ORIGINAL RESEARCH PAPER INTERNATIONAL JOURNAL OF PURE MEDICAL RESEARCH

Anaesthesiology

KEYWORDS: DAS, ASA, SAD, AEC, ETT

A STUDY TO COMPARE EASE OF REINTUBATION OVER AIRWAY EXCHANGE CATHETER WITH OR WITHOUT I-GEL AS CONDUIT

Volume - 6, Issue - 12, December - 2021 ISSN (O): 2618-0774 | ISSN (P): 2618-0766

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INTERNATIONAL JOURNAL OF PURE MEDICAL RESEARCH

Abstract

It is well known that tracheal extubation may be associated respiratory complications leading to morbidity and mortality. Difficult Airway Society (DAS) and American Society of Anesthesiologists Task (ASA) Force have suggested guidelines emphasising the need of a pre-formulated extubation strategy involving the use of supra glottic airway device (SAD) and airway exchange catheter (AEC) for rapid reintubation.1 The available literature revealed that use of intubation introducers through a supraglottic airway device facilitates tracheal intubation. Various airway exchange catheter/stylettes acts as a guide over which an endotracheal tube (ETT) can be passed.2 In literature, the success rate of reintubation using intubation catheter was reported from 92-98%.[3,4]

Introduction

It is well known that tracheal extubation may be associated respiratory complications leading to morbidity and mortality. Difficult Airway Society (DAS) and American Society of Anesthesiologists Task (ASA) Force have suggested guidelines emphasising the need of a pre-formulated extubation strategy involving the use of supra glottic airway device (SAD) and airway exchange catheter (AEC) for rapid reintubation.1 The available literature revealed that use of intubation introducers through a supraglottic airway device facilitates tracheal intubation. Various airway exchange catheter/stylettes acts as a guide over which an endotracheal tube (ETT) can be passed.2 In literature, the success rate of reintubation using intubation catheter was reported from 92-98%.[3,4]

In this study, we hypothesized that the presence of i-gel as airway conduit, with AEC as stylette inside the airway tube, will facilitate insertion of ETT. This study was carried out to find whether presence of SAD (i- gel) with AEC inside it will be better strategy than performing insertion of ETT over AEC alone.

Materials and Methods:

This study was conducted on one hundred patients ASA grade 1 or 2, undergoing elective surgery requiring endotracheal intubation. Patients with difficult airway, possibility of airway deterioration in operative period, risk of aspiration and presence of Ryle,s tube at end of surgery were excluded from the study. The anesthetic management included induction with fentanyl plus propofol and maintenance with inhalational agents 66% nitrous oxide and 1.2% isoflurane with oxygen. At the end of surgery, neuromuscular blockade after (TOF ratio > 90%) was reversed using glycopyrrolate and neostigmine to allow spontaneous breathing. The depth of sedation was maintained using 2% sevoflurane with 100%oxygen.

AEC was inserted in the ETT till a predetermined depth according to position of endotracheal tube.The intratracheal position of AEC was confirmed by end tidal CO2 tracings on monitor. Thereafter, in one group, intubating laryngeal mask airway endotracheal tube ((ILMA ETT) size 6/6.5 internal diameter for female and male patients respectively was loaded over AEC and advanced till predetermined depth. Intra tracheal position of ETT was confirmed by appearance of square waveform on capnometer. In the other group, after exchanging AEC and confirming its position, i-gel size 3/4 for female and male patients respectively was inserted over AEC and position of i-gel was checked in a usual manner. Thereafter, ETT insertion over AEC with i gel as conduit was carried out.

The second attempt required withdrawal of ETT and its rotation by 90º before reinsertion. In third attempt, jaw thrust was applied. First attempt success rate and numbers of manoeuvres required for reinsertion of ETT were noted.

Our pilot cases required the opening of mouth by chin lift and increase in depth of sedation by supplementing propofol 0.5 mg/Kg body weight prior to i-gel insertion to facilitate the insertion of i-gel. Sucess rate of reinsertion of ETT, reinsertion time, manoeuvres required and post procedure morbidity like oral cavity trauma and any occurrence of complications were noted.

Sample size:

The sample size was calculated based on 92% success of reintubation with AEC in the literature4 and our assumption of success of over 98- 100% when AEC to be used with i- gel. The minimum number of cases in each group, hypothesising a difference of 6% or 8%, taking α –error 0.05 and power of study 80%, comes out 150 or 120 respectively. Since this was only our hypothesis and studies on i-gel as conduit with AEC as stylette are not available, we conducted it as a preliminary study with fifty patients in each group.

Statistical analysis:

Success rate of reintubation, complications of reintubation and post-operative morbidity in the two groups is expressed as percentage and Chi Square test was used for statistical significance. Reintubation time , hemodynamics and SpO2 during reintubation at various timings were expressed as mean+ standard deviation & statistical significance was carried out by student t test. Data was analysed by SPSS statistical software version 17.0 & statistical significance was taken at p value<0.05.

Results:

The results are tabulated in the table 1-3. In AEC group (n=50), reinsertion of ETT over AEC was achieved in forty nine patients. In one patient, AEC was accidently removed by movement of patient before attempting reintubation due to inadequate sedation. In other group (AEC with i-gel, n=50), i-gel could not be properly placed in one patient and ETT entered in esophagus in anther out of fifty patients. The overall difference in the success rate of reinsertion of ETT among both groups was not statistically significant (p value > 0.05). The first attempt success rate of reinsertion in AEC group was better 64.0 % (32/50) compared to 44.0 % (22/50) using i-gel as conduit with AEC (p value < 0.042). The total number of maneuvers required to facilitate reinsertion of ETT were 17 vs 27 (p value < 0.05) in the AEC group versus AEC with i-gel as conduit respectively. Jaw thrust to assist reinsertion of ETT was required in three patients with AEC as compared to thirteen patients in AEC with i-gel group. During insertion of i-gel, thirty patients required additional sedation using propofol to open mouth. Desaturation (SpO2 < 92%) was recorded in eight patients in AEC with i-gel group (in five patients during i-gel insertion and three during ETT insertion over AEC) as compared to four patients in AEC alone group. Presence of blood in oral cavity after the procedure was observed in 4 cases in AEC alone group, vs 15 in AEC+i-gel group (p-value=0.005).The incidence of sore throat was not significant between two groups 7 vs 11(P value > 0.05).

Table1: Showing the difference in reinsertion of ETT in between two groups

Sr No.	Characterstics	AEC Group	AEC+i-gel Group	p-value
1	Successful reinsertion of ETT (n)	49/49	48/49	0.315
2	First attempt success (n)	32/49	22/49	0.042*
3	Second attempt success (n) First manuevre: withdrawl of ETT and reinsertion at 90*	14/17	13/27	0.023*
4	Final attempt success (n) Second manuevre: Jaw thrust	3/3	13/14	0.315
5	Reinsertion Time (in seconds Mean± SD)	46±20.8	45.4±25.1	0.898

n= number of patients, * p-value < 0.05

Table2: Showing the difference in various findings in between two groups

Sr No.	Characterstics	AEC Group (n)	AEC+i-gel Group (n)	p-value
1	Additional sedation for i-gel insertion	-	37	-
2	Desaturation (Fall in ≤ 92% SpO2)	4	8	0.218
3	Presence of blood/ trauma oral cavity (n)	4	15	0.005*
4	Sore Throat	7	11	0.297
5	Esophageal intubation	Nil	1	-

n= number of patients, * p-value < 0.05

Discussion

The aim of our study was to find out whether establishing a conduit over AEC will have better success rate of insertion of ETT than attempting intubation over AEC alone. We hypothesized that the presence of a conduit in oral cavity will bypass resistance encountered due to soft tissues inside oral cavity while attempting reinsertion, thereby increase the success rate of reintubation. Moreover, presence of SAD will establish airway for oxygenation and ventilation avoiding the panic of reintubation failure. Thus, the presence of SAD can bridge and facilitate endotracheal intubation for ventilation. Reinsertion of ETT can be carried out using SAD as conduit and AEC as stylet.

In this study, after surgery depth of anaesthesia was maintained and thereafter, AEC was exchanged over ETT. This clinical condition is akin to the situations encountered in post-operative patients requiring sedation or muscle relaxant or combination of both to facilitate tracheal intubation due to failed extubation failure.

In this study, we found that the presence of i-gel ensures ventilation and oxygenation.However, reinsertion of ETT using i-gel as conduit over AEC had no distinct advantage over AEC alone technique due to several reasons. Firstly,we found that insertion of i-gel required manoeuvres for mouth opening and supplemental sedation with propofol in every patient. The supplementation of additional sedation after extubation can put patient at risk of apnea, obstruction or total loss of airway leading to morbidity or mortality. Any extubation strategy requiring sedation has inherent risk of losing airway, thus we need to modify the method of establishing airway conduit.

The first attempt success rate was significantly better in the patients when reinsertion over AEC was carried out. This was contrary to what we had originally hypothesized. Realising that our hypothesis was contrary to our results, we did a post hawk analysis. Post hoc power of this preliminary study was calculated using, 65.30% as success rate of reintubation in first attempt when using AEC alone and 44.89% as success rate of reintubation in first attempt when using AEC+iGel, with α error=0.042. Post hoc power turned out to be 49.9%. This denotes that a higher sample size is required for having the power of study as 80%. For the power of study to be 80% with the same success rates and α error, the number of subjects in each group should have been at least 97.

Secondly, in one patient during i-gel insertion manoeuvres requiring jaw thrust resulted in removal of AEC. Such a situation can jeopardise the possibility of reintubation. Thus the purpose of placing AEC for reinsertion of ETT is defeated.

Thirdly, number of attempts required for reintubation were statistically significant when i-gel was used i.e. the insertion of i-gel did not improve overall success rate of reinsertion of ETT in first go. It seems that straight i-gel stem along with downfolding of epiglottis may be responsible for the low first-pass success rate of reintubation when i-gel was used as a conduit. P Michalek et al in their study speculated that straight shape of i-gel stem directs the ETT posteriorly and thus increase the risk of esophageal intubation or snaring on the arytenoids.[5]

Our study revealed that the success rate of reintubation in both the groups was comparable, occurring 100% times in Group A while 97.95% times in Group AI. The overall success were comparable to that reported by Cooper10, where 91% times (20 out of 22 reintubations) success was achieved in reintubation over ETVC, and one failure was due to operator inexperience, while the other was due to excessive pliability of the protype catheter. In our study, we used a reasonably pliable AEC. The success rate of reinsertion in our study was found higher compared to study by Mort et al.11 The main reason for failure in analysis of Mort et al series was presence of laryngeal edema as patients were admitted in intensive care unit with prolonged intubation. In contrast, our study was carried out in immediate post-operative period with patient on operating table

having ideal intubating conditions. Further, possibility of occurrence of laryngeal oedema was remote as patients undergoing surgery around airway were excluded from the study. Success rate similar to our study are reported by Loudermilk et al in four patients requiring reintubation over Cooks AEC, in patients having failed extubation in post-operative period.[12]

Fourthly, there was no advantage in putting SAD for quick reinsertion of ETT. Reinsertion time in both groups in our study was comparable and statistically insignificant (46± 20.8 sec in AEC group vs 45.4± 25.1 sec in AEC+i-gel).

In this study, we encountered a few problems. In one patient in AEC alone group, there was dislodgement of AEC due to patient movement. In the other group, accidental removal of AEC occurred in one patient during i-gel insertion. In our study, we did not secure AEC using tape or adhesive bandage as we were planning reinsertion immediately after extubation. Many authors have suggested proper fixation of AEC to prevent migration of AEC. In our study, inward movement of AEC -3.82± 2.848 cm (minus sign denotes inward movement) (range 11cm inwards to 4cm outwards) was observed in forty-eight patients at the time of insertion of i- gel over AEC.

One of the main advantages anticipated as a result of securing i-gel as conduit was ease of oxygenation and ventilation. But, in our study we observed desaturation during insertion of i- gel over AEC. This was despite the fact that all the patients in the study were oxygenated with 100% oxygen for at least three minutes in an attempt to prevent/avoid diffusion hypoxia. In our study, desaturation occurred in eight patients in AEC + i-gel group. Out of these eight patients, fall in Spo2<92% occurred during i-gel insertion in five patients. This fall in Spo2 was managed by oxygenating patient with face mask or i-gel in all the patients effectively. The fall in Spo2 < 92% might have occurred due to mandatory disconnection of oxygen supply during i-gel insertion and the time consumed to insert the i-gel over AEC.

The incidence of desaturation in our study in group A was lower than Mort's study.11 The lower incidence was probably due to our methodology wherein we incorporated oxygenating the patient through the AEC with 2 L/min of O2 in all the patients with a brief interruption only at the time of passing the ETT beyond the machine end of the AEC. In Mort's study only 7 out of 51 patients received oxygen via AEC. Moreover, almost 87% patients in Mort's study were in recovery phase of pneumonias, congestive heart failures etc. requiring life support interventions. So, the higher incidence of desaturation in their study could be due to low pulmonary reserve of the patients.

Lastly in this study, the incidence of morbidity in terms of presence of blood in oral cavity after procedure was higher (30.61% v/s 8.16%) when i- gel was inserted compared to when reinsertion was carried out over AEC alone. Although statistically insignificant, more number of patients 11 v/s 7 had incidence of sore throat when i- gel was used as conduit.

Limitation of Study: There are some limitations of the present study. Firstly, we studied only patients who had normal airways at the the time of intubation and extubation. In addition, it was not possible to blind the anaesthetist to the strategy adopted for reinsertion over AEC, thus inviting some bias.

Conclusion:

We found that Airway exchange catheter is successfully inserted with endotrachael tube in situ in all patients. One of the extubation strategies advocated is reintubation over AEC and our findings supports this. Our study found no merit in establishing airway conduit in form i-gel over AEC for reintubation in terms of success rate. Although i-gel ensure oxygenation and ventilation Further, insertion of i-gel required additional sedation and manoeuvres with inherent risk of respiratory complications.

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