

**Suction vs Water Seal for Initial Treatment of Traumatic Pneumothorax Trial (SEAL IT):
A Pragmatic Cluster-Randomized Study**

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Disclosure Information: The authors have no relevant financial conflicts to disclose.

Disclosures outside the scope of this work: Dr Patel receives honoraria payments from Elsevier, is an Associate Editor at the *Journal of Surgical Research*, and is a board member at and receives occasional travel support from the Eastern Association for the Surgery of Trauma and related surgical societies.

Support: Research Electronic Data Capture (REDCap) tools were used for data management in this study. REDCap is supported by the National Center for Advancing Translational Sciences of the NIH, grant [UL1 TR000445].

Presented at the 55th Annual Meeting of the Western Trauma Association, Big Sky, MT, March 2026.

Trial Registration: ClinicalTrials.gov (NCT06688734)

Data-Sharing Statement: The data that support the findings of this study are available from the corresponding author upon reasonable request.

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Short Title: Water Seal vs Suction for Pneumothorax

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Background: Chest tubes for traumatic pneumothorax are commonly managed with initial suction before transition to water seal, despite limited evidence supporting this practice. We hypothesized that initial water seal would reduce chest tube duration without increasing complications.

Study Design: We conducted a single-center, pragmatic, month-based cluster-randomized study of adult trauma patients with pneumothorax requiring chest tube placement from October 2024 to May 2025. Patients with a hemothorax component >300 mL or chest tube placement before computed tomography were excluded. Patients were assigned by alternating calendar month to initial suction or water seal; subsequent management was at clinician discretion. The primary outcome was initial chest tube duration. The trial was registered at ClinicalTrials.gov (NCT06688734).

Results: Among 3,372 trauma admissions, 133 patients required chest tubes for pneumothorax and 72 met inclusion criteria (37 suction, 35 water seal). Four patients died before chest tube removal and were excluded from the primary outcome analysis. Initial water seal was associated with shorter median initial chest tube duration compared with suction (41 vs 51 hours, $p = 0.001$) and shorter total chest tube duration (44 vs 60 hours, $p = 0.011$). Complications, secondary interventions, and mortality were similar between groups (all $p > 0.05$).

Conclusions: Initial water seal management was associated with shorter chest tube duration without an observed increase in complications. These findings challenge routine initial suction for selected patients with traumatic pneumothorax and support evaluation of an initial water seal strategy in larger multicenter studies.

Introduction

Traumatic pneumothorax is identified in up to 20% of major trauma patients and can be seen in both blunt and penetrating trauma [1-3]. These injuries are caused by bronchial or pulmonary parenchymal injuries, resulting in air leakage into the pleural space leading to lung collapse [4-5]. Chest tubes are utilized in approximately one third of patients with traumatic pneumothorax to evacuate intrapleural air, facilitate lung re-expansion, and prevent progression to tension pneumothorax, and can be placed to either suction or water seal [6-7]. Despite major trauma organizations making no specific recommendations regarding suction status of chest tubes, common practice has developed largely from tradition, with limited supporting data [8-9]. Typically, chest tubes are initially placed to suction for a period of hours to days to facilitate lung re-expansion and monitor for ongoing air leak, followed by a transition to water seal as a trial to ensure that the lung remains expanded without evidence of persistent air leak before tube removal [10].

Chest tubes placed to suction create negative intrathoracic pressure, which may aid in lung re-expansion [11]. However, studies in patients who have undergone elective pulmonary resections suggest that suction prolongs air leaks and chest tube duration [12-15]. Accordingly, major thoracic society guidelines recommend initial water seal in most patients [16-17]. In trauma patients, the available randomized controlled trials have produced inconsistent results [18-20]. A meta-analysis of these same trials reported shorter chest tube duration and length of stay (LOS) with suction, but certainty of evidence was low due to heterogeneity and inclusion of patients with substantial hemothorax [21]. Suction may facilitate evacuation of pleural blood and improve drainage in hemothorax, which could confound interpretation of studies that include patients with both air and blood in the pleural space [22]. This raises the possibility that any

observed benefit of suction is driven by patients with hemothorax rather than those with isolated pneumothorax.

We believe that a more focused study of initial chest tube management in patients with traumatic pneumothorax may yield findings similar to higher-quality studies in thoracic surgery populations. If confirmed, this approach could obviate the need for routine suction in patients with traumatic pneumothorax and without significant hemothorax, potentially improving mobility and reducing chest tube duration and hospital LOS [23]. Therefore, we performed a single-center, pragmatic, cluster-randomized study hypothesizing that patients with traumatic pneumothorax whose chest tubes were initially managed with water seal would have shorter chest tube duration than those initially managed with suction.

Methods

Study Design and Setting

We performed a single-center, pragmatic, month-based cluster-randomized study conducted at a Level I trauma center in the United States between October 1, 2024, and May 31, 2025. The trial compared two initial chest tube management strategies, water seal versus suction, in adult trauma patients with pneumothorax. Intervention assignment was determined by calendar month, with alternating months designated for each treatment arm. This approach was chosen to facilitate protocol adherence in a high-volume trauma center and to minimize contamination between strategies. This study was conducted and reported in accordance with the Consolidated Standards of Reporting Trials (CONSORT) guidelines (Supplemental Digital Content 1 <https://links.lww.com/JACS/A760>) [24].

Ethical Approval and Oversight

The trial was approved by the Vanderbilt University Medical Center Institutional Review Board (IRB #241132, approved September 1, 2024) with a waiver of informed consent because both interventions were accepted components of routine chest tube management, the optimal initial management strategy remained uncertain, and randomization therefore posed no more than minimal incremental risk. Treating clinicians retained full discretion over subsequent chest tube management. Adverse events were monitored and reported in accordance with institutional and regulatory requirements. The trial was registered at ClinicalTrials.gov (NCT06688734).

Participants

Eligible patients were adults (≥ 18 years) admitted to the trauma service with a traumatic pneumothorax requiring chest tube placement, as determined by the treating team. Patients were excluded if they were pregnant, incarcerated, had a chest tube placed prior to initial computed tomography (CT) imaging, or had a hemothorax component greater than 300 mL on the side of chest tube placement. This threshold was selected pragmatically to minimize the influence of clinically significant pleural blood on chest tube management and isolate the effects of the initial treatment strategy for traumatic pneumothorax, consistent with contemporary trauma literature supporting observation of selected traumatic hemothoraces less than approximately 300 mL [25-26]. CT imaging was required to quantify hemothorax volume, which was estimated using Mergo's formula [27]. Baseline pneumothorax size was defined as the maximum pleural separation (greatest depth, cm) on pre-placement CT scan.

Intervention

Chest tubes were placed per standard clinical practice. Drainage consisted of either 14 Fr straight percutaneous chest tubes placed using a Seldinger technique or larger-bore (typically 28 Fr) open chest tubes, as determined by the treating surgeon. Pigtail catheters were not utilized.

The assigned intervention determined the initial post-placement chest tube management strategy. In the water seal group, -20 cm H_2O suction was briefly applied (approximately one minute) immediately after placement to evacuate the pneumothorax, after which the tube was placed to water seal. In the suction group, patients remained on continuous suction at -20 cm H_2O via a standard three-chamber drainage system. Patients initially managed with suction were generally transitioned to water seal after 24 hours if there was no enlarging pneumothorax or concern for retained hemothorax on follow-up chest radiograph, consistent with our institutional practice during the study period.

Thereafter, subsequent chest tube management generally followed institutional practice guidelines, with chest tube removal considered after a stable or improved pneumothorax on chest radiograph following water seal, drainage <200 mL over 24 hours, and absence of an air leak. Clinical decisions outside these general management principles, including management of persistent pneumothorax, prolonged air leak, suspected retained hemothorax, or other complex clinical scenarios, remained at the discretion of the treating trauma team. Changes from initial water seal to suction were documented with time and clinical rationale. A chest radiograph was routinely obtained following chest tube placement, approximately 4 hours after transition to water seal, and approximately 4 hours after chest tube removal in accordance with our institutional management protocol.

Outcomes

The primary outcome was initial chest tube duration, defined as the time in hours from placement to removal of the first chest tube. The primary estimand was the effect of the initially assigned chest tube management strategy under an intention-to-treat framework.

The key secondary outcome was total chest tube duration, defined as the cumulative duration of all chest tubes during hospitalization, including any replacement or additional chest tubes if required. Additional secondary outcomes included immediate post-placement and postoperative day 1 pneumothorax size; changes in suction status; imaging utilization; complications; need for secondary intervention; and mortality. Exploratory outcomes included intensive care unit (ICU) and hospital length of stay; ventilator days; hypoxic or hypotensive events; unplanned ICU admission; discharge disposition; and 30-day readmission.

Statistical Analysis

Patients were analyzed according to their initial assigned management strategy based on month of enrollment. For chest tube-level outcomes, each tube was analyzed as a separate observation when bilateral tubes were present because management decisions and outcomes were tube-specific rather than patient-specific. Patient-level outcomes were analyzed at the patient level.

Continuous variables were assessed for normality using the Shapiro-Wilk test and are presented as medians with interquartile ranges. Comparisons were performed using the Mann-Whitney U test. Categorical variables are presented as counts and percentages and were compared using chi-square or Fisher's exact tests.

The primary outcome and key secondary outcome (total chest tube duration) were evaluated using one-sided hypothesis tests based on a prespecified directional hypothesis. All other outcomes were analyzed using two-sided tests and should be interpreted as exploratory because no formal adjustment for multiple comparisons was performed. A p value < 0.05 was considered statistically significant.

Because treatment allocation occurred by monthly cluster rather than by individual patient, additional analyses were performed using generalized estimating equation (GEE) models with month specified as the clustering variable to account for intraclass correlation. Cluster-adjusted analyses were performed for the primary and key secondary outcomes. The intraclass correlation coefficient (ICC) for the primary outcome was estimated descriptively given the limited number of clusters.

Sample size was estimated based on patient-level assumptions without adjustment for intraclass correlation given the limited number of clusters. An interim analysis was performed near the end of the study period, after which enrollment was stopped following a statistically significant difference in the primary outcome.

All analyses were performed using Python version 3.12.4.

Results

Study Population and Baseline Characteristics

During the study period, 3,372 trauma patients were admitted, of whom 133 required chest tube placement for traumatic pneumothorax. Seventy-two patients met eligibility criteria and were enrolled (37 suction, 35 water seal). Four patients died prior to chest tube removal and were excluded from the primary outcome analysis, leaving 34 patients in each group. Patient flow through the study is shown in Figure 1.

Baseline demographic and injury characteristics were similar between groups, including age, sex, the presence of any comorbidity, mechanism of injury, injury severity, and chest Abbreviated Injury Scale score (all $p > 0.05$; Table 1).

Chest Tube and Injury Characteristics

Bilateral placements resulted in 37 chest tubes in the suction group and 35 in the water seal group. Baseline chest injury and chest tube characteristics were similar between groups, including pre-placement maximum pneumothorax depth, pre-placement hemothorax volume, number of rib fractures, chest tube placement technique, and tube size (all $p > 0.05$; Table 2).

Chest Tube–Related Outcomes

Compared with suction, initial water seal was associated with shorter median initial chest tube duration (41.0 vs 51.0 hours, $p = 0.001$) and total chest tube duration (44.0 vs 60.0 hours, $p = 0.011$). Cluster-adjusted GEE analysis accounting for month-level clustering demonstrated similar findings for the primary outcome, with initial water seal remaining associated with shorter chest tube duration (mean difference – 20.6 hours, 95% CI -36.5 to -4.7 hours; $p = 0.011$). However, the cluster-adjusted analysis of total chest tube duration was no longer statistically significant (Supplemental Digital Content 2 <https://links.lww.com/JACS/A761>). A sensitivity analysis including the four patients who died before chest tube removal yielded similar findings (Supplemental Digital Content 3 <https://links.lww.com/JACS/A7612>).

Six of 35 chest tubes (17.1%) initially managed with water seal were converted to suction, primarily for enlarging or persistent pneumothorax on imaging, with radiographic improvement following suction in three cases (50%) (Supplemental Digital Content 4 <https://links.lww.com/JACS/A763>).

Post-placement pneumothorax size, complication rates, and rates of secondary intervention, including chest tube reinsertion, were similar between groups (all $p > 0.05$; Table 3). Exploratory analyses stratified by chest tube size showed no evidence that tube size modified the association between initial management strategy and initial or total chest tube duration (interaction $p = 0.525$ and $p = 0.628$, respectively) (Supplemental Digital Content 5 <https://links.lww.com/JACS/A764>).

Patient Outcomes

Patient-level outcomes were similar between groups, including hospital length of stay, intensive care unit length of stay, ventilator days, rates of mechanical ventilation, hypoxic events, pneumonia, and in-hospital mortality (all $p > 0.05$; Table 4). Discharge disposition and 30-day readmission rates were also similar between groups.

Discussion

In this pragmatic, month-based cluster-randomized study of adult patients with traumatic pneumothorax requiring chest tube placement, initial water seal management was associated with shorter chest tube duration compared with initial suction. Patients managed with water seal had a median reduction in initial chest tube duration of approximately 10 hours and total chest tube duration of approximately 16 hours, without an increase in complications, secondary intervention, or mortality. Although modest, this difference represents nearly half a day of chest tube management. These findings suggest that initial water seal is a feasible and safe alternative to routine initial suction in selected patients with traumatic pneumothorax and that an initial water seal strategy may safely expedite chest tube removal.

Prior randomized trials evaluating suction versus water seal in traumatic chest injury differ substantially from the present study in both patient population and clinical context. The three randomized controlled trials included in the most comprehensive meta-analysis were all conducted outside the United States (U.S.) and enrolled heterogeneous cohorts that included patients with hemothorax and hemopneumothorax, rather than isolated pneumothorax [18-21]. These studies reported mean chest tube durations between 5 and 12 days, which contrasts sharply with the markedly shorter durations observed in contemporary U.S. trauma practice. Differences in injury patterns, drainage thresholds, imaging practices, and institutional protocols likely contributed to these prolonged durations and limit the generalizability of prior findings to modern trauma systems. In contrast, high-quality thoracic surgery literature, including randomized trials and consensus guidelines, has consistently demonstrated that routine suction prolongs air leaks and chest tube duration after pulmonary resection, leading to recommendations favoring water seal in most patients [12-16]. The alignment of our findings with this thoracic surgery evidence suggests that the physiologic benefits of avoiding routine suction may extend to selected trauma patients with pneumothorax, particularly in the absence of significant hemothorax.

Our pragmatic trial demonstrates that initial water seal management is feasible and appears safe in a contemporary U.S. trauma population with relatively short chest tube durations. Chest tube duration was selected as the primary outcome because it represents the clinically actionable endpoint determining when a chest tube can be removed and directly influences patient mobility and resource utilization. Although 17% of chest tubes initially placed to water seal required subsequent transition to suction, escalation was selective and not associated with increased complications, secondary interventions, or mortality. Notably, radiographic

improvement following suction occurred in only half of converted cases, suggesting that routine suction is unnecessary for most patients and that only a subset benefit from additional negative intrathoracic pressure. Importantly, initial water seal was still associated with a reduction in chest tube duration of approximately 10-16 hours compared with suction. Although no differences were observed in downstream outcomes such as hospital length of stay, a reduction of approximately 10-16 hours represents nearly half a day of chest tube management in a contemporary U.S. trauma population. Chest tube transitions and removals at our institution were predominantly performed during daytime hours rather than routinely overnight. Thus, some of the observed reduction in chest tube duration may reflect a pragmatic workflow benefit of avoiding an additional management step rather than a purely physiologic effect. The magnitude of this benefit may differ at centers that routinely transition or remove chest tubes overnight. This association remained significant after analyses accounting for month-level clustering, supporting the robustness of the primary findings despite the pragmatic cluster-randomized study design. Whether this reduction translates into improvements in other patient-centered or health system outcomes warrants further investigation. Taken together, these findings support the feasibility and safety of an initial water seal strategy with selective escalation to suction in selected adult patients with traumatic pneumothorax requiring tube thoracostomy and without a significant associated hemothorax.

This study has several limitations. First, it was conducted at a single center with a relatively small sample size and was terminated early after a significant difference in the primary outcome was observed. Because chest tube duration was non-normally distributed and is reported as a median, the observed between-group difference is not directly comparable to the mean difference used for sample size estimation. Early termination may therefore have affected

the precision of the estimated treatment effect, potentially overestimating the magnitude of benefit, and limited the ability to detect differences in uncommon safety outcomes. Although patients who died before chest tube removal were excluded from the primary analysis because the primary outcome could not be observed, sensitivity analyses including these patients yielded similar findings. Second, although cluster randomization by month facilitated pragmatic implementation and minimized contamination between treatment strategies, it introduces the potential for temporal confounding. Although baseline patient, injury, and chest tube characteristics were similar between groups, baseline balance alone does not eliminate the possibility of residual confounding introduced by month-based allocation. We therefore performed additional analyses accounting for month-level clustering, which demonstrated findings consistent with the primary analysis. Nevertheless, the limited number of clusters reduced statistical precision, and the estimated ICC should be interpreted cautiously. Third, most patients in this cohort sustained blunt trauma; therefore, results may not fully generalize to penetrating injuries, which may have different patterns of lung injury and a higher risk of persistent air leak. Additionally, chest tube durations at our institution were relatively short compared with prior randomized trauma studies, reflecting contemporary practice at a high-volume Level I trauma center. The magnitude of benefit observed with an initial water seal strategy may therefore differ in centers with different patient populations or chest tube management practices. Pigtail catheters were not used in this study, therefore, whether these findings apply to pigtail catheters remains uncertain despite their similar caliber. We also excluded patients with hemothoraces > 300 mL to isolate the effects of initial chest tube management for traumatic pneumothorax. Although this pragmatic threshold was selected based on contemporary literature supporting observation of smaller hemothoraces, lesser volumes of

pleural blood may still have influenced chest tube management and responses to suction [25-26]. Fourth, although the initial chest tube management strategy was assigned by monthly cluster randomization, subsequent management decisions were left to the treating clinicians, which may have introduced practice variability. Air leak documentation was inconsistent in the medical record, precluding reliable comparison of air leak prevalence between treatment groups. Mechanical ventilation may alter pleural pressure dynamics and could influence chest tube management strategies; however, the number of mechanically ventilated patients in this cohort was small and similar between groups, limiting meaningful subgroup analysis. Fifth, because clinicians were aware of the assigned management strategy, a Hawthorne effect cannot be excluded, and participation in the study may have influenced clinical decision making. Finally, chest tube duration was measured from placement to removal and may have included delays between the clinical decision to remove the tube and the actual removal procedure.

Conclusions

In adult patients with traumatic pneumothorax requiring chest tube placement and without a significant associated hemothorax, initial water seal management was associated with shorter chest tube duration without an observed increase in complications. These findings support the feasibility and safety of an initial water seal strategy in selected patients and should be considered hypothesis-generating pending confirmation in larger multicenter studies.

Supplemental Digital Content

Supplemental Digital Content 1. CONSORT 2025 checklist for reporting a cluster-randomized trial.

Supplemental Digital Content 2. Cluster-adjusted analyses of major outcomes using generalized estimating equations (GEE).

Supplemental Digital Content 3. Sensitivity analysis of the primary outcome including patients who died before chest tube removal.

Supplemental Digital Content 4. Reasons for and outcomes of conversion from initial water seal to suction in traumatic pneumothorax.

Supplemental Digital Content 5. Exploratory chest tube duration outcomes by initial management strategy, stratified by chest tube size.

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Figure Legends

Figure 1. CONSORT flow diagram of patient enrollment, allocation, follow-up, and analysis.

Précis

In a pragmatic, cluster-randomized study of traumatic pneumothorax, initial water seal was associated with shorter chest tube duration without increased complication, suggesting routine suction may be unnecessary in selected patients.

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Table 1. Baseline Patient and Injury Characteristics by Initial Chest Tube Setting (Suction vs Water Seal) In Traumatic Pneumothorax

Characteristic	Suction (n=34)	Water Seal (n=34)	p Value
Sex, m, n (%)	27 (79.4)	25 (73.5)	0.776
Age, y, median [IQR]	50.5 [24.5, 60.8]	53.5 [36.8, 65.8]	0.326
BMI, kg/m ² , median [IQR]	28.6 [25.9, 33.7]	26.2 [23.3, 31.7]	0.237
Any comorbidity, n (%)	14 (41.2)	17 (50.0)	0.627
Mechanism of injury, n (%)			
Blunt	31 (91.2)	30 (88.2)	1.000
Ground level fall	4 (11.8)	2 (5.9)	0.673
Fall from height	6 (17.6)	6 (17.6)	1.000
Pedestrian struck	0 (0.0)	2 (5.9)	0.493
Motorcycle collision	5 (14.7)	5 (14.7)	1.000
Motor vehicle collision	14 (41.2)	14 (41.2)	1.000
Assault	1 (2.9)	4 (11.8)	0.356
Sports injury	2 (5.9)	0 (0.0)	0.493
Penetrating	3 (8.8)	4 (11.8)	1.000
Gunshot	1 (2.9)	1 (2.9)	1.000
Stab wound	2 (5.9)	3 (8.8)	1.000
ISS, median [IQR]	19.0 [14.0, 29.0]	22.0 [14.0, 29.8]	0.428
AIS Chest, median [IQR]	3.0 [3.0, 3.0]	3.0 [3.0, 4.0]	0.629

Any comorbidity was defined as the presence of ≥ 1 of the following: diabetes, congestive heart failure, hypertension, coronary artery disease, COPD, end-stage renal disease, cerebrovascular accident, dementia, or cirrhosis.

AIS, Abbreviated Injury Scale; IQR, interquartile range; ISS, Injury Severity Score

Table 2. Baseline Chest Injury and Chest Tube Characteristics by Initial Chest Tube Setting
(Suction vs Water Seal) in Traumatic Pneumothorax

Characteristic	Suction (n = 37)	Water seal (n = 35)	p Value
Pre-placement maximum pneumothorax depth, cm, median [IQR]	2.0 [1.5, 3.7]	2.4 [1.5, 4.3]	0.499
Pre-placement hemothorax size, mL, median [IQR]	0.0 [0.0, 10.0]	0.0 [0.0, 35.0]	0.121
No. of rib fractures on affected side, median [IQR]	5.0 [0.0, 7.0]	5.0 [3.0, 7.0]	0.538
Percutaneous (vs open), n (%)	24 (65.9)	29 (82.9)	0.143
Chest tube size (Fr), median [IQR]	14.0 [14.0, 28.0]	14.0 [14.0, 14.0]	0.109

IQR, interquartile range

Table 3. Chest Tube-Related Outcomes by Initial Chest Tube Setting (Suction vs Water Seal) in Traumatic Pneumothorax

Outcomes	Suction (n = 37)	Water seal (n = 35)	p Value
Size of pneumothorax post-placement, cm, median [IQR]	0.2 [0.0, 0.4]	0.2 [0.0, 0.6]	1.000
Size of pneumothorax post-placement day 1, cm, median [IQR]	0.2 [0.0, 0.5]	0.3 [0.05, 0.55]	0.437
Initial chest tube duration, h, median [IQR]	51.0 [43.0, 88.0]	41.0 [32.5, 54.0]	0.001
Total chest tube duration, h, median [IQR]	60.0 [45.0, 113.0]	44.0 [35.0, 84.0]	0.011
Change from initial water seal to suction, n (%)	NA	6 (17.1)	NA
Complication, n (%)			
Recurrent hemothorax	1 (2.7)	3 (8.6)	0.351
Recurrent pneumothorax	6 (16.2)	3 (8.6)	0.480
Recurrent hemopneumothorax	1 (2.7)	0 (0.0)	1.000
Empyema	0 (0.0)	0 (0.0)	1.000
Chest tube site infection	0 (0.0)	0 (0.0)	1.000
Secondary intervention, n (%)			
Chest tube reinsertion (removed and replaced)	7 (18.9)	6 (17.1)	1.000
Second simultaneous chest tube	3 (8.1)	2 (5.7)	1.000
Video-assisted thoracoscopic surgery	2 (5.4)	2 (5.7)	1.000
TPA	1 (2.7)	1 (2.9)	1.000

Total chest tube duration represents the cumulative duration of all chest tubes placed during the hospitalization

IQR, interquartile range; NA, not applicable, TPA, tissue plasminogen activator

Table 4. Patient Outcomes by Initial Chest Tube Setting (Suction vs Water Seal) in Traumatic Pneumothorax

Outcomes	Suction (n=34)	Water Seal (n=34)	p Value
LOS, d, median [IQR]	9.5 [6.0, 14.8]	8.0 [5.3, 19.8]	0.902
ICU LOS, d, median [IQR]	0.0 [0.0, 5.0]	0.0 [0.0, 5.8]	0.772
Ventilator time, d, median [IQR]	0.0 [0.0, 2.8]	0.0 [0.0, 2.0]	0.611
Mechanical ventilation, n (%)	13 (38.2)	15 (44.1)	0.806
Unplanned ICU admission, n (%)	3 (8.8)	3 (8.8)	1.000
Hypoxic events, median [IQR]	0.0 [0.0, 2.0]	1.0 [0.0, 1.8]	0.584
No. of chest X-rays throughout admission, median [IQR]	9.5 [6.0, 20.5]	9.0 [6.0, 18.3]	0.941
No. of CTs of chest through admission, median [IQR]	1.0 [1.0, 2.8]	1.0 [1.0, 2.0]	0.494
Complication, n (%)			
Acute hypoxic respiratory failure requiring intubation	4 (11.8)	3 (8.8)	1.000
Ventilator-associated pneumonia	6 (17.6)	4 (11.8)	0.734
Pneumonia	6 (17.6)	10 (29.4)	0.392
Discharge disposition, n (%)			
Home	22 (64.7)	19 (55.9)	0.621
Skilled nursing facility	2 (5.9)	4 (11.8)	0.673
Long-term acute care hospital	3 (8.8)	3 (8.8)	1.000
Inpatient rehabilitation	6 (17.6)	6 (17.6)	1.000
Hospice	0 (0.0)	0 (0.0)	1.000
In-hospital mortality, n (%)	1 (2.9)	2 (5.9)	1.000
30-d readmission, n (%)	3 (8.8)	1 (2.9)	0.614
Thoracic reason for readmission	0 (0.0)	0 (0.0)	1.000
Thoracic intervention during readmission	0 (0.0)	0 (0.0)	1.000

IQR, interquartile range; LOS, length of stay

Figure 1

