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ARTIGO ORIGINAL

Trauma Airway Management Training of Medical Students: Blended Learning Compared to Live Learning

Formação de Estudantes de Medicina sobre Abordagem da Via Aérea em Contexto de Trauma: Aprendizagem Híbrida em Comparação com a Aprendizagem Presencial

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Airway Management; Educational Measurement; Learning; Students, Medical
Palavras-chave
Abordagem da Via Aérea; Alunos de Medicina; Aprendizagem; Avaliação Educacional

ABSTRACT

Introduction: Blended learning gained emphasis with the COVID-19 pandemic. The main objective of this study was to compare blended to live learning regarding knowledge and skills acquisition in airway approach. Secondly, we intended to assess the participants' perception regarding the different formats and the role of simulation in undergraduate medical teaching of airway skills. Finally, we aimed to create and validate an assessment tool for airway management skills.

Methods: A randomized controlled trial was conducted with sixteen medical students. The control group attended a live lecture on airway approach in trauma. The study group had access to the content in an asynchronous online format. All participants were submitted to a live practical session, a knowledge test, and a skill evaluation. The latter was analyzed by three external observers through a Trauma Airway Assessment Tool. The results were evaluated using the Mann-Whitney test. For the assessment tool validation, the intraclass correlation coefficient was calculated. All candidates replied to an opinion survey, which was evaluated using the Mann-Whitney and Wilcoxon tests.

Results: There was no significant difference between the theoretical and practical evaluations of both groups (sig>0.05). The agreement between the observers was moderate. The opinion's survey showed that students prefer blended learning.

Conclusion: The teaching of the airway approach in trauma settings can be performed through blended format without impairing student learning. The Trauma Airway Assessment Tool is useful but needs to be improved. Students are motivated in blended learning and the integration of simulation into medical education.

RESUMO

Introdução: A pandemia COVID-19 promoveu o ensino híbrido. O principal objetivo deste estudo é compará-lo com o ensino presencial a nível da aquisição de conhecimento e competências na abordagem da via aérea. Secundariamente, avaliar a opinião dos participantes relativamente aos dois formatos de aprendizagem. Finalmente, criar e validar uma ferramenta de avaliação das competências de abordagem da via aérea.

Métodos: Ensaio de controlo randomizado com dezasseis alunos de medicina: grupo de controlo presenciou uma palestra sobre a abordagem da via aérea em trauma; grupo de estudo teve acesso a conteúdo equivalente em formato online. Ambos participaram numa aula prática presencial, um teste de conhecimentos e uma avaliação prática. A última foi avaliada por três observadores externos através da ferramenta de avaliação das competências de abordagem da via aérea. Os resultados foram analisados com o teste Mann-Whitney. Para a validação da ferramenta de avaliação, foi calculado o coeficiente de correlação intra-classe. Todos os alunos responderam a um questionário de opinião, avaliado através dos testes de Mann-Whitney e Wilcoxon.

Resultados: Não existe diferença significativa entre os resultados teóricos e práticos dos grupos (sig>0,05). A concordância entre os observadores foi moderada. A análise do questionário de opinião

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mostrou que os estudantes preferem o ensino híbrido.

Conclusão: O ensino da abordagem das vias aéreas em contexto de trauma pode ser realizado de modo híbrido sem prejudicar a aprendizagem dos estudantes. A ferramenta de avaliação é útil, no entanto, necessita de ser aperfeiçoada. Os estudantes estão interessados no ensino híbrido.

INTRODUCTION

Trauma is the leading cause of death in the first four decades of life[1] and currently fatalities still occur because of inadequate attention to the principles of basic airway management.[2] Thus, ensuring airway patency, adequate oxygenation, and supporting ventilation are priorities when approaching these patients.[3]

Throughout undergraduate education, medical students' highly value the orotracheal intubation technique for airway management. Although orotracheal intubation is the only technique which guarantees a patent and protected airway, it requires a significant learning curve, and there are other simpler techniques to permeabilize airway, improve oxygenation and assist ventilation that should be taught, such as jaw-thrust maneuver, placing an oropharyngeal tube, bag-valve-mask ventilation, and insertion of laryngeal mask airway.[4,5] These are simple life-saving techniques that are amenable to skill teaching at the undergraduate level.

Skill training is usually carried out through lectures and practical sessions in a live format. However, this model is associated with costs, time, and the need for trainers. In addition, the COVID-19 pandemic has significantly limited face-to-face teaching and has reinforced the need to find alternatives.[6]

Blended learning combines online lectures and face-to-face practical sessions with the goal of facilitating the acquisition of knowledge and skills by medical students. This method reduces face-to-face contact time, the human resources required, decreases content review times, gives opportunity for immediate self-assessment, and makes the learning process more flexible, as it can self-paced by the students.[6,7] A study conducted in 2019 in a similar way to the present study founded that combining online material with face-to-face lectures in radiology education increases student performance during tests.[8]

The key objective of this study is to compare traditional teaching (face-to-face) with blended learning to teach airway management in trauma patients.

Secondly, we also intended to study the self-perception of the study participants regarding the methods used in the learning of airway skills.

Finally, the study also intended to develop and validate a novel tool that assesses the learned skills of airway approach.

MATERIAL AND METHODS

This interventional study is a randomized controlled trial and was approved by the institutional review board (Comissão de Ética da Faculdade de Medicina da Universidade de Coimbra CE- 046/2022). All participants gave their informed consent in writing and the study took place in the Simulation Center of Faculty of Medicine of the University of Coimbra (FMUC). For this study, volunteers were recruited via an online form, from a population of fifth or sixth-year undergraduates of the Integrated Master's Degree in Medicine (MIM) of the Faculty of Medicine of the University of Coimbra (FMUC). Exclusion criteria was having attended the elective "Trauma, Emergency and Disaster", whereby fifth year undergraduate students of Faculty of Medicine of the University of Coimbra undergo training in, among other, airway management in trauma.

The study population consisted of 16 students who were subsequently randomized, via Random.org, in a control group (CG) and study group (SG). Each group included six 6th year students and two 5th year students. The CG was composed by 1 male and 7 females and the SG by 3 males and 5 females.

The identity of the participants, as well as the group to which they belong, is known only by the researcher and the participants themselves.

Firstly, in the framework of the elective "Trauma, Emergency and Catastrophe", videos and task analysis of all the techniques and steps necessary to approach the airway in a trauma setting were created.

Then, in the control group, participants attended a classroom lecture on the "Airway assessment and management in trauma patients", with ninety minutes. Participants in the experimental group had access to an equivalent content in and asynchronous online format, available over a period of five days in an online learning system. The course contents were standardized with those provided in the control group.

The instructor responsible for teaching the lecture and preparing the online content is a senior consultant in anesthesiologist (SB) with extensive experience in undergraduate and postgraduate teaching, namely invited faculty of the elective TEC, as well as Advanced Trauma Life Support (ATLS) and European Trauma Course (ETC) instructor, and Definitive Anesthetic Trauma Care (DATC) course instructor and course director. He also has significant experience in managing the airway in a trauma setting, both at the emergency department and operating room settings.

Afterwards the two groups attended a one-hour face-to-face skills training and simulation session on airway approach. Then participants underwent a practical (15 minutes duration) and theoretical (20 multiple-choice questions) test to assess the skills acquired. To allow a rigorous evaluation of the techniques performed, each participant underwent a practical test using a simulated scenario of threatened

airway in a trauma patient. The scenario was videotaped allowing external observers to review the procedures. Two simultaneous video tapes from different perspectives were recorded for each participant.

Theoretical knowledge was assessed with a 20-question multiple-choice questionnaire with a range from 0 to 20 (perfect score).

Skill acquisition was evaluated by three external observers following an original Trauma Airway Assessment Tool (TAAT) specifically developed for the study in question (*Supplementary file 1*). This tool has 60 parameters divided into six sections or tasks (General Approach, Chin lift, Mandibular Subluxation or Mandibular Protrusion, Oropharyngeal Tube Placement Technique, Ventilation with Face Mask and Insufflator - One Person, and Insertion of Laryngeal Mask Airway). Each section or task was subdivided into several technical steps. It was created based on previous published airway skills checklists.[9-11] TAAT aims to thoroughly assess all technical aspects of airway management in trauma on a three-point score for each item: not done or done with a major error (0 points); incompletely done or done with a minor error (1 point); correctly done (2 points).

The three external observers (FM, FV and VC) are senior anesthesiologist consultants with experience in undergraduate and postgraduate education and airway management in a trauma patient. Each reviewer had unlimited access to the video recordings for three months and was blinded to which group the participants belonged. To internationally validate the TAAT created for this study, two Portuguese and one Brazilian evaluator (VC) were selected.

In the end, all students completed a post-study survey with 14 questions about the self- perception of knowledge and skills of airway approach and the importance of simulation in medical education. Also included five questions about the quality of theoretical class and three about the learning format to which they were submitted (live or blended learning). Each question was rated with a Likert scale between 1 and 5, with 5 being the maximum rating attributed, corresponding to "Very Good" or "I totally agree".

The Statistical Package for Social Sciences (SPSS program, version 27.0) for Windows, was used to perform the statistical analysis of this study. As far as the TAAT designed, the intraclass correlation coefficient[12] was analyzed for each section and parameter to assess its validity. The Mann-Whitney test was used to assess whether there were significant differences between the experimental and control group. In the analysis of the opinion form, the questions about the knowledge of airway approach and the importance of simulation in the participants' eyes before and after the study were evaluated using the Wilcoxon test. The Mann-Whitney test was applied to assess the questions about the theoretical class and learning format.

RESULTS

To analyze the key objective of this study, two factors were studied: theoretical knowledge and practical skills acquired.

There were no statistically significant differences between both groups regarding the score of the knowledge test (sig.>0.05) (Table 1).

Regarding the acquisition of skills, we started by analyzing the internal reliability of the score with the intraclass correlation coefficient (ICC). An ICC=0.595 [confidence interval 95% = 0.538-0.644] with $p<0.05$ was obtained which means that the reliability is moderate.[12]

Then, a general analysis of the collected data was performed by calculating the means, medians, and standard deviation by parameter for both the CG and the SG (Table 2).

The same descriptive analysis was also performed for each section of the TAAT.

There were no statistically significant differences between the scores of control and study group in the overall airway management, and neither in specific tasks (sig.>0.05) (Table 2).

In order to assess TAAT, we examined the intraclass correlation coefficient between the three observers in each of the specific tasks. In all of the tasks, moderate reliability was confirmed, except for the insertion of laryngeal mask airway that presented an ICC<0.5.[12] (*Supplementary file 2*)

We refined the analysis further and assessed the ICC in each step of the whole score. (*Supplementary file 2*) and found that in five parameters the ICC was considered very good or excellent (ICC>0.75) and in seven parameters were considered moderate (0.50<ICC< 0.75).[12] It was not possible to obtain the value of the ICC in eleven parameters due to a total agreement between the evaluation of the three observers and all the study subjects.

Table 1. Results of the knowledge test (scored from 0 to 20) regarding airway management in trauma (N=16 students; statistics with Mann-Whitney test)

	Mean	Median	SD	N	Mean Rank	*Asymp. Sig.*
SG	17.5	18.5	2.12	8	8.63	**0.959**
GG	18.13	18	1.25	8	8.38	

SG – study group; CG – control group; SD – standard deviation; N- number of evaluations

Table 2. Results of the skill scores (scored from 0 to 2) regarding airway management in trauma (N= 16 students; statistics with Mann-Whitney test)

		Descriptive Statistics			Mann-Whitney Test		
	Group	Mean	Median	SD	N	Mean Rank	*Asymp. Sig.*
Overall score	CG	1.82	2	0.38	480	485.49	0.47
	SG	1.81	2	0.38	480	475.51	
General approach	CG	1.86	2	0.36	104	106.19	0.59
	SG	1.82	2	0.27	104	102.81	
Chin Lift	CG	1.54	1.668	0.559	32	33.84	0.54
	SG	1.43	1.667	0.5941	32	31.16	
Mandibular Subluxation	CG	1.65	2	0.47	48	48.20	0.91
	SG	1.63	2	0.51	48	48.80	
Oropharyngeal tube placement	CG	1.83	2	0.35	56	59.62	0.21
	SG	1.77	2	0.4	56	53.38	
Ventilation with face mask and insufflator	CG	1.89	2	0.32	112	110.79	0.52
	SG	1.93	2	0.20	112	114.21	
Insertion of Laryngeal Mask Airway	CG	1.86	2	0.31	128	130.10	0.64
	SG	1.84	2	0.35	128	126.90	

SG – study group; CG – control group; SD – standard deviation; N- number of evaluations

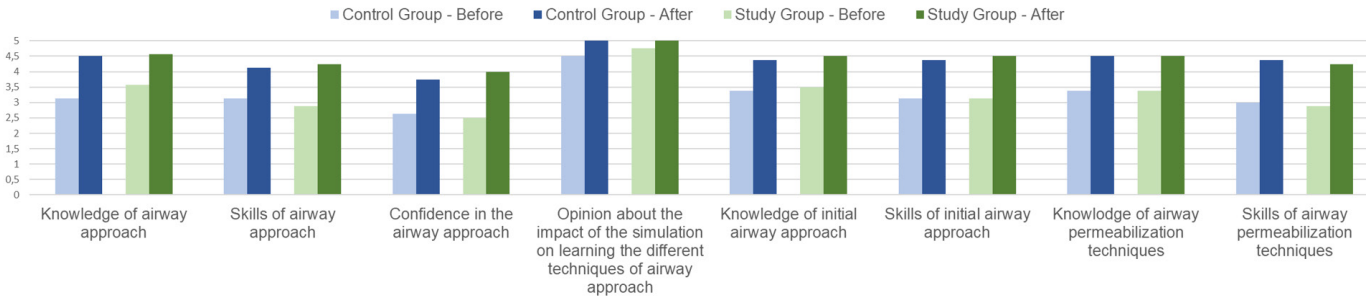

Figure 1a. Graphic with participant opinion about the knowledge of airway approach and the importance of simulation in the participant's point of view before and after the study

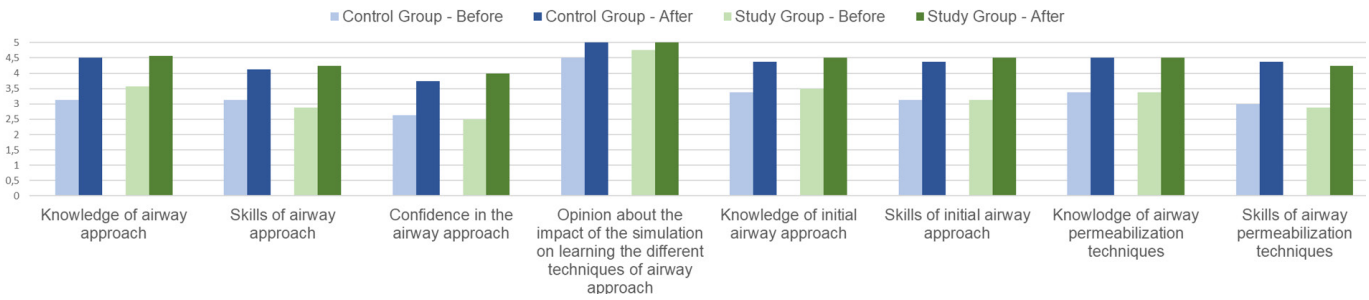

Figure 1b. Graphic with participant opinion about the knowledge of airway approach and the importance of simulation in the participant's point of view before and after the study

The participant's survey showed that the self-perceived level of knowledge, skills and confidence overall improved after the airway training in both groups (sig.<0.0001) (Figs. 1a and 1b). These questions were evaluated using the Wilcoxon test. The questions about the quality of the theoretical class and the perspective of the learning format that they were subjected to were analyzed using the Mann Whitney test.

Regarding the quality of the lecture material, there is no statistical difference in the students' opinion (sig.>0.05). However, when it comes to the learning format, there is a significant difference (sig.<0.05) between the CG and the SG. The students valued the content and learning modality. Interestingly, the study group felt that the asynchronous online format is better in time management (Figs. 2 and 3).

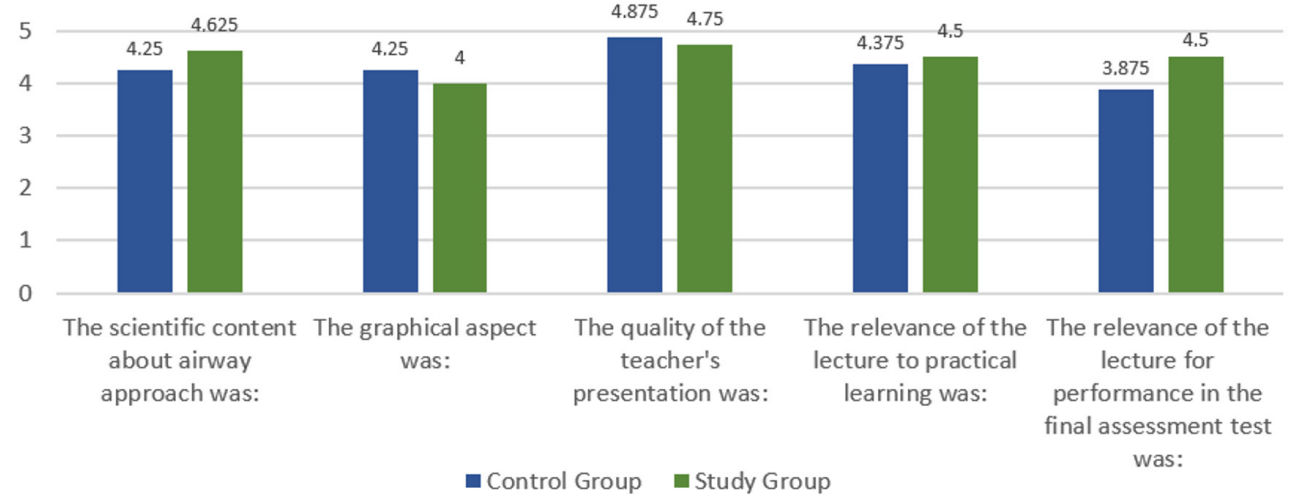

Figure 2. Graphic with participants opinion about the theoretical material

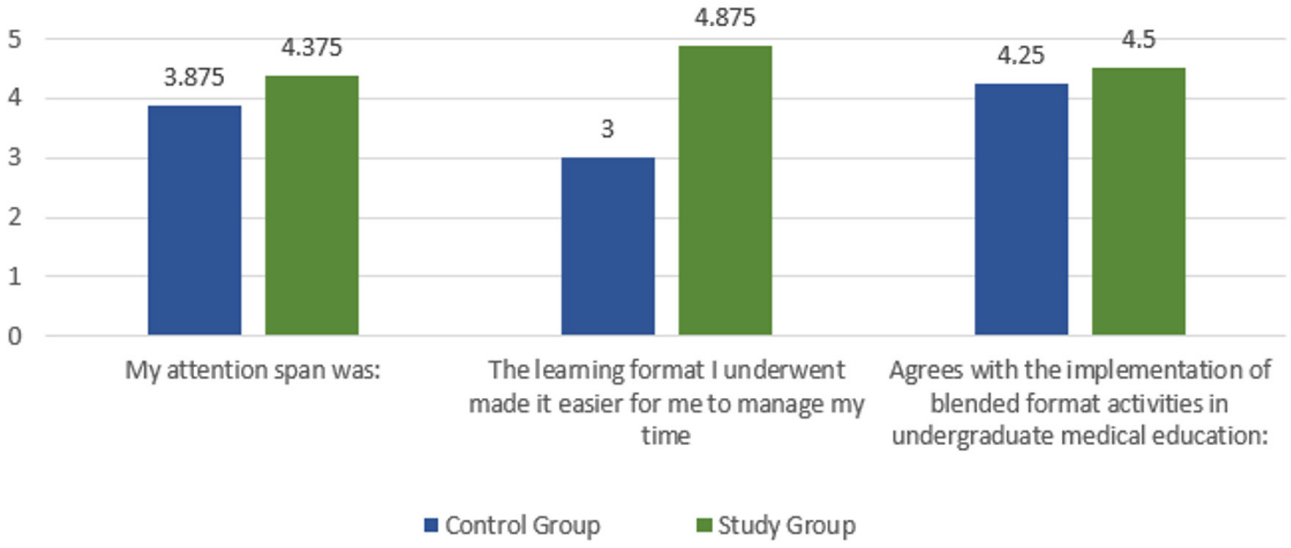

Figure 3. Graphic with participants opinion about the learning format ($p<0.05$)

DISCUSSION AND CONCLUSION

It is an undisputed fact that a fast and effective airway management ensuring adequate oxygenation, ventilation and airway protection when indicated reduces patient morbidity and mortality in trauma settings.[5,13] Endotracheal intubation, the gold standard for ensuring a definitive airway, is a technique that has a long learning curve. A recent systematic review concluded that more than 50 cases are required to achieve competence in non-elective intubation. It is, therefore, very difficult to ensure that medical students achieve competence in this technique.[14] Lack of expertise in intubation is associated with increased complications, notably hypoxemia, unrecognized esophageal intubation, regurgitation and cardiac arrest.[15,16]

Although endotracheal intubation is the method of choice in airway management, there are simpler methods such as insertion of laryngeal mask airway that can be mastered by inexperienced people.[17] Thus, to allow training the skills and prevent complications, learning through simulation-based scenarios is an efficient and safer method for medical students to acquire airway management skills.[18]

After the COVID-19 pandemic several studies were conducted proving that online teaching is an important component of medical education.[7,19,20] Students have begun to see this format as a better way to understand, master content, achieve better results and manage their time, being that the biggest advantage perceived.[21] However, regarding the learning of skills, although online material can be used as a complement to teaching (through a demonstration video, for example), physical skills cannot be learned without performing them.[22] Thus, it is relevant to have a blended teaching method (online and live learning). The meta-analysis of Vallée *et al*[23] found that blended learning can have a positive effect on the acquisition of knowledge related to the health professions. However, it highlights that different methods of blended course may have different efficacies.

Another study similar to the current one conducted in 2018 along the same lines as the present study demonstrated the

non-inferiority of blended learning in training the emergency airway management in doctors in their second or third year of clinical service of a university hospital.[24]

Thus, in order to compare blended learning (online teaching of theoretical content and face-to-face practical skills) with live learning (face-to-face theoretical and practical teaching) of the airway approach in trauma settings, this study evaluated undergraduate medical students at the theoretical and practical levels.

The skills training and simulation session were the same in both CG and SG and we found that there were no significant differences in the results between the two groups, neither in each technique nor analyzing the approach to the airway as a whole. This fact is also reported at the level of theoretical knowledge. Thus, it can be inferred that the teaching of the airway approach in trauma settings can be performed through blended format without impairing student learning.

In addition, it was found that the averages scores for both the theoretical (CG= 18.13, SG= 17.75) and practical (CG= 1.82, SG= 1.81) evaluations were quite high (on a scale of 0 to 20), concluding that the material and teaching strategies used were adequate and of high quality. However, since there was no pre-exposure test, we cannot confirm this.

As far as the TAAT is concerned, the level of agreement between the three observers in each section was moderate. When studying the TAAT in more detail, parameter by parameter evaluation showed that in some cases the ICC is very good or excellent (ICC>0.75), which leads us to conclude that these points are clear and simple to use. On the other hand, there are some parameters whose ICC is close to zero which suggest that they are not clear, or they are difficult to analyze, meaning that they should be revised.[12,25] We conclude that the TAAT although adequate, needs to be refined and improved as an airway assessment tool in trauma. Nonetheless, the existence of eleven parameters where the evaluations given by the three observers matched with each other and remained the same for all subjects, being equivalent to the maximum score leads to believe that these parameters were correctly taught and assimilated. There is also no need to redo these parameters (*Supplementary file 2*). Regarding the participants' self-perception of airway skills and level of comfort we can conclude that, in the opinion of the participants, learning was effective in both groups. Also, the students agree that simulation has a positive impact on learning the different techniques of airway management.

As far as the theoretical class there is not a significant difference between the evaluations given by the CG and the SG. However, when it comes to the learning method, the difference between GC and SG is already significant, due to the better evaluations provided by the SG. However, we recognize some limitations of the present study. The first limitation was the small sample size due to the low participation of FMUC (Faculty of Medicine of Coimbra University) students in this study. The author team appreciates the 16 students that participated in the study but hoped that the engagement of the student community would be more enthusiastic. We also point to the fact that, although the SG subjects were instructed not to share the online material with the other participants, the risk of cross-contamination remains. Another issue relates to the TAAT as an assessment tool with a less than ideal internal consistency. A factor that may have influenced the validation of the TAAT was the fact that it was quite extensive, leading to observer fatigue during the assessments.

In conclusion, our study suggests that blended learning is not inferior to live learning in the acquisition of knowledge and skills by undergraduate medical students in airway management. The assessment tool created for this purpose proved to be useful and adequate but needs to be improved and validated in another community and in a larger sample. The students' perception is that the study contributed to their learning, not only theoretical, but also practical. The study group was satisfied blended learning, namely as it allowed better time management, and both groups emphasized the importance of simulation in medical students' education and were interested in the blended learning format.

CONTRIBUTORSHIP STATEMENT / DECLARAÇÃO DE CONTRIBUIÇÃO

RV, SB e HA: Conception, design of the study; acquisition, analysis and interpretation of data; redaction; approval of the final version to be published.

FV, FM e VC: Data acquisition; critical review of the manuscript; approval of the final version to be published.

RV, SB e HA: Conceção, desenho do estudo; recolha, análise e interpretação dos dados; redação e aprovação da versão final a ser publicada.

FV, FM e VC: Recolha de dados, revisão crítica do manuscrito e aprovação da versão final a ser publicada.

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SUPPLEMENTARY FILE 1

ABORDAGEM GERAL

	Não realizou ou realizou com erro grosseiro	Realizou parcialmente ou realizou com erro ligeiro	Realizou corretamente
Verificou capacidade de resposta do doente: chamou pela pessoa ou bateu nos ombros			
Avaliou/monitorizou os sinais vitais, saturação, frequência respiratória			
Constatou que doente não tinha problema de VA porque falou adequadamente			
Identificou a necessidade de suplementação de oxigénio			
Selecionou o dispositivo mais adequado para administração de oxigénio (máscara Venturi ou máscara com reservatório)			
Colocou o dispositivo corretamente e ligou a fonte de oxigénio ou pediu para ligarem			
Selecionou / pediu 15 L /min			
Após agravamento do estado clínico			
Identificou que o doente apresentava dificuldade respiratória (dispneia, utilização dos músculos acessórios da respiração)			
Inspecionou a orofaringe			
Identifica a necessidade de aspiração da orofaringe/remoção qualquer corpo estranho			
Selecionou o equipamento de aspiração mais adequado —cânula rígida—			
Realizou a aspiração da orofaringe			

ELEVAÇÃO DO MENTO

	Não realizou ou realizou com erro grosseiro	Realizou parcialmente ou realizou com erro ligeiro	Realizou corretamente
Colocou uma mão na região frontal para estabilizar a cabeça impedindo a flexão ou extensão cervical			
Colocou as pontas dos dedos da outra mão sob a mandíbula e levantou, trazendo o queixo para a frente			
Avaliou a resposta à manobra realizada (padrão respiratório / frequência respiratória / expansão torácica / oximetria)			
Manteve a máscara facial com aporte de oxigénio			

SUBLUXAÇÃO MANDIBULAR OU PROTUSÃO DA MANDIBULA

	Não realizou ou realizou com erro grosseiro	Realizou parcialmente ou realizou com erro ligeiro	Realizou corretamente
Removeu qualquer corpo estranho ou vómito o mais rapidamente possível			
Colocou a mão em cada lado do maxilar inferior da vítima no ângulo do maxilar, abaixo das orelhas			
Estabilizou a cabeça da vítima com o antebraço ou com a região tenar e hipotenar da mão bilateralmente			
Utilizou os dedos para projetar a mandíbula para cima enquanto usou os polegares para empurrar a mandibula da vítima em direção aos pés			
Avaliou a resposta à manobra realizada (padrão respiratório / frequência respiratória / expansão torácica / oximetria)			
Manteve a máscara facial com aporte de oxigénio			

TÉCNICA DE COLOCAÇÃO DO TUBO OROFARÍNGEO

	Não realizou ou realizou com erro grosseiro	Realizou parcialmente ou realizou com erro ligeiro	Realizou corretamente
Reconhece a necessidade de colocação de tubo orofaríngeo			
Selecionou o tubo orofaríngeo indicado: o tubo correto corresponde à distância entre os incisivos e o ângulo da mandíbula da vítima			
Abriu a boca e verificou se existiam corpos estranhos			
Identificou a necessidade de aspiração da orofaringe/remoção qualquer corpo estranho			
Introduziu o tubo orofaríngeo na cavidade oral em posição invertida, isto é, com a parte convexa virada para a língua			
Introduziu até passar o palato duro e então rodou-o 180º, de forma que a parte côncava ficou virada para a língua. Continuou a empurrar em direção à faringe			
Avaliou a resposta à manobra realizada (padrão respiratório/frequência respiratória/expansão torácica/oximetria)			

VENTILAÇÃO COM MÁSCARA FACIAL E INSUFLADOR – UMA PESSOA

	Não realizou ou realizou com erro grosseiro	Realizou parcialmente ou realizou com erro ligeiro	Realizou corretamente
Identificou a necessidade de assistir à ventilação/ventilar			
Selecionou a máscara facial mais adequada ao doente			
Selecionou insuflador com reservatório			
Conectou ou pediu para conectar insuflador ao oxigénio			
Conectou a máscara ao insuflador			
Realizou uma técnica "CE" com uma mão para segurar a máscara na posição correta. - Formou o "C" colocando o polegar sobre a parte da máscara que cobre a ponte do nariz e o dedo indicador sobre a parte que cobre a fenda do queixo. - Selou a máscara firmemente no rosto empurrando para baixo com o polegar e o indicador, enquanto puxa para cima a mandíbula formando o "E" com os outros três dedos, abrindo as vias respiratórias ao executar a elevação da mandíbula			
Manteve a máscara vedada com uma mão usando pressão firme para manter a máscara na posição correta evitando fugas			
Apertou o insuflador com a outra mão durante 1-2 segundos enquanto observa a subida do peito. Deste modo analisa-se se os pulmões estão a insuflar eficazmente			
Deixou terminar a expiração antes de iniciar nova inspiração			
Assegurou insuflação a cada 5-6 segundos (10-12 respirações/minuto)			
Foi avaliando a expansão torácica			
Foi avaliando a oximetria de pulso			
Manteve o colar cervical ou imobilização da coluna cervical			
Pediu ajuda para ventilar a 4 mãos			

MÁSCARA LARÍNGEA

	Não realizou ou realizou com erro grosseiro	Realizou parcialmente ou realizou com erro ligeiro	Realizou corretamente
Perante dificuldade na ventilação com máscara facial decidiu colocar máscara laríngea			
Escolheu a LMA de tamanho apropriado			
Pediu ou lubrificou a máscara laríngea adequadamente			
Abriu a boca e desobstruiu a via aérea			
Manteve imobilização em linha da coluna cervical			
Inseriu a máscara laríngea até à orofaringe e avançou com movimento adequado			
Conectou o balão autoinflável			
Forneceu uma ventilação durante 1 segundo			
Apertou o insuflador até haver expansão torácica (considerar parcialmente se apertou o insuflador todo)			
Verificou a elevação do tórax			
Avaliou/perguntou a oximetria			
Fixou a máscara laríngea no lugar correto			
Executou uma frequência respiratória correta (1 respiração a cada 5-6 segundos)			
Forneceu cada ventilação durante 1 segundo			
Libertou completamente o insuflador entre ventilações			
Identificou a necessidade de intubação e solicitou ajuda diferenciada			

SUPPLEMENTARY FILE 2: INTRACLASS CORRELATION COEFFICIENT

INTRACLASS CORRELATION COEFFICIENT ABOUT PRACTICAL EVALUATION FOR EACH SECTION

	ICC	95% Confidence Interval	
		Lower Bound	Upper Bound
Overall	0.595	0.538	0.644
General approach	0.61	0.489	0.702
Chin lift	0.58	0.344	0.736
Mandibular subluxation	0.553	0.374	0.688
Oropharyngeal tube placement	0.610	0.459	0.723
Ventilation with face mask and insufflator	0.578	0.473	0.665
Insertion of laryngeal mask airway	0.490	0.372	0.589

SG - study group; CG - control group; N - number of evaluations; ICC - Intraclass correlation coefficient

INTRACLASS CORRELATION COEFFICIENT ABOUT PRACTICAL EVALUATION BY STEP

Abordagem geral	N.º	Parâmetro	ICC
	1	Verificou capacidade de resposta do doente: chamou pela pessoa ou bateu nos ombros	0,000
	2	Avaliou/Monitorizou os sinais vitais, saturação, frequência respiratória	0,000
	3	Constatou que doente não tinha problema de VA porque falou adequadamente	0,000
	4	Identificou a necessidade de suplementação de oxigénio	*
	5	Selecionou o dispositivo mais adequado para administração de oxigénio (máscara Venturi ou máscara com reservatório)	1.000
	6	Colocou o dispositivo corretamente e ligou a fonte de oxigénio ou pediu para ligarem	0.306
	7	Selecionou/pediu 15 L/min	0.873
	8	Identificou que o doente apresentava dificuldade respiratória (dispneia, utilização dos músculos acessórios da respiração)	0
	9	Inspecionou a orofaringe	0
	10	Identifica a necessidade de aspiração da orofaringe/remoção qualquer corpo estranho	*
	11	Selecionou o equipamento de aspiração mais adequado	0
	12	Realizou a aspiração da orofaringe	0
	13	Identificou a necessidade de permeabilização da via aérea	*

Elevação do mento	N.º	Parâmetro	ICC
	14	Colocou uma mão na região frontal para estabilizar a cabeça impedindo a flexão ou extensão cervical	-0.178
	15	Colocou as pontas dos dedos da outra mão sob a mandíbula e levantou, trazendo o queixo para a frente	0.376
	16	Avaliou a resposta à manobra realizada (padrão respiratório/frequência respiratória/expansão torácica/oximetria)	0.567
	17	Manteve a máscara facial com aporte de oxigénio	0.563

Subluxação Mandibular	N.º	Parâmetro	ICC
	18	Removeu qualquer corpo estranho ou vómito o mais rapidamente possível	0
	19	Colocou a mão em cada lado do maxilar inferior da vítima no ângulo do maxilar, abaixo das orelhas	0.512
	20	Estabilizou a cabeça da vítima com o antebraço ou com a região tenar e hipotenar da mão bilateralmente	0.091
	21	Utilizou os dedos para projetar a mandíbula para cima enquanto usou os polegares para empurrar a mandibula da vítima em direção aos pés	0.450
	22	Avaliou a resposta à manobra realizada (padrão respiratório/frequência respiratória/expansão torácica/oximetria)	0.574
	23	Manteve a máscara facial com aporte de oxigénio	0.516

Técnica de colocação do tubo orofaríngeo	N.º	Parâmetro	ICC
	24	Reconhece a necessidade de colocação de tubo orofaríngeo	*
	25	Selecionou o tubo orofaríngeo indicado: o tubo correto corresponde à distância entre os incisivos e o ângulo da mandíbula da vítima	0.693
	26	Abriu a boca e verificou se existiam corpos estranhos	0.097
	27	Identificou a necessidade de aspiração da orofaringe/remoção qualquer corpo estranho	0
	28	Introduziu o tubo orofaríngeo na cavidade oral em posição invertida, isto é, com a parte convexa virada para a língua	0.794
	29	Introduziu até passar o palato duro e então rodou-o 180º, de forma que a parte côncava ficou virada para a língua. Continuou a empurrar em direção à faringe	0.286
	30	Avaliou a resposta à manobra realizada (padrão respiratório/frequência respiratória/expansão torácica/oximetria)	0

Ventilação com máscara facial e insuflador	N.º	Parâmetro	ICC
	31	Identificou a necessidade de assistir à ventilação /ventilar	*
	32	Selecionou a máscara facial mais adequada ao doente	0.375
	33	Selecionou insuflador com reservatório	*
	34	Conectou ou pediu para conectar insuflador ao oxigénio	-0.15
	35	Conectou a máscara ao insuflador	*
	36	Realizou uma técnica "CE" com uma mão para segurar a máscara na posição correta. - Formou o "C" colocando o polegar sobre a parte da máscara que cobre a ponte do nariz e o dedo indicador sobre a parte que cobre a fenda do queixo. - Selou a máscara firmemente no rosto empurrando para baixo com o polegar e o indicador, enquanto puxa para cima a mandíbula formando o "E" com os outros três dedos, abrindo as vias respiratórias ao executar a elevação da mandíbula.	0.364
	37	Manteve a máscara vedada com uma mão usando pressão firme para manter a máscara na posição correta evitando fugas	0
	38	Apertou o insuflador com a outra mão durante 1-2 segundos enquanto observa a subida do peito. Deste modo analisa-se se os pulmões estão a insuflar eficazmente	-0.107
	39	Deixou terminar a expiração antes de iniciar nova inspiração	0
	40	Assegurou insuflação a cada 5-6 segundos (10-12 respirações/minuto)	0.426
	41	Foi avaliando a expansão torácica	0
	42	Foi avaliando a oximetria de pulso	*
	43	Manteve o colar cervical ou imobilização da coluna cervical	0
	44	Pediu ajuda para ventilar a 4 mãos	0.846

Máscara Laríngea	N.º	Parâmetro	ICC
	31	Identificou a necessidade de assistir à ventilação/ventilar	*
	32	Selecionou a máscara facial mais adequada ao doente	0.375
	33	Selecionou insuflador com reservatório	*
	34	Conectou ou pediu para conectar insuflador ao oxigénio	-0.15
	35	Conectou a máscara ao insuflador	*
	36	Realizou uma técnica "CE" com uma mão para segurar a máscara na posição correta. - Formou o "C" colocando o polegar sobre a parte da máscara que cobre a ponte do nariz e o dedo indicador sobre a parte que cobre a fenda do queixo. - Selou a máscara firmemente no rosto empurrando para baixo com o polegar e o indicador, enquanto puxa para cima a mandíbula formando o "E" com os outros três dedos, abrindo as vias respiratórias ao executar a elevação da mandíbula.	0.364
	37	Manteve a máscara vedada com uma mão usando pressão firme para manter a máscara na posição correta evitando fugas	0
	38	Apertou o insuflador com a outra mão durante 1-2 segundos enquanto observa a subida do peito. Deste modo analisa-se se os pulmões estão a insuflar eficazmente	-0.107
	39	Deixou terminar a expiração antes de iniciar nova inspiração	0
	40	Assegurou insuflação a cada 5-6 segundos (10-12 respirações/minuto)	0.426
	41	Foi avaliando a expansão torácica	0
	42	Foi avaliando a oximetria de pulso	*
	43	Manteve o colar cervical ou imobilização da coluna cervical	0
	44	Pediu ajuda para ventilar a 4 mãos	0.846
	43	Manteve o colar cervical ou imobilização da coluna cervical	0
	44	Pediu ajuda para ventilar a 4 mãos	0.846

** Itens com variância 0*