrence ($P = 0.013$).
6.	Bayo, et al. ¹⁵ (2016)	Spain	Retrospective cohort study	126 patients	The study identified 126 patients with occult pneumothorax. Of these, 58% (73 patients) underwent immediate tube thoracostomy, while 42% (53 patients) were observed. Among the observed group, 12% (9 patients) required tube thoracostomy due to pneumothorax progression or hemothorax. No patients developed tension pneumothorax or experienced other adverse events related to the absence of tube thoracostomy. Among the observed patients, 16 were under positive pressure ventilation, with a failure rate of 19% (3 patients) in this subgroup. There were no significant differences in mortality, hospital stay, or intensive care stay between the observed and non-observed groups.
7.	Gerhardy, et al. ¹⁶ (2021)	Australia	Retrospective cohort study	82 patients	The study included 82 cases of secondary spontaneous pneumothorax (SSP). Of the 64 patients who met British Thoracic

					Society criteria for pleural intervention (interpleural distance at the hilum ≥ 1 cm), 39% (25/64) were managed conservatively, and none of them required subsequent intervention. There were no significant differences in age, gender, smoking status, or underlying lung disease between those managed conservatively or invasively. However, conservative management was associated with smaller pneumothoraces (37% vs. 54%, $P < 0.001$) and a shorter hospital stay (7.9 days vs. 9 days, $P = 0.004$).
8.	Batihan, et al. ¹⁷ (2023)	Turkey	Retrospective cohort study	28 patients	The study included 28 patients with large primary spontaneous pneumothorax. Twenty patients received chest tube treatment, while eight were managed conservatively with oxygen inhalation. The chest tube group had a longer hospital stay, while the conservative group showed a longer time for lung expansion and more outpatient visits after discharge ($P = 0.014$, $P = 0.00$, $P = 0.015$, respectively).

Walker, et al.¹⁰ (2018) concludes that conservative management of traumatic

pneumothoraces is effective, with over 90% of patients not requiring

subsequent intervention, even among those needing PPV.

Chew, et al.¹¹ (2014) concludes that a conservative approach may be a viable first-line treatment for clinically stable primary spontaneous pneumothorax, though a large randomized controlled trial is necessary to confirm this approach.

Brown, et al.¹² (2020) concludes that, while conservative management of primary spontaneous pneumothorax provides modest evidence of noninferiority compared to interventional management, the results are not statistically robust under conservative assumptions about missing data. Conservative management was associated with a lower risk of serious adverse events or recurrence.

Balta, et al.¹³ (2020) concludes that both conservative treatment and small catheter drainage are effective approaches for managing spontaneous pneumothorax, and patients should be treated with minimally invasive methods initially.

Olesen, et al.¹⁴ (2018) concludes that surgery (VATS) is an effective treatment to prevent recurrence of primary spontaneous pneumothorax, especially when high-resolution CT shows bullae ≥ 2 cm, and should be the standard of care in such cases.

Bayo, et al.¹⁵ (2016) concludes that conservative treatment observation is a safe treatment option for occult pneumothorax, even in patients receiving positive pressure ventilation.

Gerhardy, et al.¹⁶ (2021) concludes that conservative management of SSPs can be successful, even in cases that meet criteria for pleural intervention.

Batıhan, et al.¹⁷ (2023) concludes that conservative management is a viable alternative to interventional procedures for first-episode large primary spontaneous pneumothorax in patients without respiratory distress or low oxygen saturation, offering a shorter hospital stay and similar recurrence rates.

DISCUSSION

The management of pneumothorax, whether traumatic or spontaneous, remains a topic of debate, with the choice between conservative management and chest tube drainage largely depending on patient characteristics, pneumothorax type, and clinical stability. Conservative management has shown promise as an effective approach, particularly in cases where patients are clinically stable, and the pneumothorax is relatively small. This approach offers benefits such as shorter hospital stays and fewer procedural complications, making it a viable alternative to more invasive methods in selected patients. However, there remains a need for careful patient selection and close monitoring to ensure successful outcomes.¹⁸

Several studies have supported the effectiveness of conservative management in traumatic pneumothoraces, with a significant proportion of patients not requiring later chest tube insertion, even when receiving positive pressure

ventilation. These findings suggest that conservative management can be successfully applied in certain cases without increasing the risk of adverse outcomes, though the presence of factors such as a large hemothorax may necessitate a more invasive approach.¹⁰

In the context of primary spontaneous pneumothorax (PSP), conservative management has been shown to produce outcomes comparable to chest tube drainage, with no significant differences in recurrence rates or complications. Moreover, patients managed conservatively tend to experience shorter hospital stays, which may translate to reduced healthcare costs. However, randomized controlled trials are still needed to confirm the long-term safety and efficacy of this approach across various patient populations.¹¹

In some studies, conservative management of PSP has demonstrated noninferiority to interventional management, though the results are sometimes sensitive to assumptions about missing data. Despite these limitations, the lower

risk of serious adverse events and similar recurrence rates suggest that conservative management could be a beneficial strategy for certain patients.¹²

For spontaneous pneumothorax, both conservative treatment and small catheter drainage have been found to be effective initial approaches. Minimally invasive methods should be prioritized, reserving more aggressive treatments for patients who do not respond to conservative measures. This aligns with the overall goal of reducing procedural risks while optimizing patient outcomes.¹³

On the other hand, surgery, particularly video-assisted thoracoscopic surgery (VATS), has shown superior results in preventing pneumothorax recurrence, especially in patients with larger bullae. For these patients, surgery may be the preferred approach, as it offers a more definitive solution to reduce the risk of recurrence compared to chest tube drainage.¹⁴

Observation has also been demonstrated as a safe option for occult pneumothorax, including in

patients undergoing positive pressure ventilation. With appropriate monitoring, this conservative approach can be successful without leading to adverse events such as tension pneumothorax.¹⁵ In secondary spontaneous pneumothorax (SSP), conservative management can be effective even in cases that meet criteria for pleural intervention, leading to shorter hospital stays and fewer invasive procedures. However, the decision to manage these patients conservatively should be based on individual clinical factors, including the size of the pneumothorax.¹⁶

Overall, the evidence points towards a growing role for conservative management in pneumothorax treatment, especially for patients who are clinically stable and have smaller pneumothoraces. However, larger trials are necessary to confirm the long-term efficacy and safety of this approach, particularly in more complex cases such as those involving large bullae or secondary spontaneous pneumothorax.¹⁷

CONCLUSION

Conservative management of pneumothorax, particularly in clinically stable patients, has shown effectiveness comparable to chest tube drainage, with benefits such as shorter hospital stays and fewer complications. However, careful patient selection and further trials are needed to confirm its long-term safety and efficacy.

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REFERENCES

1. Lee JH, Kim R, Park CM. Chest Tube Drainage Versus Conservative Management as the Initial Treatment of Primary Spontaneous Pneumothorax: A Systematic Review and Meta-Analysis. *J Clin Med*. 2020;9(11):3456. doi:10.3390/jcm9113456
2. Walker SP, Bibby AC, Halford P, Stadon L, White P, Maskell NA. Recurrence rates in primary spontaneous pneumothorax: a systematic review and meta-analysis. *Eur Respir J*. 2018;52(3). doi:10.1183/13993003.00864-2018
3. Kwak HV, Banks KC, Hung YY, et al. Utilization and Outcomes of Observation for Spontaneous Pneumothorax at an Integrated Health System. *J Surg Res*. 2023;288:28-37. doi:10.1016/j.jss.2023.02.031
4. Avery P, Watkins M, Benger J, Carlton E. Current management of moderate to severe traumatic pneumothoraces: a survey of emergency clinicians. *Emerg Med J EMJ*. 2022;39(4):313-316. doi:10.1136/emmermed-2020-210647
5. Nava GW, Walker SP. Management of the Secondary

- Spontaneous Pneumothorax: Current Guidance, Controversies, and Recent Advances. *J Clin Med.* 2022;11(5):1173. doi:10.3390/jcm11051173
6. Broaddus VC. Clearing the Air - A Conservative Option for Spontaneous Pneumothorax. *N Engl J Med.* 2020;382(5):469-470. doi:10.1056/NEJMe1916844
7. George G, Aujayeb A. Cardiac-Device Implantation and Pneumothorax—A Symptom-Based Approach: Experience from a District General Hospital. *Y Rep.* 2022;5(4):39. doi:10.3390/reports5040039
8. Kong VY, Oosthuizen GV, Clarke DL. The selective conservative management of small traumatic pneumothoraces following stab injuries is safe: experience from a high-volume trauma service in South Africa. *Eur J Trauma Emerg Surg Off Publ Eur Trauma Soc.* 2015;41(1):75-79. doi:10.1007/s00068-014-0426-3
9. Blythe NM, Coates K, Benger JR, et al. Conservative management versus invasive management of significant traumatic pneumothoraces in the emergency department (the CoMiTED trial): a study protocol for a randomised non-inferiority trial. *BMJ Open.* 2024;14(6):e087464. doi:10.1136/bmjopen-2024-087464
10. Walker SP, Barratt SL, Thompson J, Maskell NA. Conservative Management in Traumatic Pneumothoraces: An Observational Study. *Chest.* 2018;153(4):946-953. doi:10.1016/j.chest.2017.10.015
11. Chew R, Gerhardy B, Simpson G. Conservative versus invasive treatment of primary spontaneous pneumothorax: a retrospective cohort study. *Acute Med Surg.* 2014;1(4):195-199. doi:10.1002/ams2.33
12. Brown SGA, Ball EL, Perrin K, et al. Conservative versus Interventional Treatment for

- Spontaneous Pneumothorax. *N Engl J Med.* 2020;382(5):405-415.
doi:10.1056/NEJMoa1910775
13. Balta C, Kuzucuoglu M. Conservative Treatment Approach in Primary Spontaneous Pneumothorax. *J Coll Physicians Surg Pak.* 2020;30(02):168-171.
doi:10.29271/jcpsp.2020.02.168
14. Olesen WH, Katballe N, Sindby JE, et al. Surgical treatment versus conventional chest tube drainage in primary spontaneous pneumothorax: a randomized controlled trial†. *Eur J Cardiothorac Surg.* 2018;54(1):113-121.
doi:10.1093/ejcts/ezy003
15. Llaquet Bayo H, Montmany Vioque S, Rebasa P, Navarro Soto S. Results of Conservative Treatment in Patients With Occult Pneumothorax. *Cir Esp Engl Ed.* 2016;94(4):232-236.
doi:10.1016/j.cireng.2016.03.007
16. Gerhardy BC, Simpson G. Conservative versus invasive management of secondary spontaneous pneumothorax: a retrospective cohort study. *Acute Med Surg.* 2021;8(1):e663.
doi:10.1002/ams2.663
17. Batihan G. The Role of Conservative Management in The Treatment of Large Primary Spontaneous Pneumothorax: Is Pleural Drainage Necessary? 2023;11:1124-1128.
doi:10.22038/JCTM.2023.70562.1410
18. Iacopetta BM, Donaghy M, Charlesworth C, Peddle-McIntyre CJ, Tan AL, Lee YCG. The Pneumothorax And Symptom Evaluation (PASE) study: Bendopnoea in patients with pneumothorax. *Respirol Case Rep.* 2024;12(8):e01443.
doi:10.1002/rcr2.1443