

# Adverse Pulmonary Outcomes after SSRF using RibScore

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## Introduction

- Designed and validated in 2015, RibScore is a 6-point scoring system that was introduced by using only radiographic findings based on chest wall trauma to predict adverse pulmonary outcomes. One point is given to each of the following variables:

- ≥ 6 Rib Fractures
- Bilateral Fractures
- Flail Chest
- ≥ 3 Bicortical Displaced Fractures
- 1<sup>st</sup> Rib Fracture
- Fractures in all 3 anatomical areas (anterior, lateral, posterior)

- The benefit of using only computed tomography (CT) findings provides an objective scoring system.
- Surgical stabilization of rib fractures (SSRF) is currently an option for patients to improve pain scores, decrease ventilator days, risk of ventilator-associated pneumonia, tracheostomy need, hospitalization, and overall mortality.
- Currently, there are no studies exploring the outcomes predicted by RibScore after SSRF.

## Methods

- IRB approved retrospective review of all SSRF patients at a level 1 trauma center from 1/2017 to 4/2023. Patients under 18 years of age were excluded.
- CT imaging studies were reviewed, and each patient was given a score based on the RibScore criteria.
- To assess adverse pulmonary outcomes, we used the following variables:
  - Pneumonia
  - Respiratory Failure (Need for mechanical ventilation post-SSRF >48h)
  - Tracheostomy
- Our primary outcome was the incidence of adverse pulmonary outcomes stratified by each RibScore after SSRF.
  - Linear trend between the categorical dependent variable (RibScore) and each of the adverse pulmonary outcome variables using the Mantel-Haenszel test for trend (also known as Linear-by-Linear Association).
  - Statistical significance was  $p < 0.05$ .

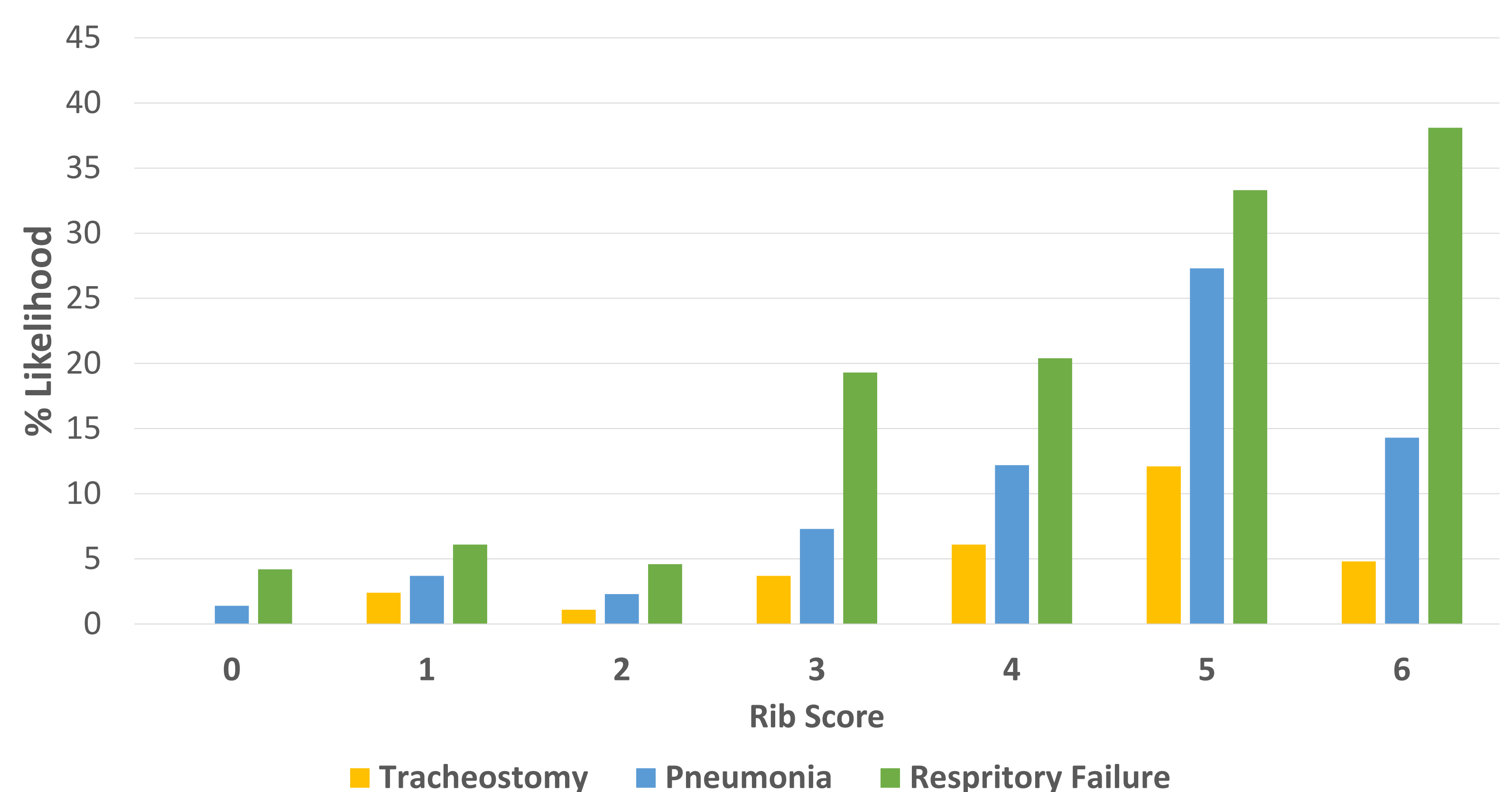
## Demographics and RibScore

Demographics	Value
Total Number of Patients	452
Age, Median (IQR)	60 (47, 70)
Gender	
Male, n (%)	314 (66.5)
Female, n (%)	138 (29.2)
Injury Type	
Blunt, n (%)	444 (94.1)
Penetrating, n (%)	6 (1.3)
Other and Unspecified, n (%)	2 (0.4)
Total Hospital Days, Median (IQR)	10 (7, 14)
Total ICU days, Median (IQR)	4 (2, 8)
Total Ventilator Days, Median (IQR)	4 (2.5, 10)
ISS, Median (IQR)	14 (10, 22)
Chest AIS, Median (IQR)	3 (3, 3)
RibScore Criteria	
≥6 Rib Fractures, n (%)	300 (66.4)
Flail Chest, n (%)	174 (38.5)
Bilateral Fractures, n (%)	103 (22.8)
First Rib Fracture, n (%)	92 (20.4)
≥3 Displaced Rib Fractures, n (%)	310 (68.6)
Fracture of each Anatomic Area, n (%)	86 (19)

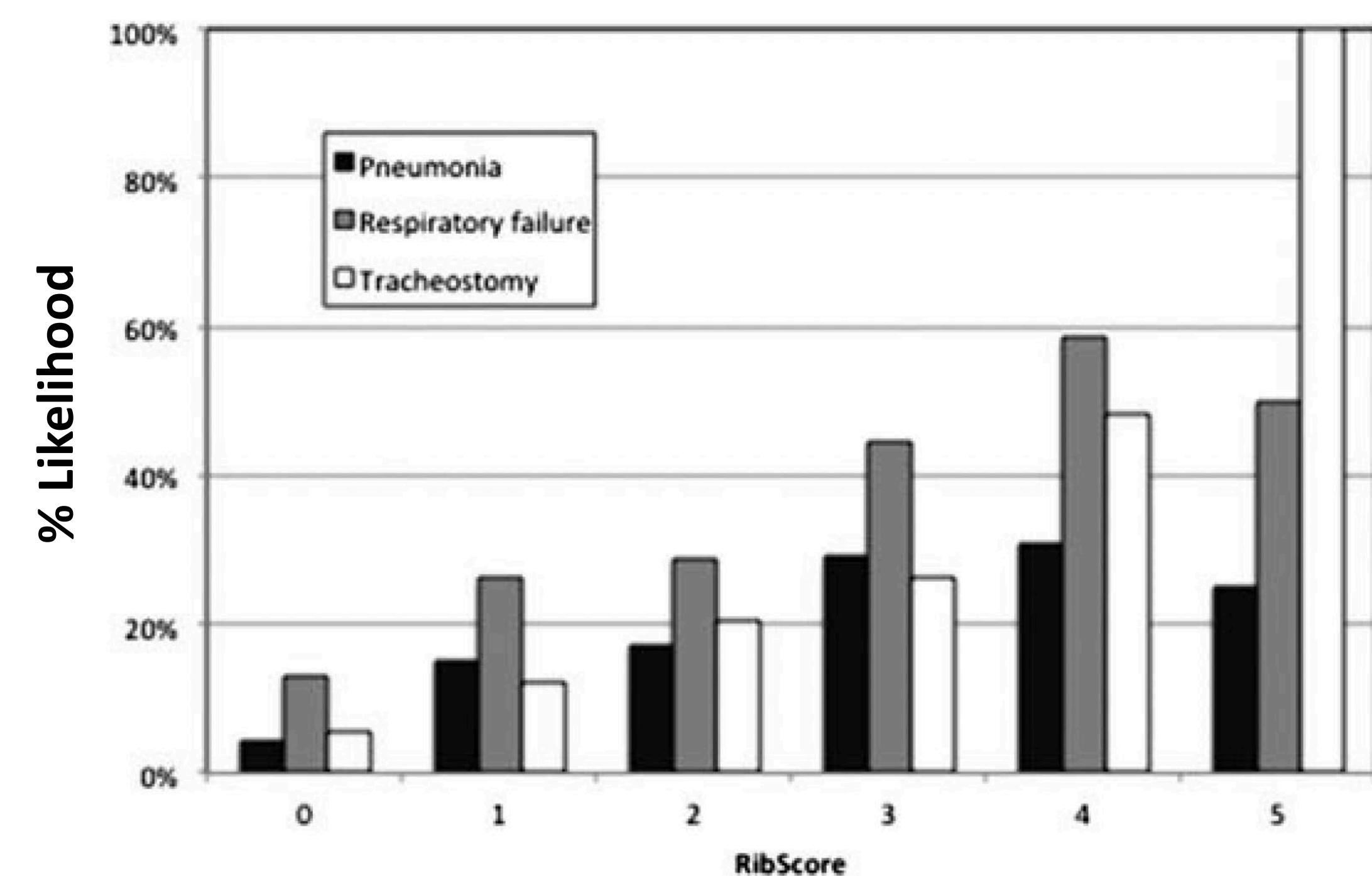
IQR = Interquartile Range, ISS = Injury Severity Score, AIS = Abbreviated Injury Score, ICU = Intensive Care Unit

## Incidence of Outcomes after SSRF per RibScore

Rib Score	N	Trach. (N)	% with Trach.	Pneumonia (N)	% with Pneumonia	Resp. Failure (N)	% with Resp. Failure
0	71	0	0	1	1.4	3	4.2
1	82	2	2.4	3	3.7	5	6.1
2	87	1	1.1	2	2.3	4	4.6
3	109	4	3.7	8	7.3	21	19.3
4	49	3	6.1	6	12.2	10	20.4
5	33	4	12.1	9	27.3	11	33.3
6	20	1	4.8	3	14.3	8	38.1
Chi-Squared	P = 0.039		P < 0.001		P < 0.001		
Linear by Linear Association	P = 0.003		P < 0.001		P < 0.001		



## Original Incidence of Outcomes in RibScore



## Conclusion and Future Aims

- This study demonstrated a statistically significant linear increase for each adverse pulmonary outcome in each subsequent RibScore after SSRF.
- Moreover, patients after having SSRF had significantly less incidence of adverse pulmonary outcomes when compared to the original pulmonary outcomes in the RibScore.
- Although additional studies are needed to confirm our results, SSRF improves pulmonary outcomes when compared to the original RibScore which can further be used to prognosticate chest wall injury outcomes.

## References

Chapman BC, Herbert B, Rodil M, Salotto J, Stovall RT, Biffi W, Johnson J, Burlew CC, Barnett C, Fox C, Moore EE, Jurkovich GJ, Pieracci FM. RibScore: A novel radiographic score based on fracture pattern that predicts pneumonia, respiratory failure, and tracheostomy. J Trauma Acute Care Surg. 2016 Jan;80(1):95-101.