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Endotracheal intubation without use of muscle relaxant in patients for cervical spine surgery: a prospective randomized comparative study.

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Abstract

Background: Endotracheal intubation is the most important step during administration of general anaesthesia. Intubation using short-acting hypnotic drug is frequently facilitated by the administration of a depolarizing relaxant such as succinylcholine. However, this may be associated, with well known side effects especially in patients with spinal cord injury and para or quadriplegia. Even the use of non depolarizing relaxants may be associated with undesirable effects such as prolonged neuromuscular blockage. Propofol is a short-acting intravenous anaesthetic that has been widely used as an induction agent. However, if used alone has been associated with several adverse effects, including hypotension, pain on injection, and excitatory motor movements. Potent inhalation agents can be used as an alternative to facilitate tracheal intubation.

Materials and Methods: 80 consenting adult patients between the age of 18-75 years, scheduled for cervical spine surgery under general anaesthesia, were divided randomly into two groups. Group P received propofol 2.5mg/kg intravenous(iv) for induction while the Group S received propofol 1.5mg/kg iv and 4% sevoflurane inhalation agent for induction of general anesthesia following which the patients were intubated using King Vision Video Laryngoscope. The ease of intubation in both the Groups was assessed with the help of Steyn's modification of Helbo-Hansen scoring system. Hemodynamics were monitored in both the groups in the form of heart rate, systolic blood pressure, diastolic blood pressure and mean arterial pressure at various time intervals.

Results: Tracheal intubation was accomplished in 100% of patients in both the groups. In Group P only 80% of the patients had acceptable intubating conditions while in group S 97.5% patients had acceptable intubating condition, which was very much statistically significant.

Conclusion: We concluded that combination of inhalational 4% sevoflurane with IV propofol 1.5mg/kg is superior to IV propofol 2.5mg/kg with respect to quality and ease of intubation and less significant with respect to hemodynamic response.

Keywords: Intubation, Cervical spine, Propofol, Sevoflurane, King vision, muscle relaxant.

Introduction

Endotracheal intubation is the most important and crucial step during administration of general anaesthesia. It helps in maintaining the airway patency, makes procedure safe and also protects the lungs from aspiration.[1,2]

Skeletal muscle relaxation with an intravenous neuromuscular blocker markedly facilitates intubation. Over the past few years, several factors have led researchers to consider omitting neuromuscular blocking agents for tracheal intubation. The driving forces were the apparent ability of propofol to blunt responses to tracheal stimulation and the availability of the rapidly acting opioids. In addition, the inappropriate use of neuromuscular blocking agents was thought to be involved in problems such as awareness and residual paralysis. The challenge was to find the correct choice and dose of induction agent and opioid drug to produce adequate intubating conditions without cardiovascular side effects.[3]

The concept of tracheal intubation without use of neuromuscular blocking drugs is well established in children. This technique has found its place in adults where there is contraindication to short acting depolarising agents (patients with muscle crush injuries, spinal cord injury, paraplegia/ quadriplegia, burns, hyperkalemia), where prolonged muscle relaxation in not required (intra-operative use of Motor evoked potentials) or dangerous (difficult airway cases such as patients for cervical spine surgery) as the use of non-depolarising relaxants may be associated with prolonged neuromuscular blockade and inability to reverse the paralysis quickly if airway management via mask or tracheal intubation is not possible.

We chose to do this study on the patients for cervical spine surgery as this group of patients are both an anticipated difficult airway cases and contraindication for short acting depolarising agents like succinylcholine. In addition many of the cases are done with simultaneous intraoperative neuromonitoring which again requires neuromuscular blocking drugs to be omitted.

Objectives

Primary objective

Comparison of intubating conditions in cervical spine surgery patients following induction with propofol alone versus propofol-sevoflurane combination and intubation with video laryngoscope using Steyn's modification of Helbo-Hansen scoring system.

Secondary objectives:

Comparison of

- hemodynamic alterations
- need for additional propofol boluses
- number of attempts for successful intubation

Materials and Methods

The study was conducted in 80 patients of ASA grade II and III, aged 18 to 75 years undergoing cervical spine surgery. Patients were randomly allocated into two groups, Group P and Group S of 40 patients each.

After a through preanesthetic checkup, patients were kept nil per oral for 8 hours following which the patients were shifted to OT. An intravenous cannula of 16 G was inserted and monitoring initiated with monitors like noninvasive blood pressure, pulse oximetry and electrocardiogram. All patients were preoxygenated with 100% oxygen for 3 minutes and given injection midazolam 1 mg iv, injection glycopyrrolate 0.2 mg iv, injection fentanyl 2 µg/kg iv, injection hydrocortisone 100 mg iv, and injection lignocaine 1.5 mg/kg iv.

In Group P patients anesthesia was induced with injection propofol 2.5mg/kg iv. After the loss of verbal response, intermittent positive pressure ventilation was commenced using 100% oxygen. Laryngoscopy and tracheal intubation was attempted at 120 seconds.

In Group S patients anesthesia was induced with injection propofol 1.5 mg/kg iv. After the loss of verbal response, intermittent positive pressure ventilation was commenced using 4% sevoflurane in oxygen. Laryngoscopy and tracheal intubation was attempted at 120s

Additional bolus of 0.5 mg/kg of propofol was given if laryngoscopy was not possible due to muscle spasm, coughing, or excessive movements.

In both groups laryngoscopy was done using King Vision video laryngoscope and trachea was intubated with a size 8 cuffed endotracheal tube in males and size 7.5 cuffed endotracheal tube in females.

During laryngoscopy and intubation, each patient was assessed for five variables. The sum of the scores of these five individual variables was computed as the Helbo-Hansen(Steyn's modification) score. Total score of 5 was considered to be excellent, 6-10 good, 11-15 poor, and 16-20 bad. Total scores were divided into clinically acceptable and not acceptable scores (total score <= 10 acceptable, >10 unacceptable).

Table 1: Steyn's modification of Helbo-Hansen scoring system

Points	1	2	3	4
Laryngoscopy	Easy	Fair	Difficult	Impossible
Vocal cords	Open	Moving	Closing	Closed
Coughing	None	Slight	Moderate	Severe
Jaw relaxation	Complete	Slight	Stiff	Rigid
Limb movements	None	Slight	Moderate	Severe(jerky)

Measurements of heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), and mean arterial pressure (MAP) were noted at different time intervals (preinduction, postinduction, postintubation at 1,3 and 5 minutes. Measurements at 1 min after injection of glycopyrrolate were taken as baseline values.In patients of both groups if intubation was not possible after two attempts, injection rocuronium 0.9mg/kg iv was given and intubation was completed.

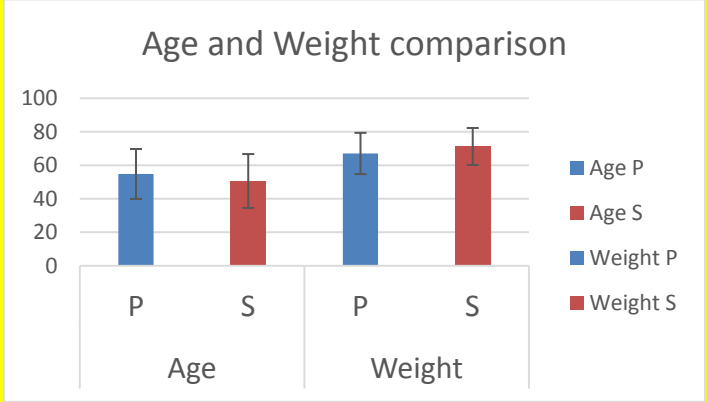
Results and Discussion

The 2 groups were comparable with respect to age, weight and gender distribution.

Table 2: Comparison of age and weight among study groups

Variable	Group	Mean	P-value
Age	P	54.80±14.91	0.230
	S	50.60±16.10	
Weight	P	67.05±12.32	0.115
	S	71.23±11.04	

Independent t-test

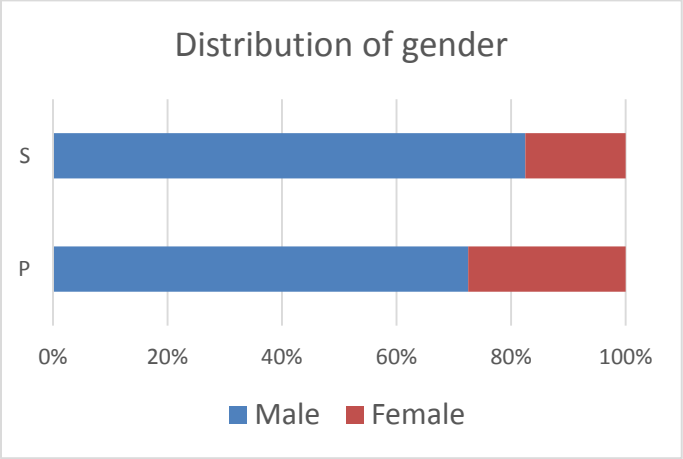


Graph 1: Age and weight comparison among study groups

Table 3: Association of gender with study groups

Gender	P	S	Total
Male	29 (72.5%)	33 (82.5%)	62
Female	11 (27.5%)	7 (17.5%)	18
Total	40	40	80

Chi square, p-value=0.284

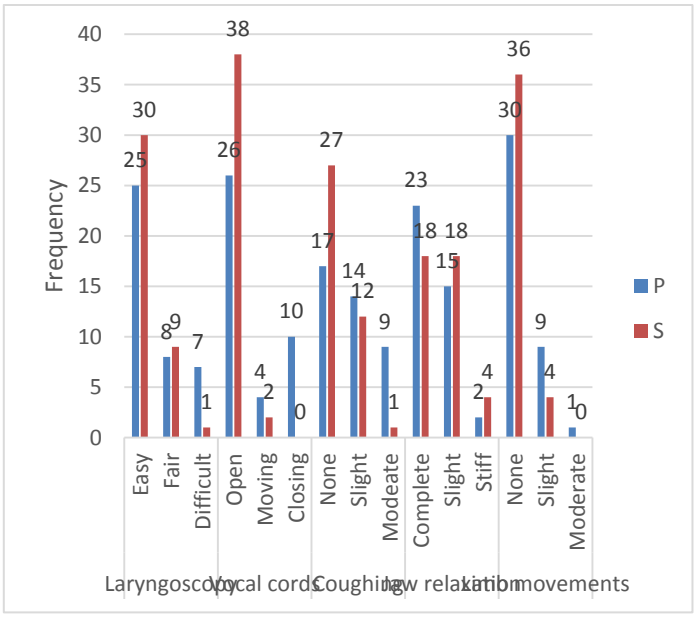


Graph 2: Distribution of gender with study groups

Table 4: Distribution of components among study groups

Variable	Response	P	S	Total	P-value
Laryngoscopy	1	25 (62.5%)	30 (75%)	55 (68.8%	0.082
	2	8 (20%)	9 (22.5%)	17 (21.3%)	
	3	7 (17.5%)	1 (2.5%)	8 (10%)	
Vocal cords	1	26 (65%)	38 (95%)	64 (80%)	0.002
	2	4 (10%)	2 (5%)	6 (7.5%)	
	3	10 (25%)	0 (0%)	10 (12.5%)	
Coughing	1	17 (42.5%)	27 (67.5%)	44 (55%)	0.012
	2	14 (35%)	12 (30%)	26 (32.5%)	
	3	9 (22.5%)	1 (2.5%)	10 (12.5%)	
Jaw relaxation	1	23 (57.5%)	18 (45%)	41 (51.3%)	0.461
	2	15 (37.5%)	18 (45%)	33 (41.3%)	
	3	2 (5%)	4 (10%)	6 (7.5%)	
Limb movements	1	30 (75%)	36 (90%)	66 (82.5%)	0.177
	2	9 (22.5%)	4 (10%)	13 (16.3%)	
	3	1 (2.5%)	0 (0%)	1 (1.3%)	

Chi-square test



Graph 3: Distribution of different components among study groups.

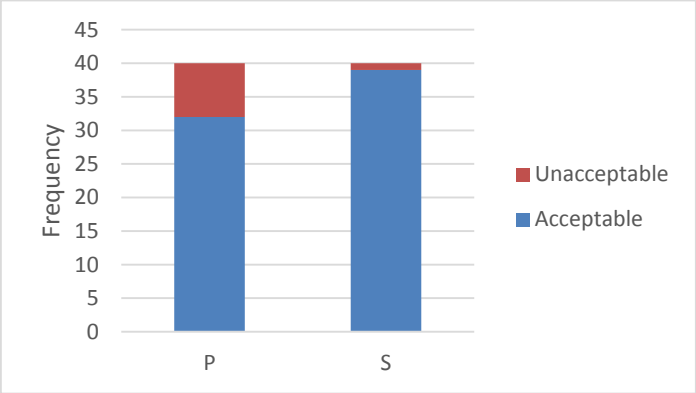
In our study in Group P only 65% patients had abducted vocal cord position whereas in Group S, 95% patients had abducted vocal cord position. In Group S 95% patients showed no movement of vocal cords where as in Group P 10% showed movement and 25% had closed vocal cords. Both the groups had difference in the results, which was statistically significant ($p<0.05$). The study of Rajan et al24 had similar results where sevoflurane induced patients had significantly better position of vocal cords at intubation. In sevoflurane group 83.3% had vocal cords in the open position versus 26.7% in Propofol group.Similarly, laryngoscopy was easy in 25%, fair in 20% and difficult in 17.5% of patients in Group P. Where as in Group S 75% patients had easy laryngoscopy and fair in 22.5% patients 2.5% patients had difficult laryngoscopy. These results were statistically insignificant. ($p=0.082$). Similarly comparable results were seen in terms of ease of laryngoscopy in study of Rajan et al24 where laryngoscopy was easy in 96.7% patients in Sevoflurane group and 93.3% patients in

Propofol group.Coughing was not seen in 42.5% of patients, slight coughing in 35% of patients and moderate coughing in 25% of patients in Group P. Whereas, in Group S 67.5% of patients showed no coughing, 30% showed slight coughing and only 2.5% patients showed moderate coughing. Hence, over all Group P patients showed more vigorous coughing in comparison to Group S which was statistically significant (p=0.012). This result is also consistent with the study conducted by Rajan et al[4] where 96.7% patients in Sevoflurane group showed no coughing as compared to only 36.7% in Propofol group.In the present study, 82.5% of patients showed no limb movements, 16.3% showed slight limb movements and 1.3% patients had moderate limb movements. In Group S 90% patients showed no movements and 10% showed slight movements. Where as in Group P only 75% patients showed no movements, 22.5% showed slight movements and 2.5% patients showed moderate movements. Limb movements were more in Group P but these difference were statistically insignificant (p=0.177). These findings are similar to the study of Rajan et al[4] where no limb movements were seen in 86.7% patients in sevoflurane group as compared to only 30% patients in Propofol group.

Table 5: Distribution of Score category among study groups

Score category	P	S	Total
Acceptable	32 (80%)	39 (97.5%)	71 (88.8%)
Unacceptable	8 (20%)	1 (2.5%)	9 (11.2%)
Total	40	40	80

Chi-square test, p-value=0.029 (Significant)



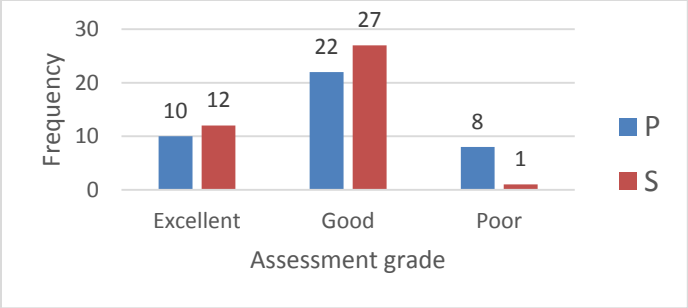
Graph 4: Distribution of score category among study groups

The intubating conditions were acceptable in 80% patients in group P compared to 97.5% patients in group S. This shows sevoflurane-propofol combination provides more acceptable intubating conditions as compared to propofol alone(p=0.029).Three major factors which made the intubating scores unacceptable in group P were vocal cords movement, ease of laryngoscopy and coughing.Our findings were in line with the findings of study conducted by Karanth et al[5] where 87.5% of patients of Group B receiving 8% inhalational sevoflurane had clinically acceptable intubation conditions as compared to only 52.5% of Group A receiving propofol i.v.A study conducted by Thwaites et al[6] also demonstrated that 8% sevoflurane with nitrous oxide in oxygen and manually assisted ventilation provided a clinically acceptable alternative to propofol and succinylcholine for tracheal intubation in elective cases where children were fasted and did not have a difficult airway.

Table 6: Association of Assessment grade with study groups

Assessment	P	S	Total
Excellent	10 (25%)	12 (30%)	22 (27.5%)
Good	22 (55%)	27 (67.5%)	49 (61.3%)
Poor	8 (20%)	1 (2.5%)	9 (11.3%)
Total	40	40	80

Chi-square, p-value=0.047



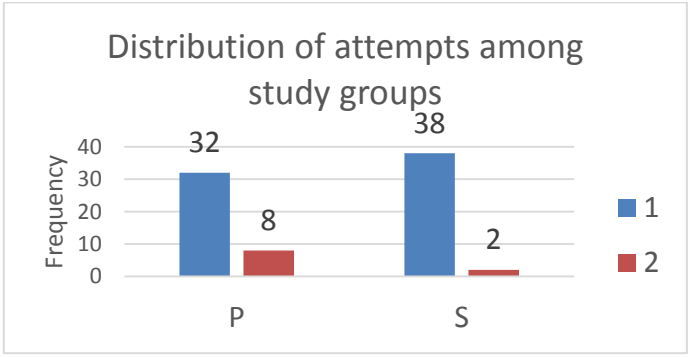
Graph 5: Distribution of assessment grade among study groups

On comparison, intubating conditions were excellent in 30% of patients in Group S and in 25% patients in Group P. They were good in 67.5% patients in group S and 55 % patients in group P. The intubating conditions were poor in 20 % patients in group P while they were poor in only 2.5 % patients in group S. The difference was statistically significant (p=0.047).In Rajan et al[4] study similar findings were observed where quality of intubation was excellent in 83.3% patients in sevoflurane group and 20% patients in propofol group.Also in Raghvendra et al study[2], similar findings were seen where quality of intubation was excellent in 83.3% of patients in sevoflurane-propofol group and 43.3% in Propofol group which was statistically significant (p=0.006).

Table 7: Association of Attempts with study groups

Attempts	P	S	Total
1	32 (80%)	38 (95%)	72
2	8 (20%)	2 (5%)	8
Total	40	40	80

Chi-square, p-value=0.043



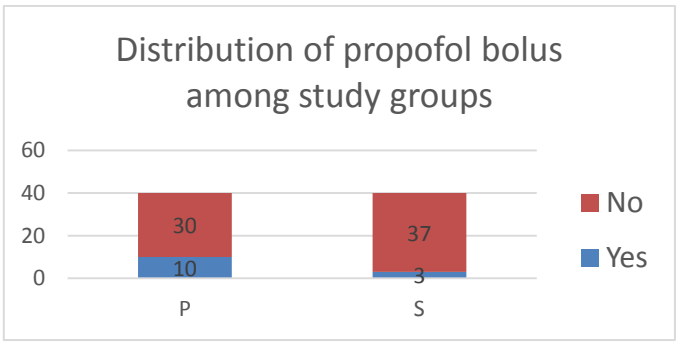
Graph 6: Distribution of attempts among study groups

20% patients required two attempts to intubate in Group P, whereas in Group S 95% of the patients were intubated in first attempt which is statically significant (p=0.043).

Table 8: Association of Propofol bolus with study groups

Propofol bolus	P	S	Total
Yes	10 (25%)	3 (7.5%)	13
No	30 (75%)	37 (92.5%)	67
Total	40	40	80

Chi-square test, p-value=0.034



Graph 7: Distribution of Propofol bolus among study groups

25% of the patients in Group P needed additional propofol bolus for intubation whereas in Group S only 7.5 % of the patients needed additional propofol bolus which is statistically significant (p=0.034).

There was no statistically significant difference among the two groups in heart rate, systolic blood pressure and diastolic blood pressure at different time intervals (preinduction, post induction, post intubation at 1,3 and 5 minutes).

Conclusion

1. Both propofol 2.5 mg/kg and sevoflurane 4% with propofol 1.5 mg/kg when used for induction and intubation without use of muscle relaxant in patients for cervical spine surgery provide acceptable intubating conditions in majority of patients.
2. A combination of 4% sevoflurane in 100% oxygen and propofol 1.5mg/kg preceded by fentanyl 2µg/kg and midazolam 1 mg, without muscle relaxants provides more acceptable intubating conditions compared to propofol 2.5 mg/kg with 100% oxygen preceded by fentanyl 2µg/kg and midazolam 1 mg, in adult patients undergoing cervical spine surgery under general anaesthesia when intubation is done using video laryngoscope.
3. Majority of patients in both the groups can be intubated using video laryngoscope in a single attempt but more number of patients require a second attempt in the propofol only group.
4. Additional propofol boluses may be required in both the groups for intubation but the requirement is more in propofol only group.
5. There is a significant change in hemodynamic parameters during induction and intubation as compared to baseline in both the groups but the changes are comparable in between the two groups.

Hence, we concluded that combination of inhalational 4% sevoflurane with IV propofol 1.5mg/kg is superior to IV propofol 2.5mg/kg with respect to quality and ease of intubation and less significant with respect to hemodynamic response during induction and intubation using video laryngoscope in adult patients undergoing cervical spine surgery without the use of muscle relaxants.

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