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Trainer Feedback with C Mac Videolaryngoscope Screen Visible Only to Trainer does not Decrease Time to Endotracheal Intubation Compared to Conventional Laryngoscopy when Performed by Novice Anaesthesiologist Trainee: A Randomized Controlled Pilot Trial

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Abstract

Introduction: A shared view of the glottis to both the trainer and the novice anaesthesia trainee (NAT) appears ideal for teaching endotracheal intubation (ETI) with regards to decreased time to intubation, trainee-trainer comfort and lesser patient morbidity. However, this is not possible in direct laryngoscopy. Video laryngoscope (VL) may provide the solution. The present study hypothesised that the time to ETI would be lesser when a NAT performs ETI with a VL with screen of VL visible only to the trainer due to real-time feedback.

Methods: First-semester anaesthesiology residents, with no previous ETI exposure were recruited and randomized to two groups after teaching about ETI using a manual and video. Group A: ETI with DL with trainer verbal feedback; Group B: ETI with VL with trainer verbal feedback, VL screen visible only to the trainer. The primary outcome was time to ETI. Secondary outcomes were success rate, teeth trauma/clicks by the laryngoscope, mucosal bleed, incidence of bougie use, trainee's perception of difficulty and oesophageal intubations.

Results: A total of 190 intubations were performed, 95 in each group. The mean time taken from insertion of laryngoscope blade to completion of ETI was not statistically significant (01:07 mins in group A vs 1:00 min in group B; P=0.1). Second attempts were significantly more in Group B (P=0.002). None of the other secondary outcomes reached statistical significance.

Conclusion: In NAT, trainer feedback via VL does not result in lesser time to intubation compared to conventional laryngoscopy probably because of lack of optimal skill and performance anxiety. Second attempts for ETI were significantly more in the former group because of trainer reassurance of visibility of attempt on VL screen.

Keywords: *Direct laryngoscopy, Video laryngoscopy, video-assisted feedback, intubation, novices, residents, training, conventional teaching, learning experience, C-Mac, Macintosh.*

Introduction

Endotracheal intubation (ETI) is one of the most important skills taught to novice anaesthesia trainees (NAT). [1] The learning curve of ETI via direct laryngoscopy (DL) by a NAT reaches above 90% success only after a mean of 57 attempts with 18% failure rate in difficult cases.[2]

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Teaching ETI to NAT in recent years has become a challenge due to restricted working hours and widespread use of supraglottic devices. When a NAT attempts DL, the trainer does not share the laryngeal view which limits appropriate feedback. This may cause prolonged time to ETI and morbidity. [3,4].

An ideal intubation method would include shared laryngoscopic view of trainer and NAT so that feedback maybe given in real time which would decrease attempted time of DL by NAT and constrict morbidity. ETI by a video laryngoscopy (VL) by a NAT will be a real time shared view between both trainer and NAT and thus would result in appropriate feedback. However, teaching laryngoscopy in the initial training period of a NAT is not encouraged with a VL as the procedure of VL does not replicate DL. Moreover, VL might not always be available in all situations in peripheral emergency. Thus, learning the skill of DL is essential.

Hypothesis of the present study was that the time to ETI would be lesser when a NAT performs ETI with a VL when screen of VL is visible only to the trainer as this would result in real time feedback.

Primary objective was to compare time to ETI by a NAT with a VL with verbal feedback from the trainer with screen visible only to the trainer compared to ETI performed by NAT with Macintosh laryngoscope with verbal feedback. Secondary objectives were to measure time from insertion of blade to 3rd wave of capnogram, intubation success rate (verified by lung inflation and 3rd capnogram wave), injury to the oral cavity structures like teeth trauma (clicks by the laryngoscope), mucosal bleed, use of gum elastic bougie, trainee's perception of difficulty, failed intubation attempt within 90 seconds, number of times instruction was given to position the blade, number of times the trainer needed to look inside the oral cavity to guide ETI, number of times the trainee was guided with feedback of a) tube approaching the oesophagus b) tube hitting other airway regions.

Methods

The present prospective randomized controlled study was conducted between August 2021 and February 2022 after obtaining Institute Ethics Committee approval and CTRI registration.

Inclusion criteria were first semester NAT with no previous exposure to performing ETI before joining the MD course at our hospital and consenting ASA I, II patients, aged between 18-60 years with BMI < 30 kg/$m^{2,}$ posted for elective surgeries requiring general anaesthesia with ETI. Exclusion criteria was refusal by trainee or patient to participate in the study and a predicted difficult airway in the patients.

Primary objective was to measure the time taken from insertion of laryngoscope blade between the teeth to the trainee verbally indicating ETI. Secondary objectives were to measure the following: time taken from insertion of blade to 3rd wave of capnogram, intubation success rate (verified by lung inflation and 3rd capnogram wave), injury to the oral cavity structures like, teeth trauma (clicks by the laryngoscope), mucosal bleed, incidence of gum elastic bougie use, trainee's perception of difficulty (easy/medium/hard), failed intubation attempt within 90 seconds, number of times oral instruction given to position the blade, in Group A, number of times the trainer looked in oral cavity to guide ETI was noted and in Group B, number of times the trainee guided ETI with instructions of tube approaching the oesophagus and/or tube hitting other airway regions.

NAT were defined as first semester junior residents from the Department of Anaesthesiology with no prior exposure to performing ETI were recruited. All NAT received a literature on intubation, at least a day prior, detailing the anatomy of the airway, view on DL, optimal head position, steps of laryngoscopy and endotracheal intubation. NATs were educated using an introductory video detailing airway anatomy and intubation techniques. Additional verbal instructions to perform DL and ETI were given by the trainer before the procedure.

NAT performed ETI according to the group allocated.

Group A (ETI=95) : DL and ETI with Macintosh laryngoscope and verbal feedback from the trainer. Group B (ETI=95): DL and ETI with C-MAC VL and verbal feedback from the trainer, with screen visible only to the trainer.

Each NAT was allowed a maximum of two ETI attempts, each lasting not more than 90 seconds with one minute of bag mask ventilation with 100% oxygen between both attempts. No repositioning manoeuvres for head and neck were entertained during the procedure. The trainers were allowed to intervene and take over the procedure if NAT took more than 90 seconds or at any point if the patient's safety was compromised (i.e. fall in oxygen saturation <95 % and/or any injury to oral cavity structures).

Parameters noted were time from the insertion of laryngoscope blade between the teeth to the NAT verbally indicating completion of ETI (time 1), time from insertion of blade to 3rd wave of capnograph (time 2), intubation success rate (verified by lung inflation and 3rd capnography wave), injury to oral cavity structures like teeth trauma

(clicks by the laryngoscope), mucosal bleed, incidence of gum elastic bougie use, NAT perception of difficulty (easy/medium/hard), failed intubation attempt within 90 seconds, number of times instruction was given to position the laryngoscope blade, in Group A the number of times the trainer needed to look inside the oral cavity to guide ETI by NAT, in Group B, number of times the trainee guided NAT with instructions of tube approaching the oesophagus and/or tube hitting other airway regions.

Statistical analysis was done with SPSS version 26. Continuous variables were expressed in mean and categorical variables as percentages. T test was used for equality of means. Categorical variables were compared using chi square test and Fischer's test as appropriate. Levene's test was used for equality of variances.

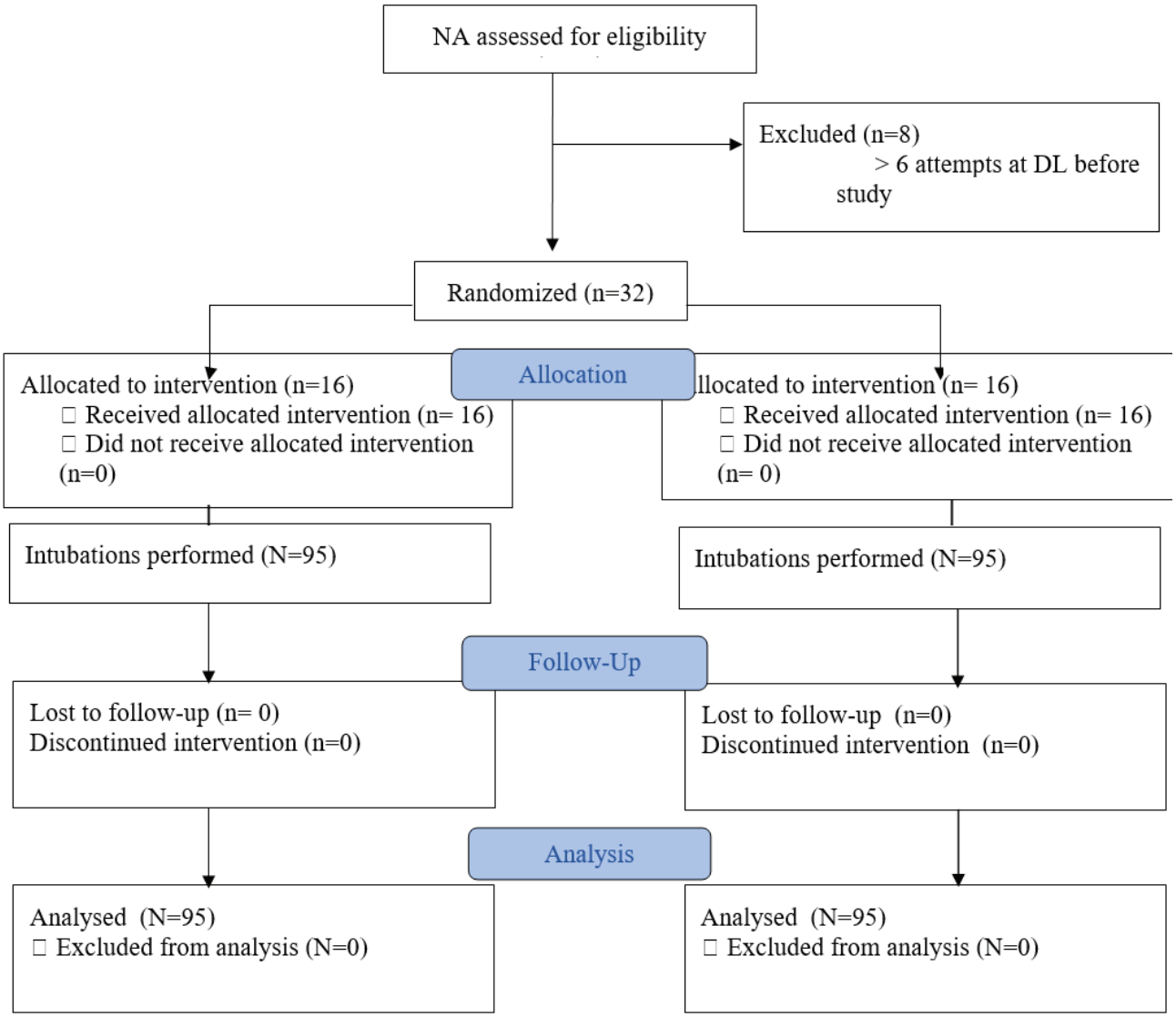
Sample size for 80% power and 5% alpha error, was 188 intubations per group. This was calculated to determine if video assisted laryngoscopy improves the effectiveness of tracheal intubation training. The mean time calculated to intubation was 72 seconds with traditional instruction and 75 seconds with video assisted instruction. The present research is thesis work and thus had to be completed in two years. Due to time constraint, only a total of 190 intubations were performed (95 per group).

Results

32 residents were recruited and randomized to two groups. A maximum of 6 ETI per NAT were allowed. (Figure 1: Consort diagram)

CONSORT
TRANSPARENT REPORTING of TRIALS

CONSORT 2010 FLOW DIAGRAM



Time from insertion of laryngoscope blade between the teeth to the NAT verbally indicating completion of ETI did not differ significantly between the two groups (Group A 67sec +/- 25 sec vs Group B 60 sec +/- 23sec; p = 0.1). (Table 1)

Table 1: Parameters of DL and ETI in both groups

Characteristics	Group A		Group B		P value
	n	Mean time in seconds (SD)	n	Mean time in seconds (SD)	
Time 1 Time taken from insertion of blade to completion of intubation (seconds)	73	60.7 (25)	75	60 (23)	0.1
Time 2 Time from insertion of blade to 3 rd wave of capnogram	73	85 (26)	75	77 (25)	0.075
	n	**%**	**n**	**%**	
Success rate of ETI	62	65.30	63	66.30	0.878
No. of second attempts	12	34.3	23	65.7	**0.002***
Oesophageal intubation	1	3.20	0	0	0.3
Bougie Use	3	4	5	5.30	0.491
Teeth Clicks	24	25.30	17	21.60	0.217
Mucosal Bleeds	10	10.50	8	8.40	0.62
Instruction to reposition blade	49	53.30	54	56.80	0.623
Trainee's Difficulty					
Easy	31	35.60	37	40.70	0.287
Medium	31	35.60	37	40.70	
Hard	25	28.70	17	18.70	
	n	**Mean (SD)**	**n**	**%**	
No of Times trainer looked into Cavity	89	1.8 (1.29)			
No. of times tube approached oesophagus			41	43.20	
No. of times tube hit other airway regions			41	43.20	

Number of second attempts to DL and ETI were statistically more in Group B (Group A 34.3% vs Group B 65.7%; p = 0.002).

Time from insertion of blade to 3rd wave of capnograph (Time 2) did not differ significantly between the two groups (Group A 85 sec +/- 26sec vs Group B 77 sec +/- 25sec; p = 0.075).

Rest of the parameters of success rate of ETI, number of second attempts, oesophageal intubation, bougie use, intubation success rate, teeth click, mucosal bleed, instruction to reposition blade and trainee's difficulty were statistically comparable between both groups.

In Group B, in 41 patients each tube approached oesophagus and tube hit other airway regions.

In Group A, in 89 patients trainer looked into the oral cavity while DL and ETI was performed by NAT. (Table 1)

Discussion

The present study concludes that under the supervision of a trainer, time taken for ETI by NAT either by DL or VLS is comparable with comparable complications when screen is visible only to trainer, however, the secondary attempts given to ETI given are more with VLS.

DL and ETI is a complex procedure which involves coordination of eyes, hands and brain. This highly precise skill requires mastering every step of DL and ETI. The initial step requires focus on achieving the best glottic view by manoeuvring the laryngoscope with the left hand. This part is easier to learn by a NAT with appropriate instructions. Once the glottis is visible, manoeuvring the ETT with the right hand while maintaining the lift by left hand is a difficult art to master. This is because lifting force from left hand becomes inadequate once NATs focus shifts to ETI which might increase the CL grade than the view initially achieved.[1]

If there is a real time verbal feedback from trainer to NAT for ETI regarding airway anatomy, laryngoscope blade positioning and correct direction of endotracheal tube towards glottis, time to ETI might be shorter with lesser morbidity. However, the results of the present study were otherwise. The probable reason could be following. NAT, who is a first semester resident, is in a new environment of the hospital and frequently in a new city, thus is already in higher level of anxiety than an older resident. A NAT might find performing a new procedure like DL and ETI under the watchful eyes of multiple personnel in the OR a stressful event. This could hamper the ability to listen and execute the verbal instructions of trainer which could be a contributing factor why the VL feedback group was not found to be significantly faster than the conventional group in the present study. This could also be a reason why ETI was not labelled as significantly easier by NAT. A study on ETI in paediatric population revealed improved confidence scores and positive learning experience without previous mannikin experience probably because of more difficult paediatric ETI compared to ETI in adults. [5,6]

When the trainer is able to see the attempt at DLI and ET by the NAT on visual screen to enable visual feedback, it ensures patient safety and confidence to give a second attempt to the trainee as was observed in the present study. The parameter of endotracheal tube hitting the surrounding oral structures and oesophagus was not statistically significant, maybe because only Group B was visible to the trainer and could be accurately assessed.

There are various types of available VLs. C-MAC blade is found most similar to the blade of Macintosh laryngoscope, thus in the present study, C-MAC VL was selected for the present study. [7-13]. Nevertheless, CMAC VL and DL blades are not the same which could have confounded the results.

The present study has few limitations. This is a single centre study. Involving multiple centres would have increased the external validity of the results. Intubating mannikins was not incorporated as part of training. Though mannikin might not be comparable to real time experience in terms of rigidity of the plastic, inability to achieve ideal positioning and lack of secretions, it might have given familiarity of structures while attempting human intubations. Baseline intubation times of NAT was not measured, which could have confounded results, despite choosing NAT with less than six attempts at laryngoscopy. Blinding of NAT was not possible. Only patients with easy airway were selected, thus results cannot be extrapolated to difficult airway settings. Another limitation is the lack of homogeneity of trainers.

Conclusion

To conclude, video feedback guided teaching is not superior to conventional teaching of laryngoscopy and ETI, in terms of time to ETI and success rate in NAT in the first six months of training. Future studies involving larger population and mannikin training before evaluation may be required to investigate the benefits of VL over conventional teaching methods.

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