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Predictive Value of Shock Index and Age-Adjusted Shock Index for Hypotension after Tracheal Intubation in Critically Ill Patients

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Abstract

Objective: To evaluate the predictive value of the Shock Index (SI) and Age-Adjusted Shock Index (AASI) for hypotension following tracheal intubation in critically ill patients, providing a theoretical basis for clinical decision-making.

Methods: Clinical data were retrospectively collected and analyzed for patients who underwent tracheal intubation in the Emergency Department of Chengdu Shangjin Nanfu Hospital from January 1, 2021, to December 31, 2022. Patients were divided into hypotension and non-hypotension groups based on post-intubation outcomes. Univariate analysis identified risk factors for post-intubation hypotension, and multivariate logistic regression determined the relationship between hypotension and these risk factors. Receiver Operating Characteristic (ROC) curves were used to determine the optimal thresholds for these risk factors.

Results: A total of 152 patients were included, with 35 experiencing hypotension after intubation. The hypotension group had significantly lower systolic blood pressure, diastolic blood pressure, oxygen saturation, hematocrit, hemoglobin, and albumin levels, while age, heart rate, SI (1.33 ± 0.62 vs. 0.87 ± 0.45), and AASI (83.23 ± 49.62 vs. 50.72 ± 30.01) were significantly higher ($P < 0.05$). Multivariate logistic regression revealed that systolic blood pressure, diastolic blood pressure, oxygen saturation, SI, and AASI were independent risk factors for post-intubation hypotension. ROC curve analysis showed that the area under the curve (AUC) for SI was 0.731 [95% CI (0.628, 0.835), $P < 0.05$], with a sensitivity of 62.9% and specificity of 78.6%. The AUC for AASI was 0.757 [95% CI (0.658, 0.856), $P < 0.05$], with a sensitivity of 65.7% and specificity of 79.5%.

Conclusion: SI and AASI have significant predictive value for hypotension following tracheal intubation in critically ill patients.

Keywords

Critically Ill Patients, Hypotension, Tracheal Intubation, Shock Index, Age-Adjusted Shock Index, Predictive Value

Introduction

Endotracheal intubation (ETI) is a life-saving invasive procedure, but it can also lead to severe hemodynamic abnormalities, such as post-intubation hypotension [1] and cardiac arrest. Green et al. [2] described post-intubation hypotension as a reduction in systolic blood pressure to ≤ 90 mm Hg (1 mm Hg = 0.133 kPa), a decrease in systolic blood pressure of ≥ 20% from baseline, a mean arterial pressure ≤ 65 mm Hg, or the initiation of vasopressors within 30 minutes of intubation. Post-intubation hypotension is a common complication associated with a poor prognosis, highlighting the importance of early identification of susceptible patients and the prevention of post-intubation hypotension.

The shock index (SI) is a non-invasive, simple indicator that can be repeatedly and dynamically measured. Research by Trivedi et al. [3] demonstrated that a pre-intubation SI ≥ 0.90 predicts post-intubation hypotension. The age-adjusted shock index (AASI), calculated by multiplying SI by age, was initially proposed for predicting mortality in elderly trauma patients [4]. Previous studies have shown that both pre-intubation AASI and SI are independent predictors of post-intubation hypotension in ETI patients [5,6], although research on this topic remains limited. This study aims to analyze the risk factors for post-intubation hypotension and evaluate the predictive value of SI and AASI in critically ill patients by summarizing clinical data from 152 ETI patients at Chengdu Shangjin Nanfu Hospital (hereinafter referred to as "our hospital").

Subjects and Methods

Study Subjects:

Clinical data were retrospectively collected from patients who underwent ETI in the Emergency Department of our hospital between January 1, 2021, and December 31, 2022. Inclusion criteria: (1) Patients requiring ETI for various reasons; (2) Age >18 years. Exclusion criteria: (1) Patients with pre-existing hypotension before ETI; (2) Patients who received fluid resuscitation or inotropic agents prior to ETI; (3) Patients after cardiopulmonary resuscitation. According to "Medical Statistics" [7], the logistic regression sample size for both case and control groups should be between 30 and 50 cases. In this study, 152 ETI patients were included, of whom 35 patients developed post-intubation hypotension (hypotension group), while 117 patients did not develop hypotension (non-hypotension group).

Research Methods:

ETI Procedure:

All patients were orally intubated by attending or senior physicians in the Emergency Department, who were proficient in this technique, using a laryngoscope under direct visualization. Once the correct position of the tube was confirmed, mechanical ventilation was initiated. Medications were selected by the ETI physician based on the patient's condition, including fentanyl (1–2 μg/kg), propofol (1.5 mg/kg), midazolam (0.02–0.05 mg/kg), and Rocuronium as muscle relaxants (0.2 mg/kg).

Hypotension was observed within 60 minutes post-ETI. Blood pressure was measured using a non-invasive method with an automated oscillometric device on the patient's upper arm. To minimize variability, repeated measurements were performed on the same upper limb for all patients. The criteria for hypotension were based on the 2016 Sepsis Shock Survival Guidelines: systolic blood pressure <90 mm Hg or a drop in systolic pressure >40 mm Hg in the absence of other causes of hypotension. Patients were divided into two groups based on whether they developed hypotension within 60 minutes after ETI: the hypotension group, consisting of patients with a pre-intubation systolic blood pressure >90 mm Hg and a post-intubation systolic blood pressure <90 mm Hg, and the non-hypotension group, in which systolic blood pressure remained >90 mm Hg both before and after ETI.

Observation indices included age, gender, primary and comorbid conditions, pre-intubation systolic and diastolic blood pressure, heart rate, respiratory rate, oxygen saturation, white blood cell count, neutrophil count, neutrophil percentage, hematocrit, hemoglobin, creatinine, albumin, serum potassium, serum sodium, blood glucose, blood pH, PO_2, PCO_2, and HCO_3 levels. Differences in these parameters between the two groups were analyzed, along with the predictive value of SI and AASI for post-intubation hypotension.

Logistic Regression Analysis:

First, all variables were subjected to univariate logistic regression analysis, and variables with $P < 0.05$ in the univariate analysis were selected. Based on the EPV (events per variable) principle, only variables meeting EPV requirements were included in the multivariate logistic regression analysis to ensure the accuracy and stability of the model. In this study, the number of post-intubation hypotension events was 35, which allowed up to four variables to be included simultaneously in the multivariate logistic regression analysis, according to the EPV principle.

Ethical Statement:

This study adheres to ethical standards and has been approved by the Institutional Review Board (IRB) of our institution (Approval No.: [2024 Audit No. (037)]). Given that this research is retrospective in nature, the requirement for obtaining informed consent from patients was waived by the IRB.

Table-1: Comparison of Baseline Characteristics Between Two Groups Prior to Intubation

Characteristics	Hypotension (n=35)	Non-hypotension (n=117)	Statistics	P value
Gender [n (%)]				
Male	21	74	$\chi2$=0.121	0.728
Female	14	43		
Age (years)	66.11±16.06	58.75±19.14	t=2.067	0.04
Comorbidities [n (%)]				
Hypertension	14	33	$\chi2$=1.755	0.185
Diabetes	5	11	$\chi2$=0.682	0.409
COPD	1	12	$\chi2$=1.886	0.17
Chronic renal failure	1	3	$\chi2$=0.009	0.924
Induction medications [n (%)]				
Propofol	16	61	$\chi2$=0.596	0.897
Midazolam	7	23		
Fentanyl	8	21		
Muscle relaxants	4	12		
Systolic blood pressure (mm Hg)	120.51±57.77	138.96±42.73	t=-2.056	0.042
Diastolic blood pressure (mm Hg)	68.14±33.46	83.56±26.03	t=-2.869	0.005
Heart rate (beats/min)	132.74±33.39	110.21±35.64	t=3.328	0.001
Respiratory rate (breaths/min)	22.51±10.63	25.21±9.74	t=-1.404	0.162
Oxygen saturation (%)	78.00 (68.00, 90.00)	90.00 (77.00, 97.00)	3.113	0.002
WBC count (×109/L)	12.22 (9.15, 18.25)	12.13 (8.73, 17.23)	0.547	0.584
Neutrophil count (%)	9.67 (5.91, 13.51)	7.92 (5.24, 12.29)	0.869	0.385
Neutrophil percentage	71.80 (48.90, 81.60)	65.10 (46.95, 82.85)	0.727	0.468
Hematocrit	0.39 (0.30, 0.43)	0.41 (0.36, 0.47)	2.074	0.038
Hemoglobin (g/L)	117.94±31.19	129.91±29.03	t=-2.104	0.037
Creatinine (μmol/L)	96.00 (74.00, 157.00)	81.00 (65.00, 109.00)	1.801	0.072
Albumin (g/L)	34.83±7.86	38.61±7.06	t=-2.708	0.008
Potassium (mmol/L)	3.90 (3.40, 5.10)	3.60 (3.20, 4.40)	1.549	0.121
Sodium (mmol/L)	139.00 (135.00, 142.00)	140.00 (135.00, 143.00)	0.697	0.486
Blood glucose (mmol/L)	10.40 (8.40, 14.00)	9.80 (7.73, 13.40)	0.652	0.514
Blood pH	7.28 (7.07, 7.37)	7.32 (7.13, 7.41)	1.217	0.224
PO_2 (mm Hg)	90.00 (61.00, 110.00)	94.00 (66.00, 139.00)	0.963	0.336
PCO_2 (mm Hg)	34.20 (20.60, 66.80)	36.90 (28.10, 55.00)	1.074	0.283
HCO_3- (mmol/L)	17.20 (9.80, 21.00)	19.50 (15.00, 23.50)	1.694	0.09
Shock Index (SI)	1.33±0.62	0.87±0.45	t=4.798	<0.001
Age-Adjusted Shock Index (AASI)	83.23±49.62	50.72±30.01	t=4.763	<0.001

Note: PO2 = partial pressure of oxygen; PCO2 = partial pressure of carbon dioxide; HCO3- = bicarbonate; mmol/L = millimoles per liter; mm Hg = millimeters of mercury; SI = Shock Index; AASI = Age-Adjusted Shock Index.

Results

Baseline Data Comparison Between the Two Groups Before Intubation:

A total of 152 patients were included in this study, with complete data available. Of these, 95 were male and 57 were female. Post-intubation hypotension occurred in 35 patients, with an incidence rate of 23.0%. Patients who developed hypotension were treated with aggressive fluid resuscitation or vasoactive agents to maintain blood pressure. The hypotension group had lower pre-intubation systolic blood pressure, diastolic blood pressure, oxygen saturation, hematocrit, hemoglobin, and albumin levels compared to the non-hypotension group, while age, heart rate, SI, and AASI were significantly higher in the hypotension group (P < 0.05) (**Table-1**).

Risk Factors for Post-Endotracheal Intubation Hypotension:

Multivariate logistic regression analysis was performed with age, systolic blood pressure, diastolic blood pressure, heart rate, oxygen saturation, hematocrit, hemoglobin, and albumin as independent variables, and the occurrence of post-intubation hypotension as the dependent variable. The results indicated that systolic blood pressure, diastolic blood pressure, oxygen saturation, SI, and AASI were independent predictors of post-intubation hypotension (P < 0.05) (**Table-2**).

Predictive Value of SI and AASI for Post-Intubation Hypotension:

ROC curve analysis showed that the area under the curve (AUC) for SI in predicting post-ETI hypotension was 0.731 [95% CI: 0.628–0.835, P < 0.001], with an optimal threshold of 1.14, a sensitivity of 62.9%, and a specificity of 78.6%. The AUC for AASI in predicting post-ETI hypotension was 0.757 [95% CI: 0.658–0.856, P < 0.001], with an optimal threshold of 73.66, a sensitivity of 65.7%, and a specificity of 79.5%. See **Table-3** and **Fig-1**.

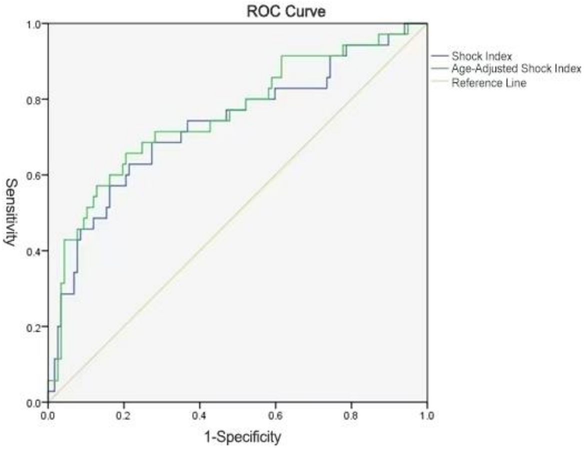

Fig-1:
ROC Curves of SI and AASI for Predicting PIH Following ETI

Table-2: Multivariate Logistic Regression Analysis of Risk Factors for PIH Following ETI

Variables	Regression Coefficient	SE	Wald χ2	*P* value	OR	95% CI
Age	-0.053	0.037	2.099	0.147	0.948	(0.883, 1.019)
Systolic blood pressure	0.041	0.015	7.557	0.006	1.042	(1.012, 1.073)
Diastolic blood pressure	-0.054	0.021	6.832	0.009	0.947	(0.910, 0.987)
Heart rate	0.01	0.015	0.502	0.479	1.01	(0.982, 1.039)
Oxygen saturation	-0.027	0.011	6.34	0.012	0.973	(0.952, 0.994)
Hematocrit	-9.989	10.816	0.853	0.356	0	(0.000, 3836.157)
Hemoglobin	0.021	0.032	0.434	0.51	1.021	(0.959, 1.087)
Albumin	-0.042	0.046	0.849	0.357	0.959	(0.877, 1.048)
Shock Index	-1.594	0.043	4.455	0.044	1.068	(0.002, 20.849)
Age-Adjusted Shock Index	0.064	0.032	5.104	0.037	1.213	(1.002, 1.134)

Note: ETI = Endotracheal Intubation; OR = Odds Ratio; CI = Confidence Interval

Table-3: Predictive Performance of SI and AASI for Post-Intubation Hypotension

Variables	AUC	Standard Error	*P* value	95% CI	Cut-off	Sensitivity (%)	Specificity (%)
SI	0.731	0.053	<0.001	(0.628, 0.835)	1.14	62.9	78.6
AASI	0.757	0.05	<0.001	(0.658, 0.856)	73.663	65.7	79.5

Note: AUC = Area Under the Curve; CI = Confidence Interval

Discussion

The Emergency Department (ED) is at the frontline of hospitals, where critically ill patients often present with severe, rapidly changing, and complex conditions. Common critical illnesses seen in the ED include respiratory failure, coma, and severe multiple trauma, frequently requiring ETI. ETI is an invasive procedure used to establish an artificial airway. Due to the critical nature of these patients, who often have unstable vital signs, physicians have limited time to assess the patient's condition during emergency interventions, increasing the likelihood of post-intubation complications [1]. One common complication is post-intubation hypotension [8,9]. Currently, there is limited research on post-intubation hypotension in critically ill patients, and existing studies, both domestically and internationally, show inconsistent results. Studies by Li Jiming et al. [10] and Green et al. [11] reported incidences of post-intubation hypotension of 30.19% and 46%, respectively, indicating a high incidence, whereas Griesdale et al. [12] reported an incidence of only 9.6%. A review by Althunayyan [5] summarized that the incidence of post-intubation hypotension ranges from 5% to 45%. The wide range in incidence is partly due to variations in the intubation environment, patient clinical characteristics, and the lack of a standard definition for post-intubation hypotension. In our study, the incidence of post-intubation hypotension among critically ill patients in the ED was 23.02%, consistent with international studies.

Experts have reported that insufficient circulating blood volume often leads to post-intubation hypotension. Currently, primary hospitals often use traditional indicators such as blood pressure, pulse pressure, heart rate, urine output, skin mottling, and neurological symptoms to determine the presence of post-intubation hypotension. However, these parameters are unreliable because they are influenced by various clinical conditions, and some may appear normal due to compensatory mechanisms [8]. The SI, first introduced by Allgöwer and Burri in 1967 [13], reflects real-time hemodynamic stability and is a non-invasive, simple indicator that can be repeatedly and dynamically measured. Increasing research has demonstrated that elevated SI values are associated with disease severity and adverse outcomes in many conditions [14]. Four systematic reviews, including three meta-analyses, have confirmed the value of SI in predicting adverse outcomes in trauma, myocardial infarction, hemorrhagic shock, and COVID-19 patients [15-18]. The study by Aleka et al. [19] showed that patients with SI ≥ 1.3 at triage had significantly higher risks of mortality or need for hospitalization. The study by Trivedi et al. [3] indicated a correlation between pre-intubation SI and post-intubation hypotension, with pre-intubation SI ≥ 0.90 being a significant predictor of post-intubation hypotension. In our study, logistic regression analysis identified AASI and SI as independent risk factors for post-intubation hypotension, and ROC curve analysis showed that the AUC for SI in predicting post-ETI hypotension was 0.731, while the AUC for AASI was 0.757. The close relationship between AASI and SI, confirmed by a 95% confidence interval, suggests that both indices are correlated with post-intubation hypotension, with AASI showing slightly better predictive performance than SI, consistent with the findings of Althunayyan [5] and Lee et al. [6].

The results of this study indicate that systolic blood pressure, diastolic blood pressure, and oxygen saturation are independent risk factors for post-intubation hypotension in critically ill patients in the ED. Most critically ill patients in the ED have compromised cardiopulmonary function, and some have concurrent infections. These factors often result in reduced effective blood volume and hemodynamic instability, leading to lower pre-intubation blood pressure compared to normal levels. Post-intubation, blood pressure may drop further, and without timely intervention, the risk of mortality increases [20,21]. The mechanisms behind post-intubation hypotension in critically ill patients are still not well understood but are believed to involve the following factors [22-24]: (1) the transition from a hyperactive sympathetic state to an inhibited state induced by anesthetic agents during rapid sequence intubation, (2) the impact of positive pressure ventilation on circulation, and (3) the presence of uncorrected, occult hypovolemia. For patients with insufficient blood volume, intubation can further undermine their physiological attempts to increase perfusion. The correlation between hypotension and increased mortality risk is well established [25]. Therefore, pre-intubation systolic blood pressure, diastolic blood pressure, and hypoxia-induced hypovolemia are significant contributors to post-intubation hypotension.

In summary, systolic blood pressure, diastolic blood pressure, oxygen saturation, SI, and AASI are independent risk factors for post-intubation hypotension in critically ill patients in the ED. Therefore, the ED should closely monitor these risk factors before intubation, observe hemodynamic changes after intubation, and intervene promptly to improve patient outcomes and ensure patient safety. For patients experiencing hypotension, the emergency department follows standard emergency protocols, including the immediate administration of crystalloid or colloid solutions to restore circulatory volume. If hypotension persists after fluid resuscitation, vasopressors (e.g., norepinephrine) are administered as an intervention. The treatment approach is individualized based on the patient's specific condition, with close monitoring of hemodynamic parameters to enhance the success rate of resuscitation and safeguard the patient's life.

Conflict of Interest

The authors have read and approved the final version of the manuscript. The authors have no conflicts of interest to declare.

References

[1] Russotto V, Rahmani LS, Parotto M, Bellani G, Laffey JG. Tracheal intubation in the critically ill patient. Eur J Anaesthesiol. 2022 May 1;39(5):463-72. [**PMID**: 34799497]

[2] Green RS, Edwards J, Sabri E, Fergusson D. Evaluation of the incidence, risk factors, and impact on patient outcomes of postintubation hemodynamic instability. CJEM. 2012 Mar;14(2):74-82. [**PMID**: 22554438]

[3] Trivedi S, Demirci O, Arteaga G, Kashyap R, Smischney NJ. Evaluation of preintubation shock index and modified shock index as predictors of postintubation hypotension and other short-term outcomes. J Crit Care. 2015 Aug;30(4):861.e1-7. [**PMID**: 25959037]

[4] Zarzaur BL, Croce MA, Fischer PE, Magnotti LJ, Fabian TC. New vitals after injury: shock index for the young and age x shock index for the old. J Surg Res. 2008 Jun 15;147(2):229-36. [**PMID**: 18498875]

[5] Althunayyan SM. Shock Index as a Predictor of Post-Intubation Hypotension and Cardiac Arrest; A Review of the Current Evidence. Bull Emerg Trauma. 2019 Jan;7(1):21-27. [**PMID**: 30719462]

[6] Lee K, Jang JS, Kim J, Suh YJ. Age shock index, shock index, and modified shock index for predicting postintubation hypotension in the emergency department. Am J Emerg Med. 2020 May;38(5):911-15. [**PMID**: 31345593]

[7] Cao DM, Wu XZ. Medical Statistics. Beijing: People's Health Publishing House; 2021.

[8] Heffner AC, Swords D, Kline JA, Jones AE. The frequency and significance of postintubation hypotension during emergency airway management. J Crit Care. 2012 Aug;27(4):417.e9-13. [**PMID**: 22033053]

[9] Russotto V, Myatra SN, Laffey JG, Tassistro E, Antolini L, Bauer P, Lascarrou JB, Szuldrzynski K, Camporota L, Pelosi P, Sorbello M, Higgs A, Greif R, Putensen C, Agvald-Öhman C, Chalkias A, Bokums K, Brewster D, Rossi E, Fumagalli R, Pesenti A, Foti G, Bellani G; INTUBE Study Investigators. Intubation Practices and Adverse Peri-intubation Events in Critically Ill Patients From 29 Countries. JAMA. 2021 Mar 23;325(12):1164-72. Erratum in: JAMA. 2021 Jun 22;325(24):2507. [**PMID**: 33755076]

[10] Li J, Yang J, Peng P. Analysis of risk factors and prognosis of hypotension after tracheal intubation in critically ill patients. Journal of Clinical Pulmonology. 2017,22(01):93-95.

[11] Green RS, Turgeon AF, McIntyre LA, Fox-Robichaud AE, Fergusson DA, Doucette S, Butler MB, Erdogan M; Canadian Critical Care Trials Group

(CCCTG). Postintubation hypotension in intensive care unit patients: A multicenter cohort study. J Crit Care. 2015 Oct;30(5):1055-60. [**PMID**: 26117220]

[12] Griesdale DE, Bosma TL, Kurth T, Isac G, Chittock DR. Complications of endotracheal intubation in the critically ill. Intensive Care Med. 2008 Oct;34(10):1835-42. [**PMID**: 18604519]

[13] Allgöwer M, Burri C. "Schockindex" ["Shock index"]. Dtsch Med Wochenschr. 1967 Oct 27;92(43):1947-50. German. [**PMID**: 5299769]

[14] Rady MY, Smithline HA, Blake H, Nowak R, Rivers E. A comparison of the shock index and conventional vital signs to identify acute, critical illness in the emergency department. Ann Emerg Med. 1994 Oct;24(4):685-90. Erratum in: Ann Emerg Med 1994 Dec;24(6):1208. [**PMID**: 8092595]

[15] Olaussen A, Blackburn T, Mitra B, Fitzgerald M. Review article: shock index for prediction of critical bleeding post-trauma: a systematic review. Emerg Med Australas. 2014 Jun;26(3):223-28. [**PMID**: 24712642]

[16] Zhang X, Wang Z, Wang Z, Fang M, Shu Z. The prognostic value of shock index for the outcomes of acute myocardial infarction patients: A systematic review and meta-analysis. Medicine (Baltimore). 2017 Sep;96(38):e8014. [**PMID**: 28930837]

[17] Alsagaff MY, Kurniawan RB, Purwati DD, Ul Haq AUD, Saputra PBT, Milla C, Kusumawardhani LF, Budianto CP, Susilo H, Oktaviono YH. Shock index in the emergency department as a predictor for mortality in COVID-19 patients: A systematic review and meta-analysis. Heliyon. 2023 Jul 24;9(8):e18553. [**PMID**: 37576209]

[18] Pacagnella RC, Souza JP, Durocher J, Perel P, Blum J, Winikoff B, Gülmezoglu AM. A systematic review of the relationship between blood loss and clinical signs. PLoS One. 2013;8(3):e57594. doi: 10.1371/journal.pone.0057594. Epub 2013 Mar 6. Erratum in: PLoS One. 2013;8(6). [**PMID**: 23483915]

[19] Aleka P, Van Koningsbruggen C, Hendrikse C. The value of shock index, modified shock index and age shock index to predict mortality and hospitalisation in a district level emergency centre. Afr J Emerg Med. 2023 Dec;13(4):287-92. [**PMID**: 37822303]

[20] Green RS, Butler MB, Erdogan M. Increased mortality in trauma patients who develop postintubation hypotension. J Trauma Acute Care Surg. 2017 Oct;83(4):569-74. [**PMID**: 28930950]

[21] Ferrada P, Manzano-Nunez R, Lopez-Castilla V, Orlas C, García AF, Ordonez CA, Dubose JJ. Meta-Analysis of Post-Intubation Hypotension: A Plea to Consider Circulation First in Hypovolemic Patients. Am Surg. 2019 Feb 1;85(2):167-72. [**PMID**: 30819293]

[22] Lin CC, Chen KF, Shih CP, Seak CJ, Hsu KH. The prognostic factors of hypotension after rapid sequence intubation. Am J Emerg Med. 2008 Oct;26(8):845-51. [**PMID**: 18926339]

[23] Heffner AC, Swords DS, Nussbaum ML, Kline JA, Jones AE. Predictors of the complication of postintubation hypotension during emergency airway management. J Crit Care. 2012 Dec;27(6):587-93. [**PMID**: 22762924]

[24] Sun Y. Sedative effect of pre-infused dexmedetomidine and its influence on the response to tracheal intubation in general anesthesia patients. J Contemporary Medicine, 2020, 26(26): 140-41.

[25] Ferrada P, Callcut RA, Skarupa DJ, Duane TM, Garcia A, Inaba K, Khor D, Anto V, Sperry J, Turay D, Nygaard RM, Schreiber MA, Enniss T, McNutt M, Phelan H, Smith K, Moore FO, Tabas I, Dubose J; AAST Multi-Institutional Trials Committee. Circulation first - the time has come to question the sequencing of care in the ABCs of trauma; an American Association for the Surgery of Trauma multicenter trial. World J Emerg Surg. 2018 Feb 5;13:8. [**PMID**: 29441123]