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ASSESSMENT OF KNOWLEDGE, ATTITUDES, AND PRACTICES REGARDING CRICOID PRESSURE APPLICATION IN EMERGENCY SURGERIES AMONG ANESTHESIOLOGISTS AT TERTIARY CARE HOSPITALS IN KARACHI

Suraj Kumar[1], Kashif Naeem[2], Mahendar Wanwari[2], Tarique Aziz[2], Adeel ur Rehman[2], Vinod Kumar[3]

[1]Resident, Anesthesia Department, The Indus Hospital And Health Network, Karachi

[2]Consultant Anaesthetist, Anesthesia Department, The Indus Hospital and Health Network, Karachi

[3]Specialist, Anesthesia Department, The Indus Hospital and Health Network, Karachi

Corresponding author: Kashif Naeem, Consultant Anaesthetist, Anesthesia Department, The Indus Hospital and Health Network, Karachi,

Email: drkashif2003@gmail.com, ORCID ID : https://orcid.org/0009-0001-5523-8556

ABSTRACT

Introduction: Cricoid pressure (CP), established by Brian Sellick in 1961, is a method employed to avert regurgitation and aspiration during endotracheal intubation. It is commonly employed in emergency procedures, where the danger of aspiration is increased due to full stomach conditions. Although commonly employed during rapid sequence induction and intubation, the effectiveness and appropriate implementation of CP remain contentious issues

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Objectives: To assess the knowledge, attitudes, practices, and adherence rates of anesthesiologists regarding cricoid pressure application during rapid sequence induction in emergency settings at tertiary care hospitals in Karachi, Sindh, Pakistan.

Method A cross-sectional study was undertaken at The Indus Hospital, Aga Khan Hospital, Civil Hospital, JPMC, LNH, SIUT, Patel Hospital, and Abbasi Shaheed Hospital in Karachi over a six-month period from June 23, 2023, to December 23, 2023. A total of 85 anaesthesiologists were included in the present study. The questionnaire comprises three primary sections: knowledge of cricoid pressure, attitudes, and a final component addressing attitudes.

Results: The mean age of the patients was 30.73 ± 4.59 years. Merely 25% of participants accurately identified the anatomical position of the cricoid cartilage. Approximately 99% recognised that cricoid pressure is utilised to avert stomach aspiration during the induction of anaesthesia. Moreover, around 86% of individuals indicated that they acquired information predominantly through clinical practice.

Conclusion: In conclusion, our findings underscore the necessity for focused educational initiatives, standardised training programs, and continuous professional development to guarantee a uniform and evidence-based application of cricoid pressure in peri-operative care.

Key Words: Cricoid pressure, Naso-gastric tube, Peri-operative care knowledge among Anesthetists

INTRODUCTION

Cricoid pressure (CP) was first articulated by Brain Sellick as an effective technique to safeguard patients from the aspiration of gastric contents during endotracheal intubation. [1]

Consequently, to safely induce anaesthesia in patients classified as having a 'full stomach' and at danger of regurgitation and aspiration, the practice of 'rapid sequence induction'

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(RSI) was implemented [2]. Safe and effective execution of this manoeuvre necessitates training, anatomical understanding, proficiency in the application of cricoid pressure, and awareness of its accompanying complications [3].

The cricoid cartilage exerts pressure on the body of the sixth cervical vertebra, compressing the oesophagus to inhibit passive regurgitation. This method of administering CP cannot halt the ongoing vomiting [3]. It is predominantly utilised during rapid sequence induction (RSI) to avert pulmonary aspiration of gastric and esophageal contents in patients with a full stomach [4].

According to Sellick, before to the induction of anaesthesia, the cricoid cartilage is palpated and gently grasped between the thumb and index finger of the same hand; once anaesthesia induction commences, pressure is applied to the cricoid cartilage using the index finger. Consistent pressure is exerted without compromising the patient's airway until effective endotracheal intubation and cuff inflation are achieved [5].

As initially articulated by Selilick, just before to the intravenous induction of anaesthesia, cricoid pressure is given gently (20 N or 2 kg) by a skilled assistant while the patient remains conscious. Upon the patient's loss of consciousness, the pressure applied to the cricoid cartilage is elevated to 40 N or 4 kg. Cricoid pressure is alleviated upon the confirmation of tracheal intubation.2 Vanner initially calibrated the force to be applied, informed by a cadaver research. He recommended an initial force of 20 N for aware patients and 30 N following the loss of consciousness in subjects. In 1999, he proposed that the initial force be reduced to 10 N in aware subjects and subsequently increased to 30 N as the patient became unconscious [3].

CP was reported by 83.1% of respondents in the UK and 39.4% in the rest of Europe, resulting in an overall reported usage of 49.8%. Anaesthetists utilise CP less frequently (35.6%) compared to physicians from other specialities (63.6%). The predominant rationale for not utilising CP (76.7%) was a perceived deficiency in data supporting its efficacy.

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Over the past two decades, clinicians have scrutinised the efficacy and necessity of cardiopulmonary resuscitation (CPR). Certain clinicians have proposed discontinuing its use since the oesophagus is not precisely located posterior to the cricoid cartilage, and applying pressure to the cricoid cartilage does not consistently occlude the oesophagus. Some have also posited that it complicates tracheal intubation and causes relaxation of the esophageal sphincter [6].

Conversely, one must consider the severe repercussions of regurgitation and pulmonary aspiration, which may include aspiration pneumonitis, lung injury, acute respiratory distress syndrome (ARDS), and potentially mortality within a short duration of critical illness [7]. Notwithstanding the debate around the efficacy and safety of cricoid pressure (CP), it continues to be a standard practice among the majority of anaesthesiologists and is endorsed by the current 2015 Difficult Airway Society (DAS) recommendations during rapid sequence induction. [8]

Inappropriately administered CP may result in airway distortion, complicate intubation, and lead to considerable morbidity [9]. Various assessments undertaken among anaesthesiologists in the UK, USA, and Sweden revealed consistently inadequate theoretical understanding and discrepancies in the execution of this manoeuvre. This survey aimed to evaluate the attitudes, knowledge, and practices about CP application among anaesthesiologists in tertiary care institutions in Karachi, Pakistan.

The study's rationale is that all emergency surgery cases are deemed full stomachs, posing a risk of regurgitation and aspiration during induction. Consequently, the application of cricoid pressure during rapid sequence induction and intubation is a standard practice in anaesthesiology to mitigate these risks. The results of this study will enable us to ascertain the attitudes, practices, trends, and training patterns in this regard. We may provide a program to educate anaesthesiologists on the advantages of proper CP application.

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METHODS

This cross-sectional study was conducted using a non-probability convenient sampling method to assess anesthesiologists' knowledge and attitudes regarding cricoid pressure. The sample size was determined through Openepi software based on an 8% precision, a 95% confidence interval, and an estimated knowledge percentage of 83%. The required sample size was 85. The study was conducted at several tertiary care hospitals in Karachi, including The Indus Hospital, Aga Khan University Hospital, Civil Hospital, JPMC, Liaquat National Hospital, SIUT, Patel Hospital, and Abbasi Shaheed Hospital, over a period of six months, from June 23, 2023, to December 23, 2023.

The inclusion criteria for participation were as follows: anesthesiologists with a minimum of two years of experience, including consultants, specialists, and FCPS residents in anesthesiology, working at a tertiary care hospital, aged between 23 and 75 years, and those willing to participate. Exclusion criteria included MCPS residents and anesthesiologists working in primary or secondary care hospitals, as well as individuals who chose not to participate.

Prior to conducting the survey, approval was obtained from the chairperson of CPSP and the department of anesthesia at each participating hospital. The study targeted anesthesiologists practicing at the selected tertiary care hospitals in Karachi. The survey questionnaire consisted of three sections: Section A (questions A1 to A7) assessed knowledge of cricoid pressure, Section B (questions B1 to B7) evaluated attitudes, and Section C (questions C1 to C6) focused on behavior. The principal investigator or a team member met with eligible anesthesiologists to explain the purpose of the research, and those who provided informed consent were given the questionnaire to complete. Data was analyzed using SPSS version 26.0. Descriptive statistics, such as mean (SD) or median (IQR), were calculated for continuous variables like age, years of experience, and the number of emergency procedures, depending on the data distribution, which was tested using the Shapiro-Wilk test for normality. Frequency and percentage were

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computed for categorical variables such as gender, designation (specialist, consultant, resident), hospital type, and knowledge of cricoid pressure. Stratification was used to control for effect modifiers such as age group, gender, and hospital type, and post- stratification chi-square tests were applied. A p-value of <0.05 was considered statistically significant.

RESULTS

A total of 85 anesthesiology were included in this study. Age distribution of the patients is shown in figure 1. The average age of the patients was 30.73±4.59 years. Mean experience of anesthesiologist and number of emergency procedure were also reported in table 1. There were 61(71.76%) male and 24(28.24%) female (figure 2). Almost 52% of the participant were consultant and 48% were resident (figure 3). Out of 85 anesthesiologist, 56.47% were from public sector and 43.53% from private (figure 3).

Assessment of the peri-operative care knowledge among Anesthetists about proper applications of Cricoid pressure is shown in table 2. The correct anatomic position of cricoid cartilage was identified by 25%. Almost 99% of the participants replied cricoid pressure is applied to prevent aspiration of stomach contents during induction of anesthesia.

The correct response for force applied on the cricoid cartilage during rapid sequence induction in an awake and anesthetized patient was 86.9%. Thirty six percent of the respondents believed release the force and suction the patient's pharynx while 31.8% believed Decrease the force and suction the pharynx if a patient vomits. Similar almost 44% of the respondents believed maintain the same force and suction the patients' pharynx and about 32% believed to increase the force and suction the patient's pharynx if a patient

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regurgitates. 82% of the participants be replied releasing cricoid pressure after confirmation the position of endotracheal tube.

Regarding the attitude, there were 77.6% anesthesiologist used cricoid pressure in emergency surgeries. 70% of them used number of cricoid pressure below 50 times. Almost 86% participates learn by clinical practice or student attachment. Most the anesthesiologist (84%) responded released cricoid pressure after confirmation the position of endotracheal tube.

Majority, 86%, of the respondents do not mask ventilate during rapid sequence induction and they do aspirate the naso-gastric tube if present. Half, 42%, of the respondents have witnessed regurgitation during application of cricoid pressure and 93% do not remove the naso-gastric tube before rapid sequence induction. Fifty four percent had experienced difficulty of endotracheal intubation during application of cricoid pressure.

Stratification analysis was performed according to age, gender, designation of anesthesiologists (specialist, consultant, and resident), hospital type and difference in knowledge, attitude and practice among Anesthetists about proper applications of Cricoid pressure was not statistically significant as reported in table 5

Figure 1: Age distribution of the participants

n=85

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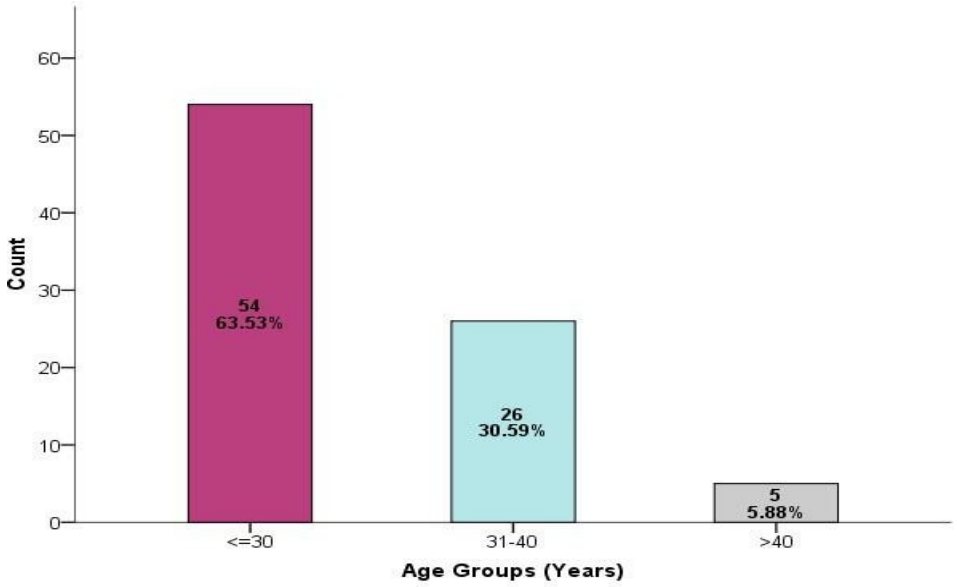

Table 1: Demographic characteristics of the participants

Variables	**Mean**	**SD**	**Median**	**IQR**
Age (in years)	30.73	4.59	29	4
Years of experience (Years)	5.02	3.11	5	4
Numbers of emergency of procedures (Years)	5.77	4.12	5	4

Figure 2: Gender distribution of the participants

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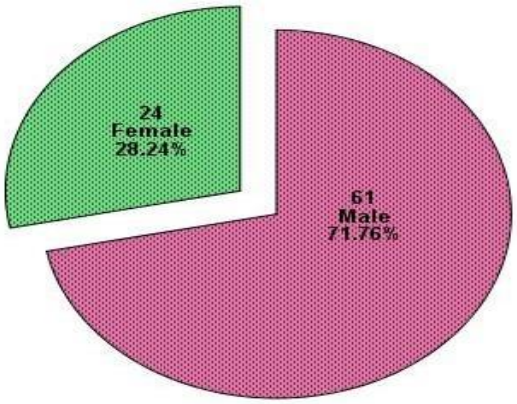

n=85

Figure 3: Designation of anesthesiologist n=85

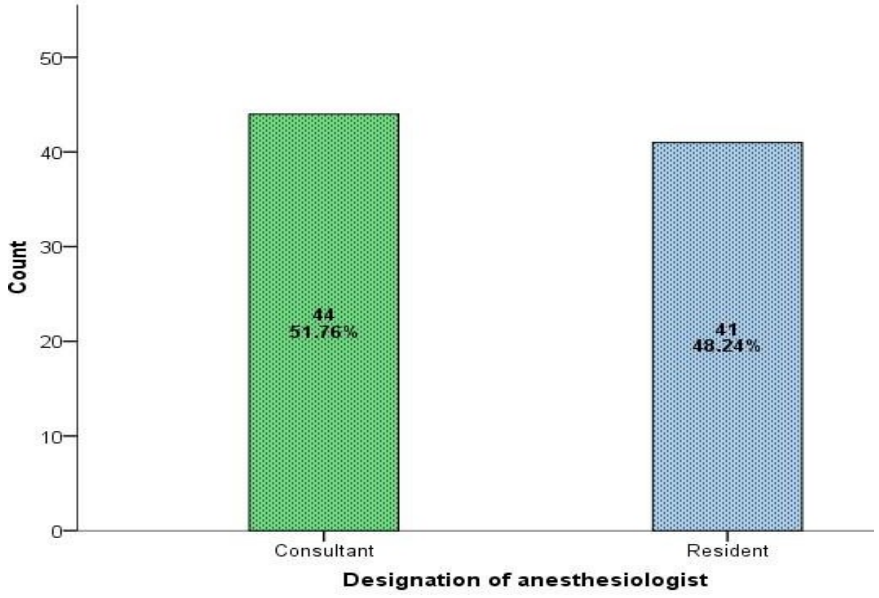

Figure 4: Type of Hospital n=85

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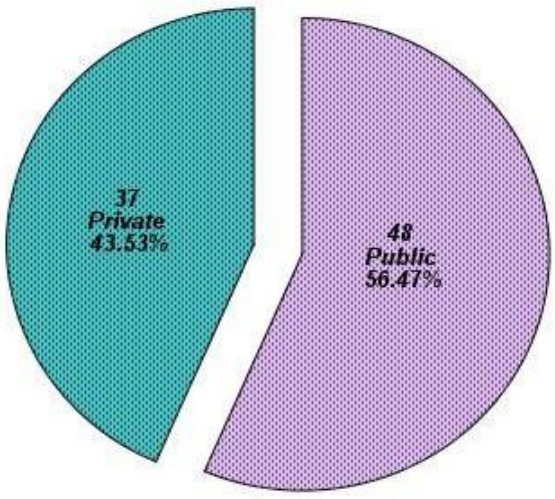

Table 2: Assessment of the peri-operative care knowledge among Anesthetists about proper applications of Cricoid pressure in RSI

Peri-operative care Knowledge on cricoid pressure		**n**	**%**
Where does cricoid cartilage lie?	In front of the thyroid cartilage	59	69.4%
	Behind the thyroid cartilage	3	3.5%
	Below the thyroid cartilage	21	24.7%
	Behind the esophagus	2	2.42%
Why cricoid pressure is used?	Prevent aspiration of stomach contents during induction of an anesthesia	84	98.8%
	Prevent patient breathing during induction	1	1.2%
	Prevent vomiting during induction	0	.0%

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	Prevent gastric gas insufflation during bag mask ventilation	0	.0%
The correct cricoid pressure in awake patient is?	Do not know	6	7.1%
	10 N	73	85.9%
	20 N	3	3.5%
	30 N	3	3.5%
	50 N	0	.0%
The correct cricoid pressure in anesthetized patient is?	Do not know	2	2.4%
	10 N	7	8.2%
	20 N	19	22.4%
	30 N	53	62.4%
	50 N	4	4.7%
What is correct measure if a patient vomits during cricoid pressure application?	Maintain the same force and suction the patients pharynx	12	14.1%
	Increase the force and suction the patients pharynx	15	17.6%
	Decrease the force and suction the pharynx	27	31.8%
	Release the force and suction the patients pharynx	31	36.5%
	Maintain the same force and suction the patients pharynx	37	43.5%

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What is correct measure if a patient regurgitate during cricoid pressure application?	Increase the force and suction the patients pharynx	27	31.8%
	Decrease the force and suction the pharynx	7	8.2%
	Release the force and suction the patients pharynx	14	16.5%
When to release cricoid pressure?	After intubation	7	8.2%
	After the inflation of cuff	8	9.4%
	After confirmation the position of endotracheal tube	70	82.4%
	I do not know	0	.0%

Table 3: Assessments of the peri-operative care attitude among Anesthetists about proper applications of Cricoid pressure

Peri-operative care attitude		Count	%
Do you use cricoid pressure in emergency surgeries?	No	2	2.4%
	Yes	28	32.9%
	Always	38	44.7%
	Sometimes	16	18.8%
	Not Applicable	1	1.2%
Number of cricoid pressure?	< 50 times	59	69.4%
	>50 times	26	30.6%

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How did you learn to apply cricoid pressure?	on a patient during clinical practice or student attachment	73	85.9%
	By reading only	4	4.7%
	By practicing on a model or manikin	7	8.2%
	I have never been taught about it	1	1.2%
What is correct measure if a patient regurgitate during cricoid pressure application?	Maintain the same force and suction the patients pharynx	27	31.8%
	Increase the force and suction the patients pharynx	26	30.6%
	Decrease the force and suction the pharynx	19	22.4%
	Release the force and suction the patients pharynx	13	15.3%
When to release cricoid pressure?	After intubation	6	7.1%
	After the inflation of cuff	7	8.2%
	After confirmation the position of endotracheal tube	71	83.5%

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	I do not know	1	1.2%

Table 4: Assessments of the peri-operative care practices among Anesthetists about proper applications of Cricoid pressure

Peri-operative care practices		**Count**	**%**
Do you routinely mask ventilate during rapid sequence induction?	No	73	85.9%
	Yes	12	14.1%
Do you aspirate NGT before rapid sequence induction?	No	11	12.9%
	Yes	74	87.1%
Do you remove NGT before rapid sequence induction?	No	79	92.9%
	Yes	6	7.1%
Have you witnessed regurgitation during application of cricoid pressure?	No	50	58.8%
	Yes	35	41.2%
Have you experienced difficulty to intubate during application of cricoid pressure?	No	39	45.9%
	Yes	46	54.1%
Who applies cricoid pressure when you intubate?	Anesthetists	9	10.6%
	Anesthesia assistant	74	87.1%
	Nurses	2	2.4%
	Others	0	.0%

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Table 5: Assessment of the peri-operative care knowledge/attitude and practice among Anesthetists about proper applications of Cricoid pressure in RSI by age groups/gender/ Designation of anesthesiologist / HOSPITAL TYPE

Peri-operative care knowledge		**Age Groups**				P-Value
		≤30		**>30**		
		Count	%	Count	%	
Where does cricoid cartilage lie?	In front of the thyroid cartilage	38	70.4%	21	67.7%	0.602
	Behind the thyroid cartilage	1	1.9%	2	6.5%	
	Below the thyroid cartilage	14	25.9%	7	22.6%	
	Behind the esophagus	1	1.9%	1	3.2%	
Why cricoid pressure is used?	Prevent aspiration of stomach contents during induction of an anesthesia	53	98.1%	31	100.0%	0.446
	Prevent patient breathing during induction	1	1.9%	0	.0%	

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	Prevent vomiting during induction	0	.0%	0	.0%	
	gastric gas insufflation during bag mask ventilation	0	.0%	0	.0%	
The correct cricoid	Do not know	3	5.6%	3	9.7%	0.398
	10 N	47	87.0%	26	83.9%	
Pressure in awake patient is?	20 N	1	1.9%	2	6.5%	
	30 N	3	5.6%	0	.0%	
	50 N	0	.0%	0	.0%	
The correct cricoid pressure in anesthetized patient is?	Do not know	2	3.7%	0	.0%	0.475
	10 N	5	9.3%	2	6.5%	
	20 N	11	20.4%	8	25.8%	
	30 N	32	59.3%	21	67.7%	
	50 N	4	7.4%	0	.0%	
What is correct measure if a patient vomits during cricoid	Maintain the same force and suction the patients pharynx	7	13.0%	5	16.1%	0.765

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pressure application?	Increase the force and suction the patients pharynx	10	18.5%	5	16.1%	
	Decrease the force suction and pharynx the	19	35.2%	8	25.8%	
	Release the force and suction the patients pharynx	18	33.3%	13	41.9%	
What is correct measure if a patient regurgitate during cricoid pressure application?	Maintain the same force and suction the patients pharynx	26	48.1%	11	35.5%	0.174
	Increase the force and suction the patients pharynx	13	24.1%	14	45.2%	
	Decrease the force and suction the pharynx	4	7.4%	3	9.7%	
	Release the force and suction the	11	20.4%	3	9.7%	

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	patients pharynx					
When to release cricoid pressure?	After intubation	6	11.1%	1	3.2%	0.344
	After the inflation of cuff	4	7.4%	4	12.9%	
	After confirmation the position of endotracheal tube	44	81.5%	26	83.9%	
	I do not know	0	.0%	0	.0%	

Perioerperative attitude and practice		Age Groups				P-Value
		≤3		>30		
		Count	%	Count	%	
Do you use cricoid pressure in emergency surgeries?	No	1	1.9%	1	3.2%	0.408
	Yes	15	27.8%	13	41.9%	
	Always	28	51.9%	10	32.3%	
	Sometimes	9	16.7%	7	22.6%	
	Not Applicable	1	1.9%	0	.0%	
Number of cricoid pressure?	< 50 times	44	81.5%	15	48.4%	0.001
	>50 times	10	18.5%	16	51.6%	

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How did you learn to apply cricoid pressure?	Shown on a patient during clinical practice or student attachment	48	88.9%	25	80.6%	0.505
	By reading only	2	3.7%	2	6.5%	
	By practicing on a model or manikin	4	7.4%	3	9.7%	
	I have never been taught about it	0	.0%	1	3.2%	
What is correct measure if a patient tate during cricoid pressure application?	Maintain the same force and suction the patients pharynx	14	25.9%	13	41.9%	0.014
	Increase the force and suction the patients pharynx	14	25.9%	12	38.7%	
	Decrease the force and suction	18	33.3%	1	3.2%	

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	the pharynx					
	Release the force and suction the patients pharynx	8	14.8%	5	16.1%	
When to release cricoid pressure?	After intubation	5	9.3%	1	3.2%	0.410
	After the inflation of cuff	3	5.6%	4	12.9%	
	After confirmation the position of endotracheal tube	45	83.3%	26	83.9%	
	I do not know	1	1.9%	0	.0%	
Do you routinely mask ventilate during rapid sequence induction?	No	47	87.0%	26	83.9%	0.687
	Yes	7	13.0%	5	16.1%	
Do you aspirate	No	6	11.1%	4	13.3%	0.763
	Yes	48	88.9%	26	86.7%	

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NGT before rapid sequence induction?						
Do you remove NGT before rapid sequence induction?	No	50	94.3%	28	90.3%	0.490
	Yes	3	5.7%	3	9.7%	
Have you witnessed regurgitation during application of cricoid pressure?	No	39	73.6%	10	32.3%	0.0005
	Yes	14	26.4%	21	67.7%	
Have you experienced difficulty to intubate during application of cricoid pressure?	No	23	42.6%	16	51.6%	0.422
	Yes	31	57.4%	15	48.4%	
Who applies cricoid pressure when you intubate?	Anesthetists	6	11.1%	3	9.7%	0.907
	Anesthesia assistant	47	87.0%	27	87.1%	
	Nurses	1	1.9%	1	3.2%	
	Others	0	.0%	0	.0%	

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Peri-operative care knowledge		**Gender**				P-Value
		Male		**Female**		
		Count	**%**	**Count**	**%**	
does Where cricoid cartilage lie?	In front of the thyroid cartilage	42	70.0%	17	70.8%	0.429
	Behind the thyroid cartilage	1	1.7%	2	8.3%	
	Below the thyroid cartilage	16	26.7%	5	20.8%	
	Behind the esophagus	1	1.7%	0	.0%	
cricoid is Why pressure used?	Prevent aspiration of stomach contents during induction of an anesthesia	61	100.0%	23	95.8%	0.109
	Prevent patient breathing durin	0	.0%	1	4.2%	

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g induction				
Prevent vomiting during induction	0	.0%	0	.0%

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	Prevent gastric gas insufflation during bag mask ventilation	0	.0%	0	.0%	
correct The cricoid[nt] pressure in awake patie is?	Do not know	5	8.3%	0	.0%	0.315
	10 N	50	83.3 %	23	95.8%	
	20 N	2	3.3%	1	4.2%	
	30 N	3	5.0%	0	.0%	
	50 N	0	.0%	0	.0%	
	Do not know	1	1.7%	0	.0%	

The correct cricoid pressure i n anesthetized patien t is?	10 N	4	6.7%	3	12.5%	0.856
	20 N	13	21.7 %	6	25.0%	
	30 N	39	65.0 %	14	58.3%	
	50 N	3	5.0%	1	4.2%	
	Maintain samethe					

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What is correct measure if a patient vomits during	force and the suction patients pharynx	7	11.5 %	5	20.8%	0.608

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cricoid pressure application?	Increase force the suction and patients the pharynx	10	16.4 %	5	20.8%	
	Decrease force the suction and pharynx the	21	34.4 %	6	25.0%	
	Release the force suction nd patients the pharynx	23	37.7 %	8	33.3%	
What is correct measure if a patient regurgitate durin g cricoid pressure application?	Maintain same the force suctionand patients the pharynx	29	47.5 %	8	33.3%	0.597
	Increase force the suction and patients the pharynx	18	29.5 %	9	37.5%	
	Decrease force the suction and pharynx the	4	6.6%	3	12.5%	
	Release the force suction nd patients the	10	16.4 %	4	16.7%	

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	pharynx					

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When to release cricoid pressure?	After intubation	6	9.8%	1	4.2%	0.368
	After the inflation of cuff	7	11.5 %	1	4.2%	
	After confirmation the position of endotracheal tube	48	78.7 %	22	91.7%	
	I do not know	0	.0%	0	.0%	

Peri-operative care attitude and practices		Gender				P-Value
		Male		Female		
		Count	%	Count	%	
Do you use cricoid pressure in emergency surgeries?	No	2	3.3%	0	.0%	0.303
	Yes	21	34.4%	7	29.2%	
	Always	25	41.0%	13	54.2%	
	Sometimes	13	21.3%	3	12.5%	
	Not Applicable	0	.0%	1	4.2%	
r of cricoid pressure?	< 50 times	42	68.9%	17	70.8%	0.858
	>50 times	19	31.1%	7	29.2%	
How did you learn to apply cricoid pressure?	Shown on a patient during clinical practice or student attachment	53	86.9%	20	83.3%	0.758

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	By reading only	3	4.9%	1	4.2%	

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	By practicing on a model or manikin	4	6.6%	3	12.5%	
	I have never been taught about it	1	1.6%	0	.0%	
What is correct measure if a patient regurgitate during cricoid pressure application?	Maintain the same force and suction the patients pharynx	14	23.0%	13	54.2%	0.025
	Increase the force and suction the patients pharynx	19	31.1%	7	29.2%	
	Decrease the force and suction the pharynx	17	27.9%	2	8.3%	
	Release theforce and suction the patients pharynx	11	18.0%	2	8.3%	
When to release cricoid pressure?	After intubation	5	8.2%	1	4.2%	0.299
	After the inflation of cuff	6	9.8%	1	4.2%	
	After confirmation the position of endotracheal tube	50	82.0%	21	87.5%	
	I do not know	0	.0%	1	4.2%	
Do you routinely mask ventilate during	No	50	82.0%	23	95.8%	
	Yes	11	18.0%	1	4.2%	0.098

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rapid sequence induction?						
Do you aspirate NGT before rapid sequence induction?	No	9	14.8%	1	4.3%	0.189
	Yes	52	85.2%	22	95.7%	
Do you remove NGT before rapid sequence induction?	No	56	93.3%	22	91.7%	0.789
	Yes	4	6.7%	2	8.3%	
Have you witnessed regurgitation during application of cricoid pressure?	No	39	65.0%	10	41.7%	0.050
	Yes	21	35.0%	14	58.3%	
Have you experienced difficulty to intubate during application of cricoid pressure?	No	26	42.6%	13	54.2%	0.336
	Yes	35	57.4%	11	45.8%	
Who applies cricoid pressure when you intubate?	Anesthetists	5	8.2%	4	16.7%	0.033
	Anesthesia assistant	56	91.8%	18	75.0%	
	Nurses	0	.0%	2	8.3%	
	Others	0	.0%	0	.0%	

	Designation of anesthesiologist	

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Peri-operative care knowledge	Consultant	Resident	P-Value

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		Count	%	Count	%	
Where does cricoid cartilage lie?	In front of the thyroid cartilage	28	65.1 %	31	75.6 %	0.452
	Behind the thyroid cartilage	2	4.7%	1	2.4 %	
	Below the thyroid cartilage	13	30.2 %	8	19.5 %	
	Behind the esophagus	0	.0%	1	2.4 %	
Why cri coid pressure is used?	Prevent aspiration of stomach contents during induction of an anesthesia	44	100.0 %	40	97.6 %	0.297
	Prevent patient breathing during induction	0	.0%	1	2.4 %	
	Prevent vomiting during induction	0	.0%	0	.0%	
	Prevent gastric gas insufflation during bag mask ventilation	0	.0%	0	.0%	

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The correct cricoid pressure in awake patient is?	Do not know	1	2.3%	4	9.8 %	0.467
	10 N	38	88.4 %	35	85.4 %	
	20 N	2	4.7%	1	2.4 %	
	30 N	2	4.7%	1	2.4 %	
	50 N	0	.0%	0	.0%	
The correct cricoid pressure in anesthetized patient is?	Do not know	1	2.3%	0	.0%	0.147
	10 N	1	2.3%	6	15.0 %	
	20 N	11	25.0 %	8	20.0 %	
	30 N	30	68.2 %	23	57.5 %	
	50 N	1	2.3%	3	7.5 %	
What is correct measure if a patient vomits during cricoid pressure application?	Maintain the same force and suction the patients pharynx	6	13.6 %	6	14.6 %	0.026
	Increase the force and suction the patients pharynx	3	6.8%	12	29.3 %	

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	Decrease the force and suction the pharynx	14	31.8 %	13	31.7 %	
	Release the force and suction the patients pharynx	21	47.7 %	10	24.4 %	
What is correct measure if a patient regurgitate during cricoid pressure application?	Maintain the same force and suction the patients pharynx	18	40.9 %	19	46.3 %	0.472
	Increase the force and suction the patients pharynx	14	31.8 %	13	31.7 %	
	Decrease the force and suction the pharynx	3	6.8%	4	9.8 %	
	Release the force and suction the patients pharynx	9	20.5 %	5	12.2 %	
When to release cricoid pressure?	After intubation	0	.0%	7	17.1 %	0.016
	After the inflation of cuff	5	11.4 %	3	7.3 %	

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	After confirmation the position of	39	88.6 %	31	75.6 %	
	endotracheal tube					
	I do not know	0	.0%	0	.0%	

peri-operative care attitude and practices		Designation of anesthesiologist				P-Value
		Consultant		Resident		
		Count	%	Count	%	
Do you use cricoid pressure in emergency surgeries?	No	0	.0%	2	4.9%	0.129
	Yes	18	40.9%	10	24.4%	
	Always	16	36.4%	22	53.7%	
	Sometimes	10	22.7%	6	14.6%	
	Not Applicable	0	.0%	1	2.4%	
Number of cricoid pressure?	< 50 times	24	54.5%	35	85.4%	0.002
	>50 times	20	45.5%	6	14.6%	
How did you learn to apply cricoid pressure?	Shown on a patient during clinical practice or	40	90.9%	33	80.5%	0.162

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	student attachment					
	By reading only	2	4.5%	2	4.9%	
	By practicing on a model or manikin	1	2.3%	6	14.6%	
	I have never been taught about it	1	2.3%	0	.0%	
What is correct measure if a patient regurgitate during cricoid pressure application?	Maintain the same force and suction the patients pharynx	17	38.6%	10	24.4%	0.034
	Increase the force and suction the patients pharynx	11	25.0%	15	36.6%	

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	Decrease the force and suction the pharynx	6	13.6%	13	31.7%	
	Release the force and suction the patients pharynx	10	22.7%	3	7.3%	
When to release cricoid pressure?	After intubation	0	.0%	6	14.6%	0.031
	After the inflation of cuff	5	11.4%	2	4.9%	
	After confirmation the position of endotracheal tube	39	88.6%	32	78.0%	
	I do not know	0	.0%	1	2.4%	
Do you routinely mask ventilate during rapid	No	39	88.6%	34	82.9%	0.450
	Yes	5	11.4%	7	17.1%	

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sequence induction?						
Do you aspirate NGT before rapid sequence induction?	No	6	14.0%	4	9.8%	0.553
	Yes	37	86.0%	37	90.2%	
Do you remove NGT before rapid sequence induction?	No	41	93.2%	37	92.5%	0.904
	Yes	3	6.8%	3	7.5%	
Have you witnessed regurgitation during application of cricoid pressure?	No	16	36.4%	33	82.5%	0.0005
	Yes	28	63.6%	7	17.5%	
Have you experienced difficulty to intubate during application of cricoid pressure?	No	20	45.5%	19	46.3%	0.935
	Yes	24	54.5%	22	53.7%	
Who applies cricoid pressure	Anesthetists	6	13.6%	3	7.3%	0.639
	Anesthesia assistant	37	84.1%	37	90.2%	

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when you intubate?	Nurses	1	2.3%	1	2.4%	
	Others	0	.0%	0	.0%	

Peri-operative care attitude and practices		Hospital type				P-Value
		Public		Private		
		Count	%	Count	%	
Where does cricoid cartilage lie?	In front of the thyroid cartilage	33	68.8%	26	72.2%	0.643
	Behind the thyroid cartilage	1	2.1%	2	5.6%	
	Below the thyroid cartilage	13	27.1%	8	22.2%	
	Behind the esophagus	1	2.1%	0	.0%	
Why cricoid pressure is used?	Prevent aspiration of stomach contents during induction of an	47	97.9%	37	100.0%	

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	anesthesia					0.377
	Prevent patien t breathing during induction	1	2.1%	0	.0%	
	Prevent vomiting during induction	0	.0%	0	.0%	

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	Prevent gastric gas insufflation during bag mask ventilation	0	.0%	0	.0%	
The correct cricoid in pressure awake patient is?	Do not know	3	6.3%	2	5.6%	0.393
	10 N	41	85.4%	32	88.9%	
	20 N	3	6.3%	0	.0%	
	30 N	1	2.1%	2	5.6%	
	50 N	0	.0%	0	.0%	
	Do not know	1	2.1%	0	.0%	0.688
The correct cricoid pressure in anesthetized patient is?	10 N	3	6.3%	4	11.1%	
	20 N	12	25.0%	7	19.4%	
	30 N	29	60.4%	24	66.7%	
	50 N	3	6.3%	1	2.8%	
What is correct measure if a patient vomits during cricoid pressure application?	Maintain the same forcethe and suction patients pharynx	8	16.7%	4	10.8%	
	Increase force the suction and the	8	16.7%	7	18.9%	

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						0.813

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	patients pharynx					
	Decrease the force suction nd pharynx the	16	33.3%	11	29.7%	
	Release the force and suction the patients pharynx	16	33.3%	15	40.5%	
What is correct measure if a patient regurgitate during cricoid pressure application?	Maintain the same forceand suction the patients pharynx	21	43.8%	16	43.2%	
	Increase force the suction and patients the pharynx	13	27.1%	14	37.8%	
	Decrease the force suctionand pharynx the	4	8.3%	3	8.1%	
	Release the force and					

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						0.565

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	suction the patients pharynx	10	20.8%	4	10.8%	
	After intubation	4	8.3%	3	8.1%	0.934
When to releas e cricoid pressure?	After th e inflation of cuff	5	10.4%	3	8.1%	
	After confirmation the position of endotracheal tube	39	81.3%	31	83.8%	
	I do not know	0	.0%	0	.0%	

Peri-operative care attitude and practices		Hospital type				P-Value
		Public		Private		
		Count	%	Count	%	
Do you use cricoid pressure in emergency surgeries?	No	1	2.1%	1	2.7%	0.442
	Yes	14	29.2%	14	37.8%	
	Always	20	41.7%	18	48.6%	
	Sometimes	12	25.0%	4	10.8%	
	Not Applicable	1	2.1%	0	.0%	
Number of cricoid pressure?	< 50 times	40	83.3%	19	51.4%	0.002
	>50 times	8	16.7%	18	48.6%	
How did you learn to apply cricoid pressure?	Shown on a patient during clinical practice or	42	87.5%	31	83.8%	0.705

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	student attachment					
	By reading only	2	4.2%	2	5.4%	
	By practicing on a model or manikin	3	6.3%	4	10.8%	
	I have never been taught about it	1	2.1%	0	.0%	
What is correct measure if a patient regurgitate during cricoid pressure application?	Maintain the same force and suction the patients pharynx	14	29.2%	13	35.1%	0.694
	Increase the force and suction the patients pharynx	14	29.2%	12	32.4%	
	Decrease the force and suction the pharynx	13	27.1%	6	16.2%	
	Release the force and suction the patients pharynx	7	14.6%	6	16.2%	
When to release cricoid pressure?	After intubation	4	8.3%	2	5.4%	0.778
	After the inflation of cuff	4	8.3%	3	8.1%	

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	After confirmation the position of endotracheal tube	39	81.3%	32	86.5%	
	I do not know	1	2.1%	0	.0%	
Do you routinely mask ventilate during rapid sequence induction?	No	40	83.3%	33	89.2%	0.442
	Yes	8	16.7%	4	10.8%	
Do you aspirate NGT before rapid sequence induction?	No	6	12.8%	4	10.8%	0.784
	Yes	41	87.2%	33	89.2%	
Do you remove NGT before rapid sequence induction?	No	45	95.7%	33	89.2%	0.247
	Yes	2	4.3%	4	10.8%	
Have you witnessed regurgitation during application of cricoid pressure?	No	31	66.0%	18	48.6%	0.110
	Yes	16	34.0%	19	51.4%	
Have you experienced difficulty to intubate during application of cricoid pressure?	No	17	35.4%	22	59.5%	0.027
	Yes	31	64.6%	15	40.5%	
Who applies cricoid pressure when you intubate?	Anesthetists	3	6.3%	6	16.2%	0.167
	Anesthesia assistant	43	89.6%	31	83.8%	
	Nurses	2	4.2%	0	.0%	
	Others	0	.0%	0	.0%	

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Peri-operative care knowledge		Years of Experience				P-Value
		<=5		>5		
		Count	%	Count	%	
Where does cricoid cartilage lie?	In front of the thyroid cartilage	46	79.3%	13	50.0%	0.030
	Behind the thyroid cartilage	1	1.7%	2	7.7%	
	Below the thyroid cartilage	10	17.2%	11	42.3%	
	Behind the esophagus	1	1.7%	0	.0%	
	Prevent aspiration of stomach contents during induction of an anesthesia	57	98.3%	27	100.0%	
	Prevent patient breathing during induction	1	1.7%	0	.0%	
	Prevent vomiting during induction	0	.0%	0	.0%	
	Prevent gastric gas insufflation					

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Why cricoid pressure is used?						0.493

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	during bag mask ventilation	0	.0%	0	.0%	
The correct cricoid pressure in awake patient is?	Do not know	4	6.9%	1	3.8%	0.259
	10 N	52	89.7%	21	80.8%	
	20 N	1	1.7%	2	7.7%	
	30 N	1	1.7%	2	7.7%	
	50 N	0	.0%	0	.0%	
	Do not know	1	1.8%	0	.0%	0.761
The correct cricoid pressure in anesthetized patient is?	10 N	6	10.5%	1	3.7%	
	20 N	12	21.1%	7	25.9%	
	30 N	35	61.4%	18	66.7%	
	50 N	3	5.3%	1	3.7%	
What is correct if measure a patient duringvomits pressure cricoid application?	Maintain the same forcethe and suction patients pharynx	8	13.8%	4	14.8%	
	Increase force the suction and patients the pharynx	13	22.4%	2	7.4%	

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						0.148

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	Decrease the force suctionand pharynx the	20	34.5%	7	25.9%	
	Release force the suction and patients the pharynx	17	29.3%	14	51.9%	
What is correct measure if a patient regurgitate during cricoid pressure application?	Maintain the same forceand suction the patients pharynx	28	48.3%	9	33.3%	0.368
	Increase force the suction and patients the pharynx	18	31.0%	9	33.3%	
	Decrease the force suctionand pharynx the	5	8.6%	2	7.4%	
	Release force the and suction the patients pharynx	7	12.1%	7	25.9%	

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	After intubation	7	12.1%	0	.0%	0.034

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When to release cricoid pressure?	After the inflation of cuff	3	5.2%	5	18.5%	
	After confirmation the position of endotracheal tube	48	82.8%	22	81.5%	
	I do not know	0	.0%	0	.0%	

Peri-operative care attitude and practices		Years of Experience				p-Value
		<=5		>5		
		Count	%	Count	%	
Do you use cricoid pressure in emergency surgeries?	No	2	3.4%	0	.0%	0.079
	Yes	15	25.9%	13	48.1%	
	Always	31	53.4%	7	25.9%	
	Sometimes	9	15.5%	7	25.9%	
	Not Applicable	1	1.7%	0	.0%	
r of cricoid pressure?	< 50 times	51	87.9%	8	29.6%	0.0005
	>50 times	7	12.1%	19	70.4%	
How did you learn to apply	Shown on a patient during clinical practice or student attachment	49	84.5%	24	88.9%	
	By reading only	3	5.2%	1	3.7%	

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cricoid pressure?	By practicing on a model or manikin	6	10.3%	1	3.7%	0.353

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	I have never been taught about it	0	.0%	1	3.7%	
What is correct measure if a patient regurgitate during cricoid pressure application?	Maintain the same forceand suction the patients pharynx	16	27.6%	11	40.7%	0.0005
	Increase force the suction and patients the pharynx	19	32.8%	7	25.9%	
	Decrease the force and suction the pharynx	19	32.8%	0	.0%	
	Release the force and suction the patients pharynx	4	6.9%	9	33.3%	
	After intubation	6	10.3%	0	.0%	

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When to release cricoid pressure?	After the inflation of cuff	2	3.4%	5	18.5%	0.039
	After confirmation the position of endotracheal tube	49	84.5%	22	81.5%	

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	I do not know	1	1.7%	0	.0%	
Do you routinely mask ventilate during rapid sequence induction?	No	49	84.5%	24	88.9%	0.587
	Yes	9	15.5%	3	11.1%	
Do you aspirate NGT before rapid sequence induction?	No	4	7.0%	6	22.2%	0.044
	Yes	53	93.0%	21	77.8%	
Do you remove NGT before rapid sequence induction?	No	54	94.7%	24	88.9%	0.331
	Yes	3	5.3%	3	11.1%	
Have you witnessed regurgitation during application of cricoid pressure?	No	40	70.2%	9	33.3%	0.001
	Yes	17	29.8%	18	66.7%	
Have you experienced difficulty to intubate during application of cricoid pressure?	No	26	44.8%	13	48.1%	0.775
	Yes	32	55.2%	14	51.9%	
Who applies cricoid pressure when you intubate?	Anesthetists	5	8.6%	4	14.8%	0.446
	Anesthesia assistant	51	87.9%	23	85.2%	
	Nurses	2	3.4%	0	.0%	
	Others	0	.0%	0	.0%	

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DISCUSSION

Various surveys pertaining to the CP application have been conducted in diverse regions globally. In 2007, Krishnan BS et al. performed a survey of 360 anaesthesiologists in

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India, revealing a consistent deficiency in knowledge among the majority of participants and significant variability in practice patterns.10

The findings indicated that, regardless of years of experience, there was a clear necessity for enhancement in the formal instruction of anaesthesia skills, such as CP application. A 2009 assessment of emergency department personnel at large teaching hospitals in the USA revealed a general deficiency in theoretical understanding among the staff, potentially resulting in inadequate use of cardiopulmonary resuscitation (CPR).[11] Our survey revealed same findings regarding inadequate knowledge and disparate behaviours among anaesthesiologists with diverse levels of expertise. This survey aimed to assess the knowledge, attitudes, and practices regarding the administration of cricoid pressure during rapid sequence intubation in tertiary care institutions in Karachi. In our country, only a limited number of educational institutions provide models for practicing cricoid pressure application to demonstrate the appropriate forces, and these centres do not do practical assessments of anaesthetists' proficiency in CP. The evaluation of anaesthetists' knowledge concerning the appropriate implementation of cricoid pressure in peri- operative care reveals significant insights and opportunities for enhancement. The study uncovers a combination of correct and erroneous beliefs among participants, illuminating contemporary procedures and attitudes within the medical community.

In our study, a notable finding is that nearly 99% of participants accurately recognised the principal function of cricoid pressure as the prevention of aspiration of gastric contents during anaesthesia induction. This elevated awareness signifies a broad comprehension of the purpose of cricoid pressure in reducing the danger of aspiration during specific medical procedures. Nonetheless, the findings also underscore specific deficiencies in understanding. In our study, hardly 25% of participants were able to reliably identify the precise anatomical position of the cricoid cartilage. This information is essential for the

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accurate implementation of cricoid pressure, and the comparatively low percentage indicates a necessity for improved education or training in this particular domain.

A local study [12] involving 212 respondents revealed that 36 (16.98%) answered all six "knowledge" questions correctly, 80 participants (37.73%) answered five correctly, while the remaining 96 participants (45.29%) answered fewer than five correctly. A survey done by Schmidt A. et al.[13] among anaesthesiologists in Southern Sweden regarding the understanding and practice of cardiopulmonary resuscitation (CPR) highlighted the application of force in a laryngotracheal model by various anaesthesia specialists using both dominant and non-dominant hands. The results indicated no significant variations between the dominant and non-dominant hands of personnel, with approximately 69% lacking information regarding the recommended level of force to be applied.

The responses about the force exerted during rapid sequence induction reveal a multifaceted scenario. Although 86.9% gave the correct answer, a significant number of respondents harboured misconceptions on the proper procedures to follow if a patient vomits or regurgitates. The diverse reactions highlight the necessity of standardised training regimens to guarantee a uniform and precise application of cricoid pressure across various clinical situations.

The research also examines the attitudes and practices related to the use of cricoid pressure. A significant majority (77.6%) of anaesthesiologists indicated the utilisation of cricoid pressure during emergency procedures. Nonetheless, the application frequency varied, with 70% utilising it fewer than 50 times. This variation in practice necessitates additional investigation into the elements affecting the decision-making process for the application of cricoid pressure. In the study by Butt and Hoda [12], 210 participants answered questions concerning the "practice" of CP application. 168 participants (80%) consistently administer CP to all patients with full stomachs.

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Our study reveals that 86% of participants acquired knowledge about cricoid pressure through clinical practice or student attachments, underscoring the dependence on experiential learning in this domain. This indicates the necessity of augmenting academic knowledge with practical training to improve the comprehensive understanding and application of cricoid pressure. Although 82% of participants applied cricoid pressure after verifying the endotracheal tube's location, the study indicates that 54% had challenges with endotracheal intubation during the administration of cricoid pressure. This raises concerns regarding the potential obstacles and complications connected with the simultaneous application of cricoid pressure and endotracheal intubation. In the study by Butt and Hoda [12], 209 participants provided responses concerning the "training" of the CP application. 116 individuals (55.50%) received supervised instruction on anaesthetised patients, 19 individuals (9.1%) underwent training courses with manikins, and 74 individuals (35.4%) acquired knowledge solely from books before practicing on patients. Two hundred eight people answered the question concerning the "time since formal training" in CP application. 109 individuals (52.4%) had more than two years of experience following official CP application training, 25 people (12.01%) had less than 12 months since their training, and 74 participants (35.5%) had no formal training.

Ninety-three percent of anaesthetists acquired the skill of applying cricoid pressure on patients via clinical practice or student attachments, indicating a significantly higher rate compared to a research conducted in New Zealand, which reported that only 53% received instruction on a real patient. In this study, approximately 20% were instructed using a model or mannequin [14]. A study on simulator training by Meek T and colleagues concluded that practical training on a simulator enhanced CP performance.[15] Can regular training and assessment of CP application significantly impact the overall accuracy of its implementation? A study indicates that a single training session on manikins can markedly enhance

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performance.[16] Approximately 72% of anaesthesia personnel retain the capacity to correctly administer the CP and suitable force for 14 to 21 days following a single training session.Seventeen Anaesthesia personnel can learn and maintain the appropriate amount of CP for around three months.[18] It has been proposed that anaesthesia personnel undergo simulation training every three to six months to renew their understanding and practise of CP application.[17]

The study possesses several limitations. Firstly, it utilised a non-probability convenience sampling method, potentially constraining the generalisability of the results to the broader population of anaesthesiologists. Secondly, the self-reported nature of the questionnaire may introduce response bias, as participants could exaggerate their knowledge or practices. Thirdly, the research was conducted in tertiary care hospitals in Karachi, which may not accurately reflect practices in other regions or healthcare environments. Furthermore, the cross-sectional design captures data at a singular moment, complicating the assessment of changes or trends over time. Lastly, the dependence on a relatively small sample size may diminish the statistical power to identify subtle differences or associations.

CONCLUSION

In conclusion, although the study reveals a predominantly high awareness of the purpose of cricoid pressure, significant knowledge gaps and discrepancies in practice among anaesthetists are apparent. These findings underscore the necessity for focused educational initiatives, standardised training programs, and continuous professional development to guarantee a uniform and evidence-based administration of cricoid pressure in peri-operative care.

Conflict of interest:

The authors declared no conflict of interest.

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Authors' contributions:

Suraj Kumar, Tarique Aziz: Conception and designing.

Vinod Kumar: Acquisition of data, data gathering and analysis, the initial version of the article.

Kashif Naeem, Mahendar wanwari, Adeel ur Rehman: Manuscript's final review and approval.

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