

Investigating the Airway Assessment of COPD Patients Based on the SARI Protocol: A Descriptive Cross-Sectional Study

Ibrahim Kareem Muhammad¹, Pegah Arman^{1*}, Maryam Zamani², Nahid Manoucherian³

¹Department of Anesthesiology, School of Paramedicine, Hamadan University of Medical Sciences, Hamadan, Iran.

²Student Research Committee, Hamadan University of Medical Sciences, Hamadan, Iran.

³Department of Anesthesiology, Hamadan University of Medical Sciences, Hamedan, Iran.

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ABSTRACT

Introduction: Airway management is crucial in patients with chronic obstructive pulmonary disease (COPD) undergoing surgery due to their heightened risk of respiratory complications. COPD is a chronic inflammatory condition that results in airway narrowing, rendering patients more susceptible to stressful situations such as surgery. Therefore, it is essential to conduct thorough preoperative airway assessments to prevent complications and enhance patient outcomes.

Methods: This cross-sectional descriptive study was conducted in Hamedan hospitals and included 400 randomly selected COPD patients undergoing surgery. The Simple Airway Risk Index (SARI) was utilized to assess intubation difficulty, taking into account parameters such as mouth opening, thyromental distance, and Mallampati score. The collected data was analyzed using SPSS software, and relationships between variables were examined using ANOVA and t-tests.

Results: The study revealed a significant association between SARI score and factors such as gender, age, BMI, and certain medical conditions. For instance, male patients and those over 30 years of age exhibited higher SARI scores, signifying an elevated risk of difficult intubation. Moreover, conditions like hypertension and diabetes demonstrated a correlation with higher SARI scores.

Conclusion: The SARI score proves to be a valuable tool for predicting airway management challenges in COPD patients. This study underscores the significance of comprehensive preoperative airway assessments employing the SARI score to anticipate and mitigate potential complications, thereby enhancing the quality of surgical care for COPD patients.

Introduction

Airway management before surgery is crucial in patients with chronic obstructive pulmonary disease (COPD) because they face multiple risks from chronic respiratory problems and reduced lung capacity [1]. COPD is a chronic inflammatory disease that narrows the airways and impairs the efficient exchange of oxygen and carbon dioxide in the lungs [2]. Consequently, these patients are susceptible to acute

respiratory complications, particularly in high-stress situations like surgery [3].

Proper management of the airway is necessary during the pre-operative phase for these patients to prevent surgical complications associated with respiratory problems [4]. The purpose of evaluating airway management is to identify and minimize risks related to respiratory problems and effectively manage the patient's condition during and after surgery [5]. Various tools, such as spirometry, arterial blood gas examination, and clinical evaluation, are used to assess the severity of COPD and the patient's respiratory function [6].

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*Corresponding author.

E-mail address: ibrahim.anesthesiology@edu.umsha.ac.ir, pegah.arman96@gmail.com

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Increasing the rate of surgery in patients with COPD, as well as the complications related to the management of these patients, more research in this field seems necessary [7]. The lack of a standard and comprehensive protocol for airway assessment and management in these patients increases the risk of complications during and after the operation [8].

Considering scientific advances and the need to improve the quality of medical services, accurate and regular assessment of the airway condition of these patients before surgery is particularly crucial [9]. In this regard, SARI Score indicators have been considered a reliable measure to evaluate risks related to the airway [10]. These indices, specifically developed to measure the risks associated with airway management in patients with certain conditions, can help predict and reduce complications related to this issue [11].

Here, he examines the necessity of using Sari Score indicators in assessing airway management for COPD patients before surgery and discusses the challenges and importance of improving clinical outcomes [12]. Since COPD patients typically have complex respiratory disorders and require careful airway management, these indicators can help predict potential issues and guide appropriate decisions during and after surgery. This is particularly critical for high-risk surgeries and situations requiring general anesthesia [13].

Therefore, the purpose of this research is to investigate the accuracy of Sari Score indicators in predicting and managing airway challenges in COPD patients. The aim is to enhance the quality of medical care and reduce complications associated with surgical procedures.

Methods

Ethical considerations

This research was conducted under the supervision of the Ethics Committee of Hamedan University of Medical Sciences. After obtaining the code of ethics (IR.UMSHA.REC.1403.169) from this committee, sampling was carried out using a non-probability method. Additionally, the participants were provided with the right to withdraw from the research.

Investigation settings and study population

The current cross-sectional study was conducted in educational hospitals under the supervision of Hamadan University of Medical Sciences (Besat, Beheshti, Fatemiye, and Sina). Surgical candidate patients who were suffering from COPD and did not meet the exclusion criteria were selected using an available method. The exclusion criteria include a history of surgery in the neck area, a history of radiation therapy in the neck area, having a mass in the neck area, facial deformities, cases of emergency surgery, full stomach, tracheostomy, age less than 18 years, the patient does not

need tracheal intubation, and people who were not given a neuromuscular blocking agent. The sample size was determined through sequential sampling, which included the selection of all available cases (n=400) in a specific time period (between December 1402 and December 1403).

Interventions

At the onset of the patient's arrival in the surgery waiting room, the researcher explained the objectives and research methodology, addressing all the patient's questions. Afterward, informed consent was obtained from the patient. Subsequently, the researcher completed the demographic profile checklist in collaboration with the patients. This checklist encompassed gender, age group, residence, occupation, marital status, nationality, BMI, medical history, and preoperative examination.

Then, the researcher assessed the patients using SARI indicators. The Simple Airway Risk Index (SARI), also known as the Elgansori Risk Index (EGRI), is a multivariate risk score utilized to estimate the difficulty of tracheal intubation. To calculate the SARI score, seven parameters (mouth opening, thyromental distance, Mallampathi score, neck movement, ability to create underbite, body weight, and previous intubation history) are taken into account. The SARI score ranges from 0 to 12 points, with a higher score indicating a more challenging airway. A SARI score of 4 or higher is classified as a difficult intubation. The grading in the survey using the SARI index is as follows:

1. Mouth opening: A mouth opening greater than 4 cm between the incisors results in 0 points, while a lesser distance results in 1 point.

2. Thyromental distance: A thyromental distance greater than 6.5 cm is given 0 points, while a distance between 6.5-6 cm is given 1 point, and finally, a distance less than 6 cm is given 2 points.

3. Mallampathi score: Class I and II of the modified Mallampathi scoring are given 0 points, while class III is given 1 point, and class IV is given 2 points.

4. Neck movement: The ability to move the neck more than 90 degrees results in 0 points, while a range of motion of 80-90 degrees results in 1 point, and a range of motion below 80 degrees results in 2 points.

5. Underbite: If the patient can protrude the jaw enough to create an underbite, a score of 0 is given. If not, 1 point.

6. Body weight: A weight less than 90 kg has 0 points. A weight of 90 to 110 kg is given 1 point, and a weight above 110 kg is considered 2 points [14].

Then the patients were transferred to the operating room to receive general anesthesia and undergo surgery. In the operating room, Propofol (2 mg/kg), atracurium (0.4 mg/kg), midazolam (2 mg/kg), and lidocaine (30 mg/kg) were used to induce anesthesia in the patients. The anesthesia team ventilated the patient for 3 minutes. Afterwards, an experienced anesthesiologist with 5 years

of experience intubated the patient. He was present at the patient's bedside during intubation and recorded the number of attempts made to intubate the patient.

Statistical Analysis

After collecting the data, we checked for normal distribution. Then, we examined the relationships between the data using ANOVA and t-test. Statistical evaluations of this study were performed using SPSS version 22 software. The level of significance in this research was set at 0.05.

Results

The socio-demographic characteristics of participants, focusing on gender, age, and BMI in relation to SARI scores. The analysis shows that male participants had a higher proportion of difficult airway management, reflected in SARI scores greater than 4 (53.1%). Younger participants (<30 years) also displayed lower SARI scores compared to older participants, indicating a potential correlation between age and airway difficulty. Additionally, a higher BMI was associated with elevated SARI scores, suggesting that overweight individuals may face increased challenges in airway management. Statistical significance was determined using the Fisher's exact test, with P values indicating meaningful associations for gender (P value= 0.047), age (P value= 0.012), and BMI (P value= 0.031). (Table 1)

The relationship between medical history and SARI scores among participants, revealing significant associations with various factors. The analysis highlights that individuals with chronic conditions such as hypertension and diabetes tend to have higher SARI scores, indicating a greater risk for difficult intubation.

Notably, the presence of drug sensitivity was associated with a higher SARI score (80.0% of patients with antibiotic sensitivity scored >4), while a normal blood pressure was linked to lower SARI scores (34.8%). The statistical significance of these relationships was confirmed using Fisher's exact test, particularly for hypertension (P value= 0.002) and drug sensitivity (P value= 0.028) (Table 2).

Presents the SARI scores in relation to various airway management conditions such as mouth opening, Thiromental distance, neck movement, and weight. The findings indicate a clear correlation between airway characteristics and SARI scores, with a significantly lower Thiromental distance (<6 cm) strongly associated with higher SARI scores (>4) (P value< 0.001). Additionally, restricted neck movement (<80 degrees) was also linked to increased SARI scores (P value= 0.039). Although mouth opening and weight showed no significant relationship with SARI scores, these airway management parameters collectively underscore the importance of thorough preoperative assessments. Statistical analyses were performed using Fisher's exact test (Table 3).

Evaluates the impact of SARI scores on the number of attempts required for successful intubation. The results show that participants with higher SARI scores (>4) often required multiple attempts for successful intubation, with a striking 59.62% of these cases necessitating two attempts. Conversely, all patients scoring less than or equal to 4 achieved intubation on the first attempt. This clear distinction emphasizes the predictive value of the SARI score in assessing the difficulty of intubation in COPD patients, further supporting its clinical utility in preoperative airway assessment. Statistical significance was established using Fisher's exact test (Table 4).

Table 1- Socio-demographic Characteristics

SARI categories		<4	>4	P value
Gender	Male	92(46.9%)	104(53.1%)	0.047*
	Female	116(56.9%)	88(43.1%)	
Age	<30	104(46.4%)	120(53.6%)	0.012*
	>30	72(40.9%)	104(59.1%)	
BMI	Underweight	76(57.6%)	56(42.4%)	0.031*
	Normal	68(53.1%)	60(46.9%)	
	Overweight	40(38.5%)	64(61.5%)	

*P value of Fisher exact test for cells less than 0.05

Table 2- Medical history data in SARI score

SARI categories		=<4	>4	overall	P value
Type of current surgery	Major	92(47.9%)	100(52.1%)	192(100.0%)	0.974
	minor	100(48.1%)	108(51.9%)	208(100%)	
Type of anesthesia	General	188(48.0%)	204(52.0%)	392(100%)	0.909
	spinal	4(50.0%)	4(50.0%)	8(100%)	
Drug sensivity	antibiotic	4(20.0%)	16(80.%)	20(100%)	0.028
	others	12(42.9%)	16(57.1%)	28(100%)	
	none	176(50.0%)	176(50.0%)	352(100%)	

Chorionic disease	hypertension	24(40.0%)	36(60.0%)	60(100%)	0.002
	Heart disease	12(75.0%)	4(25.0%)	16(100%)	
	diabetics	16(40.0%)	24(60.0%)	40(100%)	
	arthritis	4(100%)	0(0.0%)	4(100%)	
	cancer	0(0.0%)	4(100%)	4(100%)	
	others	12(75.0%)	4(25.0%)	16(100%)	
None obstructive apnea	none	124(47.7%)	136(52.3%)	260(100%)	0.286
	Yes	16(40.0%)	24(60.0%)	40(100%)	
Blood pressure	no	176(48.9%)	184(51.1%)	360	<0.001
	normal	64(34.8%)	88(47.8%)	32(17.4%)	
	Elevated BP	64(69.6%)	16(17.4%)	8(8.7%)	
	Hypertensive stage 1	12(25.0%)	20(41.7%)	16(33.3%)	
Lunge auscultation	Hypertensive stage 2	24(31.6%)	24(31.6%)	28(36.8%)	0.239
	Normal	4(25%)	4(25%)	4(25%)	
	Wheezing	76(38.8%)	84(42.9%)	36(18.4%)	
	Headaches	36(40.9%)	32(36.4%)	20(22.7%)	
	Coughing	40(45.5%)	28(31.8%)	20(22.7%)	
Blood glucose level	Increasing breathlessness	8(66.7%)	0(0.0%)	4(33.3%)	0.094
	Normal	84(46.7%)	48(26.7%)	44(24.4%)	
	Prediabetes	60(34.9%)	88(51.2%)	24(14.0%)	
	diabetics	20(41.7%)	12(25.0%)	16(33.3%)	
Previous surgery	Neck dissection	4(100.0%)	0(0.0%)	4(100.0%)	0.024*
	maxillofacial	4(33.3%)	8(66.7%)	12(100.0%)	
	others	72(42.9%)	96(57.1%)	168(100.0%)	
	none	112(51.9%)	104(52.0%)	216(100.0%)	

Table 3- SARI score in Airway management condition

Total no.=400		SARI Score		P value
		=<4	>4	
Mouth opening	>4cm	160(50.6%)	156(49.4%)	0.288
	< 4cm	36(42.9%)	48(57.1%)	
Thyromental distance	<6 cm	0(0.0%)	4(100.0%)	<0.001*
	6-6.5 cm	80(80.0%)	20(20.0%)	
	>6.5 cm	188(63.5%)	108(36.5%)	
Neck movement angle	< 80 degree	4(25.0%)	12(75.0%)	<0.039
	80-90 degree	24(42.9%)	32(57.1%)	
	> 90 degree	228(57.0%)	100(43.0%)	
Weight	< 90 KGs	176(51.8%)	164(48.2%)	0.195*
	90-110 KGs	28(50.0%)	28(50.0%)	
	>110 KGs	0(0.0%)	4(100.0%)	
Malamapati	I	164(100.0%)	0.0(0.0%)	<0.001*
	II	124(83.8%)	24(16.2%)	
	III	4(4.8%)	80(95.2%)	
	IV	0.0(0.0%)	4(100.0%)	
Underbite	good extension	204(52.6%)	184(47.4%)	0.189
	Poor extension	4(33.3%)	8(66.7%)	

Table 4- SARI Score in Attempting Intubation

Total no.=400	SARI Score			
	=<4		>4	
	Trying one times	Trying two times	Trying one times	Trying two times
	192(100.0%)	0(0.00%)	84(40.38%)	124(59.62%)

Discussion

COPD is one of the most significant health problems and is the fourth leading cause of death worldwide [15]. These patients are highly susceptible to respiratory diseases such as Covid-19, often requiring respiratory support and the use of an artificial airway in many cases [16]. Additionally, due to the increasing prevalence of COPD, a considerable number of these patients require surgery and anesthesia each year [17].

Furthermore, individuals with COPD are vulnerable to various internal diseases, including cardiovascular diseases, endocrine and metabolic disorders, neuro-psychiatric conditions, and digestive diseases [15]. It emphasizes the importance of assessing airway control in these patients. This study investigated the SARI scores of patients and evaluated the correlation between this test and difficult airway control in COPD patients.

The study's findings revealed that high weight can be one of the factors assessed by the SARI test, which is important for airway control and can make tracheal intubation difficult in these patients. This finding aligns with the results of Bhavana et al. The study also indicates that weight gain can increase neck diameter, decrease thioriented distance, and complicate tracheal intubation [18].

Additionally, weight gain is a condition that can be associated with COPD [19]. Several studies have shown a higher prevalence of obesity in COPD patients compared to non-COPD patients [20]. Furthermore, research suggests that weight gain in COPD patients can lead to mechanical ventilation issues, in addition to intubation problems [19].

Among other factors of SARI, restriction in neck movements is considered a useful guide for identifying difficult intubation, according to research findings. The present study's results suggest that limited neck movement could be a statistically significant factor for diagnosing intubation difficulty in patients, which contradicts Mamta Harjai and her colleagues' research findings. Their research did not identify the limitation in neck movement as an important factor in evaluating difficult airway in patients [21].

However, studies like the one conducted by De Cassai and his colleagues, who focused on patients undergoing thyroid surgery, reported results that support the findings of the present study. They stated that limited neck movement can indeed complicate intubation in patients [22].

According to the results of this research, male gender and old age can also be effective in controlling patients' airways. According to the statistical results, they are considered important factors in the preoperative assessment of patients, especially those with COPD [23]. Previous studies have also investigated the effect of old age and male gender on assessing patients' airways and

have reported results consistent with the present study. Hindman BJ and colleagues found that intubation of male patients requires more force than female patients, which may contribute to the difficulty of intubating men [24].

Another interesting aspect of this study is the correlation between systemic diseases in COPD patients and their SARI score. Given that COPD is associated with many systemic diseases, it would be interesting to consider the impact of these diseases on patients' airway control.

One of the systemic diseases associated with COPD is diabetes, which not only affects the function of many body organs such as the heart, brain, lungs, and kidneys but also increases the risk of COPD [25].

Studies have shown that diabetes can increase the risk of respiratory diseases. In cases where mechanical ventilation is used for a long period, it can delay the patient's spontaneous breathing and lead to respiratory dependence on the device [26].

Conclusion

The present study's results indicate that diabetes may be associated with an increased SARI score and difficult intubation in COPD patients. Additionally, the study found a statistically significant relationship between hypertension and patients' SARI score. This suggests that airway control could be problematic for patients with both hypertension and COPD.

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