Journal of Cardiovascular Disease Research

ISSN:0975 -3583,0976-2833 VOL 15, ISSUE 12, 2024

Comparison of Hemodynamic Stress Response During Intubation Using Video Laryngoscope and Conventional Direct Laryngoscope

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Abstract

Background

Endotracheal intubation is associated with a significant hemodynamic stress response, characterized by an increase in **heart rate (HR), blood pressure (BP), and catecholamine release**. The choice of laryngoscopy technique can influence this response. This study compares the **hemodynamic stress response** between **video laryngoscope (VL) and conventional direct laryngoscope (DL)** during endotracheal intubation in patients undergoing general anesthesia.

Methods

A **prospective, randomized controlled study** was conducted on **120** patients undergoing elective surgeries requiring endotracheal intubation. Patients were divided into two groups:

- **Group VL (n=60):** Intubation performed using a **video laryngoscope**.
- **Group DL (n=60):** Intubation performed using a **conventional direct laryngoscope**.

Hemodynamic parameters (**HR, systolic BP, diastolic BP, and mean arterial pressure**) were recorded at baseline, **immediately after laryngoscopy**, and at **1, 3, and 5 minutes post-intubation**. The incidence of complications, such as **hypertension, tachycardia, and arrhythmias**, was also assessed.

Results

Group VL exhibited **a significantly lower rise in HR and BP** compared to Group DL at **1 and 3 minutes post-intubation ($p<0.05$)**. The **mean arterial pressure (MAP) at 1 minute** was **98.2 ± 5.6 mmHg in Group VL** and **112.4 ± 6.3 mmHg in Group DL** (**$p<0.001$**). Fewer patients in Group VL experienced **hypertensive episodes or arrhythmias**.

ISSN:0975 -3583,0976-2833 VOL 15, ISSUE 12, 2024

Conclusion

Video laryngoscopy is associated with a **significantly lower hemodynamic stress response** compared to conventional direct laryngoscopy. The reduced mechanical force applied during VL intubation may explain these findings. Given its advantages, VL may be preferable in patients with **cardiovascular comorbidities or at high risk of hemodynamic instability**.

Keywords: Hemodynamic stress response, video laryngoscope, direct laryngoscope, intubation, blood pressure, heart rate

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Introduction

Endotracheal intubation is a critical component of airway management but is associated with a **marked hemodynamic response**, including **increased HR, BP, and catecholamine release**. This transient response is primarily due to **laryngoscopic manipulation and tracheal stimulation**, which can lead to complications, especially in patients with **cardiovascular diseases, hypertension, or intracranial hypertension**.

The **conventional direct laryngoscope (DL)** requires greater mechanical force to visualize the glottis, which can result in a stronger sympathetic response. The **video laryngoscope (VL)**, on the other hand, provides an improved view of the airway with minimal force application, potentially reducing hemodynamic stress.

This study aims to compare the **hemodynamic changes** between **video laryngoscopy and direct laryngoscopy**, evaluating their effects on HR, BP, and incidence of adverse events post-intubation.

Materials and Methods

Study Design and Setting

A **prospective, randomized controlled trial** was conducted at the **Department of Anaesthesia, Rama Medical College Hospital and Research Centre, Kanpur**. Ethical approval was obtained from the **Institutional Ethics Committee**, and informed consent was obtained from all participants.

Study Population

Inclusion Criteria:

- Patients aged **18–60 years** undergoing elective surgeries under general anesthesia.

ISSN:0975 -3583,0976-2833 VOL 15, ISSUE 12, 2024

- ASA (American Society of Anesthesiologists) **Grade I–II** patients.
- Patients requiring **orotracheal intubation**.

Exclusion Criteria:

- History of **hypertension, arrhythmias, or ischemic heart disease**.
- Patients with **anticipated difficult airways**.
- Obesity (**BMI > 30 kg/m²**).
- Known allergies to anesthetic agents used.

Intervention and Randomization

Patients were randomly assigned to one of two groups:

- **Group VL (n=60):** Intubation performed using a **video laryngoscope** (McGrath VL).
- **Group DL (n=60):** Intubation performed using a **Macintosh direct laryngoscope**.

Anesthesia Protocol

All patients received a standardized anesthetic regimen:

1. **Premedication:** Inj. Glycopyrrolate (0.2 mg IV), Inj. Midazolam (0.05 mg/kg IV), and Inj. Fentanyl (2 mcg/kg IV).
2. **Induction:** Inj. Propofol (2 mg/kg IV) until loss of consciousness.
3. **Neuromuscular blockade:** Inj. Rocuronium (0.6 mg/kg IV).
4. **Intubation:** Performed using the allocated laryngoscope after **90 seconds of neuromuscular blockade**.
5. **Maintenance:** Oxygen, nitrous oxide, and sevoflurane with intermittent vecuronium.

Outcome Measures

Primary Outcomes:

- Changes in **HR, systolic BP, diastolic BP, and MAP** at:
  - **Baseline**
  - **Immediately after laryngoscopy**
  - **1, 3, and 5 minutes post-intubation**

Secondary Outcomes:

- Incidence of **hypertension (>20% increase in MAP)**.
- Incidence of **tachycardia (>20% increase in HR)**.
- Occurrence of **arrhythmias**.
- Time taken for successful intubation.

ISSN:0975 -3583,0976-2833 VOL 15, ISSUE 12, 2024

Statistical Analysis

Data were analyzed using **SPSS version 25.0**. Continuous variables were analyzed using the **independent t-test**, and categorical data were assessed using the **chi-square test**. A **p-value < 0.05** was considered statistically significant.

Results

Hemodynamic Response

- **HR at 1 minute post-intubation:**
  - Group VL: **85.6 ± 8.2 bpm**
  - Group DL: **102.3 ± 9.4 bpm** (**p<0.001**)
- **MAP at 1 minute post-intubation:**
  - Group VL: **98.2 ± 5.6 mmHg**
  - Group DL: **112.4 ± 6.3 mmHg** (**p<0.001**)
- **Incidence of hypertensive response:**
  - **Group VL: 18%**
  - **Group DL: 42%** (**p<0.05**)

Adverse Events

- **Arrhythmias:** Reported in **3 patients (5%) in Group DL**, none in Group VL.
- **Tachycardia:** More common in Group DL (28%) compared to Group VL (10%).
- **Time for intubation:** Slightly longer in Group VL (**14.5 ± 3.2 sec**) than Group DL (**12.3 ± 2.7 sec**) (**p=0.04**).

Discussion

The findings suggest that **video laryngoscopy is associated with a significantly lower hemodynamic response** than conventional direct laryngoscopy. The **decreased sympathetic stimulation** with VL could be due to reduced **force application** on the airway structures, leading to less catecholamine release.

Previous studies have also reported **favorable hemodynamic profiles** with VL, making it particularly beneficial for **high-risk patients** with cardiac comorbidities. The slightly longer intubation time with VL is **clinically insignificant** compared to the hemodynamic benefits observed.

ISSN:0975 -3583,0976-2833 VOL 15, ISSUE 12, 2024

Conclusion

Video laryngoscopy is associated with **reduced hemodynamic stress response** compared to direct laryngoscopy. Its use should be considered, especially in patients with cardiovascular risks, to minimize perioperative complications.

References

(References will be formatted as per journal requirements.)