Evaluation of Intubating Conditions with Varying Doses of Propofol without Muscle Relaxants

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ABSTRACT

Background: Since 1988 anaesthesiologist have proved that induction dose of propofol is sufficient to intubate patient without muscle relaxants. Propofol is unique in having property to suppress airway reflexes better than any other agent. Therefore study was undertaken to evaluate clinically acceptable intubating conditions with different doses of propofol without muscle relaxants.

Patients and Methods: 90 ASA grade I and II patients posted for elective surgery requiring general anesthesia divided randomly into group I (propofol 2 mg kg$^{-1}$); group II (2.5 mg kg$^{-1}$); group III (3 mg kg$^{-1}$). Premedication with inj. Glycopyrollate, inj. Ranitidine, inj. Ondansetron; inj. Midazolam and inj. Fentanyl was done. After waiting for 5 minutes, induction dose of propofol was given followed by inj. lignocaine 90 seconds prior to intubation. Intubating conditions were assessed and hemodynamic changes were recorded at various levels.

Results: Ideal intubating conditions were obtained in 96.7% of patients in group II (2.5 mg kg$^{-1}$ propofol) and 100% in group III (3 mg kg$^{-1}$ propofol). We found that clinically acceptable intubating conditions can be achieved with 2.5 mg kg$^{-1}$ and 3 mg kg$^{-1}$ propofol without significant hemodynamic changes and 100% success can be obtained with 3 mg kg$^{-1}$ of propofol.

Conclusion: Ideal intubating conditions without muscle relaxants can be achieved with propofol 3 mg kg$^{-1}$ with fentanyl 2 µg kg$^{-1}$ and lignocaine 1.5 mg kg$^{-1}$ without significant hemodynamic changes.

KEYWORDS: Propofol, intubation without muscle relaxants.

Keaveny JP and Knell PJ were amongst the first workers to propose the concept of intubation with only propofol without muscle relaxants.$^1$ This was the beginning for the thought of elimination of muscle relaxants for intubation. In 1988, Mckeating K, Bali IM, Dundee JW compared thiopentone (4and5mg kg$^{-1}$) and propofol (2.5mg kg$^{-1}$) to assess suppression of airway reflexes and found propofol to be better hypnotic.$^2$ Stevens JB, Vesoco V, Harris K found that etomidate with alfentanil and propofol with alfentanil produce comparable intubating conditions, better than thiopentone with alfentanil. They also found that addition of lignocaine improves condition for intubation with attenuation of intubation response.$^3$ Saarnivaara L, Klemola VM could achieve 89% success in intubation with 2.5 mg kg$^{-1}$ propofol with 30µg kg$^{-1}$ alfentanil without muscle relaxants.$^4$ Mulholand D, Carlisle RJT compared tracheal intubation with 2.5 mg kg$^{-1}$ propofol with and without 1.5 mg kg$^{-1}$ lignocaine without any opioids and muscle relaxants. They found that dose of 2.5mg kg$^{-1}$ propofol is sufficient to intubate the trachea without muscle relaxants and addition of lignocaine 1.5 mg kg$^{-1}$ attenuates the stress response to intubation well.$^5$

We in our study have compared different doses of propofol with lignocaine and fentanyl to obtain clinically acceptable intubating conditions without using muscle relaxants. Attenuation of pressor response and haemodynamic changes were also observed during the study.

PATIENTS AND METHODS

90 ASA class I and II patients who were posted for abdominal, orthopaedic, gynaecological, ENT surgeries requiring general anesthesia were chosen for study and divided randomly into 3 groups.

Group I received 2 mg kg$^{-1}$ propofol, Group II 2.5 mg kg$^{-1}$ propofol and group III received 3 mg kg$^{-1}$ propofol.

Criterion for choosing the patients include age between 20 to 65 years, ASA class I or II and MPC grade I or II. Patients with history of hypertension, asthma and previously documented difficult intubation were excluded from the study.

Written informed consent was obtained from each patient.

On the OT table each patient was attached to ECG monitor, Pulse-oximeter and NIBP. All the patients were cannulated with 18G cannula and 10 ml kg$^{-1}$ of ringer lactate solution was given 10 minutes before induction.

All patients were premedicated with inj. Glycopyrollate 5µg kg$^{-1}$, Inj. Ranitidine 0.3 mg kg$^{-1}$, Inj. Ondansetron 100
µg kg⁻¹, inj. Midazolam 0.02 mg kg⁻¹ and Inj. Fentanyl 2 µg kg⁻¹ one after the other as slow i.v bolus in the same order.

After giving inj. Fentanyl patients were watched for apnea, oxygen saturation and given 100% oxygen by mask.

As fentanyl takes 5-7 minutes for its plasma concentration to equilibrate with that of brain concentration, we waited for 5 minutes after giving inj. fentanyl after which inj. propofol either 2mg kg⁻¹, 2.5 mg kg⁻¹ or 3 mg kg⁻¹ in precalculated amount, chosen randomly (based on computer generated randomization) and grouped accordingly was given slowly intravenously over 10 seconds followed by inj. Lignocaine 1.5 mg kg⁻¹ as i.v bolus.

The order of giving Propofol and lignocaine was planned such a way that laryngoscopy and intubation was done at 7 minutes after giving Fentanyl.

Patients were watched for apnea, oxygen saturation and ventilated bag mask with 100% oxygen.

90 seconds after completion of propofol injection, laryngoscopy and intubation was performed. We waited for 90 seconds because good to excellent intubating conditions are reported 90 seconds after hypnotic doses of propofol.³

For success only one attempt at laryngoscopy and intubation was considered. All male patients were intubated with portex cuffed endotracheal tube no.8.5 and female patients with no.7.5

Intubating conditions were assessed as follows:

| Criteria               | Conditions          | Score |
|------------------------|---------------------|-------|
| Jaw Relaxation         | Full Relaxed        | 1     |
|                        | Mild Resistance     | 2     |
|                        | Tight but open      | 3     |
|                        | Impossible          | 4     |
| Vocal Cord Position    | Widely Open         | 1     |
|                        | Mid Position        | 2     |
|                        | Moving but open     | 3     |
|                        | Closed              | 4     |
| Intubation Response    | None                | 1     |
|                        | Diaphragmatic moves | 2     |
|                        | Slight Coughing     | 3     |
|                        | Severe Coughing     | 4     |

Excellent = score < 3
Good = score 4-6
Inadequate = score > 7

Clinically acceptable intubating conditions = excellent+ good Hemodynamic responses were recorded at following stages:
- baseline value, after premedication, at 5 minutes after inj. Fentanyl, after giving propofol and lignocaine, pre-intubation, post-intubation, 5 minutes after intubation.

If patients could not be intubated they were given muscle relaxant to facilitate intubation. Following intubation, anesthesia was maintained at the discretion of attending anesthesiologist.

Data was analyzed using multiple regression analysis.

![Figure 1](image1.png)
Figure 1: Gender distribution in three propofol groups.

| Table 2: Comparison of intubating conditions in 3 Propofol groups |
|---------------------------------------------------------------|
|                  | 2 mg Propofol | 2.5 mg Propofol | 3 mg Propofol |
|------------------|---------------|-----------------|---------------|
| Excellent No.    | 3             | 18              | 17            |
| %                | 10.00%        | 60.00%          | 56.70%        |
| Good No.         | 17            | 11              | 13            |
| %                | 56.70%        | 36.70%          | 43.30%        |
| Inadequate No.   | 10            | 1               | 1             |
| %                | 33.30%        | 3.30%           | 0.00%         |

RESULTS

There was no significant difference in gender of cases in any of the propofol group

In group II clinically acceptable intubating conditions (excellent+good) were present in 96.70% with failure rate being 3.30%. In group III clinically acceptable intubating conditions (excellent+good) were present in 100% patients with failure rate being zero.

During laryngoscopy and intubation there was significant increase in heart rate in all the three groups (P < 0.05) but when compared between group I, II and III there was no significant difference.

During laryngoscopy and intubation there was significant rise in MAP in group I (P < 0.05) not only from
the baseline level but also from the level at preoxygenation.5
minutes after laryngoscopy and intubation the MAP returned
almost to the baseline level. In group II and III, during
laryngoscopy and intubation there was rise in MAP but it
remained below the baseline level and remained the same
5 minutes after intubation.

DISCUSSION
Keaveny JP et al were one of the first workers who achieved
95% success rate of intubation without neuromuscular
blocking agents; only with propofol 2.5 mg kg\(^{-1}\).\(^{1}\)

Anaesthesiologists have tried to formulate combination
of drugs which will help us to intubate patients without
coughing or bucking in absence of muscle relaxants.

Mullholand D et al have used lignocaine 1.5 mg kg\(^{-1}\)
and found incidence of post intubation coughing lower than
in which lignocaine was not used.\(^{5}\)

In our study in Group I (Propofol 2 mg kg\(^{-1}\)) we found
that 10% of patients had excellent and 56.70% patients had
good intubating conditions (Table 1). Thus 66.70% patients
had clinically acceptable intubating conditions (excellent +
good) However 33.30% patients could not be intubated
and had to be given muscle relaxants to achieve it. Better
intubating conditions with 2 mg kg\(^{-1}\) of propofol have been
reported by Erhan E et al achieved along with remifentanil
30µg kg\(^{-1}\) \(^{6}\) Scheller M et al achieved 100% success rate
with 2 mg kg\(^{-1}\) propofol and 40 µg kg\(^{-1}\) Alfentanil as optimum
dose. They observed that when dose of Alfentanil was
increased to 50 µg/kg\(^{-1}\) success rate dropped to 93% and
with 60 µg/kg\(^{-1}\) it further dropped to 86%. Authors could not
explain the reason.\(^{7}\)

However Saarnivara L et al achieved only 16% success
rate with 2 mg kg\(^{-1}\) propofol and 30 µg kg\(^{-1}\) Alfentanil.\(^{4}\)

Compared to our study the higher success rate achieved
by Grant S et al\(^{10}\) and Scheller M et al\(^{7}\) might be due to use
of Remifentanil and Alfentanil.

In our study in group II (propofol 2.5 mg kg\(^{-1}\)) we found
that excellent intubating conditions were present in 66% of
patients and good intubating conditions were present in
36.70%. Thus 96.70% patients had clinically acceptable
intubating conditions and only 3.30% patients could not
be intubated and were given muscle relaxants for achieving
it (Table 1).

The result obtained by us are significantly better than
Leitaut T et al who found clinically acceptable intubating
conditions in only 35% of patients with propofol 2.5 mg
kg\(^{-1}\) (like us) and Fentanyl 3 µg kg\(^{-1}\) (higher than us). In their
study authors performed Laryngoscopy and Intubation 3
mins after Fentanyl injection whereas we did Laryngoscopy,
Intubation at 7 mins after Fentanyl injection.\(^{9}\)

The peak action of Fentanyl comes after 7 mins\(^{3,4}\) and
the smaller time lag after Fentanyl injection might be the
cause of their poor success.

Davidson JAH et al found clinically acceptable intubating
conditions in 93% of patients with propofol 2.5 mg kg\(^{-1}\)
and Alfentanil 20 µg kg\(^{-1}\) with 1 mg kg\(^{-1}\) propofol and Alfentanil
10 µg kg\(^{-1}\).\(^{10}\) Alcock R. et al found 86% clinically acceptable
intubating conditions with 2.5 mg kg\(^{-1}\) propofol and Alfentanil
10 µg kg\(^{-1}\).\(^{11}\)

Clinically acceptable intubating condition in 66% of
patients with 2.5 mg kg\(^{-1}\) propofol and 1.5 mg kg\(^{-1}\) Lignocaine
has been reported by Mullholand D et al. the authors did
not use any opioids in that study.\(^{5}\) May be this is the cause
for lower success rate.

Howorkaa J et al have studied intubating conditions
without muscle relaxants with Pentothal 5 mg kg\(^{-1}\) and
propofol 2.5 mg kg\(^{-1}\). They found that they could visualize
the cords in 60% of patients and intubate easily in 48 % of
patients in Pentothal group as against 46% visualization
and 22% intubation in propofol group.\(^{12}\)

However better intubating conditions with propofol than
other hypnotics have been reported by Erhan E et al\(^{6}\)
and Mckeating K et al.\(^{2}\)

In our study with 3 mg kg\(^{-1}\) Propofol we got excellent
intubating conditions in 56.70% of patients and good
intubating conditions in 43.30% of patients. Thus clinically
acceptable intubating conditions were found in 100% of
patients; Failure rate being Zero% (Table 1).
Khouri SJ et al reported 62.5% clinically acceptable intubating conditions. This lower success rate of authors as compared to our results could be due to early intubation by them. They intubated the patients 90 seconds after Fentanyl whereas we intubated after 7 mins of Fentanyl injection.

Attenuation of pressor response and hemodynamic changes were also assessed. For this we took the blood pressure recordings after premedication (midazolam and fentanyl) as the baseline blood pressure for comparison between different propofol groups.

We found that in all the three groups after premedication there was a fall in MAP compared to baseline level which is not significant.

When compared between the three groups there was no significant difference in the fall of MAP with 2, 2.5, 3 mg kg\(^{-1}\) of propofol (Graph 4) and none of the patients had to be treated for hypotension.

Similar results of fall in MAP not requiring active management have been reported by Stevens J et al; and Davidson JAH et al.\(^{10}\)

During Laryngoscopy and intubation there was significant increase in Heart rate in all the three groups but when compared between gr I, II and III there was no significant difference (Graph 3).

However during Laryngoscopy and Intubation there was a significant rise in MAP in Gr. I. The rise was significant not only from the baseline level but also from the level at preoxygenation. 5 min after Laryngoscopy and Intubation the MAP returned almost to the baseline level. (Graph 4).

In gr. II and III during laryngoscopy and intubation there was rise in MAP but it remained below the baseline level and remained same 5 min after intubation (Graph 4).

There was significant difference in response to laryngoscopy and intubation between group I and group II and III. There was good attenuation of response to laryngoscopy and intubation in 2.5 mg kg\(^{-1}\) and 3 mg kg\(^{-1}\) propofol group along with 1.5 mg kg\(^{-1}\) Lidocaine and 2 µg kg\(^{-1}\) fentanyl. (Graph 4)

Thus in conclusion, ideal intubating conditions for intubation without using muscle relaxants are possible with 3 mg kg\(^{-1}\) propofol with 2µg kg\(^{-1}\) fentanyl and 1.5 mg kg\(^{-1}\) lignocaine and the stress response to laryngoscopy and intubation gets attenuated well.

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